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Research and Analysis: The Opportunity of the Year 1917



SEARCHING analysis should accompany and result from the present great activity in the electrical industry. Production has been the rallying cry for 1916. Need for greater output has taxed capacities of engineering resources, of manufacturers, of central stations and other generating plants and of distributers of electrical products. New standards in gross output have meant the overhauling of industrial methods, and out of this comes a lesson which 1916 passes along to 1917.

Research is no longer merely a laboratory viewpoint, but a necessary approach to the problems of the industry. New economic conditions, forced by the great war, have emphasized the need of a broad interpretation and application of the principles of research in all industry.

High prices, scarcity of materials, shortages in labor, unprecedented increases in volume of business, have demanded immediate readjustment of accepted standards. These conditions have turned engineering and manufacturing and commercial branches to closer analyses in an attempt to eliminate wastefulness, whether in design, in manufacture, in distribution or in sales plan, and to provide new ideals for the future.

In scientific and engineering branches the need of unrestricted research for new laws and new principles has been given fresh impetus by the lack and scarcity of materials, growing out of war and acute industrial conditions, and due to our past failure to consider research work in the correct perspective. Similarly, in the critical analyses of manufacturing costs, the more general insistence on new standards in the cost of doing business, the discussion of service costs and rates, serious consideration is being given to basic factors which may be broadly interpreted as a part of a research movement.

The spirit of research has never been far from the electrical industry. In the early days scientific and engineering research gave birth to the art. With the ramifying of the industry has come a growth of the movement. In 1916 it is found expressed not only in the laboratory and the design room, not only by the laboratorian and the engineer, but by the manufacturer, by the distributer of electrical products, by the central station and by the user.

A new impetus is being given to pure research for the discovery of new laws and principles. The background and purpose of this movement are discussed in Dr. Whitney's article in this issue. Research has made its appearance, though not by that title, in the field of practice outside the laboratory. The leading articles in this issue voice the new attitude in engineering and industrial affairs. Scientific progress in industry is no less an expression of the spirit of research than the creation of government and private laboratories.

Our nation has awakened and is discussing its economic relations within itself and with other nations. We are thinking of problems outside our own boundaries. Many men enter the year 1917 with a new conception of the relation of the branches of the industry to each other and of the relation of the industry to other arts and industries.

We need this year to have big men thinking on the big problems. More research in known fields of usefulness, more design with new standards of cost, more planning and better directed sales effort, more public education on the relation between financing, cost and rates of public utilities, a keener realization of the relation of the electrical engineer to all these activities —these are great demands which the new year brings to the electrical industry.

THERE will be no failure to respond to the demands of the times. The industry is conscious of its shortcomings in the past. It has men and it has organization. With its highly developed organizations of country-wide associations, the industry has an excellent foundation upon which to base its new outlook. The systematic and efficient co-ordination of all of these factors presents a task which both the scientist and the practical engineer will welcome as a real opportunity.

THIS issue, conforming to the custom of the ELECTRICAL WORLD, *presents signed articles from engineers and business men in the industry upon important developments and tendencies of the times. It is a period when clear judgment and prophetic vision are sorely needed; and the contributions in this number take the conservative "look ahead" which will help our readers to solve the problems of the New Year.*

On account of lack of space in this number, several articles which it had been intended to publish were unavoidably withheld and will be published in subsequent issues during January.



Within a month or two there will be launched at the Brooklyn Navy Yard the *New Mexico* (at first called the *California*), the first battleship of any nation to be electrically propelled. In size and fighting equipment the *New Mexico* is the sister ship of the newly commissoned *Arizona*, pictured above (2). In the insert at the top of page (1) is shown the electrically propelled collier *Jupiter*, tests on which led to the adoption of electric propulsion in the Navy. In the lower right-hand corner (4) appears one of the *Jupiter's* prime-mover sets, and at the left (3) is pictured the ceremony of laying the keel of the electrically propelled *New Mexico* in the presence of Secretary Daniels and other officials, early in 1916.

Electric Propelling Machinery Has Been Ordered for Our Seven Latest Battleships, and Is Specified for the Four Great New Battle-Cruisers.



W. L. R. EMMET

". . . When prejudices are overcome electricity will develop an extensive use in large high-power warships. In . . . scouts and destroyers . . . it is relatively much less desirable, but even in such cases . . . it might . . . develop a legitimate application. In merchant ships also it may afford great advantages."

Advantages and Future of Electric Ship Propulsion

By W. L. R. Emmet
Consulting Engineer, General Electric Company

THE writer has been asked to write an article on the future of electric ship propulsion, and while prophecy is generally an undesirable task for an engineer, the present conditions seem to be such that a statement of opinion is desirable.

The writer has for many years actively advocated electric drive for the larger vessels of the navy, and as a result of a long campaign of designing, experimentation and educational activity this method has been adopted on a large scale by our Navy Department. Electric propelling machinery has been ordered for the last seven battleships which have been authorized, and is specified for the four new battle cruisers which form part of the present naval program. These battleships are very large and important vessels, requiring 33,000 hp. each, and the battle cruisers present the most stupendous propulsion problem ever brought forth, since they require no less than 180,000 hp. each. Only two or three of our cities use as much electricity as will be generated on one of these ships at 35-knot speed.

Electric propulsion has from the first had many opponents, and it is still being very actively opposed by nearly all the shipbuilders of the country, by Sir Charles Parsons, Charles G. Curtis, and others who have had important influence in marine engineering. Most of this opposition is undoubtedly sincere, but is not altogether disinterested, since shipbuilders want to use machinery which they know how to build, and since turbine inventors have in the past received large royalties from turbine-driven ships which are cut off by the advent of electric drive. Although the power still comes from turbines, the electric drive is, by license agreements, free from royalty charges. The possibilities of large electrical apparatus do not appeal strongly to those who are not thoroughly familiar with its uses. Electric propelling machinery will be generally heavier and more expensive than the best developments of geared turbine machinery, and variations of opinion have rested upon the relative importance given to advantages and disadvantages.

The General Electric Company has, under the writer's direction, also carried on extensive developments and operations in ship propulsion by turbines connected to ships' propellers by gearing. Machinery of this class for seventy-nine large vessels has been contracted for by them, and many of these ships are in service and showing unqualified success. Our view, therefore, is not entirely one sided, and although it may be considered that we are particularly interested in the development of the uses of electrical machinery, we believe that we have judged fairly and that our efforts will lead to important and lasting success.

Advantages of the Electric Drive

In explaining the advantages of electric drive, comparisons will be made only with the geared turbine drive. All other methods for propelling large vessels may be considered obsolete, although many ships are still being built with engines or with direct-connected turbines.

A wise rule in engineering is to advocate new things only for the purpose in which they afford the greatest advantages, and this rule has been closely followed in the promotion of electric propulsion, which was originally advocated mainly for large warships. This first move was made before the use of mechanical gearing, for such a purpose had been suggested, but its advantages for this particular use are so striking that it is still believed that the wonderful development of gearing possibilities have not changed the original case.

The subject of electric drive is too large for full discussion in such an article as this. Its possibilities and advantages can be best suggested by taking as an example the case of the new battle cruisers in which its use has been and still is the subject of much discussion and criticism. This may be considered as the extreme case where advantages are most important and in which the disadvantages of increased weight is most serious.

Four of these vessels are authorized in the navy bill of 1916. They are designed to make 35 knots each, requiring 180,000 hp. delivered to four shafts turning at full speed about 250 r.p.m. These are the fastest and most highly powered vessels ever built. The electrical installation proposed in each of them far exceeds in extent any single installation ever made for any purpose.

Apparatus Proposed

It is proposed to install in these ships four high-speed turbine-driven generating units of the best type, similar in most respects to those used in power stations on shore. Upon each of the four propeller shafts will be mounted two independent induction motors. Cable connections and switching arrangements will be provided by which any combination of motors and generators can be immediately provided for and by which all the changes of connections for operation, reversal, etc., can be instantly made under all running conditions. The details of design and method of operation need not be described in this discussion. They are quite simple; in fact, much simpler than in most electrical installations. The electric supply is produced for the one purpose of propulsion, and is varied or discontinued according to need. Connections are changed only on dead circuit, even in the ordinary operations of stopping, starting and reversing, and automatic means are provided by which any diversion of current from any cause produces an unbalancing which instantly breaks the field circuit and de-energizes the system.

The aggregate weight of this equipment with cables, switches, instruments and controlling apparatus is 1865 tons.

Equipment if Gear Driven

If such a vessel were gear driven, a plurality of ahead turbines would be connected through helical gearing to each propeller shaft, one or more backing turbines would also be connected through the same gearing, and if good cruising economy was sought, it would be necessary to provide also cruising turbines connected through separate systems of gearing and arranged with couplings so that they could be detached during high-speed operation.

A just comparison of this method with the electric equipment proposed would require a complete design and analytical study of the geared equipment and its performances. The writer has not made such a study in the case of these vessels, therefore no exact figures can be given. The space and number of turbine elements connected to each shaft will determine the space required for turbines, and this spacing will govern the length and weight of the shafts, piping, valves and supporting structures.

In some of the installations which have been proposed abroad for vessels of much less power than these, the multiplication of parts has been very great and the size and extent of turbines and supporting structures such that the adoption of similar methods in these ships would certainly give weights nearly as great if not greater than those proposed for the electric drive. Some of our ship builders in bidding to the government on these vessels have stated that by using geared equipment they could save about 1000 tons in weight and about $1,000,000 in cost, but whether these statements will bear analysis or not cannot be said without study of their detailed designs, if any have been made.

Detachment and Interchangeability

Without further description or discussion of either type of apparatus, we are in a position to make a comparison which constitutes one of the most important advantages of electric drive. In the geared equipment, each shaft has a system of turbines, gears, bearings, thrust balancing devices and lubricating systems all mechanically locked together. With high-speed machinery any kind of trouble with any of these parts will almost certainly necessitate the immediate stoppage of the whole system. To keep a high-speed turbine running out of balance or with bearing trouble is impossible, and the gearing part would present almost equal difficulty. In the event of mechanical trouble of such character a ship would have to be stopped until the wreck could be cleared. The work necessary to uncouple and disconnect any part of such very heavy apparatus would be a serious matter involving much time, including that required to stop the ship. After the disconnection was made the idle propeller would act as a very serious drag on a fast vessel.

In the electrically driven ship there is no mechanical connection of the shaft to anything but the rotors of motors. These are self-contained, iron-clad structures and cannot by any possibility be subject to mechanical interference. The shafts are subject to the same possibilities of bearing or thrust trouble as shafts in other ships, but the presence of the motors does not increase this danger, and the speed being low it is remote in any case. With this equipment any motor, generator or turbine, if in any kind of trouble, can be instantly disconnected without stopping the ship and with only a small loss from the highest speed capacity.

Such interchangeability as this power of disconnection gives constitutes one of the most important advantages of electric drive in such a ship. With one motor out of eight in trouble, only one-eighth of the maximum capacity is lost and the ship's maximum speed is impaired by only about 1 knot. If a generator or turbine is in trouble the maximum speed is reduced only about 2 knots. With two generating units and four motors out the ship can make 26 knots, and with three generators and four motors out she can made 19 knots. If parts give trouble they are simply cut out and repaired at leisure or as opportunity offers. The value of this interchangeability in a warship can hardly be overestimated, it largely overcomes the military danger incident to accidents to the driving power, a danger which has always been of primary importance.

Backing Power

In turbine-driven ships, not electric, it is necessary to provide backing turbines which must run idle in the reverse direction when the ship is going ahead. These backing turbines involve complications which are very objectionable, and if these are reduced to a desirable minimum the backing power will be greatly inferior to that easily provided with electric drive. Experiment has shown that a turbine forced in an opposite direction involves about seven times as much friction loss as when driven in its normal direction. This loss is very appreciable in the backing turbines of ships and causes heating which must be dissipated by circulating steam, which causes further loss and waste. There are also serious difficulties and dangers in high-speed apparatus incident to the abrupt and wide changes of temperature where steam is suddenly admitted to a cold reversing turbine. Steam which expands without doing work has a high temperature, and if work is done upon it by a reversed turbine the heat is considerably increased. With superheat these temperatures may be extreme, and they affect the main turbine as well as the other, since it also must be used for reversal of direction and since the two often occupy the same casing. The mechanical effect of such abrupt change of steam temperature upon fragile structures presenting very extended surfaces is a matter which has been little considered, but which has caused much serious trouble. With electric drive the turbine never need be stopped when the ship is under way, and its operation is easier than in a power station because the load is steadier. with modern high-speed turbines superheat affords large gains in fuel economy, and the ability to safely use high degrees of superheat may constitute one of the important reasons for adopting electric drive.

Efficiency of Transmission

Various statements and estimates have been published concerning losses in high-speed gearing for which the authority is not known by the writer. Tests at Schenectady have shown losses about double those generally estimated, with rapid diminution of efficiency as load falls. These tests were of a most accurate character with large smooth running gears and by the motor-generator method where losses alone were measured, the same power being transmitted with and without the gearing.

With the electric drive in these battle cruisers, the losses from turbines to propeller shaft at full speed will amount to 7 per cent, and by adjustment of voltage the transmission efficiency can be kept equally good at all speeds. Considering gearing losses, reversing turbine losses, losses incident to necessary subdivisions of the turbine and additional packings it is believed that the actual transmission from turbine blades to shaft at full speed cannot be made more than 2 per cent better in the geared equipment than it is in the electric. At reduced loads the geared equipment will be much less

efficient. The normal cruising speed of these ships will require less than one-tenth of full load, and the drag of gearing, bearings, reversing turbines and idle parts of main turbines will be very serious.

CRUISING ECONOMY

With the electric design, the number of motors and turbines used can be adapted to the demand for power, while with the other all parts must be kept running. This gives very important gain in economy at all speeds below the maximum. At 19 knots only one turbine is required to drive the ship, and electrical arrangements are made by which it can be run at full speed instead of running at half speed, as it would if the ratio was fixed as by gearing. Thus the steam efficiency at 19 knots, a desirable cruising speed, is equal to the best attainable at any speed. Assertions which have been made by ship builders and others that equal cruising results can be obtained by the use of cruising turbines are obviously absurd. The cruising turbines themselves would be greatly inferior to the single main turbine so used, and they would be burdened with all the drags which are mentioned above. Cruising economy gives increased cruising radius without renewal of fuel supply. This has always been considered a matter of the greatest importance in warships; it is a feature in respect to which electric drive can have no rival.

STATE OF DEVELOPMENT AND EXPEDIENCY

Enough has been said to give an idea of the reasons for the use of electricity in such ships, but in addition it should be considered that everything used in such an electric installation is a matter of exact knowledge and wide experience, while methods of gearing on such a scale are backed by little and brief experience and are the subject of wide difference of opinion as to methods of design and proportions.

The writer believes that the differences of weight and cost which have been predicted by shipbuilders and others are not based upon just comparisons, but that even if they are true they are not sufficient to balance the practical merits of electric drive for such vessels.

For these reasons it is believed that when prejudices are overcome electricity will develop an extensive use in large high-power warships. In such light vessels as scouts and destroyers, for reasons of weight and space, it is relatively much less desirable, but even in such cases with the lightest and most compact designs, and with very high pressure and superheat, it might in the future develop a legitimate application. In merchant ships also it may afford great advantages. With electricity, turbine units can be installed in duplicate, either in single or twin-screw ships. Machinery can be installed where convenient with motors near propellers and turbines near boilers, auxiliaries can be driven electrically from the main units. The highest superheat can be used without danger or complication, and main units can be applied to other power uses such as cargo pumping or handling. These advantages have led to the preference of electric drive at a higher price in certain large freighters recently ordered, and will doubtless lead to many other applications in ships of various types.

The advantages here mentioned have been developed with a wonderful skill and foresight by the Swedish engineer Ljungstrom in the 900-hp. ship Mjolner, which has been in successful operation for about two years. This vessel has shown a fuel economy decidedly superior to anything produced elsewhere in a steamship, and has maintained this high standard throughout her period of service. Such a result with such small power is very remarkable and significant. The Mjolner uses an extremely high degree of superheat.



HALFORD ERICKSON

"In the interest of equal justice it is absolutely necessary in rate-making to give due consideration to the question of rising prices. The failure to do this has forced at least one commission to repeatedly raise rates which under increasing costs had become too low."

Problems in Rate Regulation Accentuated by Higher Operating Costs

BY HALFORD ERICKSON

Of Hagenah & Erickson, formerly Chairman Wisconsin Railroad Commission

IT is now generally recognized that in some form governmental regulation of railways and public utilities generally is here to stay. This idea is considerably strengthened by the fact that, as is already apparent to many, such regulation is about as necessary where such utilities are owned and operated by the public as when they are owned by private persons. Whether the regulation that is thus likely to prevail is the present form or some other form is not so clear.

Regulation deals mostly with questions that are of an economic nature. These questions depend upon and are affected by circumstances which vary greatly from time to time and which are often very complicated. In order to avoid injustice they must often receive prompt attention and firm treatment. The administrative acts involved in passing upon them are subject to much effective criticism from many who have neither the time nor inclination to master the facts and conditions upon which the decisions are based. While the utility commissions have shown marked desire to do justice to all concerned and have done a great deal of good, their work is often affected by so many circumstances that there are times when it is almost impossible for them to decide matters as promptly and to give as full weight to all the facts and conditions involved as equal justice to all would demand. There are many examples in point, as experience shows.

One of these examples relates to the effect upon the rates or the net earnings of railways and other public utilities of the increases that have taken place during the past two decades in the prices of the labor, material and capital which enter into the cost of the service which such utilities furnish. These rises in prices greatly increase the cost of such service, and make it exceedingly difficult to fix future rates thereon. Ex-

perience also indicates that these difficulties have proved too great to be fully overcome. For instance, many rates made by commissions during the past decade or more have been found to be too low soon after they were put into effect. Whether the reason for this is found in the fact that due consideration was not given to the effect of rising prices upon the cost of the service, or to the fact that to have made the rates high enough would have been unpopular, or to both, may be an open question. These advances in prices have, in fact, created some of the most perplexing problems which confront those who are making rates for the future. It is to point this out that the present article was prepared.

Regulating Service and Rates

Regulation as it is now known relates mostly to the quality of the service rendered by the utilities and to the fairness of the rates charged for such service. The laws usually require that the service must be adequate and the rates reasonable. What constitutes adequate service is largely a question of engineering facts which can, as a rule, be established and applied with a fair degree of accuracy. This is also true of such changes in the service rules as may be necessary from time to time. Yet just service rules are not always easily applied and readily accepted.

The question of what constitutes reasonable rates, on the other hand, is much more complicated. While such rates have been defined as rates which, under normal conditions, will yield sufficient returns to cover reasonable allowances for the operating expenses, depreciation and interest and profit on the investment, the facts involved in determining such rates are often so uncertain and variable as to be difficult to ascertain and correctly apply.

Rate schedules are likely to be affected by practically all the conditions which affect the industrial and commercial situation generally. A reasonable rate is therefore not only difficult to establish in the first instance, but such rates when once made may require frequent and equally difficult readjustments. Downward revisions are popular, but upward revisions are, as a rule, very unpopular, even when necessary for the good of the service. As rate-making bodies depend very largely upon the good will of the public it is only natural that they should hesitate in raising rates, even when such raises would be just.

Trouble in Rate-Making

It is upon the rate-making side of regulation that commissions are thus likely to encounter the most trouble. In the industrial and commercial world neither price nor rates can remain the same very long. Frequent changes therein become necessary because of changing conditions, and these changes are often far-reaching in their effect. Since changes in the upward direction are very unpopular, particularly in the utility field, commissions are often slow in authorizing the same. This is even true in cases where delay in this respect tends to harm the service and cause capital to be withheld from the utility field. The situation in practically all branches of the transportation industry seems to furnish a telling example of this. The reason why the prevailing rates of transportation have of late years yielded less than fair returns is mainly found in the fact that the price of practically everything that enters into the cost of transportation has increased at the rate of from 2 to more than 3 per cent a year.

The cost of railway and other utility service depends entirely upon the amounts that have to be paid for the labor, material, capital, and the enterprisers involved. The cost of labor and material of all kinds enters directly into the construction and the operating expenses. Changes in the prices of these factors are therefore felt or noticed almost immediately after they are made. The costs of capital and of the enterpriser, on the other hand, are indirect burdens, and while they are as much a part of the total cost of the service as any other expense, the changes therein are not always as clearly shown as is the case of the direct expenses. Increases in the cost of capital are first felt in the new capital that is needed. That this should be the case is only natural, since the charges on much of the capital already invested are fixed and do not vary until the securities mature and the question of refunding is raised.

When the prices of the factors of production are thus rising from year to year it also inevitably follows that the cost of the service is increasing. This is particularly true of the total cost. It is also true of the cost per unit of service, except perhaps in cases where the service is rapidly growing in volume, and where, besides this, the plant has so much unused capacity as to be able to meet this growth without extensive additions to the investment.

Basing Rates on Past Costs

Rates made by commissions are usually based on present and past cost. When the prices of the factors of production, or of labor, material and capital remain about the same from year to year past costs, if judiciously applied, are also an important factor in the basis for rates. In periods of rapidly rising prices, however, such as during the past twenty years, rates based on past cost will usually be found to be too low soon after they have gone into effect. Examples of this are numerous. In the railway and utility service, for instance, rates, which a few years ago were regarded as fair, are now yielding returns that are too low to adequately cover the cost of all the factors of production. Many rates, based on past and existing costs, made by commissions during the past decade, have also turned out to be unremunerative shortly after they were put to a trial. Of the rates which have thus been found to yield less than reasonable returns, some have been raised while others again have been permitted to stand at their old level. Such advances as have thus far been made in rates that were too low, however, have come about very slowly. They have not always been granted as promptly as was necessary to prevent serious losses to the utilities or the roads.

Most industrial enterprises have been able to meet the rising prices or increased cost of production by establishing higher prices on what they have to sell. Where this is the case the producers may not have suffered through the change in prices. It is even possible that it may have made many better rather than worse off. Railways and other public utilities, however, have not been in position to follow this practice. They have not only been unable to raise the prices of the services they render in proportion to the increases in prices on what they must buy, but their rates to-day are in many instances actually lower than they were when the present upward turn in the general price level was first noticed.

Course of General Prices

Owing to their importance in this connection it is thought proper to herein present a few of the leading facts which indicate in a general way the course of the general price level, and the tendencies of the rates of transportation and of other utility service, as well as the trend of the purchasing power of the average receipts per unit of such services during the past decade or more. In addition to this, facts showing the trend in the cost of labor and the cost of capital are also given.

Table I shows the average receipts per ton per mile for freight transportation; the approximate receipts per 1000 cu. ft. of gas and per kilowatt-hour in some of the very largest gas and electric plants, together with the percentages by which the rates for each prior year exceeded the rates for 1914. It also shows the index numbers which represent the course of wholesale prices and the per cent by which the prices in 1914 exceeded the prices for each preceding year.

Table II shows the course of the purchasing power of the average receipts per unit of service, as given in Table I, together with the percentage by which the purchasing powers for the preceding years exceeded those for 1914.

While these tables explain themselves a few points concerning them may be mentioned. The average receipts per unit of service were much higher in 1897-98 than they were in 1914. The percentages of these excesses amounted to 9.02 per cent for freight, 43.9 per cent for gas and 319.04 per cent for electrical energy. For the remaining years the excesses over 1914 show smaller percentages. For wholesale prices, on the other hand, the course is in the opposite direction. The prices in 1914, for instance, were 48.88 per cent higher than in 1897.

The effect of this downward trend in the rates and upward trend in general prices upon the purchasing power of the receipts per unit of service has been tremendous. The amount that could be purchased by the earnings per unit was much greater in 1898 than in 1914. In fact, it exceeded that of the latter year by 51.13 per cent in the case of freight rates, by 108.19 per cent in the case of gas rates, and by 506.41 per cent in the case of the rates for electric energy.

Prices at the mines on coal for fuel or power were 44.5 per cent higher in 1914 than in 1897.

On all sorts of supplies and material such as are used by railways and utilities the prices were from 20 per cent to more than 60 per cent higher in 1914 than in 1897.

The average daily wage in the railway service was about 47.9 per cent higher in 1914 than in 1897. These relations appear to hold good for other utilities as well. In 1914 the average rate was 22.2 per cent higher than in 1905. Since 1914 there have been important increases in the rates of wages in almost all occupations.

The cost at which capital can be had depends very largely upon the risks involved, the course or state of general prices, and the demand for capital.

Cost of Capital

Close studies of the cost of capital during the past fifteen years or more indicate quite clearly:

That on safe bonds, that is bonds that are protected by property and net earnings that amount to about twice as much as the principal and the charges for interest thereon, the cost of capital was about 4 per cent from 1900 to 1907, when it rose to about 4½ per cent. In 1909 this cost rose to about 5 per cent; in 1913 it advanced to more than 5 per cent and has remained at about this figure ever since.

That on stocks which do not amount to much more than the difference between the par value of the bonds by which the stock is thus preceded and the full value of the property and equities of the plant, and which stock is also protected by a net income thereon for dividends and for surplus for risks and contingencies that amounts to from 50 per cent to 100 per cent more than the 6 per cent which is usually demanded in dividends, the cost of obtaining capital is about 10 per cent, or about twice as much as the cost of that part of the capital which was had on the bonds. The higher returns which are thus demanded on the stock as compared with the bonds represent the compensation which the investors in stock require for the extra risks to the investment, and for the responsibilities and work involved in connection with the management of the plants which the stockholders have to assume.

These are in substance the terms upon which investors, under normal conditions, are willing to furnish capital. They are also in the main the conditions and terms with which those who desire to obtain capital must comply. They indicate that on the first one-half or, say, 65 per cent of the investment which is represented by bonds the cost of the capital is something more than 5 per cent, while on the balance of the investment which is represented by stocks the cost of the capital is not far from 10 per cent. In order to meet these costs it is therefore necessary that a utility should earn at least 7 per cent on the fair value of the prop-

Decline in Purchasing Power Accompanies Decline in Rates

TABLE I—COURSE OF FREIGHT RATES AND GAS AND ELECTRICITY RATES IN SOME OF THE LARGEST PLANTS

Years	Tons One Mile		Gas Per 1000 Cubic Feet		Electricity per Kilowatt-Hour		Wholesale Prices	
	Cents per Ton per Mile	Per Cent by Which Prior Years Exceed 1915	Average Receipts 1000 Cu. Ft.	Per Cent by Which Prior Years Exceed 1914	Average Receipts per Kilowatt-Hour, Cents	Per Cent by Which Prior Years Exceed 1914	Index Number Average 1890 to 1899 Equals 100	Per Cent by Which 1914 Exceeds Prior Years
1897	.798	9.02	.....	.....	.....	.....	90	48.88
1898	.753	2.86	$1.18	43.90	8.8	319.04	93	44.08
1899	.724	1.10*	1.16	41.46	8.5	304.76	102	31.37
1900	.729	.41*	1.21	47.56	8.1	285.71	111	20.72
1901	.750	2.46	1.24	51.21	7.8	271.42	109	22.93
1902	.757	3.41	1.22	48.78	7.1	238.09	113	18.58
1903	.763	4.23	1.16	41.46	6.7	219.04	114	17.54
1904	.780	6.55	1.09	32.92	6.3	200.00	113	18.58
1905	.766	4.64	1.08	31.70	5.8	176.19	116	15.51
1906	.748	2.19	.88	7.31	4.0	90.47	123	8.94
1907	.759	3.69	.82	.....	3.1	47.61	130	3.07
1908	.754	3.01	.84	2.43	2.7	28.57	123	8.94
1909	.763	4.23	.84	2.43	2.4	14.28	127	5.51
1910	753	2.87	.85	3.65	2.2	4.76	132	1.51
1911	.757	3.41	.84	2.43	2.2	4.76	129	3.87
1912	.744	1.64	.81	1.23*	2.2	4.76	134	.....
1913	.729	.41*	.82	.....	2.1	.....	135	.74*
1914	.733	.14	.82	.....	2.1	.....	134	.....
1915	.732	.....	.....	.....	.....	.....	.....	.....

*Decrease.

TABLE II—COURSE OF THE PURCHASING POWER OF RECEIPTS PER UNIT OF SERVICE

Yeras	Receipts per Ton per Mile		Receipts per 1000 Cubic Feet Gas		Receipts per Kilowatt-Hour	
	Purchasing Power	Per Cent by Which Prior Years Exceed 1914	Purchasing Power	Per Cent by Which Prior Years Exceed 1914	Purchasing Power	Per Cent by Which Prior Years Exceed 1914
1897	846	75.15	.....	.....	.....	.....
1898	730	51.13	127	108.19	946	506.41
1899	608	25.87	114	86.88	833	433.97
1900	569	17.80	109	78.68	729	367.30
1901	615	27.32	114	86.88	715	358.33
1902	606	25.46	108	77.04	628	302.56
1903	610	26.29	101	65.57	587	276.28
1904	639	32.29	97	59.01	557	257.05
1905	597	23.60	94	54.09	500	220.51
1906	539	11.59	71	16.39	325	108.33
1907	524	8.48	63	3.27	238	52.56
1908	550	13.87	68	11.47	219	40.38
1909	549	13.66	66	8.19	189	21.15
1910	512	6.00	64	4.91	166	6.41
1911	530	9.73	65	6.55	171	9.61
1912	491	1.65	60	1.66*	164	5.12
1913	467	3.42*	61	.....	155	.64*
1914	483	.....	61	.....	156	.....

*Decrease.

erty and equities of the plant. When these rules are deviated from it appears to be mostly for special reasons which apply to particular cases only.

The Purely Investment Enterprise

The facts as to prices which affect the cost of the service have thus been given in some detail in order to emphasize their importance to the rate-maker, and in order also to point to the injuries that may result from failures to adequately consider the same in fixing rates for the future. This applies as much to increases in the cost of capital as to increases in the cost of labor and material. The terms and conditions upon which capital can be had, however, are perhaps less well understood than the prices on the other factors, but are nevertheless as real as any part of the cost of the service. These terms, as stated above, have been laid down by the investors themselves. They are based upon experience as to what is necessary in the way of protection and earnings in order to place the securities on an investment basis. The investor thus appears to hold that there should be a fairly close relation between the capitalization, on the one hand, and the value of the property and business which it represents, on the other; that in order to avoid receiverships in hard times and under adverse conditions in other respects the bonds should not greatly exceed one-half of the valuation of the plant; that risk and responsibilities are an element of cost and should be largely borne by the stockholders; that the extra risk and responsibilities which the stockholders must thus assume should be offset by greater returns upon their part of the investment; that on such investment securities as those outlined above the cost of capital is at least 5 per cent on that part which is represented by the bonds and about twice as much for that part which is represented by the stocks; that of these returns on the stock about 6 per cent must be paid as dividends while the balance above this represents a surplus that is required for safety and for contingencies to be used for the benefit of the stockholders as an additional compensation for the risks they must bear on their investment and for the responsibilities they must assume for the management and the service; and that securities which are less well protected by property and income than those which come under the above rules are speculative rather than investment propositions, and must therefore be dealt with on other bases than those outlined.

Great Increase in Cost of Capital

The cost of the capital obtained on such investment securities as those described thus appears to have advanced from 20 per cent to 35 per cent during the past decade or more. The ratio of the advance in this case is about the same as the ratios of increase in the prices of labor and material during the same period. That investors, when discovering that the purchasing power of their principal is declining at a rate of from 2 to 3 per cent a year should, as a partial offset to this loss, demand higher rates of interest on their investments is only what should be expected.

The returns and earnings thereon which are thus demanded by the investors, plus such commissions and certain other expenses as may be connected with the sale and issuance of the securities, thus represent the cost of the capital. This cost from an economic point of view is as much a part of the cost of the service as the amounts paid for the labor and material which enter into such service. It is a cost which, like the operating expenses proper, must in the end be borne by the customers if the service is to be furnished.

In studying the price advances that have thus taken place it is found that trust-controlled and tariff-protected articles have risen no faster than articles subject to competition and articles on the free list. Other causes of increasing prices than the trusts and tariff must therefore be looked for. It is possible that the gradual using up of our natural resources is partly responsible for the rise. It is even likely that the growing scarcity or higher cost of many raw materials may have resulted in even greater advances in prices than those which have actually taken place had not this growing scarcity been, at least partly, offset by greatly improved methods of production. The most important causes of the rising prices, however, must be traced to the great increases in gold production that have taken place during the past twenty-five years, and to the great improvements in our credit facilities that have been developed during the same period. The dollars have not only increased in number more rapidly than the growth in business, but each dollar is now doing much more work than formerly.

The effects of such increases in prices have been varied as well as far-reaching. In the railway field, for instance, as well as for other utilities, the effect of these rises in prices and of the failure of the rates charged for the service to keep up with the advances on everything that enters into the cost of the service has often resulted in increasing the proportion of the operating expenses to the gross revenues by as much as from 15 per cent to 40 per cent, thus leaving a proportion for fixed charges that is constantly growing smaller.

Reaching the Limits of Efficiency

These increases in the proportion of the operating expenses to the gross earnings would have been much greater even than the figures given had not the managements of the utilities exerted themselves to the utmost in increasing the efficiencies of operation. While through such efforts much of the increasing cost has been offset the economies resulting therefrom have now about reached their limits. Prices, however, other than railway and utility rates keep on climbing. They are now higher than at any other time during the past three or four decades.

If all prices rose or fell at the same time and to about the same extent no one would either lose or gain through such changes. The experience is, however, that price changes are irregular both as to time and amount. In consequence of this those are gainers who happen to receive high prices for what they have to sell and to pay low prices for what they must buy, while those are losers who have to sell cheap and buy dear. The gains and losses from such sources are often great and very far-reaching in their effect. For it is obvious that when the money income fails to grow as rapidly as the rises in prices of those things which must be purchased with such money income, serious financial embarrassments are almost certain to follow.

Those who are so situated that they have been able to offset the increased costs of what they buy by higher prices on what they sell have, of course, been in position to bear the rises in the prices in question without losses. Those, on the other hand, who like railways and public utilities generally have not been permitted to raise the prices on the services they render have often found their net earnings badly shrinking and their financial position much weakened. In many cases this trend for the worse has reached such a stage as to alarm the investor and make it exceedingly difficult to obtain new capital for much needed additional facilities and for expansions of the service. A situation like this not only retards the necessary development of the utilities themselves and deprives people of much needed service, but it has a bad effect upon industrial and commercial conditions generally. A policy or practice of

which this must be said is clearly contrary to public interest.

That such increases in prices and cost as the country has had to face during the past twenty years must receive serious consideration from the rate-maker if trouble is to be avoided is now clear beyond dispute. Under such rises in prices it is certainly not often safe to base future rates on past cost, as has been the common practice in the past. With prices increasing at the rate of from 2 to 3 per cent per year it is obvious that past costs must be lower than future costs, and that for this reason rates based on past cost will also be too low for future requirements. That this is the case has been clearly shown by past experience in these matters. When instances are met where the costs per unit of service have not been increased by higher general prices, it is probably because of the fact that these utilities were so happily situated as to have been benefited by the law of increasing returns. But even in such cases the evil day is only postponed. For as soon as the existing facilities are exhausted and new facilities on a larger scale have to be provided it will be found that the law of increasing returns is operating from a higher level and that the existing rates are likely to be too low.

These facts certainly indicate that in the interest of equal justice it is absolutely necessary in rate-making to give due consideration to the question of rising prices. The failure to do this has forced at least one commission to repeatedly raise rates which under increasing costs had become too low. Many of the rates so raised had been put in by the commission itself, and most of these rates were, when so put in, based on existing cost with little or nothing above this in the way of margins for contingencies. If rates, when thus found to be too low, were promptly readjusted as soon as the need for it was discovered, the injustice inflicted by the error would not be as great. But owing very largely to the bitter opposition that is usually stirred up against such increases, the advances in the rates which justice thus requires are often postponed from time to time regardless of the fact that these delays are proving very costly and unfair to the utilities.

SHORTCOMINGS TO BE REMEDIED

These facts also show what a delicate and difficult task proper rate-making really is; and that while cost is an important factor in rate-making, the cost that should be considered in this connection is not the past cost alone, but rather the past cost modified by probable future changes therein. To determine the fair cost and the fair rate under such circumstances is exceedingly difficult, and yet it must not be shirked if regulation is to be in line with public interest. The importance of this is readily seen when we remember that a large proportion of all the really valid objections that have thus far been raised against the regulation of rates seem to be based upon orders in which commissions have provided rates which were barely high enough to cover past costs, and which therefore left no margins for such increases therein as were almost continually brought about through advancing prices. These and certain other shortcomings in connection with regulation have resulted in many inequalities as between the interests involved. They have also caused many investors to withhold new capital for new and much needed extensions to the plant and in the service it rendered. Whether these shortcomings can be remedied would seem to largely depend upon the makeup of the commissions, and upon whether the commissions will be placed in such a position that, like the courts, they can do justice to all concerned without fear of being unduly interfered with.



PETER JUNKERSFELD

"Central stations in general have grasped a fine opportunity to strengthen their position as regards power load in the last year. . . Continued growth from the same source may be expected in at least the first half of 1917."

The Sale of Electric Service in Larger Quantities

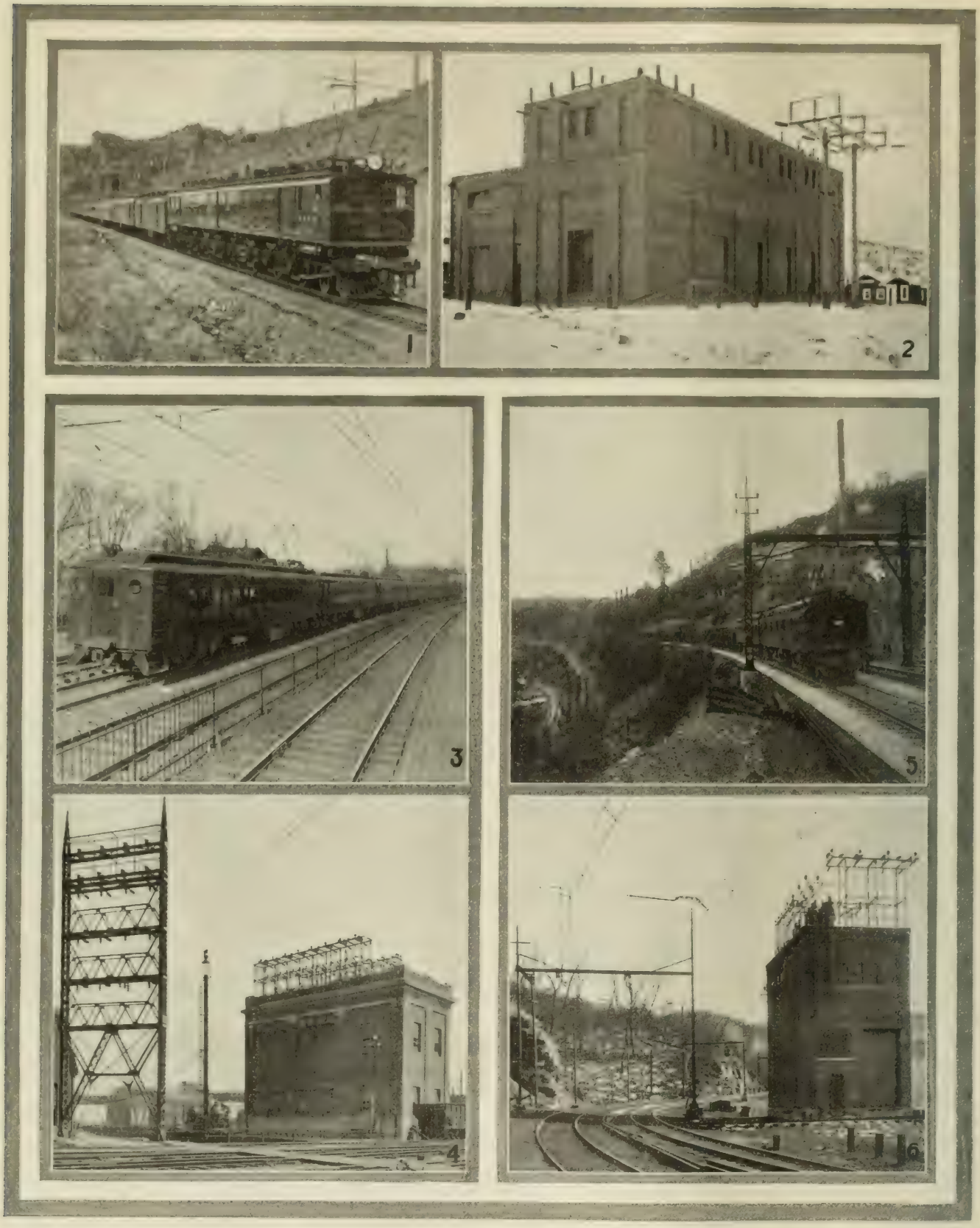
BY PETER JUNKERSFELD

President Association of Edison Illuminating Companies

AMERICA'S enormous industrial expansion in 1916 and the marked advance in general commodity prices have been and still are responsible for an almost unprecedented epoch of growth in the central station industry. The reasons underlying this situation, in its relation to electricity supply companies, are quite easily understood. First, the 1915 stimulation of practically all American manufactures created a demand for an immediate increase in power facilities. The manufacturer who was using central station power and operating his factory below its normal output, quickly secured additional power; there was then a resultant increase in his energy consumption. The manufacturer who was not so doing found in casting about for a solution of his power problem that prices of equipment were going up and found deliveries in an unreliable state. He also found labor scarce and increasing in price. But in his consideration of central station power he found service for his full requirements almost immediately available at a staple price, the trend of which has been constantly downward. His choice, therefore, could hardly be other than for central station power.

This solution of the power problem, therefore, contributed largely to the growth in central station sales. In addition to this the increase in manufacturing and the need for greater safety and higher efficiency all called for more electric light in the factory; the establishment of better merchandising methods also required the liberal use of electric light in more commercial establishments, and better living resulted in the use of electric light and of electric appliances in more homes.

As yet what is perhaps the full extent of this growth has not manifested itself in the energy output records; a great volume of business now contracted for, but not connected, will not begin to be active until the first half of the coming year. In that period the true con-



1.—The fast transcontinental passenger train "Olympian" in Silver Bow Canyon, drawn by electric locomotives of the Chicago, Milwaukee & St. Paul Railway. Electrified service was started on this division early in 1916.

2.—Substation at Janney, Mont., on electrified division of the Chicago, Milwaukee & St. Paul, which receives energy from the system of the Montana Power Company.

3.—Electric train on Philadelphia-Paoli section of the Pennsylvania Railroad, handling suburban service out of Philadelphia. Ths section was electrified late in 1915.

4.—Stepdown substation at West Philadelphia and supporting tower for 44,000 volt incoming lines and outgoing 11,000 volt trolley feeders for the Philadelphia-Paoli electrified section. This substation receives single-phase energy from the New Christian Street generating station of the Philadelphia Electric Company.

5.—270-ton locomotive hauling freight on the Norfolk & Western Railroad near Coalville, W. Va., showing steam station of Appalachian Power Company in the background. The Norfolk & Western will shortly tie in with this station at the Maybury substation near by. The system was electrified in 1914-1915.

6.—Maybury substation, which receives 44,000-volt single phase energy from the Bluestone Junction generating station of the Norfolk & Western Railroad, and transforms it to 11,000 volts for trolley service

Steam Road Electrifications that Employ Central Station Service

dition should begin to be reflected on the output records. To illustrate this point several central station companies in the Eastern and Middle Western States have contracted for twice as much new power business in 1916 as they did in 1915, and a few of them for about three times as much.

RAILWAY POWER APPLICATIONS

Among the spectacular developments in the field of electricity supply is the broader application of central station power in passenger and freight transportation. Railway companies which formerly generated a part or all of their electrical energy are from year to year purchasing a larger portion of their power from central station companies. The economies resulting from specialization and massed power production in a single territory are beginning to be much better understood by all parties interested; the business of transportation is to distribute people and goods; the business of electricity supply is to distribute electricity for every purpose. So at the end of 1916 we find central stations supplying direct current or alternating current, either single-phase or three-phase, for urban and interurban electric railways, for steam railway terminals or trunk lines in any quantities desired. These loads are taken regardless of their size or their intermittent characteristics, all with great advantage to the communities in which such central stations operate.

The total amount of electrical energy required for terminal electrification while large is not as large as commonly supposed. In the Chicago district even the quite ambitious plan reported on early in the year by a committee of the Chicago Association of Commerce, under which all freight and passenger traffic would be moved electrically on 3500 miles of single track, was estimated at 532,000,000 kw.-hr. per annum with a yearly maximum demand of about 125,000 kw. For convenience in comparison it may be said that the electrical energy used in 1916 for surface and elevated railroads in the same area was 736,000,000 kw.-hr., and it is estimated will be about 1,100,000,000 kw.-hr. in 1927. Even if all the electrification reported on by the above mentioned committee were in operation in 1927, the probability of which is very remote, the ratio of steam railway terminal energy requirements to local electric railway requirements would be on the order of one to two. The ratio is likely to be less than one to two, and in smaller railway centers the ratio would be much less.

The successful operation during the year of the St. Paul electrification in Montana and of the Pennsylvania Railroad terminal in Philadelphia, both supplied with central station power, has been especially noteworthy. The St. Paul now terms its electric locomotive "King of the Rails," and advertises to the public its many proven advantages. The accumulated experience with electrified terminals and the largely increased business of the steam railroads, and consequent need for more intensive and efficient use of some of their terminals and trackage, points more definitely than ever before to electrification as an early solution. Only a few weeks ago the Illinois Central Railroad has, in negotiation with the City of Chicago, offered to electrify its terminal and suburban service within five years.

ELECTROCHEMICAL AND ELECTROMETALLURGICAL APPLICATIONS

The year has been particularly marked by a phenomenal expansion of the electrochemical and electrometallurgical industries due largely to the increased domestic demand resulting from the feverish activity of industries which can no longer import materials from abroad. At the same time the power situation at Niagara Falls has become so acute that many of the electrochemical industries located there have not only been unable to expand in response to the increased demand for their products, but have actually been compelled to curtail their production.

This power shortage at Niagara Falls has resulted in the establishment of several plants for manufacturing electrolytic alkalies and chlorine in other parts of the United States. Before the war the manufacture of electrolytic alkalies was limited by the amount of by-product chlorine which could be sold. This condition is now reversed, as there is a very large market for chlorine for bleaching purposes and for use in chlorination in several industries. At the same time development work is being done in the electrolytic manufacture of chlorates and perchlorates, while hypochlorites for bleaching purposes are already being made on a small scale.

The Great Western Electrochemical Company is building a plant at Pittsburgh, Cal., which will employ 2500 hp. supplied by the Great Western Power Company, for the manufacture of alkali and chlorine. The output will be about 5000 tons of caustic soda and 10,000 tons of bleach annually. The electrolytic production of hydrogen and oxygen has expanded greatly during the year. New plants for this purpose have been built in Boston and in Quincy, Mass., and elsewhere. Over 300,000,000 cu. ft. of hydrogen per year is now being generated in the United States.

The various processes for the fixation of atmospheric nitrogen have naturally experienced a greatly increased application because of the use of nitrogen in explosives. The total installed capacity of the cyanamide, arc, and synthetic ammonia processes, expressed in tons of nitrogen per year, increased from 92,240 tons in 1913 to 298,910 tons on Jan. 1, 1916, or more than 200 per cent. About 1,000,000 hp. is used in this industry. Practically none of the development has taken place in the United States, although an American cyanamide plant on the Canadian side at Niagara Falls has experienced a considerable expansion.

Electrolytic processes for the production of organic compounds have been worked out in the laboratory, but for the most part have not yet become commercial. Among other substances which can be prepared in this manner are the "intermediates" used in the manufacture of coal-tar dyes. The electrolytic process has certain very pronounced advantages and, in view of the present expansion of the American dye industry, further developments along this line are to be expected.

ELECTRIC STEEL FURNACE

One feature of present tendencies in electrometallurgical development is worthy of special notice. Electrical processes are gaining ground rapidly in every industry where the prevention of waste or the production of an article of exceptional quality has become of prime importance. When the demand for steel exceeds the supply and junk piles are searched for available metal, the electric steel furnace experiences a boom because it is capable of making an excellent quality of steel from a comparatively poor quality of iron and steel scrap. Electric steel castings command a premium for work in which unusual durability and resistance to stress are required. As a more and more careful conservation of our resources becomes necessary, as our standards of quality become higher and the specifications for the products of industry become more exacting, electrical processes steadily gain ground because of their greater economy in the use of raw materials and the improved quality of their products.

On Jan. 1, 1916, there were approximately seventy-three electric steel furnaces operating in the United

States, producing at a rate of perhaps 100,000 tons per year.

Although complete figures for 1916 are not yet available, it seems that the number of electric furnaces in operation has been doubled and that their present output probably exceeds 1,000,000 tons per year. The United States now has more electric steel furnaces in operation than any other country. These furnaces require in the neighborhood of 150,000 hp. Among the largest single installations under way are the addition of one 15-ton and two 20-ton Heroult furnaces at the South Chicago plant of the Illinois Steel Company to the one 15-ton furnace already in operation there. Most of the furnaces installed are employed in making castings, using scrap as a raw material, but a few are used for making ingots from Bessemer or cupola metal.

Electric Lighting and General Power Applications

While the present and possible future sales of electric service for such special applications as the foregoing are extremely important, it must be remembered that they are only available for such central station companies as operate in present or prospective industrial centers. Moreover, these special applications are all in a stage of rapid development, and, therefore, in large part susceptible of many further changes which may affect the stability and permanency of the sale of electric service for such purposes. It is probably of greater importance to the central station industry that more intensive work be done toward developing the less spectacular but more stable business of electric lighting, general power and sale of power to electric railways and to other public utilities.

An analysis of the income accounts of even large central stations in industrial centers indicates that more than half of the revenue results from electric lighting, particularly commercial lighting. The saturation of residence lighting is surprisingly low, in many cases only one family out of four or five being supplied with electric lighting, and a much lesser number with electric appliances. In one well-known instance the revenue from the four principal classes of business in 1916 was as follows: Residence lighting, 18 per cent; commercial lighting, 37 per cent; power for general and industrial purposes, 22 per cent; power for railway purposes, 23 per cent. The saturation or percentage served of possible business is highest on power for urban railway purposes and lowest for residential purposes. The street lighting is furnished from a municipal plant. The power for railway purposes was all the power used and to be used in that community until railroad terminals are electrified. The service for residential purposes had only reached the point of supplying one family out of three. Even in this central station, with its highly developed railway and power business and no street lighting, 55 per cent of revenue was due to electric lighting. In the average central station this percentage is much higher and electric lighting correspondingly more important.

And so to sum up the situation, it would appear that central stations in general have grasped a fine opportunity to strengthen their position as regards power load in the last year. They are awake to the situation, and continued growth from the same source may be expected in at least the first half of 1917.

There is also evidence of a better appreciation of electric lighting as a revenue producer, particularly from existing mains. It would seem very important during the coming year that central stations should not neglect the study and development of lighting and better illumination because in that field large and real possibilities still exist.



DR. W. R. WHITNEY

"The contributions of pure research are seldom in response to recognized needs, but the needs themselves are developed or disclosed through the research."

The Great Need of Promoting Research in America

By Dr. W. R. Whitney

Director of the Research Laboratory, General Electric Company

If we had a movie film of the growth of our American nation from the beginning, and this were speeded up so that we could see our history reviewed at a rate where general trends became visible, one peculiar thing would appear very clearly. It would look as though we were going to the dogs at a rapid rate. At first the land is covered with forests and filled with game. Rapidly the trees are cut down and burned, and the game disappears. Grass and grains sweep across the country from East to West, in a wondrous growth, but almost as quickly the growth deteriorates and abandoned farms appear. The people rapidly increase in numbers. They crowd together. Holes are dug into the rock and all the coal is removed. Through other holes all the oil and gas is quickly drawn. A few little water-wheels turn around in isolated spots and help to feed countless little lights which rapidly appear in all parts of the country. A lot of wood- and coal-burning apparatus goes whizzing across the land, to be followed in feverish haste by rapidly augmenting myriads of other automatic devices, consuming the oil and gasoline. Everyone knows the fertility cannot last. Everyone sees that the wood, coal, and oil will go only a little farther, and nobody worries.

Run at high speed, the film shows that great numbers of the people die too quickly, and many of them from identical and simple diseases. It seems as though the thing ought to be stopped and this defect remedied before it goes farther. A few such readjustments have evidently been made before. It isn't entirely clear from the film that changes in happiness are taking place at all, and yet the general rapidity of change and energy consumption seems always increasing. Nowhere does the mental level seem to rise. A most marked peculiarity is the mechanical or engineering force which is quickly turning all knowledge into apparatus, and now, as we wonder how the film can long continue, it stops, and leaves the rest to us. At the beginning of a new year it seems to me more fitting that we should think

of the future than review even with satisfaction the accomplishments of the past.

UTILIZING THE WORLD'S KNOWLEDGE

Coincident with our history, other countries, somewhat differing from our own, have been increasing the world's store of knowledge by a certain system. It is by utilizing this store that we have made most of our advances. From it we have made our engines, healed our wounds and cured our sick, talked through wires, and heard through infinite space. We inventors and engineers, using, generally, the scientific products of foreign lands, have turned knowledge into utility. But we have taken no time to contribute to the world's needed supply of new facts. We owe a debt we hope our descendants will pay. We might as well defy them to pay it.

Compared with other countries, we have been exceedingly shortsighted. We are much more active as users than as producers of knowledge. We make no provision for repairing the rapid exhaustion of our soils, replacing our disappearing coal and oil, nor providing the new knowledge on which future life or happiness must be based. Inventors and engineers are being rapidly grown, but searchers to unearth the knowledge on which engineering is based are not being produced. In medicine there are hundreds of thousands of engineers (practising physicians), but only a few research men. All of the former use diphtheria antitoxin, for example, and save the lives of thousands of children. This is possible because there was a certain research carried out by a trained man who did not have to be an engineer in order to live. Certainly tuberculosis and cancer call for experiments to help the engineering physician. He simply cannot efficiently perform the necessary researches and be the engineer too. Other countries have provided for the education, support, and encouragement of men who practically devoted their lives to pure or scientific research. Their investigations seemed more or less academic. These were careful physical analyses of natural phenomena which, at the time, had no visible utilitarian value. As we look into the lives of these pioneers, we find that they were usually much like keenly interested but highly intelligent boys in their appreciation of Nature. They were always learning, and spreading their information broadcast. By some public plan they were immune from the interruptions of conflicting cares, and could pursue their studies uninterrupted. It is not surprising to find that most of the foundations of engineering, whether they be antitoxins or ether vibrations, have come to us through professors of science in European universities or institutions.

TEACHING SECONDARY TO RESEARCH

As we review the history of scores of such cases, it is evident that most foreign universities have held teaching to be secondary to research and have, for several decades, at least, employed and given great facilities to men who made experiments their life work and taught science for the purpose of preparing similar investigators. It is we Americans who have prostituted teaching for the use of the industries.

In a volume on German culture edited by a group of English writers, there are comparative lists of great contributors to engineering science. There are listed twelve leaders in chemistry and twelve in physics from England, France, Germany, and the rest of the world, making ninety-six in all. They were the producers of new science in the nineteenth century. Of these ninety-six, only five were from the United States. Forty-eight mathematicians are also compared, and no American is among them. In other words, from a scientific point of view, we represented about 3 per cent of the world's constructive gray matter.

Another and different criterion occurs in the recipients of the Nobel prizes. These are annually awarded, without regard to country, to the individual who is most deserving in the particular fields of physics, chemistry, physiology or medicine, literature, and peace. Here again we do not shine very brightly. In physiology or medicine, among the thirteen awards down to 1914, America had received one. Also in physics, the United States had received one out of thirteen, and in chemistry none. That is, in new and constructive scientific work of this kind during these recent years, America had been recognized only twice out of thirty-nine chances—again a value so small as possibly to be attributed to error of observation.

WE FAIL TO LAY FOUNDATIONS

While we may be doing our share in the applications of science, we have failed in laying foundations. This is thoroughly deprecated in J. J. Carty's recent presidential address before the American Institute of Electrical Engineers. Until we can learn to do still better, let us follow the example of the German universities or of the British institutions. There the teaching of science is not confined to the preparation of men to earn a living as engineers. In practically every one of scores of universities, particularly in Germany, there are professors whose main object seems to be to advance knowledge, to discover new facts, and to teach by precept the acquirement, instead of the storage of information. They work with their own hands. The very great value of these professors is seldom realized, and so I want to call to mind a few of them. There is no end to the possible list, and I will consider more or less connected lines of endeavor, so as to maintain some semblance of order. The point I wish to make is that apparently most of our advances may be traced back to one of these professors, who, trained to be an observer, matured in a laboratory supported by the state, has had time and facilities to follow the lead of some natural observation.

RESEARCH DISCLOSES NEEDS

Consider electric lighting, for example. The earliest impetus was given to it by experiments using the cells of Grove and Bunsen. They were famous for their research and teaching as well. One was a professor in England, the other in Germany. The publications on these batteries at the time show the men to have made careful and interested studies of novel phenomena. Of course they had no thought of electric lights, and even when these were produced by battery currents much as pocket lamps are to-day, there was no commercial development until the current generating machines were produced. But even with the cells of Grove, Sir Humphry Davy produced the first electric arc between carbon electrodes. Davy was for many years the chief chemist and lecturer of the Royal Institution. If we go back of Grove or Bunsen, we come to the professors of Boulogna and Pavia, who made the first researches on current generation. Galvani investigated the frog's legs and Volta the metal pile. They published their observations. Fundamental observations and the necessary experiments are always more certain to be performed by such trained observers than by others. Faraday, the life-long investigator of the Royal Institution, had disclosed the principles of the generation of electric current by using permanent magnets, and further research then became rapid. Apparently Professor Wheatstone made the first machine for producing current by mechanical means without permanent magnets, though Siemens presented his paper to the Royal So-

ciety first and both were read before the society the same evening. In either case the product came from the kind of mind and the type of study which I am showing contributes to our knowledge. The contributions of pure research are seldom in response to recognized needs, but the needs themselves are developed or disclosed through the research.

The more recent history of lighting is filled with the studies of engineers and students, and greatest of these is Edison, but even here one cannot help noting the radical or unexpected steps whose foundations are laid in the professor's laboratory. An entirely new type of electric illuminant was disclosed by Professor Nernst by his studies of oxide conduction. Dr. Welsbach, in rare oxide investigations, not only found the gas mantle, but produced the osmium incandescent lamp as well. Von Bolton, student of Ostwald and highly trained in experiments, worked out tantalum and produced a new lamp, and even the recent tungsten gas lamps depend on the purely scientific researches of the able English professors, Rayleigh and Ramsay, for the argon used in them.

The Invisible End of Observation

Readers of *Popular Mechanics* some time ago selected by vote the seven wonders of the modern world. The highest votes were received by wireless, the telephone, aeroplane, radium, antiseptics, antitoxins, spectrum analysis, and X-rays. How were these originated? All of them were produced by the identical formula. In the first place, they were not the result of a direct attempt to accomplish what was really attained. The end was not visible when the foundations were laid. The real work was done by thoroughly well-trained observers—not by laymen. They were professors in every case. They followed up a lead opened by an observation which was too insignificant to attract the attention of less trained men.

It would be impracticable to give the histories of these so-called wonders. Anyone who reads may learn how Professor Helmholtz, an expert German investigator, was the instigator of the work of Hertz, which in turn was based on the principle of Maxwell that variation in elective displacement is electric current. This, Maxwell had derived from work on Faraday's researches. And thus, in the foundations of the single wonder of wireless, we find the co-operating efforts of at least four experimenting professors of science. They were all working for the public and supported by a university or public institution.

Radium and X-rays are of so recent disclosure that it is hardly necessary to recall that the work was done by English, German, and French professors.

Another interesting international grouping of the typical kind of thoroughly high grade workers in science, all professors, is found in the experiments on antiseptics. Professor Lister, of England, is usually considered the leader in this line, but he thanked Pasteur for giving him "the only principle which could have conducted the antiseptic system to a successful issue." Koch, in Germany, advanced the line on which Pasteur was at work, and discovered the bacillus of tuberculosis, while Tyndall, another of the men of the Royal Institution, finally laid at rest the related question of spontaneous generation.

Federal Appropriations Should Promote Research

One might well conclude from the history of the British Royal Institution alone that pure research was a good governmental investment if the environment was capable of developing such products as Davy, Faraday, Tyndall, and Rayleigh. Surely we may hope to awaken ourselves to the importance of constructive action for the advancement of science. If we count only on on such private bequests as have already helped so much in studies of disease, we are evidently not awake. Federal appropriations to assist American colleges in research seem a fair way to discover and produce good men and to economically supply them with apparatus and atmosphere.



DR. E. F. ROEBER

"It is not yet sufficiently appreciated how intimately the products of the electrochemical industries enter into the daily life of everyone. . . The electrochemical industries are absolutely needed in the industrial life of this country."

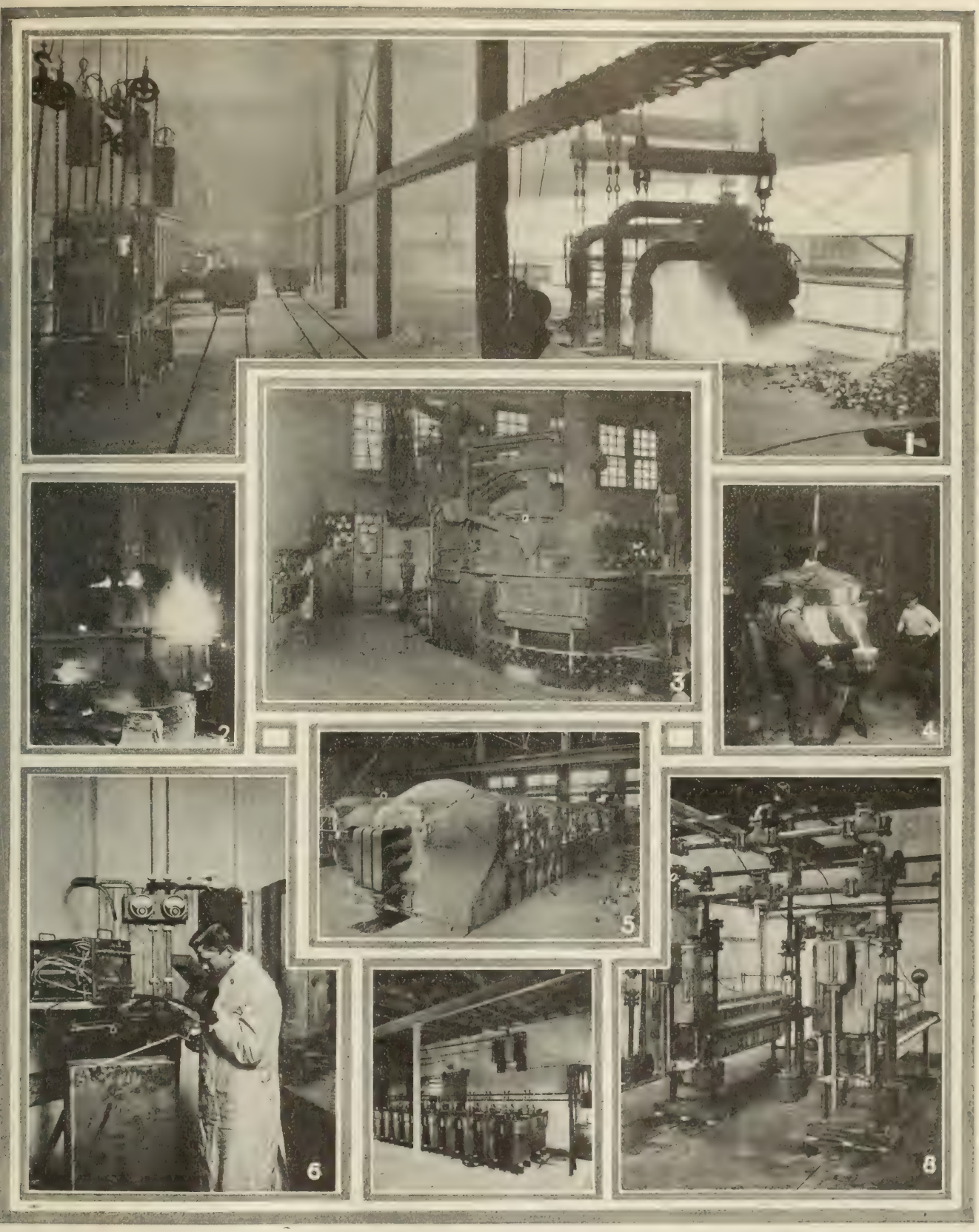
The Future Opportunities for American Electrochemistry

By Dr. E. F. Roeber

Editor *Metallurgical and Chemical Engineering.*

During 1916 the electrochemical industries of the United States have been extraordinarily active and prosperous. But in one respect at least a limit of their development has been reached in so far as all the power at present available at Niagara for electrochemical purposes is now utilized and no further increase of electrochemical plant capacity on the American side of Niagara is possible, unless Congress acts.

Naturally the prosperity which the electrochemical industries of this country have enjoyed has been part of the general industrial activity and has been closely related to the international trade conditions brought about by the European war. The direct effect of the war has been especially manifest in the steel industry. The heavy consumption of alloy steels formerly made largely by the crucible process has greatly favored the rapid progress of the electric steel furnace, the decisive economic advantage being the much larger capacity of the furnace unit over the crucible; if the year 1915 saw a doubling of electric steel furnaces in America, the progress in 1916 has been at the same rate and new electric steel furnaces have been erected all over the country. Again this heavy production of alloy steels has resulted in a greatly increased demand for ferro-alloys, and this has been accentuated by the shutting-off of imports since the start of the war. At the outbreak of the war about one-half of the domestic ferrosilicon consumption was imported, but now practically all ferrosilicon needed for consumption is manufactured here, and a small amount is exported. Three



1.—One of eight 2400-kva. carbide furnaces used by American Cyanamid Company in its Niagara Falls plant, which uses central station energy.

2.—One-ton three-phase Heroult furnace operated from system of Edison Electric Illuminating Company of Lebanon, Pa.

3.—Three-ton three-phase electric furnace operated from system of Detroit Edison Company.

4.—200-kw. single-phase furnace installed at North Tonawanda, N. Y., and operated from system of Cataract Power & Conduit Co.

5.—Electric furnace of Acheson Graphite Company, operated on Niagara Falls energy.

6.—Welding tank with slag-vapor arc at plant of Automatic Weighing Machine Company, Newark, N. J., which is supplied with central station service.

7.—Unit type oxy-hydrogen generators rated at 3.2 cu. ft. of oxygen per hour with 0.85 kw. continuous demand.

8.—Bipolar-type oxy-hydrogen generators forming part of International Oxygen Company installation at Newark, N. J., rated at 140 cu. ft. of oxygen per hour with 36 kw. continuous demand.

Attractive Electrometallurgical and Electrochemical Loads for Central Stations

new manufacturers of ferrosilicon started production during the past year, and to provide part of the needed furnace capacity a calcium carbide plant in Niagara was switched over to ferrosilicon manufacture. Similar activity has been manifest in the manufacture of other ferro-alloys.

Dependent on Electrochemical Industries

But it would be wrong to think that "war orders" were chiefly responsible for the activity of the electrochemical industries. It is not yet sufficiently appreciated how intimately the products of the electrochemical industries enter into the daily life of everyone—artificial abrasives, graphite, bleaching powder for water purification, caustic soda for soap making, calcium carbide for lighting and oxy-acetylene welding, electrolytic copper for electric conductors, aluminum for kitchen utensils, automobiles, and so on infinitely. Only one strikingly specific example may be quoted. At the Chemical Exposition in the Grand Central Palace in New York in September, 1916, the American Electrochemical Society exhibited in its booth an automobile chassis showing by means of placards what a large part electrochemical products played in its manufacture—"Niagara Made Detroit Possible." As Mr. F. J. Tone has pointed out, it is no exaggeration to say that if the automobile manufacturer was now deprived of artificial abrasives (made in the electric furnace) and compelled to go back to the grind stone and at the same time we took away the other products of Niagara power, aluminum, oxy-acetylene welding, and high-speed steel, an automobile factory that now produces 500 cars per day would be reduced to an output of 100 cars per day with the same plant and the same workmen and the cost would be correspondingly increased. In fact, there would be no automobile industry on its present existing lines.

The electrochemical industries are absolutely needed in the industrial life of this country. Concentrated as they have been in the past chiefly at Niagara Falls and having reached there the limit of their development, along what lines may we expect future developments to proceed? We will leave out of consideration electrolytic copper refining, which has developed along independent lines with centralization near New York Harbor, and likewise the problem of fixation of atmospheric nitrogen so important both for the fertilizer industry in peace time and the explosive industry in war time; but as this problem is closely allied with the program of national defense, the best location of plant rests on other considerations than those of ordinary industrial geography. We will restrict our remarks to the question: How may we expect the electrochemical industries which have centered so far in Niagara to expand in future?

Further Expansion

The new steam plant of the Buffalo General Electric Company will provide some relief to a limited extent. Then other water powers in other parts of the country will be utilized as they have been during the past year. Keokuk now has a ferrosilicon and other electrochemical plants. Great Falls, Mont., has now its electrolytic zinc plant, and the new electrolytic zinc plant at the Mammoth smelter in Shasta County will get its current from Northern California water power, while a new caustic soda and chlorine plant on the Bay of San Francisco is supplied with energy from the Great Western Power Company. All these are promising and highly interesting developments. But it must not be overlooked that the abundant water powers of the Pacific Coast cannot compete in most electrochemical products with Niagara Falls in the Eastern market on account of prohibitive freight rates. The Pacific Coast must look for its own markets either in the Pacific Coast States or in export trade West and South.

The question then remains: What chances have the electric central stations all over the country in the future development of electrochemistry? It is evident at once that for large-scale developments, as at Niagara, most central stations have not sufficient continuous power available. Most of the Niagara electrochemical industries could not well be operated intermittently; even in most cases where it would be technically possible it would be unsound economic policy, since very often the investment in electrochemical plant is higher than the investment in the electric power plant so that more interest would be lost in leaving the electrochemical plant idle at times than would be saved by keeping the power plant fully loaded continuously. But granting the strength of this argument, there remains enough that could be undertaken successfully by central stations

Electric Steel Furnace Progress

The progress of the electric steel furnace is perhaps the most instructive example in point. There are now quite a number of central stations supplying current for steel refining or for making steel castings, with results very satisfactory both to the steel maker and the central station. The cost of electric energy is by no means of greatest importance in the cost sheet so that a very low power rate is not necessary. On the other hand, at least in times of normal activity, it could be arranged to operate the electric steel furnace only at hours of light load in the central station, so that it would be possible to fill out the valleys in the load curve and quote a lower power rate. In parentheses it may be remarked with respect to the selection of the furnace type that three-phase and in a few cases two-phase furnaces have been installed almost exclusively for the production of alloy-steel ingots, while in the field of steel castings the high-power single-phase furnace has made considerable progress.

When a fool-proof electric furnace for brass melting becomes available, it should prove likewise a very attractive load for central stations. This is a matter to which central stations in the New England States might profitably pay some attention.

Electrolytic Processes

Among electrolytic processes which have proven valuable loads for central stations we may mention only two. One is the electrolysis of water for the production of oxygen and hydrogen for oxyhydrogen welding and cutting. There are quite a number of such plants now in existence, especially along the Pacific Coast. The second example is the production of hypochlorite solution (bleaching liquor) by electrolysis of brine for laundry uses.

Finally, if the electrochemical plant is located near the central station, the availability of exhaust steam for evaporating purposes is an attractive asset for many purposes.

The Central Station Opportunity

In any case, to what particular field of electrochemistry an electric central station might pay special attention will depend on local conditions. Highly progressive central stations like the Commonwealth Edison Company of Chicago and the Detroit Edison Company, which are going out for an electrochemical load, are proceeding along such logical lines. In locations where there is a steel industry the electric steel furnace is the thing to push, in localities with paper and pulp mills the manufacture of chlorine and caustic soda, and so on.

But after everything is said as to what can be done by the electric central station in creating an electrochemical load, it is evident that the Niagara power problem cannot be solved in that way. Electrochemical industries have already begun to emigrate from this country to Canada and Norway. If this country is to keep unimpaired its electrochemical industries, the only solution is further development of Niagara waterpower, and this requires the courageous action of an enlightened Congress.



EDWARD N. HURLEY

"The manufacturers of electrical supplies should not only work out cost accounting systems for themselves, but should also work out such a system for the retailer. . . The business man who cannot afford to know his costs cannot afford to risk his capital by remaining in business."

The Constructive Movement for Scientific Cost Accounting

By Edward N. Hurley
Chairman Federal Trade Commission

DEVELOPMENTS in the last year have materially strengthened the conviction that sound cost accounting principles are vital to business; and in the coming year the Federal Trade Commission will extend its efforts to impress upon business men of every class the immeasurable importance of facing the facts of cost. It has seen substantial progress in the movement to disseminate information on this subject and a constructive interest which promises to yield satisfactory and lasting results.

The earnest manner in which the question is being approached by many industries throughout the country is a clear indication that business will be on a better plane, a safer one for the banker and investor and the only possible firm basis for a permanent individual organization and the largest measure of reward for labor.

It is the purpose of the commission to make its aim definite and to give constructive aid to organizations of business men on this fundamental question. Arrangements are now being made by the commission with the Institute of Public Accountants to approve a uniform set of rules in conformity with which chartered accountants will henceforth make reports. When the commission takes final action upon this matter it will refer the questions involved to the Federal Reserve Board and if that department of the government should co-operate favorably the outcome will be of far-reaching importance.

Co-operation by Governmental Agencies

It would mean that this country will have two governmental bodies which will be firmly committed to the principle that conservative, illuminating accounting is a necessary protective measure in business. A strong, co-operative attitude on the part of these governmental agencies will not only be of material assistance to the chartered accountants in their work, but it will also be a guide-post for manufacturers by supporting standards for the various industries. This will assure the condition that competitors in a given industry will follow a standard method under which a uniform plan will be followed for the treatment of depreciation, depletion, obsolescence and other items which are so vital to any industry and this will tend to make prices more uniform.

A Great Educational Campaign

What the commission has done, is now doing and hopes to do in the future is to conduct an educational campaign the fruits of which will extend to every industry. Our plan, if we can persuade Congress to grant the necessary appropriation of $100,000 especially for cost accounting purposes, is to divide the country into zones corresponding to the Reserve Bank zones. The subject would then be taken up by representatives of the commission in the different zones in connection with trade associations, trade papers and other groups of business men—retailers, wholesalers and manufacturers.

The work which the commission can do in this direction has really been given a preliminary start by the booklets on cost, of which 350,000 have now been distributed. It is significant of the real interest in this reform that it was not necessary to send these booklets to lists of those whom it was thought would be interested but that they have received this large circulation as the result of individual requests received by the commission. So thoroughly have different sections of the country and different industries been represented in these requests that we are asking Congress to meet the cost of an additional issue of 500,000 of the booklets.

Needs of the Electrical Industry

In every step of this nature the electrical industry has a profound interest. Through its trade associations the industry is taking hold of the problem, recognizing it as a real economic one of great importance. These associations realize that the large motive of the commission is to aid them in creating a strong foundation below the frost line upon which the superstructure of business may rest in safety.

Having a particular personal interest in the electrical business I feel keenly the position of the different elements of this industry upon this question. On account of the rapid growth of the industry and the fact that it leans for support upon many patents it has not in the past paid as much attention as it might have done to details of costs, etc. In later years competition has become more keen, and since provision was not made in the early days for careful attention to the matter of cost accounting it is most important that the various companies should work together now in those respects in which they may legally co-operate.

Manufacturers Should Help Retailers

I think that the manufacturers of electrical supplies should take a personal interest in the retailer and

should not only work out cost accounting systems for themselves, but should also work out such a system for the retailer. Cost accounting in the organization of the manufacturer alone without such a system in the distributer's operations will render the entire movement ineffectual.

The manufacturers should promote joint action by themselves and the retailers. If they look beyond the immediate problems of their own factories they will be able, in co-operation with retail dealers, to protect the industry against the inefficiency which comes from disregard of costs. If the small retailer will be efficient he will be a permanent influence in the electrical industry. But it is necessary for him to swim if he is not to sink and in learning to keep up he will require friendly guidance.

Expense of Cost Accounting

One general criticism of cost accounting systems is that they are too expensive to install and continue. This criticism is heard less frequently in times like the present. Indeed, the very prosperity which leads people to think less of the expense involved in such systems is forcing them for their own protection to study costs with the greatest care. It is therefore an ideal moment for agitating the importance of the subject. The business man who cannot afford to know his costs cannot afford to risk his capital by remaining in business. Under the conditions of the last year business men found that increased volume did not always mean increased profits. They know that every item costs more and that generally they are not making the same percentage of profit that they did two or three years ago but unless they analyze costs they are not able to place their fingers exactly on the reasons why this is so.

Of National Importance

Scientific cost accounting will have so profound an effect upon our commercial operations that it should be regarded as a movement of far-reaching national importance. But in order that it may be in this position the various industries and sections of the various industries will have to do much intensive work in their own fields. If they will follow the recommendations of the Federal Trade Commission they will gain a reward in better business methods which will richly repay all effort. These recommendations, however, mean a radical change in the methods of so many business men that they are likely to be effective throughout the country only after a long educational campaign shall demonstrate their usefulness.

International Conditions

Developments in the international situation indicate that a return to normal conditions in the world at large is nearer. When peace is declared I think that a natural reaction from our tremendous industrial pace will follow for a few months. Since the output of our factories is sold for six months ahead the purchasing power of labor will not be affected much while this condition lasts.

Our present momentum is so strong that in my judgment the reaction will be only temporary and it will be followed by a new period of activity resulting from European reconstruction. Not only the belligerent countries but also other nations, such as those of South America, will buy freely when the tension is relaxed and uncertainty gives way to certainty and confidence. While this activity continues and new conditions of European competition are crystallizing this country will be tested and it should not delay the introduction of progressive movements which will assist it in the world-wide contest for commerce.



DR. A. E. KENNELLY

"What is needed in education for national development in America is trained foremen as well as engineers. . . By opening up fundamental economic laws in simple and logical terms to all who propose to be foremen of industry, a vast amount of misconception, suspicion and intolerance would be swept away."

The Relation of Engineering Education to National Development

By Dr. A. E. Kennelly
Professor of Electrical Engineering, Harvard University

In the primitive stage of national development represented in sparse Colonial settlement and widely-separated farms the functions of engineering are necessarily restricted to improving highways, telegraphs and means of communication. This was the condition of American life in the seventeenth century. Such a condition may be economically stable and capable of being perpetuated indefinitely, but the growth of population, aided by natural emigration to where land can be had for the asking, inevitably leads to the formation of cities and of industrial communities. The need for engineering and for the education of new engineers then rises with leaps and bounds. Whereas on the primitive farm, for example, each family works its own well, in the city the well must give place to waterworks of a very expensive type. It is necessary not only that these works should be erected under the direction of engineers, whose skill and knowledge shall be utilized to save all unnecessary expense in the process, but also that there shall be specialists developed among engineers who shall devote themselves particularly to the study of water and waterworks from physical, mathematical, chemical, structural and economic standpoints. It is to the development of this highly specialized training and knowledge among water-distribution engineers that we may hope for future improvements, developments and economies in the constantly expanding engineering problems of supplying water to large communities.

In the same way, as the density of population increases, the need for large-scale operations increases also in every branch of industry and production. This calls for more expenditure of aggregated capital and for more intelligence, experience and knowledge in directing the work. This, in turn, means more engineers and more engineering training. It also means more specialties and specializing among engineers. In

the days of Moses engineering was a well-recognized calling among the ancient Egyptians; but subdivision or specializing among them seems to have been almost unknown. As a class, they were confined to the priesthood. Any one engineer could take up the work of any other. At the present time there are perhaps fifty branches of engineering, with yet more numerous twigs or minor subdivisions, so that while the fundamental training of all is the same the special occupations and experiences vary so greatly that those in one branch know but little of the doings of other branches, and they cannot immediately take up each other's tasks.

It is therefore reasonable to expect that as time goes on there will be more density of population, more intensive construction and production and more engineering and education of engineers. The danger of overproduction of young engineering graduates by the colleges is at present insignificant. There is always more demand for good men than there is supply. The excess of the needs for young men who have received a college engineering training in the ranks of the profession is eagerly absorbed in manufacturing industries. This does not mean that there are large emoluments awaiting all young engineering graduates any more than in the other professions and walks of life. Education can develop, but it can no more create ability in the professions than in the arts, and only those should enter a profession who have some natural ability in the kind of occupation it offers. It should mean, however, that there is opportunity for energy and ability in a number of branches of engineering and particularly for those who have had a good special preparatory education.

What is needed, however, in education for national development in America at the present time is trained foremen as well as engineers. For one trained and experienced engineer we need perhaps twenty trained and experienced foremen to execute and conduct the work which the engineers are able to plan and direct. It is not enough to have the trained officers for the army of industry. There must also be enough trained non-commissioned officers and trained men in increasing ratio. Moreover, the opportunity must always be open for trained men to develop into foremen, and for trained foremen to develop into engineers. At present we have more than a hundred engineering schools in America engaged in training engineers. We have relatively only a few engaged in training foremen. It is as unreasonable to expect that foremen can be adequately trained in the field or factory alone as that engineers can be adequately trained in the field or factory alone. Such field or factory training is indeed indispensable and constitutes experience. But experience alone, without study and mental training, can only produce adequately competent engineers or foremen in the relatively few cases of natural gifts and natural energy sufficient to impel private study and individual mental hard work.

What is needed then is a greatly expanded system of vocational schooling for young men and women in which to study the elementary principles of their vocations before taking these up entirely as experience and economic support. The expense of this vocational training can be largely recouped by the industrial results of the system, with its output of foremen and specially trained workers.

What is also needed in the vocation schools is a teaching not only of the elementary scientific principles of machinery and production, but also of the elementary economic principles underlying the same. It is almost self-evident that the fundamental laws of economics regarding production and distribution are as simple and as rigorous as those of mechanics or of electricity. To a large proportion of the industrial world these fundamental economic laws are a sealed book. By opening up these laws in simple and logical terms to all who propose to be foremen of industry, a vast amount of misconception, suspicion and intolerance would be swept away. Economic fallacies breed apace and may create more human misery than earthquakes.



PRESTON S. MILLAR

"Scientifically, artistically and commercially there is reason to believe that artificial lighting is at the beginning of an important period of development."

The Outlook in Illumination at an Important Period of Development

By Preston S. Millar
General Manager Electrical Testing Laboratories

ONE HUNDRED years ago artificial light cost per unit about twenty times as much as at present. Furthermore, it was practically impossible to secure adequate illumination indoors because of the excess of smoke and fumes which would be produced by tallow dips and whale oil lamps which were generally used in all but luxurious practice in this country.

Modern illuminants of higher efficiency supplied with cheaper energy or fuel make available in all but the humbler rural buildings ample light without deleterious vitiation of the atmosphere or other objectionable effects. Progress, especially during the last few decades, has been so great that one may be tempted to believe that most of the improvement to be obtained through artificial lighting has been achieved and that developments of the near future are apt to be less marked.

Likewise when one contemplates man's nocturnal activities, whether they be industrial or recreational, he may be inclined to think that further extensions will be of modest limit because so much of the possible ground has been covered.

What are the possibilities?

Light Sources

It is difficult to believe that the production of artificial light will not advance in efficiency materially beyond the present low attainment. At the same time, as far as general information is concerned, no radical advance is in sight. It is possible that when the next radical step in improvement of light efficiency is made, the result may be of a character which does not render the new light source practicable for ordinary use. The public has become accustomed to a degree of simplicity and convenience in the use of light sources which can-



1.—A Seattle (Wash.) office building flood-lighted from curb standards.

2.—Salt Lake City's new ornamental street lighting.

3.—New York's ever-glittering Great White Way of Broadway signs.

4.—Liberty, permanently flood-lighted.

5.—"Daylight" lamps used in office illumination.

6.—Niagara bathed in tungsten sunshine of its own making.

7.—Spectacular lighting effects in a Los Angeles restaurant, secured by mixture of indirect lighting of primary hues.

8.—In home interiors the tendency is toward table portables and shaded bracket lamps.

A Year of Lighting Achievement Traced in Pictures

not be thoughtlessly sacrificed for a gain in efficiency of light production. Also, there are fairly definite ideals, and indeed fairly definite requirements as to color of light. To be effective, advance in efficiency of light production must satisfy these other requirements to be capable of general adoption.

Coming to the subject of lamps and their probable development in the very near future, one may anticipate further progress in the substitution of the gas-filled lamps for the vacuum-tungsten lamp; the continuance of the replacement of the older carbon arc lamps by gas-filled incandescent lamps; and the extension of the gas-filled type into smaller sizes.

The need for light of a variety of colors and the awakening of illuminating engineers to the possibilities of the use of colored light are bringing a demand for colored bulb incandescent lamps which may some day result in transferring such modified lamps from the special into the regular classes in spite of the reluctance of all concerned to see increase in the variety of lamps to be manufactured and stocked. The tendency to extend the gas-filled lamps into smaller sizes and the manufacture of concentrated filament vacuum lamps (the latter an objectionable development which seems to have run its course) has brought brightness violations which are objectionable and damaging.

It is probable that the requirements thus imposed for reduction in brightness will lead to the development of diffusing glass bulbs, at least before there is launched a gas-filled lamp smaller in size than the present 75-watt lamp.

Incandescent Lamp Patents

The arrangement under which the General Electric Company is licensing existing "independent" small lamp manufacturers, permits them to use the incandescent lamp patents of the General Electric Company. This may increase the advantage which accrues from the general control of the lamp manufacturing situation by one responsible organization. As time passes this advantage is becoming more patent and should continue to bring real advantage to the lighting industry so long as the present disposition to promote the best interests of lighting continues to characterize the policy of the lamp manufacturers.

If there is any impending development in the arc-lamp field it is not a matter of general knowledge at the present time.

Lighting Accessories

Lighting fixtures are divided (not without exception) into two general classes, respectively metal and glass—candelabra and bowls. The fundamental reason for this division is of course traceable to the commercial consideration that the glass manufacturers feature fixtures in which glass is used largely, and the other manufacturers do not. It has been stated to the writer by one who has made a recent examination of the latest products of these kinds that the tendency in the candelabra type of fixture design is toward the use of a multiplicity of small lamps affording protection to the eyes only in that the lamp bulbs are frosted or coated, though occasionally candle shades are attached; and that the tendency in the case of illuminating glassware is toward light direction with more or less complete inclosure of the light source, the directional effect being obtained by the utilization of prisms or enamel or a variety of densities of glass.

Replacement of Antiquated Fixtures

The replacement of antiquated fixtures, which are generally uncouth and which afford little or no protection against glare, by some of the great variety of modern fixtures which are more or less satisfactory in these particulars, proceeds but slowly. It is this problem which constitutes the principal impediment at the present time to the general improvement of lighting throughout the country. The machinery for effecting the replacement in residences particularly, and in some other classes of installations, has not yet been provided.

Here is a duty and an opportunity of which some organization or organizations connected with the lighting industry may avail themselves. Who will obtain the credit for this achievement?

Illuminating Engineering

Colored light has been but little employed in practice. Generally speaking, light has been used in the hues in which it is produced. Where color has been employed, it has been restricted principally to special use, as in theatrical lighting and for festivities and celebrations of a special nature. The wonderful opportunities offered for the artistic employment of colored light to achieve effects which are in themselves capable of application to permanent lighting have not been recognized.

Even in commercial lines where every incentive is present to employ colored light with a view to direct economic advantage, it is not the practice to select light of the color best adapted to the purpose in hand. In considering these simple relations one finds ample opportunity for speculation as to probable developments in the use of colored light without taking into account the relatively unexplored aspects of colored light, for which we must look to the physiologist, the psychologist and the artist for further elucidation.

Flexibility of Electric Lighting

There seems reason to believe that in certain classes of installations, alternate lighting equipments offer opportunities for utility and decoration. Electric lighting is so flexible that the public need not be limited to light of one particular quality. Adjustable or exchangeable or alternate lighting systems may be provided. When once it is appreciated that lighting in its several qualities may be adapted to the occasion, a considerable extension in the flexibility of illumination may be anticipated.

The lighted ornament offers a possibility for an extension of artificial lighting which may receive more attention in the near future.

Flood-Lighting

The gas-filled tungsten lamp with high power and small area light source has been successfully applied in flood lighting in special cases. Here and there a notable building has been illuminated externally at night, or an exposition has been lighted (it may be noted that the Panama-Pacific International Exposition lighting was principally by arc lamps rather than by incandescent lamps as just indicated). The lighting of the Statue of Liberty in New York Harbor and of such buildings as the tower of City Hall, Philadelphia, suggests that in the very near future historical spots throughout the country may be illuminated attractively at night.

Also notable bits of architecture, such as the City Hall, New York, in its setting of modern office buildings, may be revealed at night through the medium of flood lighting. How much farther will this new kind of exterior illumination be carried? May it not be the experience of the near future that flood lighting may be carried much farther than in the mere lighting of occasional notable buildings? May we not anticipate the

lighting of whole streets of notable buildings, thus forming a glorified street lighting system?

Outdoor Recreation Lighting

Outdoor recreation at night is encouraged by the extension of artificial lighting. Already, tennis courts, baseball diamonds, football gridirons, athletic tracks and portions of golf links have been illuminated successfully at night. It would appear reasonable to look forward to extensions of illumination for recreational activities which will make it more generally possible for the public to find suitable opportunity for night recreation of a wholesome sort. With lower rates for power and higher efficiency illuminants now available, we need only an awakening on the part of the public to the low cost at which it is possible to secure the full advantages of artificial light to bring about developments in lighting which will have something of the same advantage which artificial irrigation possesses over natural irrigation; namely, an ample supply wherever, when ever and how ever required for any purpose. Lighting enthusiasts believe that a start in this direction has been made. Must we feel that they are wrong, or may we too anticipate rapid growth in this direction for the very near future?

The Illuminating Engineering Society

Probably the strongest single factor operating to improve illuminating conditions is the Illuminating Engineering Society. For ten years it has accumulated knowledge of lighting principles, serving as a forum for the discussion of both principles and practice, and disseminating the information developed through its activities. It is understood that the society is now engaged in organizing a movement designed to afford a trial of the value of good lighting. If success attends its efforts within the next year or two, there may be some definite measure of the practical advantages to be attained through the adoption of really good illumination.

If the facts indicate that industry and economy are promoted, and that commerce is accelerated, we may hope that the appeal of such results will bring about a large improvement in lighting generally through the sheer economic advantage to be obtained. This accomplished, the improvement of lighting where the commercial advantage is lacking may follow from the good example.

Photometry

Some of the most important problems in photometry appear to be in a fair way of settlement. The integrating sphere has emerged as the most practical and desirable form of photometer for measuring the light output of illuminants. The scheme of heterochromatic photometry developed by Ives and adopted by the Bureau of Standards seems likely to solve most of the problems of color photometry. The requirement for a simple, inexpensive device for rough measurement of illumination is understood to be in process of satisfaction.

Conclusion

Developments in the lighting field proceeded rapidly during the past year. Scientifically, artistically and commercially there is reason to believe that artificial lighting is at the beginning of an important period of development.

In the past the large benefits of improvement in artificial lighting have grown out of advances in light production. Are we not justified in believing that large benefits in the near future will be derived from improvements in the utilization of light?



PROF. W. F. DURAND

"Both capital and labor seek the highest market and no scheme which attempts to provide power or any other product at less than its fair cost can hope to represent a permanent factor in our economic development."

Progress and Outlook in Prime Movers

By W. F. Durand

Professor of Mechanical Engineering, Leland Stanford University, California

THE situation as regards coal and oil fuel for steam power production remains much the same as in recent years, but with a pronounced tendency toward higher prices for oil manifest throughout the year. This has caused serious apprehension on the part of those primarily dependent on oil fuel, regarding the future of the next five or ten years. Boiler plant designs, with special reference to stack proportions and general arrangements have been planned with careful reference to a possible or even probable change to coal fuel within the life of the plant. These are primarily questions of economics and not of engineering difficulties. Either type of fuel can be efficiently handled and the question of use will, in the years to come, be determined solely on the basis of economic advantage.

Utilization of Low Grade Coal

In the meantime the search continues for ways and means of effectively utilizing low grade coal fuels. During the last year pulverized coal has attracted increasing attention as a fuel not only for industrial purposes such as heating billet furnaces, etc., but for power purposes as well. For the most part these studies have been directed toward its utilization as a locomotive fuel, but in a few cases central power stations have been fitted to burn this fuel. One of the largest and most successful of these is at the railroad shops of the Missouri, Kansas & Texas Railroad at Parsons, Kan.

Low grade bituminous and lignite coals are used carrying as high as 20 per cent ash and 30 per cent moisture. For effective burning in pulverized form the coal must be finely ground and dried. The equipment in general thus consists of means for (1) drying, (2) pulverizing, (3) blowing the fuel in the form of dust into the furnace, and (4) special furnace design to protect the tubes and sheets from the high temperatures developed.

The drying should leave the coal with residual moisture not exceeding 0.5 per cent.

To obtain the best results in the furnace the coal should be ground to a degree of fineness which will insure the passage of 95 per cent through a 100 mesh screen and 85 per cent through a 200 mesh screen.

With coal thus prepared and with heating value 11,580 B.t.u., tests have shown an equivalent evaporation of 8.38 lb. per pound of coal fired and of 10.9 lb. per pound of combustible. With Texas lignite with a heating value of 11,250 the results showed 7.26 lb. per pound of coal fired and 8.81 lb. per pound of combustible. The cost of coal dust thus prepared was about $1.795 per ton and of evaporating 1000 lb. of water, on the basis of the first of the tests above noted, was 11.6 cents. These results are significant in high degree and the possibilities of such low grade fuel should receive increasing attention on the part of power plant engineers.

Smoke Abatement

Smoke abatement continues to receive attention, especially in large cities. A recent report of the Massachusetts Gas & Electric Light Commission, referring to a certain part of the city of Boston shows for the year 1915, violations of the smoke laws for only 1.5 per cent of the observations on power plant chimneys, as compared with 15.5 per cent for 1911. Electrical precipitation of the solid constituents of furnace gases by the Cottrell method is also beginning to attract increased attention. This method has been long and favorably known in connection with smelter fumes, cement dust, etc., and its possibilities with reference to ordinary chimney smoke have been recognized. Practical difficulties lie in the way of its widespread use, but the discussion of these difficulties is in progress and we may look for this method to play an increasing part in the problem of smoke abatement in the future.

The size of boiler units is ever on the increase. Units of 10,000 to 15,000 sq. ft. heating surface are now by no means uncommon. The station of the Detroit Edison Company has four boilers of 23,654 sq. ft. each and recently the Ford plant has installed four six drum single units of 25,000 sq. ft. heating surface each. These are, to date, the largest boiler units installed in the country.

Superdreadnaught Turbines

With prime movers themselves, the most impressive features have been those relating to units of superdreadnaught size.

Thus turbines of 60,000 kw. capacity have reached the status of design and order. These units, for which bids have been submitted to the Interborough Rapid Transit Company, are to consist of three elements of 20,000 kw. each, arranged side by side, the center acting as high pressure and the two side elements in parallel as low-pressure elements. Again the Detroit Edison Company has on order a 45,000 kw. unit comprising a single turbine attached to a single generator while units of equal capacity are on order for the Narragansett Electric Light Company of Providence and for the Commonwealth Edison Company of Chicago. In the second case the unit is cross compound with two generators, while in the third case it is compound with single generator and both elements on the same shaft.

The steam pressure for these huge units are also rising. Thus for the 60,000-kw. unit two conditions were considered, 275 lb. pressure and 270 deg. Fahr. superheat or 600 lb. pressure and enough superheat to give the same temperature, while the Chicago 45,000-kw. unit is reported to be designed for 230 lb. pressure and 200 deg. Fahr. superheat. The size of the condensers for these units has been growing at equal pace. Thus the Chicago unit is to have a surface condenser with 50,000 sq. ft. of surface, and the Narragansett unit a Le Blanc jet condenser and air pump capable of handling 18,000,000 lb. of water per hour.

The test results of the 30,000-kw. units in the Seventy-fourth Street station of the Interborough Rapid Transit Company have naturally attracted the keenest attention. The most economical load was found to be about 26,760 kw. and the water rate at that load 11.25 lb. per kilowatt-hour with a thermal efficiency of 24.81 per cent for the unit. The record for high economy during the year as reported seems to go to a 20,000-kw. unit in Buffalo using steam at 275 lb. pressure and 275 deg. Fahr. superheat, which on test gave a water rate of 10.2 lb.

An interesting long period economy test reported during the year was carried out at the Conners Creek Station of the Detroit Edison Company. Six months records closing November, 1915, showed an average consumption of 1.45 lb. coal per kilowatt-hour. The average calorific value of the coal was 13,606 B.t.u. per pound and the monthly load factor 66 per cent. Four boilers were employed of 23,654 sq. ft. heating surface each, generating steam at 225 lb. pressure and 200 deg. Fahr. superheat.

The dividing line between the turbine and the reciprocating engine is now too clearly drawn to merit discussion or extended notice. In large units and for large plants the turbine stands unrivaled. For small units and in small plants the reciprocating steam engine is still holding its own. In fact the chief rival of the engine for small units is not the turbine but the internal combustion engine of the Diesel or so-called semi-Diesel type. A significant feature in connection with reciprocating steam engines seems to be the general growth in appreciation of the uniflow type, especially where economy with simplicity is of importance.

Gas and Steam Engine Units

An interesting combination of gas and steam engine units is now being worked out at the power plant of the Ford Motor Company. Horizontal gas-steam engines rated at 6000 hp. generate direct current at 250 volts. The ultimate capacity of the plant is to be 54,500 hp. The jacket water of the gas engines is used as feed water for the boilers. The exhaust gases superheat the steam in the receiver between high pressure and low-pressure cylinders and then pass through the jacket of the high-pressure steam cylinder, then through feed water heaters and are then discharged through nozzles into the boiler room stacks where they serve to augment the draft. The results of this combination of steam and internal combustion units will be watched with the keenest interest by power plant engineers.

The Diesel and semi-Diesel types of internal combustion prime movers continue to make progress on the field of small and medium size plants. An interesting series of tests showing results of operation in Texas for eight small stations aggregating 5545 hp. and ranging from units of 170 hp. to 500 hp. gave economic results ranging from 11,492 to 17,154 B.t.u. per kilowatt-hour or thermal efficiencies of 18 per cent to 29.7 per cent on load factors ranging from 35.6 per cent to 64.2 per cent. The sizes of engines of this type are also increasing. Engines of 300 to 600 hp. are very common and a six cylinder unit of 1000 hp. is reported.

Regarding four cycle versus two cycle, the balance of advantage, giving due weight to economy, seems to lie with the former, but the advantages in the way of simplicity which the latter can claim may be counted on to bring some solution to the difficulties which lie in the way of its wider use.

As an illustration of the diversified uses to which the Diesel engine is now being put, the erecting floor of one of the leading builders recently showed units for driving

a direct-current generator, an alternating-current generator, a ventilating fan, an oil pipe line pump and a flour mill through a rope drive. The units ranged in size from 300 to 1000 hp.

Cheap Hydroelectric Power for Chemical Industries

The possibilities of cheap hydroelectric power with reference to the building up of great chemical industries and with special reference to the fixation of nitrogen have been attracting increasing attention and interest. The key to the situation seems to be cheap power, power which can be sold on a high load factor at figures approximating $10 per horsepower year. It will be well to realize what this means as applied to water power development in the United States. In the first place it may be observed that hydroelectric power may be and not infrequently is sold at less than cost—that is, less than cost on any proper basis of accounting. Thus if a consumer will agree to take all of his power between the hours of midnight and 6 o'clock a. m., the power producer may consider that the additional cost of producing this consumer's power between these hours is little or nothing and he may therefore make him a price which is really below cost. In connection with such cases two things should be remembered:

1. Hydroelectric power always means water, and unless there is water in excess, the value of the water used expressed in terms of the average sale value of electricity must be charged against the power developed.

2. The additional cost in terms of labor and supervision for only one consumer may presumably be negligible, but as a mode of accounting the sale of such power at an unduly low rate involves a fallacy. This is readily apparent if extended to the entire output, for example, between midnight and 6 a. m. Whatever is turned out between these hours should share equally in carrying the cost of production, and no one kilowatt or collection of kilowatts should be selected out and sold at less than a proper cost simply because it does not seem to entail additional expense as compared with the balance of the output.

Taking now a price of $10 per horsepower year we have $13.40 as the equivalent per kilowatt year. Money will cost a private corporation, at least on the Pacific Coast, not far from 6 per cent. In order to pay bond interest on the part of an undertaking financed by bond sales and dividends on the part financed by stock sales a return of at least 8 per cent on the investment will be required. Taxes and depreciation will add about 4 per cent more, carrying the fixed charges to say 12 per cent. For a company wholesaling electricity the operating expenses are likely to be in the neighborhood of one quarter the fixed charges, or say 3 per cent. The gross income must be therefore not far from 15 per cent on the investment. Hence with a gross income of $13.40 per kilowatt-year the investment must not exceed $89.33 or say $90 per kilowatt-year sold, up to the point of sale to the consumer.

Now in point of fact there are very few locations where the investment per kilowatt-year sold can be reduced to anything like this figure. Even where peculiarly favorable location might permit a development for some such figure per kilowatt capacity, there is often a long step between the kilowatt sold and the kilowatt capacity.

One of the most favorable, possibly the most favorable of the locations in the United States for such power development on a large scale and at low investment costs is at The Dalles, Oregon, on the Columbia River. Here, for approximately such an investment, some 375,000 kw. may be developed. However, a large part of the investment must be put in, even for the first beginnings of power delivery, and the development cannot be economically justified unless a full load can be assured within a very short period after completion and initial operation of the plant.

Investment Costs Too High

These considerations point the way to some of the more significant problems in connection with the development of very cheap hydroelectric power. Broadly speaking, the investment costs are too high in most developments to permit of sale at the figure required for the fixation of nitrogen and for certain other chemical and metallurgical processes calling for electric power at very low rates. Even in those where the development might be carried out within such limit, full load will be required almost from the start if the business of power production is to rest on a sound economic basis. Time will doubtless bring some adjustment which will permit of the utilization of some of these magnificent power projects, but in the meantime we cannot forget that both capital and labor seek the highest market and that no scheme which attempts to provide power or any other product at less than its fair cost can hope to represent a permanent factor in our economic development.



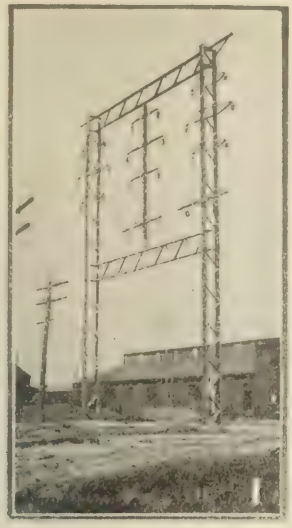
DR. LOUIS BELL

"Attention will be centered more and more upon working out mass operations, a campaign of the organized armies of industrial science."

Water Power Development and the Future of Power Transmission

By Dr. Louis Bell
Consulting Engineer

IT is easy to summarize the progress of power transmission during the last year, but difficult to reckon on what the immediate future will bring. The work of advancement has been mostly in details, individually without sensational features, but collectively of importance in smoothing out the operation of power transmission plants and networks and increasing that reliability of operation which is all-important in the successful distribution of power. If one follows the developments as recorded in the pages of this journal for the last year he will find many items of interest dealing with just these minor but none the less important matters. To characterize the situation briefly, power transmission has spent the last twelve months in consolidat-





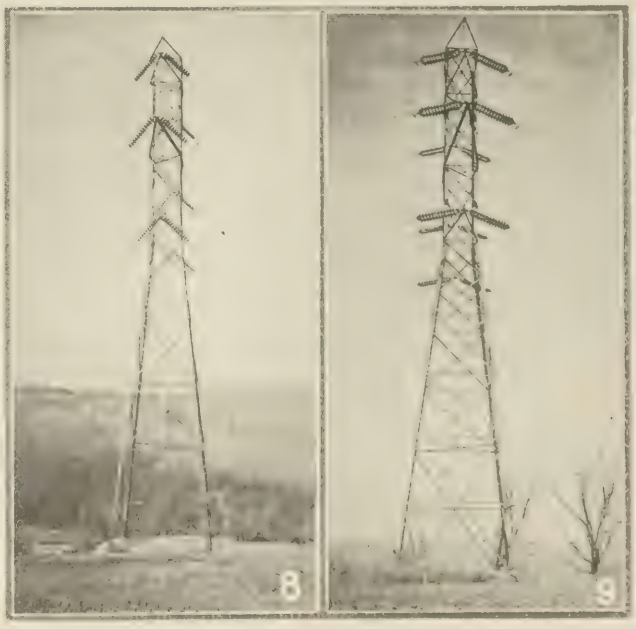












1.—Special structure recently constructed from transformer house of Niagara Falls Power Company and carrying six 50,000 circ. mil circuits, replacing wooden pole line.

2.—First steel-tower transmission line in State of Connecticut and fourth that was built in New England. Part of main line of Connecticut Power Line into Hartford.

3.—A frame line of Iowa Railway & Light Company west of Cedar Rapids which operates at 66,000 volts.

4.—1916 line of Duquesne Light Company carrying two three-phase, 66,000-volt, 250,000 circ mil copper cables out of Brunots Island steam station.

5.—Small individual consumer substation on 33,000-volt wood pole line of Dayton (Ohio) Power & Light Company.

6.—A typical transmission line of the Pacific Coast.

7.—Recently constructed 22,000-volt line of Cleveland Electric Illuminating Company, running to Bedford, Ohio, showing 69-ft. structure in foreground.

8 and 9.—Two methods employed to attach cables at strain towers of Windsor (W. Va.) and Canton (Ohio) line of the American Gas & Electric Company from steam plant at Windsor.

Transmission Lines Typical of Present Day Construction

ing the positions just taken rather than in making new and sweeping assaults.

Legislation for Water-Power Development

The greatest thing for consideration in the near future is the further development of water powers. Every time that a proposition is made for the utilization of hydraulic privileges in the national domain an immediate howl is raised about the water-power trust, monopolies designed to rob the public of its birthright, and all that sort of thing.

In point of fact there is no such thing as a water-power trust and, if we get sane regulation, there is not likely to be. It is not surprising that investors who have had experience in power transmission should be looking for further opportunities, but the movement is as spontaneous as that which has impelled investors to buy copper or steel or oil stocks in the belief that experience has shown their possession to be profitable. Meanwhile what happens? The hydraulic rights are tied up so that the public cannot use them and many millions of dollars worth of available power runs to waste annually without being put to service in cheapening production and generally meeting public needs for light and power. It is earnestly to be hoped that during the next year we will get reasonable legislation for helping instead of hindering the growth of power transmission systems.

Union of Transmission Systems

So much for the physical basis of the art, and next comes a question closely allied to it, the union of transmission systems into networks capable of covering the country with a reliable supply of transmitted power. Here again one meets with prejudice which works to public disadvantage. It is perfectly true that now and then there have been unwise mergers of isolated properties with no excuse for being save the desire to trade in securities watered as thoroughly as seemed to be safe.

On the other hand, the majority of increases in common ownership have been with the direct intent of uniting systems to form a coherent whole, which can be operated more efficiently and more economically than before, and therefore may serve both public and owners to better advantage. Every addition of a power station to a growing network means greater security against interruption of service and more efficient utilization of the conducting system installed. With copper around 40 cents a pound this is no mean advantage. Public service corporations in these days expect regulation on the part of the governing authorities and make little objection to this policy of safeguarding the rights of the public provided it is followed openly and fairly and with due regard for the chances taken by the investors in the business. Equitable and reasonable regulation of these properties is one of the things to be hoped for in the near future.

Advance Toward Higher Voltages

As regards the technical parts of the art the obvious line of advance is toward the more general use and standardization of higher voltages. At the present time the systems of the country represent the successive periods of growth in the development of the art, involving many voltages that should be characterized as intermediate between those of the timid past and those of the conservative present and future. With the advent of suspension insulators the limitations of earlier days have for the most part disappeared, and the question now raised is not what voltage is strictly conservative, but what is required by the conditions of economy.

With copper at its present price the tendency must steadily be upward, and there is no longer reason for the existence of the modest pressures in common use a decade ago. For real transmission networks a pressure of 50,000 to 100,000 volts is reasonable and conservative, assuming a fair amount of power to be transmitted, as is quite universally the case, while in a widespread supply still higher figures are easily attainable when necessary. The inevitable tendency, therefore, will be toward high transmission voltages without a passage through intermediate stages to those voltages from which direct transformation for consumers' use is readily available.

Simplification in Construction and Operation

Again, there is a great and wholesome tendency toward simplification in construction and operation. The rapidly increasing use of outdoor substations, for example, means lessened cost of supply from widely ramifying lines. And the operation of these substations is gradually becoming more and more thoroughly automatic, so that labor can be utilized chiefly for inspection and controlling rather than for idly watching the operation of transformers and switches. The switching problem itself is in the way of development.

The earlier high-tension switching appliances were, and many still are, expensive to install, bulky and costing not a little in care. That day is going by, and there is promise of appliances for indoor and outdoor use, operated either automatically or manually, to take care of modern voltages without demanding much in the way of inspection or attention. Part of the gain, too, is coming in a greater simplification of the whole operative system.

When a pair of stations are linked together in a common system of supply it is not necessary that each should be elaborately equipped for individual reserves, since each plant serves as the reserve for the other. More and more it is likely to be the habit to regard a generator and its high-tension transformer as the operative unit, and to link these units together with sufficient electro-dynamic cushioning to secure their safe operation. This is the lesson learned from the beautiful flexibility of plants connected through long lines which in themselves safeguard operation.

Mass Operation

The time is coming rapidly when networks will be regulated as such, as a whole, and not merely in parts. The use of synchronous apparatus, loaded if convenient, or unloaded if necessary, for regulating purposes has long proved its value and if wisely applied at a few points is capable of giving wonderful steadiness in the performance of systems covering hundreds or even thousands of square miles. The skillful systems of load dispatching already applied in not a few instances are an example of this tendency to look at the big things instead of at the little things. A great deal has been done of late in the perfection of details, of circuit breakers, and lightning arresters, meters and instruments, but all these things should be regarded as means to an end, and that end is the coherent and systematic operation of great distribution systems capable of bringing cheap and reliable power to every consumer within reach, whether on the basis of wholesale or retail service.

In these days the difficulties of simple straightaway transmission are almost negligible, granted sound construction methods and reasonable care. Attention will therefore be centered more and more upon working out mass operations, a campaign of the organized armies of industrial science.



B. A. BEHREND

"As at present, all over the world, conditions are undergoing a radical and complete change, so, in the field of engineering, there is taking place a turn in the tide."

The Signs of the Times in Generating Apparatus

BY B. A. BEHREND
Consulting Engineer

THE tremendous activity of the year 1916 has not been conducive to new developments. Such new developments as take place from time to time require considerable experimental work which cannot be conducted with success in times in which the workshops of the country are filled and crowded to their utmost capacity.

As a result of this state of affairs the most noteworthy work achieved has been along lines which the present writer predicted ten years ago in a paper in *Cassier's Magazine*, in the following words. "We no longer talk without substantial foundation when we consider the building of units of 15,000 hp., or even of 25,000 hp. Such units will be built in the near future, and they will be more substantial and economical than the smaller units. With the growth of the cities the power station of the immediate future will contain as many 20,000 kw. units as the power station of to-day contains units of 5,000 kw." It is with a certain measure of amusement and gratification that the writer recalls the sarcastic remarks made at the time his article appeared. There have since been designed generators and steam turbines even in excess of the sizes stated and these units have been successful in all respects.

LARGE UNITS ESSENTIAL

We may then say, with a considerable measure of truth, that the past year will be remembered as the year in which units of large capacity were realized as essential and important equipment in the power stations of our large cities. The development of these units required certain essential changes in the point of view of the performance of such units. Whereas in the past a great deal of weight was placed on such characteristics as the regulation, the requirements of large units are such that, even if such close regulation were desirable, units could not well be designed without disregard of this particular feature. And it has developed that such disregard has not been at all disadvantageous in the operation of the power stations, so that no difficulties have been experienced on this score.

DIFFICULTIES IN MANUFACTURE

The terrific speeds at which such units as these extremely large units are operated require the use of special grades of alloyed steels, which, in times like the present, are hard to obtain on account of the workshops being filled with pressing commercial work in which quality is a matter of less importance. It is this which causes the designers and the builders of these units a great deal of uneasiness, as it is by no means possible to find substitutes for materials the properties of which have been utilized to the utmost limit.

MATERIAL ALTERATIONS NOT FEASIBLE

It is also not feasible commercially to alter radically and materially the structural designs of machinery because of temporary difficulties experienced in obtaining materials or because of temporary excessive prices which have to be paid for materials under the present extraordinary conditions. While the cost of materials which enter into the construction of electrical machinery has doubled in many cases, yet it must be remembered that the price of labor has also greatly increased and that, in times of great prosperity, the quality and efficiency of the labor of the individual workman are usually inferior to that obtained in normal times. Thus it becomes increasingly necessary to make the designs and the construction as fool-proof as possible so as to be able to utilize with safety even inferior workmanship to which one has to resort in these extraordinary times.

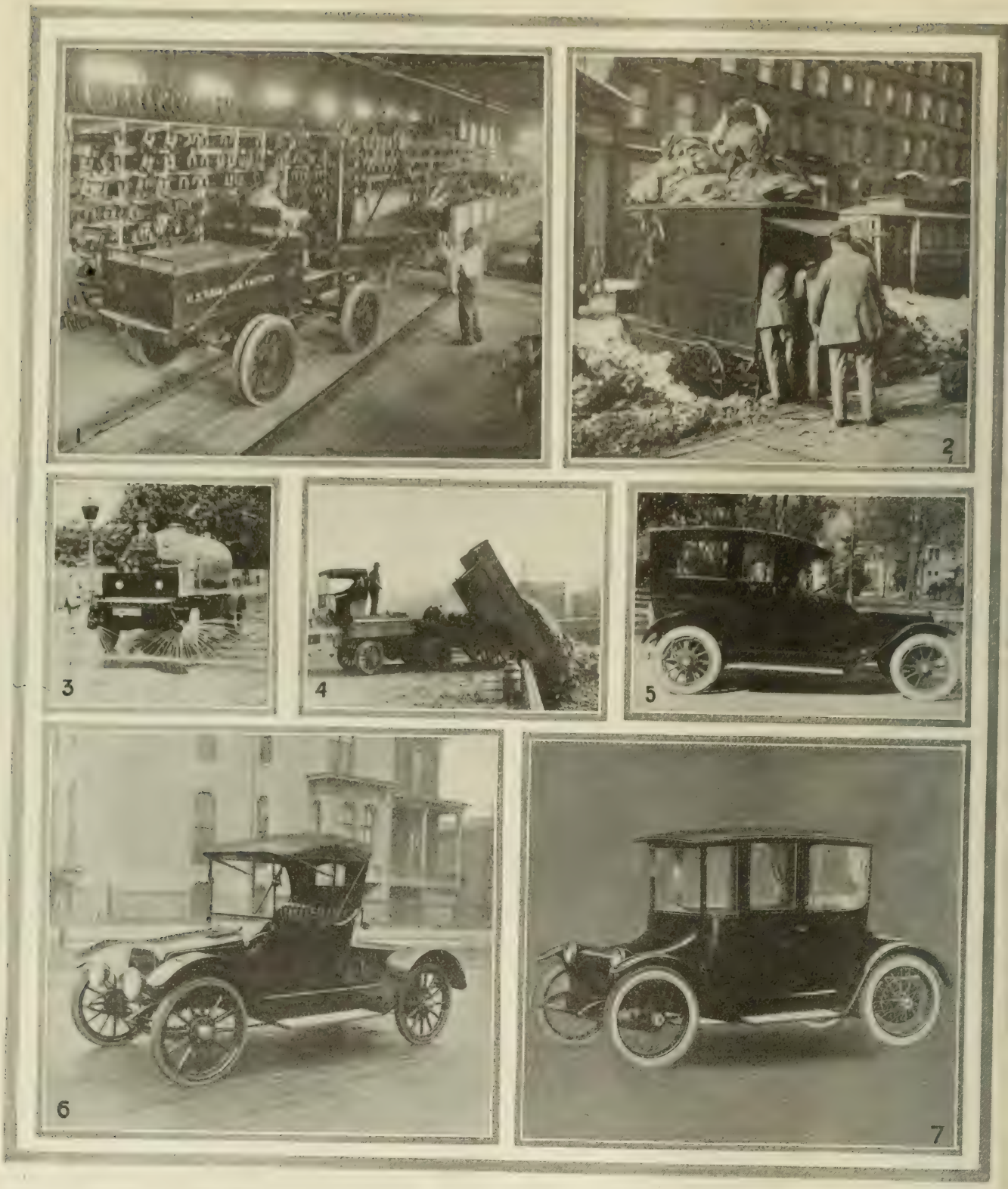
ELECTRIC SHIP PROPULSION

In connection with the adoption of large generating units it is appropriate to refer to the decision reached by the Navy Department of the United States to utilize electric propulsion in the super-dreadnaughts and battle-cruisers which are now being laid down. While in the super-dreadnaughts the speed is moderate and, therefore, the size of the units, generators as well as induction motors, does not exceed conditions with which the designer is familiar, the great speed adopted for battle-cruisers requires units of extraordinary capacity. Here, then, as in the field of stationary engineering, similar tendencies are clearly marked.

CONDITIONS CHANGING RADICALLY

It is, however, in the very nature of things that evolution cannot be perpetually in an upward direction. There must be a time when its course becomes stationary or downward. It is not possible to continue to increase the individual size of a unit beyond a certain limit, and a maximum limit must be reached some time.

It is the writer's opinion that, as at present, all over the world, conditions are undergoing a radical and complete change, so, in the field of engineering, there is taking place a turn in the tide. So far as our own short-sighted vision can picture things, a limited individual size seems to have been reached. It is curious to speculate on the things which lie ahead; in fact, it is a matter of the utmost importance to the engineer to be able to see the future with his mind's eye and to predict the new coming events in his profession. Just so far as he can do this successfully, he is likely to be a pioneer in his own field.



1.—Electric truck equipped with jib crane handling naval guns and pedestal parts in a government gun shop.

2.—Electrics in parcel-post delivery in New York City. Owing to their superior reliability under all weather conditions, these electric wagons are given the longer routes and the heaviest loads. Some are in service twenty-three hours per day, with changes of batteries and drivers.

3.—The electric in municipal service. This American-built electric sprinkling wagon is one of a group purchased by an English city.

4.—Electric trucks used for hauling garbage and for street-cleaning duty. During the night hours, when not required for this refuse-disposal work, the electric tractor here shown can be quickly and easily "unhitched" and used to haul street-cleaning apparatus.

5.—Electric taxicabs, by reason of their easy-riding and silent-running qualities, cleanliness, and dependability of service, have rapidly won popular favor wherever introduced. Several Eastern cities are now following the lead of Detroit in providing fleets of electric limousines at the call of the public.

6.—The electric in the field of the every-day passenger car. A recent battery-driven runabout designed for the use of central-station men.

7.—One of the latest types of the light electric passenger car. An all-year-round vehicle, especially adapted for the service of the professional or business man and excellent for family use.

The Electric, the Universal Car for Government, Business and Family Use



Seeing Ahead for the Electric Vehicle

An Interview with THOMAS A. EDISON

"THE growth of the electric vehicle has been hindered by lack of charging facilities. Selling electric current is a mercantile business just like any other business. Not enough central stations realize this, and very few search out *every* way that current may be marketed. As a result, undeveloped markets exist for the sale of central station energy. It's a funny business when so few central stations realize that there is a waiting market for the sale of current for charging electric cars. The public is in the curious position of wanting to buy something for which there is no place to go.

"In my opinion the central station should go into the garage business and provide in this way the best means of furnishing a place to which the customer can go to buy what he wants, electric current, in the form of mileage.

"If I were in business to sell current I would find every possible way to sell current. If I were a central station manager I would put up a garage and go into the business of selling electricity for driving cars. I would put up or rent a four or five-story building and install a proper elevator. I would charge vehicles at night on banked fires, just as they do in Hartford, Conn., at the present moment. I would have trucks on the first floor and an elevator big enough to handle pleasure cars on the other floors. I would not sell current for charging but for mileage, which is what the customer wants. I would make a service charge per mile that would include the cost of current. A garage charge of this sort could be made to be profitable to both the central station and the business man. Perhaps I would rent out, under a contract with a reliable firm or person, the washing and repairing of the vehicles at fixed and reasonable prices, relieving me of that detail, and confine myself to the selling of current.

"I believe that the central station should go into the garage business because the electric garage needs the intelligent supervision and reliability that the central station can give it. One of the main difficulties in garaging both gas and electric cars is the lack of knowledge of the average garage man. The storage battery to-day doesn't need experts to supervise it but it does need the same intelligent and responsible care that any mechanical or electrical equipment needs. The average garage standards of this country for either gas or electric cars are far too low. The central station, if it went after the business on the basis of building up a profitable income, would raise the standard of garage service and reap the reward for it. When I say that I have known men in an average garage to pour sulphuric acid into our alkaline batteries, and to make outrageous charges to their customers, it is easy to see that we can never expect the electric to come into its own until we have more intelligence and reliability in the places where cars are charged.

"Even the big men don't seem to realize the opportunity for increasing their sales to the public by establishing charging stations, and by making a profit on selling electric mileage to the community. There is an opportunity for big sales of current on a profitable service basis. Business needs imagination. The electrical business is no exception. Sometimes I think the men who ought to see ten years ahead see only next week."

Year's Great Progress Shown by Statistics

New Records Made in Larger Volume of Business in Every Department of Electrical Activity
Electrical World Figures on Income and Kilowatt-Hour Output



T. C. MARTIN

"The year 1916 has shown that, amidst the wildest prosperity, capital cannot be lured into new railroads or water power conservation under the harsh ban of restrictive and hostile legislation."

Enormous Totals of Gross Business in Every Branch of the Industry

By T. C. Martin

THAT our country has had a year of exceptional prosperity in 1916 is already a commonplace. The figures are stupendous, although we do not begin to realize their ultimate and intrinsic significance. We hate to see the Great War go on, and yet hesitate to entertain peace as a respectable person. We rejoice at gold imports of $600,000,000, glory in exports aiming close to the $4,000,000,000 mark; then wince and foam at the inevitable higher cost of living, and start official investigations to prove that we ourselves are all the criminals who did it on consenting to participate in the profits.

In the extraordinary transition period 1914-1916 there have been vast, incredible changes in output, income, values, losses, by which probably relatively few individuals or concerns have benefited on a spectacular scale, but that there has been a general diffusion of wealth and prosperity is incontestable. From being a "debtor" nation we have reached the point where our loans to foreign nations and cities since the war began has reached $2,000,000,000 and still we are ready to entertain reasonable suggestions for the relief of an over-swollen and bloated gold chest, most of whose contents might as well be under the bed or in the buried crock for all the good they are doing in the war-torn world. It is well to pile up. That is selfish. It is sometimes better to let go, which is both human and divine.

The inter-relation of our energies, activities and industries is in these melancholic days of colossal war-strife closer than ever, but the real conditions cannot possibly be envisaged until the war stops, and any attempt to deal with the presumable data of 1916 is beset with difficulties unequaled by those of the very latest type of golf course. This review deals chiefly, if not wholly, with the development of public utility enterprises in America, and with the manufacturing production mostly a corollary thereof; but we are confronted with weird and startling facts both among our fellow member companies in the kindred industry in other parts of the Americas and in Europe, as to the imposition of the heavy hand of control and restriction for reasons of "national safety" and otherwise. We, perhaps, begin to realize that in the next kingdoms to come of the earth there may be worse terrors than public service commissions and that a mere coal embargo and confiscation may be a blessing in disguise, as compared with drawbacks and disturbances such as confront electrical industries elsewhere in the world. In all respects there may already, though it is doubtful, have ceased to be any question as to the possibility and desirability of the coming of the price of peace. The real question for us, here no less than elsewhere, is the price of peace.

Electricity in Front

All of which is, by way of incidental and collateral to an estimation of where we electricals stand in 1916 in respect to the activities of the nation as a whole; and of the relation to other industries. That electricity is far up, a front liner, is not in doubt, which means it is also within scale. The statement has been made that 70 per cent of the people in the United States use electricity in some service or other in their daily lives, and that means 75,000,000 at least, on the latest figures of population. This is probably as high a ratio as that of the steam railroads, if not higher. There are many remote districts that the railroad will never penetrate, but where the telephone line and the power transmission circuit have been familiar for years; and the end of such far-flung electrical service is not yet. Out of such universality of service, large totals must inevitably ensue.

It is to be noted that the railroads, with 230,500 miles, carried from operation in 1916 not less than $15,655 per mile, or gross receipts in excess of $3,600,000,000, with a net of $1,098,000,000. This is the highest record, and might serve to indicate that generally the railroads are in prosperous circumstances; but on the other hand there is the significant little fact that little new railroad mileage was built in 1916—only 1098 miles, or the smallest except that of 1915 since the Civil War. There is a suggestive parallel here as to later lack of expansion, from causes not unlike, with the present paralysis of American water-power development. The year 1916 has shown that amid the wildest prosperity, capital cannot be lured into new railroads or water-power conservation under the harsh ban of restrictive and hostile legislation.

The electrical utilities and industries as a group are fast overtaking the railroads as a group in total investment and earnings. If the utilities or "service companies" be taken alone they show for 1916 a total income of not less than $1,750,000,000; and if we add electrical manufacturing and the various other branches of supply and service outside of straight utilities we reach a grand total that must be somewhere around

$2,500,000,000. This is certainly an impressive figure, especially when taken in relation with the high electrical rates of increase. The agricultural produce of the country is valued for 1916 at not quite $6,800,000,000, which puts it easily next to railroads. Textiles in 1914 were valued at $3,414,615,000 and iron and steel and their products at $3,223,144,000. It would appear, allowing as must be done, for abnormal increases in both in 1915 and 1916, that electricity must even now stand not lower than fifth among the producers and contributors to our national wealth. If export trade is to be regarded as a specific department, with its $3,547,000,000 in 1915 and about $5,400,000,000 in 1916, this would leave electricity in sixth place. As to utilities considered alone, they are in second place, after railroads. As to manufacturing alone, it is one of the great group of twenty-five leading industries of the country, according to value of product.

Telegraph Expansion

Narrowing down to closer details, we may best take the leading electrical departments in brief review, for reaching our gross figures of 1916. "E. and O. E." Taking first the good old field of telegraphy, we find there conditions of prosperity and activity, due to the enterprise of private capital, as thus acknowledged in a November editorial in the Government organ of the kindred service in England, which says: "We can look with a little envy upon the greater elasticity with which the American administrations can adapt their telegraph methods to industrial needs by means of particularly rapid services. We should be more than human if we did not view with envy the position of an administration which in ten years' time has come not very far short of trebling the traffic." Not only is there life in the old dog yet, but she has bred a fine lot of pups. Western Union receipts in 1910 of $33,889,202 ran up to more than $51,000,000 in 1915, a magnificent showing to say the least, rivaling the younger, larger fields in rate of increase. When one adds for 1916 the totals of the great Postal Telegraph systems, the earnings of all the cables, the wireless business, fire alarm, police alarm, burglar alarm and other numerous services, a total of $150,000,000 does not seem out of the way.

Progress in Telephony

Next in line may be taken telephony. Here again is found no want of increase and progressiveness. During the past ten years the gross revenue of the Bell Telephone system has increased about 110 per cent, from $128,500,000 to $270,000,000. This is a measure of the growth of telephony as a whole, but leaves indefinite a great many items, more particularly the income of the independent systems, sometimes reported individually, but nowhere to be found as a whole, except when the five-year canvass of the United States Census Office is made. The figure of $400,000,000 may be set down as it was last year, which does not imply any stagnation, for the conditions are all the other way, but the margin of uncertainty is lessened. Great feats, especially in wireless, are on the telephonic roll of fame for 1916, but they may perhaps better be read in terms of publicity than of income. It is all to the good!

Electric Railway

The electric railway meant at one time only the street trolley, but now includes the elevated and the subway, with many suburban and interurban lines, main line terminals, and big stretches of track away out in the distance. The best of income for all the trolley systems of every kind is the United States census figure of 1912, which gave for that year a total just up to $586,000,000. The conservative estimate of the writer of the whole electric traction field for 1915 was only $700,000,000, or at the rate of about 5 per cent increase annually. This seems low, but the data collected by the American Electric Railway Association for 1915-1916 over about 30 per cent of the mileage showed an increase in operating revenues of 3.47 per cent. Hence the $700,000,000 figure could not have been much out of the way for electric traction as a whole, and meanwhile the conditions have been greatly improving, and the field has shown most marked signs of revival and expansions. Strikes and jitneys have been lived down, and the growth of population goes on as ever, offsetting substantially any slight reduction in revenue per passenger; while in many instances fares have gone up. The income of electric traction service as a whole in 1916 can be safely put at $750,000,000.

Central Station Growth

Estimates of income in the central station field are on a very firm basis, due to the excellent work of the ELECTRICAL WORLD in its monthly compilations drawn from authentic reports covering at least 60 per cent of the industry. These statistics have now been thoroughly tried out and compare very favorably with those in any other national field of activity. They check up closely with those obtainable in other ways, as for example, the percentage dues on income of the member companies of the National Electric Light Association, and enjoy the element of dependability, having been tested through a two-year period of violent vicissitudes in central station affairs. The records show beyond any doubt that the total station income for 1916 is far in excess of that of any previous year, taken month by month and in the aggregate. From earnings alone a total of $425,000,000 has certainly been reached; it may well be $450,000,000. Besides which about 2000 central stations are in the supply business, and many are in the steam heating, ice-making, and other collateral lines. It may not be a poor guess to put down $500,000,000 for the central stations in 1916.

Isolated Plant Development

As collateral to this, it may be noted that last year, the writer assumed the value of isolated plant service at $125,000,000, and thought the figure to be high. Last September the ELECTRICAL WORLD came along and put the same estimate up to $201,600,000, after a very careful survey of the field. Something is wrong somewhere when estimates are thus widely apart, but perhaps it may all be explained by the enormous overtime working of such plants in war years, and this would fit in with many other data of a munition era. If $150,000,000 is set down for 1916 it may be taken as exuberantly conservative on the part of one who is desirous of making out the best kind of brief for electricity.

Manufacturing Progress

The intricacies of any calculation as to the value of electrical manufacturing output are beyond description, but everybody knows them, none better than the manufacturer in buying raw material or in gaging the prospective market in equivocal days when the howling times of war may at any moment become the piping times of peace.

The total value of electrical manufacturing output in 1914 of 1121 establishments was $359,412,676, and that was by no means all, for it did not include a variety of things, such as porcelain electrical supplies, globes, battery jars for electrical use, a mass of poles, pins, crossarms, telephone cabinets, etc. On the straight, distinctive stuff, the increase of output from 1909 to 1914 was 50 per cent, or 10 per cent a year,

so that the figure given in these pages last January of $450,000,000 was well within the mark. But what are we going to say now, when prices of raw materials have climbed to the skies, and when there has been shortage of every kind of appliance and apparatus in spite of it and because of it? Copper as compared with two years ago shows an approximate increase of 220 per cent, and steel 300, alloys 200 to 800, rubber 110 to 125; cotton 130 to 150, lead and spelter 200—and so on all up and down the line, not forgetting note paper, due perhaps to the inordinate use of it made in communications to European governments. But summing it all up and allowing that the gross figure of $450,000,000 for electrical manufacturing was warranted for 1915, it would seem that at least a 20 per cent increase is justifiable for 1916, or say roughly, $550,000,000. This has nothing to do with munitions. The output might be and could have been even greater but for the war and should not let up whenever in God's mercy it ends.

Development in Miscellaneous Fields

There is an endless amount of electric service not included in any of the above categories, of which merely electro-therapy and electric vehicle service may be mentioned as one item. To sum it up is impossible, but as heretofore a total of $125,000,000 is attached to it. Quite likely it may be less, or easily it might be more. Thus coming out at the end of the inquiry as to what electricity in service and supplies represents to the American public in 1916, we reach the total as shown in the following table:

	1916.
Telegraphy of all kinds	$150,000,000
Telephony	400,000,000
Central Stations (earnings from all sources)	500,000,000
Electric Railways	750,000,000
Isolated Plants	150,000,000
Electrical Manufacturing	550,000,000
Miscellaneous	125,000,000
	$2,625,000,000

This may seem a formidable total, but is quite probably under the mark. It is only $235,000,000 above the figure estimated for 1915 in spite of service to the public at a constantly lowering cost.

INCOME FROM ENERGY SALE $417,000,000 IN 1916

Kilowatt-Hour Output Estimated at 23,300,000,000, an Increase of 4,400,000,000 Kw.-Hr. Over 1916—October Output Passes Two Billion Mark

CENTRAL station earnings and output during 1916, according to returns made to the ELECTRICAL WORLD, reflected the big business condition that prevailed during the past twelve months. Based on these returns with estimates for the months of November and December, for which no figures have yet been received, the earnings from the sale of energy in 1916 were $417,000,000. This is larger than the 1915 earnings by more than 15 per cent, or roughly $55,000,000. The output for 1916 amounted to 23,300,000,000 kw.-hr., an increase of 4,400,000,000 kw.-hr. over 1915, or 23 per cent. The earnings are from the sale of electrical energy only and do not include any of the other miscellaneous central station earnings, such as merchandising sales or profits, interest on bonds held in the treasury or service connection charges.

TABLE I CENTRAL-STATION RETURNS FOR TWELVE-MONTH PERIOD

	Percentage of Industry Represented	Income from the Sale of Energy			Kw.-Hr. Output		
		1915	1914	Per Cent Increase	1915	1914	Per Cent Increase
Nov.	65	21,899,048	19,720,232	11 6	1,150,669,073	948,704,941	21.3
Dec.	64	23,418,774	20,962,264	11.8	1,230,655,404	1,004,108,399	22 5
		1916	1915		1916	1915	
Jan.	65	25,286,336	22,352,721	13 2	1,200,672,452	984,205,683	22.0
Feb	65	22,133,485	19,175,537	15.3	1,121,452,738	869,537,132	29.1
March	65	22,027,627	18,722,742	17.8	1,212,363,217	969,888,339	25.2
April	64	21,206,946	18,375,014	15 5	1,137,602,995	920,464,917	23.1
May	64	20,345,529	17,559,786	16.0	1,170,143,766	944,681,881	24.0
June	64	20,254,732	17,551,769	15.4	1,170,679,212	968,724,416	21.0
July	64	19,760,120	17,301,686	14.2	1,174,374,141	976,704,993	24.4
Aug.	64	20,502,137	17,861,413	15.0	1,262,575,492	1,015,805,383	22.4
Sept.	64	21,432,670	18,600,229	15.2	1,268,339,571	1,037,976,528	21.2
Oct.	57	20,510,753	17,899,429	14.7	1,190,435,370	985,920,332	21.8

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE MONTH PERIOD

	Month	New England States				Atlantic States				Central States (Illinois Excluded)				Pacific and Mountain States			
		Percentage of Industry Represented	1915	1914	Per Cent Increase	Percentage of Industry Represented	1915	1914	Per Cent Increase	Percentage of Industry Represented	1915	1914	Per Cent Increase	Percentage of Industry Represented	1915	1914	Per Cent Increase
INCOME	November	66	2,472,539	2,188,049	13 0	67	8,894,805	8,158,589	9.0	57	6,342,582	5,554,226	14.2	88	4,069,995	3,703,124	10 0
	December	66	2,817,557	2,448,813	15 0	67	9,335,396	8,529,866	9 4	57	6,983,909	6,063,349	15.1	88	4,150,045	3,773,810	10.0
			1916	1915			1916	1915			1916	1915			1916	1915	
	January	66	2,819,144	2,452,177	15 0	67	9,589,347	8,564,488	12 0	57	7,834,831	6,717,799	16.6	88	4,182,114	3,823,156	9.4
	February	66	2,599,760	2,185,967	18 8	67	8,978,797	7,854,345	14 3	57	6,660,062	5,568,337	19.7	88	3,761,364	3,443,182	9.3
	March	66	2,595,777	2,122,177	22 0	67	8,998,962	7,660,667	17.5	57	6,470,612	5,394,250	20.1	88	3,787,925	3,386,286	11.9
	April	64	2,221,544	1,898,749	17 0	67	8,794,056	7,596,567	15.8	56	6,289,092	5,292,974	19.0	88	3,825,701	3,520,381	8.8
	May	65	2,103,585	1,788,219	17.0	67	8,226,231	7,131,063	15 4	56	6,085,407	5,123,132	18.7	88	3,874,270	3,469,871	11.6
	June	65	2,208,994	1,906,233	16.0	67	8,045,839	6,905,114	16.5	56	6,007,742	5,143,452	16 9	88	4,017,208	3,539,137	13.5
	July	65	2,130,684	1,875,824	13 7	67	7,832,928	6,621,832	16.4	56	5,926,776	5,095,855	16 3	88	3,755,712	3,493,032	7.6
	August	65	2,203,795	1,925,828	13.7	66	8,000,243	6,875,625	16.4	56	6,195,808	5,266,147	17.7	88	3,883,835	3,582,756	8.4
	Sept	65	2,315,514	1,982,050	16 8	66	8,631,725	7,445,243	16.0	56	6,505,593	5,537,868	17.8	88	3,979,838	3,644,058	9.2
	October	64	2,624,591	22,795,512	15 1	57	7,760,435	6,882,721	12 8	52	6,810,006	5,790,232	17.5	74	3,185,687	2,829 848	12.5
KW.-HR. OUTPUT	November	66	87,193,883	69,359,620	25.8	67	420,584,253	355,151,259	18.5	57	333,528,905	269,870,536	23.7	88	301,772,412	248,913,893	21.0
	December	66	99,744,195	80,446,521	24.1	67	447,158,465	373,213,316	20.0	57	363,859,444	293,266,707	24.1	88	311,034,100	249,996,678	24.5
			1916	1915			1916	1915			1916	1915			1916	1915	
	January	66	97,072,794	77,029,974	26.2	67	431,201,554	356,809,437	20.8	57	362,121,067	284,407,361	27.5	88	301,645,060	258,982,414	16.5
	February	66	92,855,679	68,982,525	34 8	67	411,715,612	320,924,478	28.1	57	339,326,360	252,816,291	34.1	88	268,653,564	220,662,826	22.1
	March	66	97,321,924	74,958,898	29.9	67	439,660,902	349,347,454	26.0	57	360,872,072	282,179,673	28.0	88	304,327,753	255,450,143	19.3
	April	64	84,769,660	64,816,880	30.8	67	403,223,021	326,574,302	23.4	56	344,866,175	273,367,413	26.4	88	302,386,347	253,778,348	19.2
	May	65	84,719,642	64,318,892	31 8	67	409,529,049	333,585,886	22.0	56	345,860,257	275,328,229	25.6	88	328,793,909	266,599,708	23.2
	June	65	87,829,797	69,506,884	27 6	67	396,630,887	327,541,507	21.2	56	350,015,166	288,982,024	21.2	88	328,996,553	277,915,476	18.6
	July	65	85,317,206	71,160,365	19 8	67	401,178,678	333,771,509	20.3	56	350,708,540	287,407,170	22.2	88	325,647,543	279,285,871	17.4
	August	65	97,197,131	72,990,805	33 4	66	433,129,067	344,730,909	25.7	56	374,327,105	295,866,692	26 5	88	333,468,777	279,976,391	19.1
	Sept	65	98,350,508	73,343,561	34 2	66	446,531,743	369,815,165	20.8	56	387,626,725	307,485,471	26.2	88	335,817,595	288,332,331	16.4
	Oct	64	105,641,881	81,832,381	29 3	57	407,950,506	358,105,577	14.0	52	390,293,287	312,571,363	25.0	74	277,744,432	226,336,000	22.7

TABLE III—CENTRAL STATION RETURNS SHOWING NUMBER OF CUSTOMERS, CONNECTED LOAD AND GENERATING CAPACITY FOR THE YEARS 1916 AND 1915

Territory	Total Customers		Total Connected Load in Kw.		Total Generating Capacity in Kw.	
	1916	1915	1916	1915	1916	1915
United States (37 per cent)	2,060,951	1,856,716	5,242,231	4,623,618	3,044,610	2,773,422
New England (53 per cent)	302,030	260,921	684,245	576,373	406,809	357,695
Atlantic (43 per cent)	519,046	455,183	1,628,987	1,384,976	1,021,546	901,635
Central (30 per cent)	606,324	550,770	1,626,598	1,510,287	743,771	689,623
Pacific Mountain (35 per cent)	633,557	589,842	1,302,401	1,151,982	872,384	824,469

TABLE IV—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR UNITED STATES—CITIES GROUPED BY SIZE

	Jan.	Feb	Mch.	April	May	June	July	Aug.	Sept.	Oct.
INCOME:										
Group 1	10.7	14.1	16.0	13.9	14.4	14.9	13.8	13.9	15.0	13.0
Group 2	21.3	20.0	18.5	17.0	17.5	17.7	16.8	15.7	20.4	18.5
Group 3	18.3	20.7	28.1	24.7	26.2	21.8	19.5	20.9	18.4	19.7
Group 4	13.1	15.7	17.3	17.4	15.1	11.0	9.0	9.5	11.3	14.8
Group 5	7.2	18.5	26.5	16.1	24.0	15.3	12.2	14.9	13.3	17.2
OUTPUT:										
Group 1	19.0	25.4	22.0	20.0	21.3	18.7	18.1	21.4	18.5	17.5
Group 2	28.0	40.6	28.1	25.5	18.0	17.5	22.9	33.0	32.9	30.8
Group 3	33.2	39.6	39.0	37.7	40.0	21.8	27.8	31.1	19.3	24.3
Group 4	22.6	29.7	18.2	22.7	23.0	19.3	16.1	23.0	26.0	22.0
Group 5	8.5	22.4	29.9	32.0	33.2	19.0	11.6	16.8	15.3	19.3

October returns gave a total of $36,000,000 from energy sales, an increase of 14.7 per cent. For the first time in the history of the lighting industry the output passed the 2,000,000,000 mark. The October output was 2,090,000,000 kw.-hr., an increase over October, 1915, of 21.8 per cent.

With the exception of the Pacific and Mountain States all sections of the country showed smaller percentage increases in earnings and output in October

TABLE V—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR NEW ENGLAND STATES—CITIES GROUPED ACCORDING TO SIZE

	Jan.	Feb.	Mch.	April	May	June	July	Aug.	Sept.	Oct.
INCOME:										
Group 1	16.5	18.0	21.5	16.0	17.0	16.4	12.6	9.6	16.5	12.2
Group 2	15.4	19.9	19.0	21.2	19.5	19.8	20.6	15.1	25.5	21.6
Group 3	22.1	29.7	38.7	15.5	24.0	18.2	21.2	15.0	20.5	18.0
Group 4	11.3	15.1	18.1	13.2	13.5	7.2	6.2	11.1	10.5	15.4
Group 5	20.6	26.3	54.5	27.6	27.0	21.7	14.9	17.5	18.3	18.2
OUTPUT:										
Group 1	29.0	38.5	30.9	25.0	28.2	30.9	19.2	31.3	34.9	17.6
Group 2	26.0	36.8	27.8	31.4	33.2	26.3	14.1	32.0	37.7	36.5
Group 3	39.5	41.6	49.0	38.1	43.0	15.0	31.4	45.5	32.4	42.6
Group 4	15.0	23.0	17.4	36.1	30.0	21.0	26.6	39.4	32.9	48.9
Group 5	22.6	25.6	58.7	71.8	54.4	31.7	13.5	21.3	27.4	22.0

last over October, 1915, in comparison with that registered in the preceding month. This, however, in no way reflects poorly on October, 1916, because October, 1915, was a splendid month in comparison with the months that went before it. In the Far Western States the same condition probably holds. The returns from one of the largest companies in the section are missing, but based on returns from previous months it is quite probable that the complete figures from this section

TABLE VI—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR ATLANTIC STATES—CITIES GROUPED BY SIZE

	Jan.	Feb.	Mch.	April	May	June	July	Aug.	Sept.	Oct.
INCOME:										
Group 1	11.1	13.7	16.7	15.1	14.5	16.4	16.8	16.1	16.2	12.9
Group 2	18.2	18.4	21.2	81.5	21.7	21.9	18.5	21.6	19.0	17.6
Group 3	11.9	14.6	20.5	15.3	17.7	12.0	14.2	15.0	14.0	14.5
Group 4	17.4	19.4	17.9	19.5	14.0	15.4	10.0	14.4	9.8	13.6
Group 5	16.0	15.8	12.2	15.6	13.0	15.2	13.0	19.4	8.9	14.3
OUTPUT:										
Group 1	21.1	30.8	29.2	26.1	25.5	13.1	23.4	28.5	23.6	17.0
Group 2	26.1	33.4	25.6	35.6	11.3	31.8	27.4	32.5	26.7	30.5
Group 3	20.1	22.0	16.0	13.7	18.0	13.2	11.5	16.0	24.7	4.3
Group 4	15.6	21.8	20.9	19.0	12.6	19.7	16.3	29.5	18.6	18.0
Group 5	1.5	24.0	13.1	8.9	35.0	11.1	13.5	20.4	1.3	1.5

TABLE VII—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR CENTRAL STATES—CITIES GROUPED BY SIZE

	Jan.	Feb	Mch.	April	May	June	July	Aug.	Sept.	Oct.
INCOME:										
Group 1	14.3	18.3	19.3	18.2	18.0	16.4	15.8	16.5	16.6	17.3
Group 2	25.5	20.5	19.1	18.0	17.4	17.5	17.3	21.8	21.5	20.1
Group 3	24.3	27.0	23.0	26.7	27.2	20.5	18.6	18.4	13.4	10.9
Group 4	9.6	20.2	22.9	22.8	24.1	17.5	17.5	10.7	20.0	19.7
Group 5	5.7	11.1	14.4	9.4	21.3	12.6	6.1	11.8	11.0	18.4
OUTPUT:										
Group 1	24.9	30.3	25.2	24.7	25.0	23.8	21.0	24.3	22.3	23.3
Group 2	28.8	44.0	32.3	23.9	19.5	12.3	25.7	36.4	40.0	31.7
Group 3	32.5	44.0	40.6	43.5	41.0	31.8	26.0	25.7	20.7	17.3
Group 4	53.4	41.0	31.9	39.2	38.5	34.3	21.1	23.0	33.8	27.0
Group 5	13.3	15.9	19.1	10.1	14.7	4.0	8.6	6.1	13.7	28.2

will show smaller percentages of increase over October, 1915.

Additional figures were reported by about half of the reporting companies of customers, connected load and generating capacity. Companies representing 37 per cent of the generating capacity of the United States reported 2,060,951 customers at the end of 1916 against 1,856,716 at the end of 1915, a gain during the year of more than 200,000, or 11.1 per cent. These figures include but a few of the companies operating in the very large cities and for that reason should not be multiplied by three to arrive at an estimated total for the country.

Figures representing connected load and capacity are shown graphically in Fig. 7, on page 34, for the entire country, estimated from the partial returns received by the ELECTRICAL WORLD.

For connected load from 37 per cent of the country the figures are 5,242,231 kw. in 1916 and 4,623,618 kw. in 1915, a gain of 13.5 per cent. Generator capacity figures for 37 per cent of the United States are 3,044,610 kw. in 1916 and 2,773,422 in 1915, a gain of 10 per cent. The figures are grouped sectionally in an accompanying table.

FIGURES REAL BAROMETER OF INDUSTRIAL CONDITIONS

Central station figures are undoubtedly a real barometer of industrial and business conditions. In 1915, while the earnings never went below those for the previous year, the per cent increases fell off during the first six months, after which they responded to the call of Europe for munitions, and from then until the

TABLE VIII—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT HOUR OUTPUT FOR PACIFIC AND MOUNTAIN STATES—CITIES GROUPED ACCORDING TO SIZE

	Jan	Feb.	Mch.	April	May	June	July	Aug.	Sept	Oct.
INCOME										
Group 1	11.6	6.7	8.5	3.9	7.2	7.5	4.7	5.5	6.2	8.3
Group 2	†	†	18.7	3.5*	2.3	1.2	0.6*	0.7	4.9	1.3
Group 3	19.7	22.0	28.1	10.0	39.0	39.5	28.3	32.5	28.5	32.1
Group 4	3.0	8.2	17.5	11.7	13.8	3.6	1.0	0.5	11.5	9.8
Group 5	10.5	17.8	26.3	12.0	19.1	12.8	13.2	13.0	11.7	14.1
OUTPUT:										
Group 1	9.1	13.0	22.7	8.0	12.0	8.0	10.0	6.3	7.1	10.3
Group 2	†	†	28.3	3.6*	2.2	1.9	2.0	6.5	7.8	9.7
Group 3	56.0	68.8	39.0	80.0	79.0	74.5	56.1	57.5	60.0	65.7
Group 4	1.8	13.8	18.6	10.2	21.8	10.0	4.0	7.5	12.0	1.7*
Group 5	1.0	20.1	30.0	11.7	17.5	16.0	10.8	16.5	7.0	9.8

*Decrease. †Results omitted owing to insufficient returns

beginning of the past year the rate of growth increased rapidly. In 1916, when the industries were even working at maximum output, any gain would naturally have to be at a regular and practically constant rate. The average rate of increase in earnings, it will be noticed, was 15.4 per cent, from which the maximum deviations were small. The low was 13.2 per cent, the high 17.8 per cent. The average rate of increase in output was

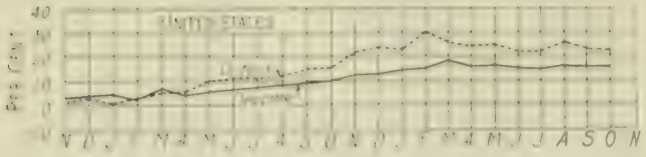
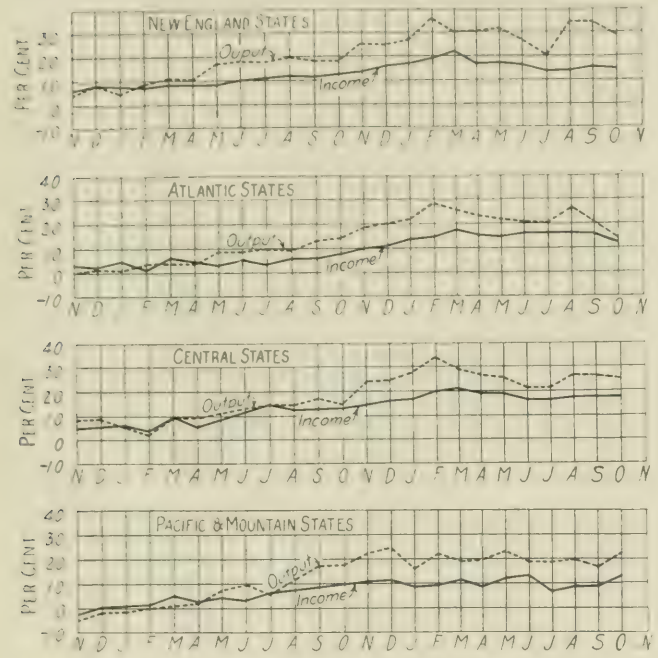


FIG. 1—CENTRAL STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT FOR UNITED STATES

23 per cent, from which the maximum deviations were also small. The low was 20.4 per cent and the high 29.1 per cent.

The year 1916 was one of large demand for power. The volume of orders for motors overtaxed the manufacturing facilities set apart for this product. The in-



FIGS. 2 TO 5—CENTRAL STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT SECTIONALLY

crease in domestic lighting load was not as great as was anticipated. This was undoubtedly due to high construction costs, lessening the amount of new building, and to the high price of copper, cutting down on the wiring of houses already built. The sale of electric household appliances, however, was larger in 1916 than ever before because, it is believed, of higher wages in 1916.

The year opened with the center of activity on war orders, but as the year moved on it was noticed that practically all industries were about equally affected. Mining was never before carried on on such a stupendous scale; clothing and machine factories were working at capacity output, iron and steel mills weekly got further behind in production. In practically every branch of industry electrical energy was used, and as a result of the tremendous growth in output and the rapid approach of the load towards station capacity the

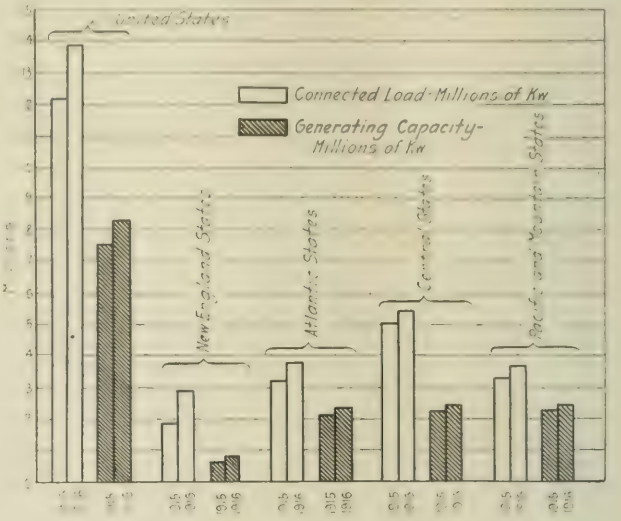


FIG. 7—CONNECTED LOAD AND GENERATING CAPACITY SECTIONALLY FOR 1915 AND 1916

central stations placed in 1916 orders for close to 2,000,000 kw. in steam turbines and in the neighborhood of 400,000 kw. in water turbines.

Figs. 1-5 show graphically the percentages of increase in income and output as contained in Tables I and II. Fig. 6 shows the monthly income and output during 1915 and 1916 of the entire central station industry of the United States. Fig. 7 shows graphically the connected load and station generating capacity of the entire industry for 1915 and 1916 based on partial returns given in Table III. The remaining tables show the percentages of increase in income and output for companies grouped according to the size of the community served. Group 1 contains those companies operating in cities having a population of over 100,000 inhabitants; group 2 in towns between 50,000 and 100,000; group 3, between 25,000 and 50,000; group 4, between 10,000 and 25,000, and group 5, between 5000 and 10,000.

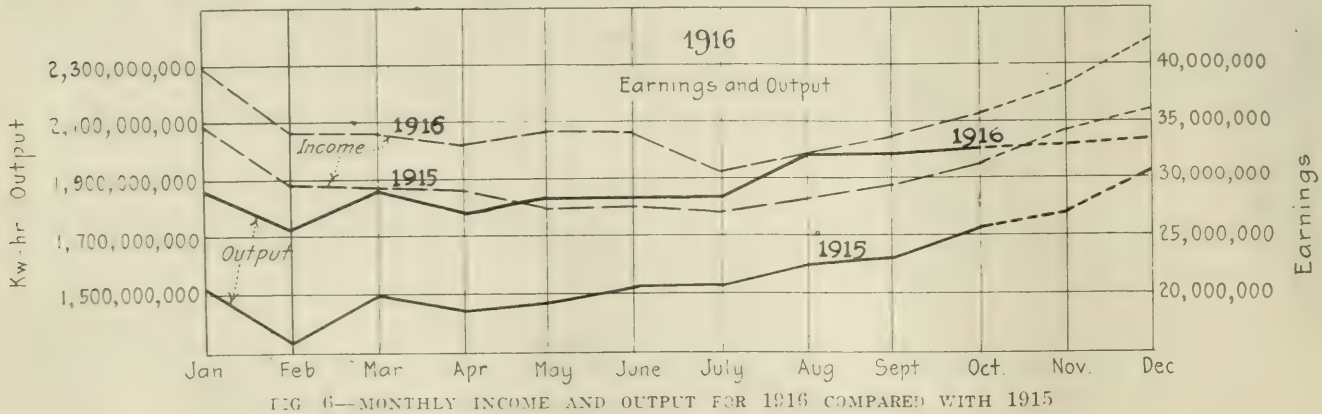


FIG 6—MONTHLY INCOME AND OUTPUT FOR 1916 COMPARED WITH 1915

STATION AND OPERATING PRACTICE

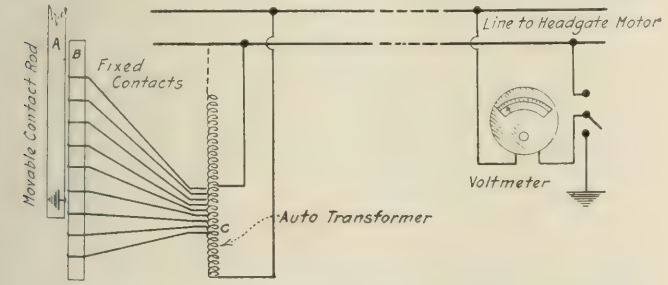
A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Method of Indicating Head Gate Position by a Voltmeter

BY WILLIAM J. HAZARD

Professor Electrical Engineering, Colorado School of Mines

A description of ingenious signaling devices appeared in the ELECTRICAL WORLD of Nov. 18, 1916, on page 1007. One of these shows the amount of motion of a headgate, by flash lamp signals. The position of the gate is then found from the previous position and the distance moved. In this connection the accompanying scheme devised at the Colorado School of Mines, whereby an alternating-current voltmeter is used as a position indicator, may be of interest. It shows the exact position or amount of opening of a gate at all times, without any calculation or record of previous position.



AN ARRANGEMENT TO SHOW POSITIONS OF HEAD GATES

The rod of wood *A* carries a grounded contact piece. This rod moves with the gate or at a proportional rate. An autotransformer *C* is connected to the line supplying the driving motor and as many taps as needed are brought out to stationary contacts as shown. One side of the voltmeter is connected to the line where it passes through the control station and the other side is grounded to save stringing a special signal wire. When the rod *A* is at the lowest point of its travel, it grounds one point of the autotransformer and applies a minimum pressure to the voltmeter. As *A* rises, it makes contact with successively higher voltage taps. The voltmeter scale has divisions added to it, showing the position of the gate on each step.

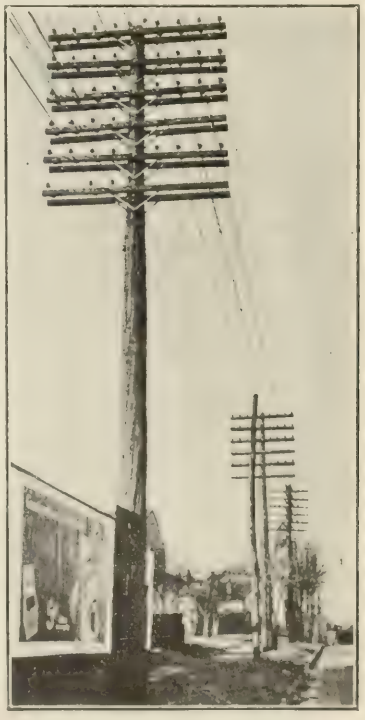
As the first 15 per cent to 25 per cent of the range of an alternating-current voltmeter is no good, it is well to make the voltage for closed gate, high enough to be accurately read. Where the voltmeter range covers the line potential, it may be connected as shown in the diagram. Where a 125 or 150-volt instrument is to be used on a 220 or 440-volt line, it is only necessary to wind the autotransformer for line voltage and use as much of it as needed for the voltmeter.

As shown here the indications are intermittent. Of course the contact on rod *A* must not touch two stationary contacts at once or a section of the transformer winding would be short-circuited. To produce a continuous indication, it is only necessary to put two contacts close together on rod *A* and connect them through a resistance. These contacts must be proportioned so that neither one will close the circuit between the two stationary contacts, but so that one or both will make connection with a stationary contact at all times. The resistance connecting the two points on *A* may be high enough to prevent an injurious current through any section of the transformer and still be low enough to make no appreciable difference in the voltmeter reading. If the middle point of this resistance be grounded instead of one end, it will double the number of steps obtained on the voltmeter by showing voltages half way between taps.

A number of modifications of this scheme, to adapt it to local conditions will suggest themselves to one having use for such an indicator.

A Wood Pole Line That Carries 12,700 Lb. per 1000 Ft. in Conductors

The pole line shown in the accompanying illustration was recently erected by the Evansville (Ind.) Public Service Company to replace an old lead which had been in service for a period of about fifteen years. The old lead of ordinary construction, was partially destroyed in a storm so that for the new line the company decided on a construction of greater strength. Northern white cedar poles were selected and specified 45 ft. tall with nothing less than 11-in. tops. Considerable difficulty was experienced in securing poles of this size, however with the co-operation of the Naugle Pole & Tie Company in searching its yards sixty 45-ft. poles and twenty-five 55-ft. poles with 8-in. tops were finally located. Each pole butt was treated at the pole yards by immersion in hot carbolineum for fifteen minutes. In the central station's yard the poles were shaved and given two coats of green paint above the ground line. They were then set in the 1-mile line with 110-ft. spans and carry the following circuits: Four 4000-volt, three-phase, four-wire, No. 0 circuits; one 4000-volt, three-phase, four-wire, No. 6 circuit; one 1000-volt, three-phase, four-wire, No. 4 circuit; eight street-lighting No. 6 circuits; and four street-railway, 500,000-circ. mil circuits. It is estimated that these lines alone, without the hardware, insulators or cross-arms, make up a load equal to about 1400 lb. per span.



EVANSVILLE (IND.) POLE LINE LOADED TO ABOUT 1400 LB. PER SPAN

Smoke Signal System Used by Pittsburgh Company

An interesting installation has just been completed at the Brunots Island power station of the Duquesne Light Company of Pittsburgh, Pa., as a further aid in the abatement of smoke. Not only has the light company done much in an indirect way to eliminate the smoke nuisance by shutting down many of the smoky stacks in the heart of the city through the substitution of its electric service, but in a direct way by using every practical means of reducing the amount of smoke emitted from its own power stations, even though the stations are located far from the business and residential districts.

In the Brunots Island station the tops of the stacks are not all visible from the boiler room, and it was to give each fireman a knowledge of the condition of the stacks serving his boilers that the following system was installed. The essential part is an observation room located out in the yard in such a position that each of the eighteen stacks is visible. In that office is an elaborate switchboard with lights which are controlled by the stack observer. Connecting the smoke observer's office with the boiler room are forty wires incased in a lead covering, by means of which red lights located in the firing aisle of each stack are operated. Gongs are also used to attract the attention of the firemen as soon as any smoke appears. Located in the observer's office are also recording instruments which show exactly how long the stacks smoke and the time of the smoking.

Graphical Analysis of Steam Plant Design and Operation

A graphical method of accurately estimating the cost of producing power under given conditions, and predetermining the effects of changes in operating conditions or equipment on plant performance, was outlined by R. J. S. Pigott at the recent meeting of the A. S. M. E. It consists of plotting the input-output curves for main units, exciters, boiler-feed pumps, forced-draft fans, stoker drive and boilers and then combining them on one chart plotted between B.t.u. input and

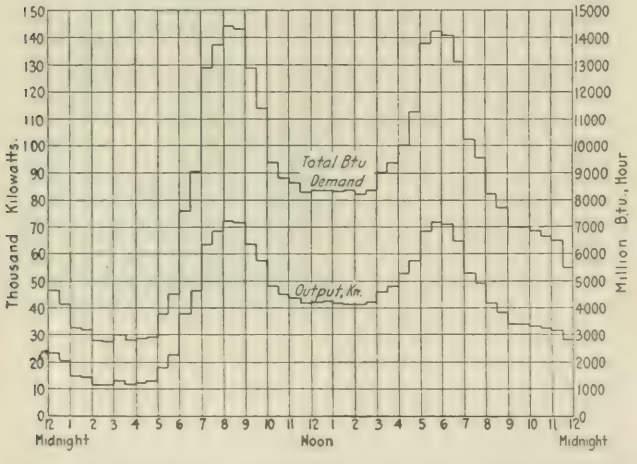


FIG. 1—ANTICIPATED LOAD CURVE WITH HEAT INPUT BALANCED

kilowatt output to correspond with the method of operation. From this chart the best method of utilizing the exhaust steam can be ascertained and by reference to the actual or anticipated load curve the required heat input can be determined. In explaining typical applications of this method extensive use was made of Willans lines. For a particular case curves were plotted for different items, indicated by the following numbers:

For (1) main units, curves were plotted between different electric loads, total steam per hour and steam per kilowatt-hour; for (2) exciters, between the same units and in addition B.t.u. per pound of exhaust and total B.t.u in exhaust; for (3) pumps, between boiler load and pump steam consumption per hour, B.t.u. per pound of exhaust; for (4) fans, between air output and steam per hour, and also between boiler output and fan brake horsepower discharge in cubic feet per minute and static pressure. By combining the curves (4) the

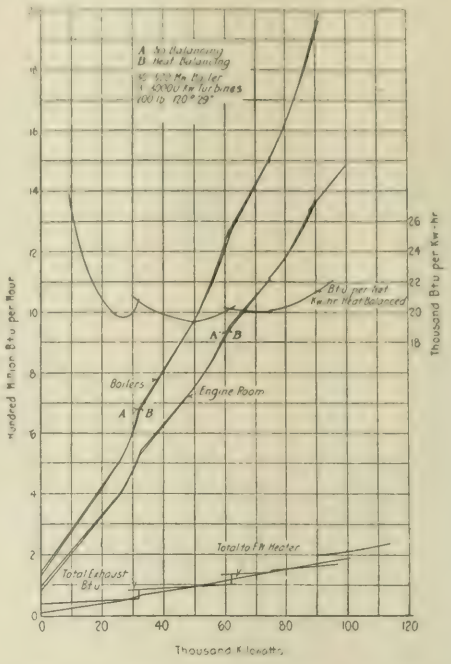


FIG. 2—PLANT INPUT-OUTPUT CURVES

relation between fan steam consumption and boiler output (5) was obtained. For (6) boilers the usual efficiency curves were plotted.

No input-output curves are needed for condenser auxiliaries, as they usually operate at constant load. By determining how many boilers would be needed for different steam outputs and how many should be banked, if any, the B.t.u. input for different boiler outputs (7) were plotted. By similar analysis and making use of curves (3) and (5) the input (8) to boiler-room auxiliaries was plotted for different boiler outputs. On the same chart (8) was plotted the heat available from auxiliary exhaust at different boiler loads. Since the stokers were operated by the fan drive, no curves had to be plotted for these auxiliaries.

Again, by arranging the prime mover input-output curves (1) end to end on a chart (9) to correspond with the points at which they are cut in, the prime-mover input-output relations for any load was obtained. Adding the constant input for the condenser auxiliaries, and the boiler-room auxiliary inputs (8) to these curves gave the total input (9) to prime movers and auxiliaries for different loads. From this information the input to the boilers at different electrical loads was calculated and plotted on the same chart (Fig. 2). At the bottom is plotted the heat required to heat feed water at different loads, and overlapping this is a jagged curve representing the heat exhausted by auxiliaries. If the auxiliary drive is so selected or operated that the exhaust heat is just sufficient for feed water heating requirements when the receiver pressure and auxiliary exhaust pressure are the same, then there will be an automatic heat balance. For instance, at light loads when the auxiliary exhaust is more

than required for heating feed water, the receiver pressure is less than exhaust pressure, so the surplus steam will be utilized by the low-pressure turbine. On the other hand, during heavy loads when the auxiliary exhaust is insufficient the receiver pressure is higher, so steam is bled into the feed water heater supply.

The effect of introducing or removing steam from compound turbines can be determined by plotting the Willans lines for the high and low-pressure turbines. For instance, the available from the exhaust can be determined from Fig. 2 and reduced to pounds of steam per hour at the particular receiver pressure. From the water rate under the particular load conditions the increase in capacity of the low-pressure turbine can be calculated. From the Willans lines for the high-pressure turbine the decrease in capacity due to increased receiver pressure can also be calculated. The difference between the gain and loss in low and high pressure capacities thus gives the net gain by introducing exhaust steam without increasing the high-pressure steam admitted to turbine.

Electric drive of auxiliaries is thermally less economical than steam drive with heat balance and in addition requires slightly more investment per kilowatt of plant rating. The advisability of using steam-electric drive, that is, motors receiving energy from turbo generators used to operate them only, depends on the load factor, increased cost of labor and maintenance. It may be pointed out that this arrangement is not as reliable as straight steam drive due to the two additional links inserted.

Motor Drive Arrangements in a Colorado Lumber Mill

Examples of arrangements which have been made at the D. C. Donovan Lumber Company, Longmont, Col., to avoid overhead shafts and obstructing belts are shown in the accompanying illustrations. In Fig. 1 is shown a 12-in. jointer belt driven by a 5-hp. Westinghouse motor installed on the floor. Connected with the same motor by means of a friction drive is a single-spindle shaper. This arrangement permits independent or simultaneous operation of both machines. The wood frame rip saw shown in the background is individually driven by a 7-hp. Westinghouse motor.

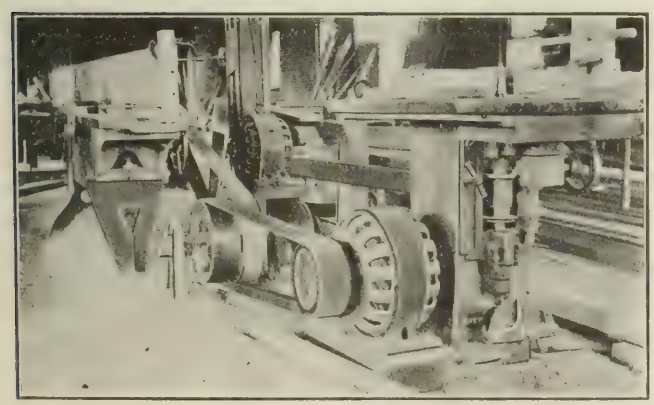


FIG. 1—METHOD OF DRIVING JOINTER AND SHAPER

Space was saved in providing for the planer and molder drives shown in Fig. 2, by using one motor, installing it in a niche in the wall, connecting by belt with the planer and by an underfloor shaft with the molder. This arrangement permits independent or simultaneous operation of the machines. The motor is a Wagner unit rated at 10-hp., the planer, which is on the right, measures 24 in. and the molder on the left is a 7-in. machine.

The remaining motors in this mill consist of a 3-hp. Westinghouse and a 5-hp. Wagner unit. The first is belt-connected to a 34-in. band saw and by means of another belt on the other end of the motor shaft can be connected with a 16-in. lathe and a double-end emery grinder. The 5-hp. motor drives the only overhead shaft

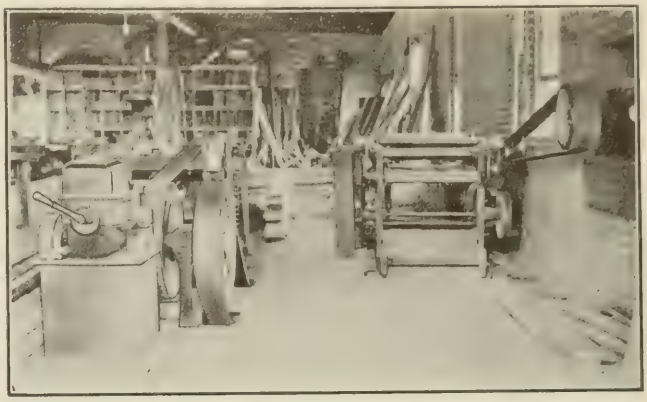


FIG. 2—MOTOR DRIVE ARRANGEMENTS FOR PLANER AND MOLDER

in the mill. From this may be operated at will a combination cut-off saw, a No. 1 tenoner, a No. 2 mortiser and borer and an arm sander.

Charles E. Nowels, manager of the mill, is enthusiastic over motor drive and states that the last mentioned shaft will be removed as the plant expands and individual drive used exclusively. Aside from the usual advantages attending individual drive, there is the absence of any obstruction to moving lumber and added safety due to reduction in moving parts. This plant operates twelve months a year, the energy consumption never being more than 400 kw.-hr. per month which at the 3-cent rate secured makes power cost only $12 a month. "If someone were to present us with an engine," says Mr. Nowels, "we could not afford to pay a man to shovel the coal."

Tests to Detect Grounds on Consumer's Circuits

About the most simple and effective means for detecting grounds on a consumer's circuit is to turn on all the lamps, apparatus or whatever the consumer may have connected to the service. After this has been done, back out the house wires of the meter and connect them together. Then connect one lead of the test lamp to one side of the incoming line and the other lead to the house wires. Should a ground exist, the test lamp will glow proportional to the resistance of the ground. Should the ground be so small that it cannot be detected by the test lamp, a rotating standard can be employed, connecting the current coil most suitable for the test. By checking a given number of revolutions of the rotating standard by means of a stop watch the wattage consumed by the ground can be determined. In the case of direct current a millivolt meter or a voltmeter should be employed.

Another method that is often used is to always make it a point to connect the current coil of the meter in the outside wire. As the neutrals are nearly always grounded at the transformer, a ground on an outside wire on the customer's premises will show in a rotation of the meter disk with all load removed. Most companies make it a part of the routine work of each meter inspector and tester to make tests on every inspection, regardless of reasons given for it.

COMMERCIAL AND BUSINESS POLICY

A Department of Plans and Methods for Widening the Application of Electricity and for Extending Electric Service

Auditorium and Model Kitchen for Use of Women's Clubs, Features of New Electric Building at Ithaca, N. Y.

One of the features of the new three-story office building recently put into service by the Ithaca (N. Y.) Gas and Electric Corporation is an auditorium on the third floor which seats 250 people and the free use of which has been extended to the various women's organizations of the city.

A model kitchen has also been installed near the auditorium. The company furnishes dishes for use at social gatherings, and the whole equipment is tendered absolutely free to any women's organization that may care to use it. Light, heat and the use of a piano and motion picture machine are also furnished gratis by the company.

Further attention to the interests of the feminine public is found on the first floor, where a spacious and well-appointed rest-room is located. Telephones, lavatory, writing table and comfortable chairs are parts of the equipment, and the efforts of the company to please have been enthusiastically received.

The cashier and the information department are located on the first floor, where also is the display of electric and gas fixtures and appliances. This floor is of tile, with marble baseboards. Showcases have been built around the various pillars, and the displayed appliances are mounted on glass shelves, making the highly polished appliances appear to stand out in space. In order to reach the cashier's desk the visitor to the office must pass these cases, and in addition to effecting space economy the display attracts the eye on account of its unusual character.

Meeting Gas-Engine Competition on a Basis of Motor-Operating Cost

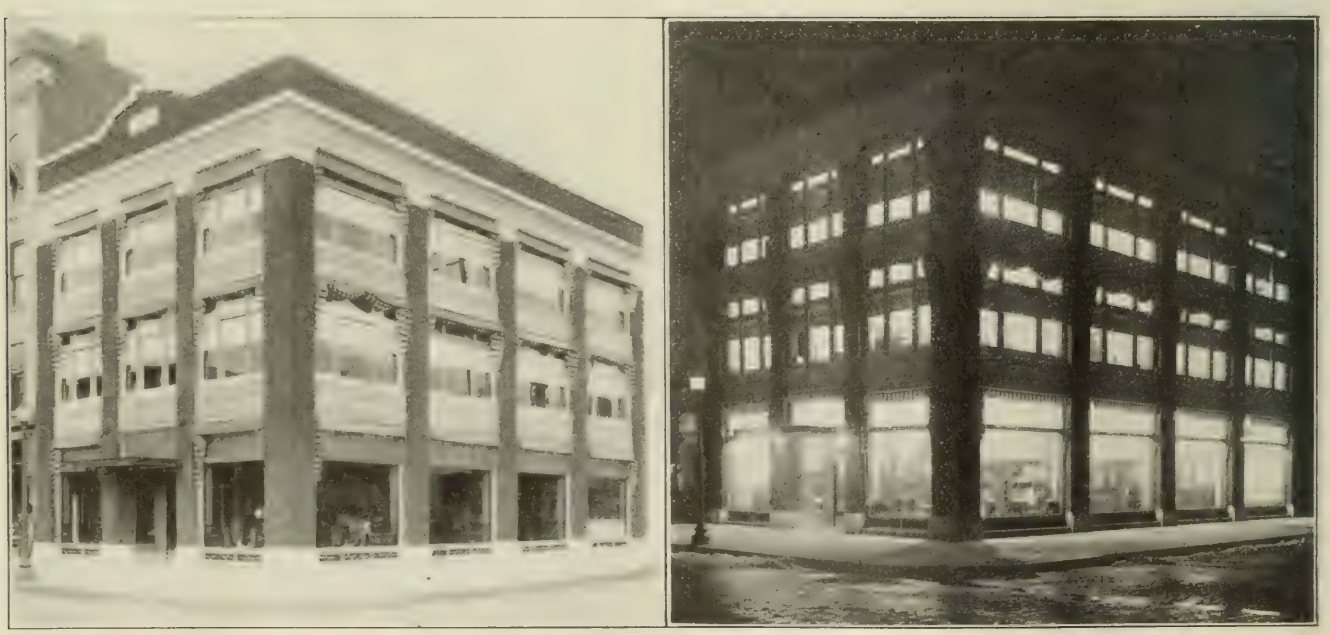
BY M. W. EHRLICH

Throughout certain sections of the United States the central-station power man has to meet the competition of the gasoline engine. These engines are extensively used in irrigation and mining work, the general run of installation ranging in size from 6 hp. to 30 hp., and averaging about 15 hp. From the nature of the work it is clear that the load factor runs high, operation in some instances continuing twenty-four hours a day. However, the average-size gas-engine plant is run but ten hours per diem, using for fuel a cheap distillate which ranges in cost from 12 to 18 cents per gallon, according to location.

TABLE I—COST PER HORSEPOWER-HOUR, IN CENTS, FOR GASOLINE-ENGINE PLANTS

Size, Horsepower	100 Per Cent Load Factor		50 Per Cent Load Factor		33⅓ Per Cent Load Factor	
	Fuel	Total	Fuel	Total	Fuel	Total
6	2.4	4.3	3.1	5.9	3.5	7.2
10	1.9	3.2	2.5	4.4	2.8	5.3
12	1.8	3.0	2.3	4.2	2.7	5.2
16	1.6	2.5	2.0	3.5	2.4	4.3
22	1.5	2.4	1.9	3.2	2.2	4.0
30	1.4	2.2	1.8	3.1	2.1	3.8

That the owners of gasoline engines in these sections are ready to welcome any other form of power, providing the cost is no higher, may be proved by a casual observation of existing operating conditions. Inter-



ATTRACTIVE CORNER MADE BY NEW ELECTRIC BUILDING AT ITHACA, N. Y.

An auditorium and model kitchen on the third floor of this building are offered gratis to any women's organization in Ithaca desiring to hold meetings or social functions as the electric company's guests. The illustrations show the attractive exterior appearance of the building by day and by night.

views will verify that there is no end of trouble in the form of breakdowns and other inconveniences with the gasoline engine.

FACTS NEEDED TO CONVINCE OWNERS

These facts having been established by a canvass of numerous engine operators, led the commercial manager of one Western central station to believe that only by facts and figures could these owners be convinced that electricity purchased from its lines would be just as economical and in many instances considerably lower in cost. In this plant alternating current is generated by large Diesel oil engines.

The first step in this campaign was to gather data on

TABLE II—COMPARISON OF FIRST COSTS OF GASOLINE ENGINES AND ALTERNATING-CURRENT MOTORS

Size, Horsepower	Gas-Engine Plant	Electric Motor	
		Cost	R.P.M.
5	$250	$110	1800
10	460	185	1800
15	620	250	1200
20	800	290	1200
30	1150	350	1200

cost of equipment and operating expenses of gasoline-engine plants. These were analyzed and compiled, the operating cost being computed for various load factors, showing the cost per horsepower-hour for ten-hour operation varies from 2.2 cents to 7.2 cents, giving an average of 3.5 cents per horsepower-hour for a 16-hp. plant at 50 per cent load factor. The various costs for different-sized installations, as computed for various load factors in gasoline-engine plants, are given in Table I, which lists the cost of fuel and supplies in one column, and the total cost, including labor and fixed charges, in another.

With this information, another tabulation was prepared showing the first cost of different-size alternating-current motors as compared with gasoline engines. The results obtained in comparing the smaller units are shown in Table II, the motors costing considerably less than the corresponding gas engine plant. With the electric motor, not only is the initial cost lower, but the maintenance and depreciation charges are also less than those for the gas power.

MOTOR AGENCY CONTRACT PRICES

A motor agency was secured to take advantage of any contract prices, thus obtaining a 10 per cent reduction. This enabled the company to sell motors at the prices given in Table II, which are for three-phase machines suitable for 110, 220, 240 or 500 volts. For larger motors, slow-speed units at 2200 volts were recommended at the following contract rates: 50 hp., 900 r. p. m., $610; 75 hp., 900 r. p. m., $760; 100 hp., 720 r. p. m., $990; 150 hp., 720 r. p. m., $2,275.

To these prices 10 per cent was added in fixing the customer's cost.

All these figures were compiled in handy form to fit the salesmen's notebooks, and a copy was given to each man sent out to solicit new business.

It was not hard, of course, to convince those contemplating new installations that an electric motor would be more satisfactory than a gasoline engine, owing to its simplicity, ease and economy in operation, and this at a lower first cost, and to shut down existing plants it proved only necessary to show at what cost the central station could supply the energy and at what price the motor could be installed.

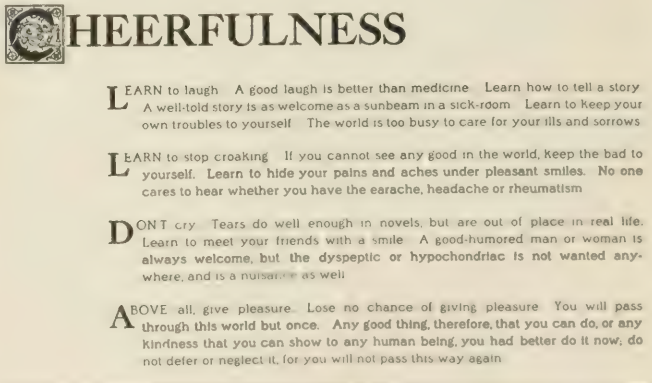
Results from Farm-Line Business in Kansas

According to C. A. Leland, Jr., electrical superintendent for the Atchison (Kan.) Railway & Light Company, farmers have not been found to be particularly good customers, but under some conditions the business is not unprofitable. The average consumption per year for five farmers on one of the company's lines was 153 kw.-hr. At 12.5 cents this amounts to $19.12 per year.

These five farmers have 5 kw. in transformer capacity, figuring one 1-kw. transformer per customer. The iron loss from these transformer units would amount to 175 kw.-hr. per year, making a total of 328 kw.-hr. delivered to the transformers. Adding 10 per cent for the remaining line loss, 360 kw.-hr. per year would be delivered to the rural line. Since the cost of energy at the city limits is $0.0276 it may be seen that 360 times $0.0276 equals $9.94, the cost to deliver energy to the line. Subtracting $9.94 from $19.12 equals $9.18. This amount remains to take care of collections, office work, overhead, etc. In this case the farmers send or bring in their readings each month and pay their bills, so the company has no cost for reading meters. They also pay a rental of 50 cents per month to the owner of the line, which, in this case, is another town which is buying energy at Atchison. Although this is not a large return, under the circumstances the farmers are thought to be not unprofitable customers. Farmers on this line paid for the transformers, fuses, service, etc. A separate set of lightning arresters was not considered necessary for each transformer.

A "Cheerfulness Creed" for Company Representatives Who Meet the Public

Realizing the importance of keeping the need for courtesy and cheerfulness constantly before company representatives who come into contact with the public, many utility companies have, during the last few years, posted service and courtesy creeds in their offices where both employees and public could read them. By printing these creeds on cards and posters for office fram-



ing and display on the company's premises the lesson of courtesy and service first, last and always, has been driven one step further home. Extending this idea one of the large Western railroads has issued a "cheerfulness" creed, which has been posted in many of that company's offices and depots for the guidance of its own men in meeting the public. One of the cards is reproduced herewith with the suggestion that such a creed might well be adopted by electrical sales organizations and sales people as an excellent guide to business conduct.

COST OF ELECTRIC COOKING

Detailed Investigation Made by Portland Company Discloses Interesting Facts

As the result of a year's detailed investigation into the cost of cooking by electricity, the Pacific Power & Light Company of Portland, Ore., has published interesting figures on the subject indicating that the average family can cook electrically for about $3 a month with energy selling at 3.6 cents net.

The Pacific Power & Light Company operates in a number of smaller cities and towns in eastern Oregon and Washington, where coal and wood are not plentiful. For several years it has made strong efforts to secure more of a cooking load, and during the year ended Sept. 30, 1916, it added sixty-five ranges to its lines, bringing the total number to 201. These ranges earned the company $4,927.31 net during the year, and they consumed 128,671 kw.-hr. The earnings per kilowatt-hour were 3.82 cents, which were slightly in excess of the unit rate because of the minimum charge bills that brought up the average. The average monthly number of ranges in service was 161, making the yearly earnings per range $30.60.

One Quarter of Cooking Bills for Dollar Minimum

During the year the company issued 1930 bills for range service, and of these bills 527 were minimum charge bills for $1 or less. This indicates that 27.4 per cent of the bills were for installations that were not used to their best advantage. It is this class of billing that the company is doing its best to eliminate, educating the customers away from considering their stoves as accessory and stand-by features only. Considerable progress has been made in this work, and it is believed that during the coming year the minimum charge bills will be less than 20 per cent of the total.

A still more undesirable feature of the business is the fact that some patrons fail to use their stoves at all, and yet pay $1 for the stand-by. During the year the company issued fifty-four of these minimum charge bills showing no energy used at all. This figure is included in the 527 minimum charge bills mentioned above. It is only by concerted efforts on the part of the local managers and solicitors that the undesirable minimum charge bills and stand-by bills can be eliminated.

Average Monthly Bill $2.55

The average monthly bill was $2.55 net. The company has deducted from the total all the minimum charge bills and their earnings, and finds that the average bill with minimums eliminated is $3.13 a month. The company feels that this is a more honest expression of the cost of electric cooking, because the minimum charge bills do not indicate that the range owners were really using these ranges to full capacity. About fifty of the ranges, or approximately 25 per cent, were used in connection with electric water heaters, operated with the range through a double-throw switch. No earnings from water heaters are included in the above statistics.

Starting Right with the Customer

When the United Illuminating Company of New Haven, Conn., installs a meter it mails a letter to the new customer telling of the various conveniences that electric service can bring to the home. The letter mentions the many uses of appliances, and a card is inclosed which by filling in and mailing the customer can obtain a two weeks' free trial of an electric iron or toaster.

Art Gallery Lighted by "Daylight" Lamps

The first installation of type C "daylight" lamps for art-gallery lighting in New York City has been installed at the Salmagundi Club, 14 West Twelfth Street. The Salmagundi Club is one of the oldest and best-known clubs in America, and its membership is composed chiefly of artists. The new lighting was installed about a week ago to light an exhibition of water colors and illustrations by members. Forty-eight blue-bulb "daylight" lamps of 150-watt rating were placed in the regular trough reflectors to take the place of the old tungsten lamps.



EXHIBIT AT SALMAGUNDI CLUB, NEW YORK, ILLUMINATED BY "DAYLIGHT" LAMPS IN REFLECTOR TROUGHS

A Co-operative Demonstration to Show the Public How Housewiring Is Done

A plan for a co-operative "House Electric" that will show the public the methods employed by the up-to-date electrical contractor in wiring a house for electric service is being worked out by an official of the commercial department of a New Jersey power company.

According to the plan now under way the electrical contractors of the community get together and after selecting an unoccupied, unwired house make an offer to the owner to wire it free in exchange for permission to exhibit the work for a period of ten days. A fixture supply house is designated to furnish equipment for the job, the owner of the house paying for the fixtures at list and the supply house turning the net profit into the common fund to meet the cost of the wiring and the subsequent exhibition.

One contractor is selected by the group to supervise the wiring and the cost is borne by the others on a pro-rata basis determined by the number of men employed.

All dirt accumulated during the installation is to be left as made, and where floor boards have been removed they are to be left up. Canopies of fixtures are to be left down and one or two switches left out of the boxes to show the box construction.

The building is to be extensively advertised and a representative of the central station and contractors will be in attendance daily from 10 a. m. to 10 p. m.

A sign calling attention to the building on exhibition will be displayed in the office of the central station, and a similar sign placed in front of the house which is on display.

In the case referred to, the local real estate dealers were found to be very ready to co-operate in the scheme, especially where the house selected is on the market.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

SENSIBILITY OF THE EYE TO VARYING DEGREES OF LIGHT

Effects of Glare and Contrasts in Brightness Levels Studied to Determine What Is Good Lighting

THE eye is the sole means of distinguishing good lighting from poor lighting. It is therefore of the utmost importance that the effects of light on the eye be determined as accurately as possible so that the illuminating engineer may design lighting systems that are efficient and at the same time comfortable to the eye. Considerable work has been carried on in this direction, the past two years, in the Research Laboratory of the Eastman Kodak Company by Dr. P. G. Nutting. Although this laboratory was founded primarily for the purpose of investigating photographic problems, a study of the eye presented many interesting aspects closely allied with the theory of photography, and for that reason work on the subject was undertaken.

As is well known, the eye accommodates itself to certain changes in lighting conditions with much facility,

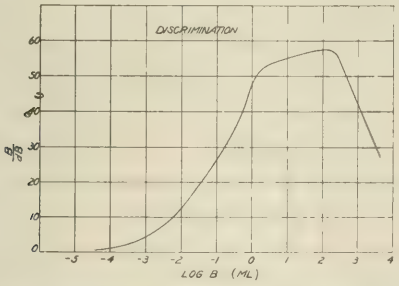


FIG. 1—CURVE SHOWING ABILITY OF EYE TO DETECT JUST NOTICEABLE DIFFERENCES IN BRIGHTNESS AT VARIOUS LIGHTING LEVELS

while with others it either works with difficulty or even does not function at all. One of the chief objects of the research on the eye has been to determine to what brightness levels and changes the eye most readily and with the greatest comfort and precision adapts itself. The ideal lighting is, of course, out-of-doors daylight lighting, lighting that is well diffused with no great contrasts anywhere. With artificial illumination the light usually comes from single directions, causing shadows and contrasts far in excess of those generally met with in the open. An increase in contrast decreases the sensibility of the eye, and it is very important to know just what degree of contrast is permissible in a given case so that the eye will operate with the least amount of irritation and smallest decrease in efficiency.

In studying the lighting conditions met with in ordinary life one may put the different kinds of lighting into four general groups as follows: (1) Exterior daylight with a mean brightness level of 1000 millilamberts; (2) interiors in daylight, 10 millilamberts; (3) interiors at night, 0.1 millilambert, and (4) exteriors at night, 0.001 millilambert. The research on the eye has been directed chiefly toward work on sensibility to brightness glare, to contrast and to lowest perceptible brightness (threshold sensibility).

The sensibility varies considerably in the four groups mentioned above. For instance, the brightness difference just noticeable in closely adjacent fields for a brightness level of 1000 millilamberts (average brightness of objects out-of-doors in full sunlight) is 0.0175, while for the 10 millilamberts level it is 0.030, for the 0.1 millilambert level, 0.123, and for the 0.001 millilambert level, 0.79. The instantaneous threshold in each

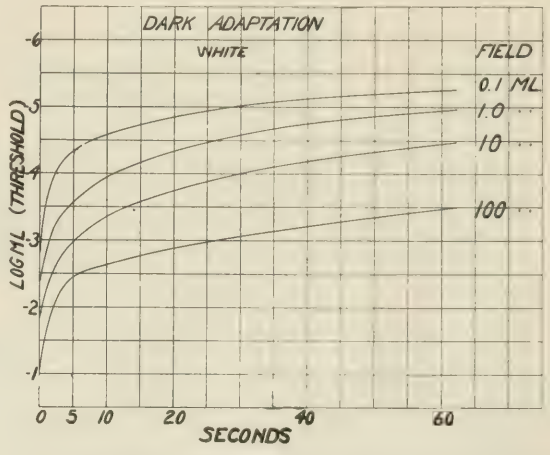


FIG. 2—TIME REQUIRED TO ADAPT THE EYE WITH WHITE LIGHT TO LOWEST LIGHTING LEVELS PERCEPTIBLE WITH DIFFERENT SENSITIZING FIELDS

case is 0.35 millilambert, 0.017 millilambert, 0.0014 millilambert and 0.00011 millilambert. These figures show that as the brightness level is decreased from that of out-of-doors daylight lighting the sensibility of the eye decreases. Taking the sensibility of the eye as unity at exterior daylight brightness the relative sensibility to glare is 200 for interiors in daylight, 18,000 for interiors at night and 160,000 for exteriors at night. Similarly the relative contrast and threshold

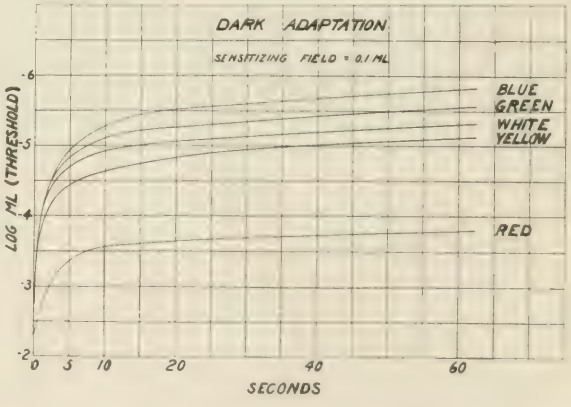


FIG. 3—DARK ADAPTATION CURVES FOR COLORED LIGHT

sensibilities are 1, 60, 1400 and 22,000 respectively and 1, 20, 350 and 3100 respectively.

A good part of the work on the eye was done with a visual "sensitometer," which consists of a large white cardboard with a small square opal-glass window in the middle which is illuminated from the rear by a Nernst lamp operating on a direct-current circuit of 160 volts.

A double lens is utilized to throw the image of the lamp on a slit. After passing through the slit the beam spreads and illuminates the small window. The intensity of the light is controlled by a black wedge which slides in metal ways past the slit. The wedge consists of a rectangular sheet of glass coated with a mixture of black dye and gelatine of varying thickness. At one

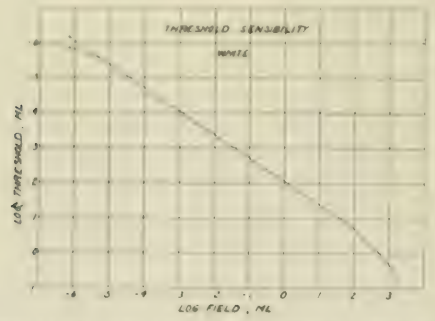


FIG. 4—RELATION OF LOWEST LIGHTING LEVELS INSTANTANEOUSLY VISIBLE TO BRIGHTNESS LEVELS TO WHICH THE EYE WAS PREVIOUSLY ADAPTED

end the coating is about a millimeter thick and is opaque, the opacity and thickness decreasing uniformly until at the other end clear glass is obtained. The coating is so arranged that the percentage of light transmitted by the wedge per unit of length can readily be obtained.

The observer faces the white cardboard at a distance of about 15 in. Back of the observer is placed a lamp of known rating, which is connected to a direct-current 115-volt circuit, for illuminating the large white field. The intensity of this lamp can be decreased to any value desired by means of light filters, which consist of sheets of gelatine dyed to the opacity required for transmitting the amount of light needed.

The brightness of the test field, which is that part of the illuminated opal glass showing through the square hole in the cardboard and of the surrounding field which is illuminated by the lamp behind the observer, can be measured at any time by a brightness photometer. This device is a small boxlike affair equipped with a battery-operated lamp. Through a small peephole one may view two very small rectangular windows placed side by side, the one being illuminated from the outside and the other by the miniature lamp. The amount of light coming from the miniature lamp can be decreased by a shutter connected to a movable hand on the outside of the box which travels over a scale calibrated in foot-candles. The readings can be changed to lamberts and millilamberts by multiplying them by a constant. The shutter is shifted until the illumination of both windows is the same. At this point a read-

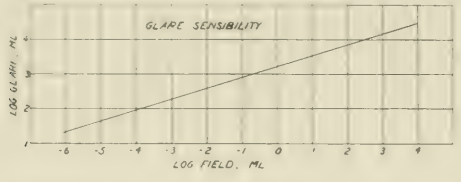


FIG. 5—BRIGHTNESS THAT JUST BECAME PAINFUL (GLARY) WITH EYE PREVIOUSLY SENSITIZED TO DIFFERENT LIGHTING FIELDS

ing is taken which indicates the brightness of the outside field.

In the original photometer used the small test windows were arranged concentric to each other. With this arrangement, however, the fovea or center of vision favored the inner window, so to speak, and there was a tendency not to match accurately the brightnesses of the two windows. With the rectangular windows as adopted in the Kodak Research Laboratory the dividing line bisects the center of the two adjacent fields taken as a single field, and although the brightness near the middle of this center line may appear different from that at the outer edges, what brightness is apparent in one part of one window, when the two are correctly matched, is also apparent in the same part of the other window.

Readings were taken with a number of observers. Before starting any experiment, however, each observer was kept in a dark room from fifteen to twenty minutes so that the eye would be affected as little as possible by previous conditions. Even then much depended on what the observer had been doing hours before. From data taken and curves plotted therefrom, in the afternoon it could be determined whether the subject had worked in a dark room during the forenoon. It was also found that a person who does considerable work in a dark room "gets his eyes" much more rapidly than one who does not, but according to data obtained the final maximum sensibility is no higher.

The sensibility of the eye to minimum contrast (brightness difference just noticeable in closely adjacent fields) was determined by first making the test field and surrounding field of the sensitometer of the same brightness and then moving the wedge until a difference in brightness between the large and small field is just perceptible. A curve was plotted (Fig. 1)

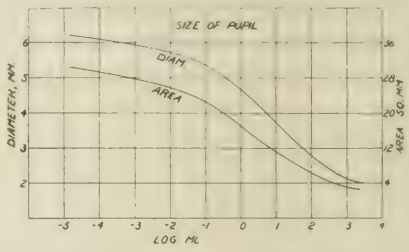


FIG. 6—VARIATION OF SIZE OF PUPIL TO VARYING LIGHTING LEVELS

with the logarithms of brightness as abscissæ and the field brightnesses divided by the just noticeable differences (discrimination factors) as ordinates. The abscissæ are given in logarithms because of the great range of brightness values. Since good seeing is said to be determined chiefly by the ability to distinguish details differing but slightly in brightness, the curve is especially useful because it shows just at what brightness levels the eye can detect the smallest differences; in other words, the greatest amount of detail in high light, half-tone and shadows.

The difference sensibility curves vary according to the amount of time to which the eye has been adapted to the large field. This is in accord with one's experience when he passes suddenly from a light room to a dark room or vice versa—the eye requires time to adapt its sensitivity to the new brightness level. Similarily, if a searchlamp is suddenly flashed in one's eyes at night time when the eyes are adapted to a very low level, the light appears very blinding, whereas if the lamp's beam is turned toward the eyes in bright sunlight, when the eye is adapted to a much higher level, it is scarcely noticeable.

Fig. 2 gives one an idea of what eye adaptability is for white light with initial brightness of 0.1 millilambert, 1 millilambert, 10 millilamberts and 100 millilamberts. Fig. 3 shows dark adaptation curves for different colors with a sensitizing field for each set of readings of 0.1 millilambert.

The discrimination and dark-adaptation curves also give one an idea of how the eye is acting when pass-

ing rapidly along an unevenly illuminated street. The eye adapts itself more quickly in brighter places, it has been found, than it does in dark localities; with even illumination its sensitivity is much greater. Again, in viewing any field exhibiting heavy contrasts, such as a machine shop, for instance, where one's attention wanders continually from dark patches to glary

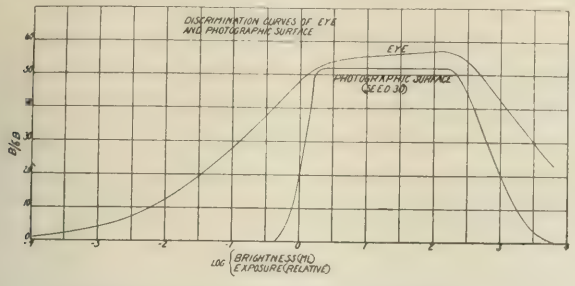


FIG. 7—CURVES SHOWING RELATIVE SENSIBILITY OF THE EYE AND PHOTOGRAPHIC PLATE TO VARYING LIGHT

surfaces, the sensibility of the eye is lowered, and consequently it is necessary to increase the intensity of the illumination.

In Fig. 4 is shown a curve plotted from data obtained by the threshold method with white light. Readings were taken by adapting the eye to a certain level with the large field and then suddenly substituting a brightness in the small field that previously had been found to be just perceptible. This instantaneous threshold, as it is called, indicates the state of the retina at any point. The curve is a straight line excepting at the extremities. The bending off near the threshold is due to the difference in the size of the two fields. At high intensities the falling off in the linear relation indicates a decrease in retinal sensibility. In the region of ordinary brightness there is a slight dip, showing that here the eye is more sensitive.

In getting data on glare sensibility the eye was adapted to a certain brightness level and then suddenly exposed to a light that appeared just uncomfortably bright. A straight-line curve was plotted from the glare-sensation readings as shown in Fig. 5. This curve can only be continued to a point where the sensitizing field itself appears glaring where adaptation ceases. This point was found to be at about 52 lamberts, which is five times as bright as white paper in direct sunlight. The readings were repeated with a number of observers and remarkably uniform results were obtained. They tell just what overload the retina can withstand. The data on glare also show very clearly why the light from a searchlamp or a headlamp of an automobile or locomotive is so blinding at night time and scarcely noticeable in the day.

In Fig. 6 are illustrated two curves which show how the diameter and area of the pupil of a normal eye decreases as the intensity of light increases, the pupil contracting automatically to protect the retina from the increased amount of light. The diameter varies from about 2 mm. to 8 mm. On being suddenly exposed to a bright light, a second is required for the pupil to contract to a size which is normal for the new brightness level; when a sudden lowering is made in the brightness the pupil expands to a diameter of 5 mm. in two seconds, and then continues to expand slowly to the limit.

Fig. 7 illustrates the eye discrimination curve shown in Fig. 1, and for comparison purposes a curve which shows the effect of short exposures of varying intensities on a photographic plate. As can be seen, the eye is far more sensitive with low intensities of light than the photographic plate.

The data obtained by the experiments on the eye as outlined are of immense value to the illuminating engineer. They show that contrasty fields are to be avoided wherever possible; if heavy contrasts are unavoidable the fields have to be illuminated to much higher brightness levels than would be necessary where moderate contrasts prevail. A study of the curves will also readily show why indirect or semi-direct illumination with the consequent elimination of the glare of light sources is preferable to direct lighting, and why white ceilings, light-colored walls and absence of dark furniture and glossy surfaces are necessary to reduce the amount of excessive contrast.

The experiments on the sensibility of the eye are being continued, new observers being used in many cases to carry on experiments performed before so as to check the results obtained so far.

Generators, Motors and Transformers

Effect of Barometric Pressure on Temperature Rise of Self-Cooled Transformers.—V. M. MONTSINGER.—A standard rating applies only when an electrical machine is installed in a temperature location and at a moderate altitude. For service in a tropical climate or at a great altitude, an electrical machine must be re-rated, as otherwise the temperatures attained may exceed approved values. The author deals with the influence of altitude and discusses the effect of altitude upon the temperature rise of oil-immersed transformers without water cooling. Tests are described which were made successively at Pittsfield, Mass., whose altitude is 305 meters; at Boulder, Col., where the altitude is 1830 meters, and at Leadville, Col., where the altitude is 3360 meters. For some kinds of transformer tanks the temperature rise at this greatest altitude exceeded that at Pittsfield by some 12 per cent. It is quite evident that a variation of so considerable magnitude cannot be ignored. Formulæ are developed by the author which will enable the effect of altitude to be accurately taken into account, and he recommends their inclusion in the A. I. E. E. standardization rules. The present recommendations concerning altitude in the American and British rules are shown by the author to be inapplicable for transformers immersed in oil in tanks of the types which were employed in the tests at Pittsfield, Boulder and Leadville. The chief results of the investigation are summed up as follows: Within a limited range of temperature, namely, from about 40 deg. to 80 deg. C., loss by radiation varies approximately

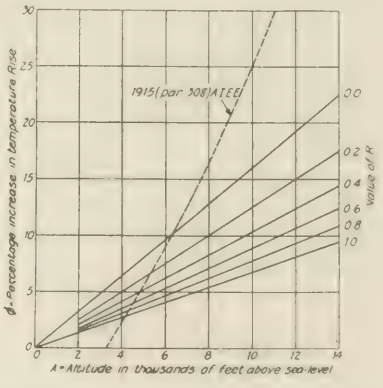


FIG. 8—CURVE SHOWING EFFECT OF ALTITUDE OR HEATING OF DIFFERENT SHAPE TANK SURFACES

as the 1.12 power of the temperature rise. Loss by convection varies as the 1.25 power of the temperature rise. For self-cooled transformers having tanks with irregular contours, the total loss dissipated usually varies as the 1.25 power of the top oil rise. For transformers having smooth surfaces the loss varies close to the 1.15 power of the top oil rise. Radiation is not

affected by barometric pressure. Convection varies approximately as the 0.5 power of barometric pressure. Or stated in another way, for a constant loss, the temperature rise varies inversely as the 0.4 power of the barometric pressure. For a constant loss supplied to tanks having different shaped surfaces, the effect of altitude on the temperature rise of top oil is expressed by the formula:

$$\varphi = \frac{1.46A}{1 + 1.3R}$$

in which φ = increase in temperature rise of top oil in percentage of rise at lower altitude; A = difference in altitude in thousands of feet; R = ratio of envelope area of tank surface to developed area of tank surface. For transformers having 40 per cent core loss and 60 per cent copper loss (which is increased with an increase in temperature due to higher altitude) the effect is to increase the constant 1.46 in the above formula to 1.6, so that we have:

$$\varphi = \frac{1.6A}{1. + 1.3R}$$

Curves calculated from this equation for different values of R are shown in Fig. 8, together with a curve representing the A. I. E. E. (par. 308) rule.—*Gen. Elec. Rev.*, January, 1917.

Installations, Systems and Appliances

Grading of Starting Resistances for Series Motors and for Series-Parallel Control.—F. T. CHAPMAN.—In practical work the value of the number of steps in a rheostat is often fixed by the type of controller to be used in a particular case, or the choice is between two or three values at the most. The value of the maximum current employed during the starting period is fixed fairly definitely by conditions all together apart from the starter. With the number of steps and the maximum current fixed the problem is to determine the minimum current and the values of the resistance steps. The author describes a simple method which has some novel features. The speed-current curve is made use of.—London *Electrician*, Dec. 8, 1916.

Magnetic Control for Miscellaneous Apparatus.—C. W. GAMMONS.—In this, the sixth installment of the series on industrial control, applications of magnetic control apparatus are described, which have been thoroughly standardized. Photographs and complementary wiring diagrams of the various types of apparatus are given with explanations of the sometimes intricate functions of the different parts of the equipment. In particular, the article treats of starters for squirrel-cage, form-wound, single-phase and direct-current motors, and equipments for master switches, valve control, arc-furnace control, and arc-welding control.—*Gen. Elec. Rev.*, January, 1917.

Starting Rheostats.—CAMPANAKIS.—A mathematical article illustrated by diagrams on the calculation of starting rheostats with oil.—*La Lumière Elec.*, Dec. 9, 1916.

Electrochemistry and Batteries

Fixation of Atmospheric Nitrogen.—HELEN R. HOSMER.—A useful list of references to the extended literature on the nitrogen industries and the fixation of atmospheric nitrogen from 1912 to 1916.—*Gen. Elec. Rev.*, January, 1917.

Electrolytic Dissociation.—H. J. M. CREIGHTON.—An article on electrolytic dissociation in non-aqueous solutions. The author considers it to be probable that the dissociating power of a solvent cannot be regarded as a well-defined physical constant, but that it must be considered as a specific property of the solvent, which has its origin in the physical constants existing between solvent and solute.—*Journ. Franklin Inst.*, December, 1916.

Units, Measurements and Instruments

Elastic Properties of Phosphor-Bronze Wires.—A. J. OEHLER. Former work on platinum-iridium wires when used as suspensions for torsion pendulums showed some remarkable elastic properties of that alloy. The principal one of these was the variation of the period with the amplitude of vibration. The present author has tested phosphor-bronze wires in the same way and found that there were three distinct states, from one to another of which the wires may change. Drawing of the wires has a tendency to increase the effect of a varying period with the amplitude. Both a long-continued vibrating and a long-continued annealing have the effect to change the state of the wire. The author concludes that phosphor-bronze wires are not desirable as delicate suspensions, in many cases where they are used. He thinks it is very probable that all alloys have their distinct peculiarities just as platinum-iridium wires and phosphor-bronze wires have been found to have.—*Phys. Rev.*, November, 1916.

Telegraphy, Telephony and Signals

Transformers in Wireless Telegraphy.—H. CHIREIX.—Numerous authors have developed equations for the charging circuit of wireless telegraphy stations operating in resonance, but have neglected in their calculations the influence of the magnetizing current of the transformer. The object of the present article is to take this effect into account. The author shows in particular how a poorly designed transformer may decrease the power of the wireless telegraph station and how it is possible to determine the best weight of copper for a given magnetic circuit.—*La Lumière Elec.*, Dec. 2, 1916.

Miscellaneous

Lord Kelvin.—ALEXANDER RUSSEL.—His Kelvin lecture before the (British) Institute of Electrical Engineers on "Some Aspects of Lord Kelvin's Life and Work." The author discusses Kelvin's early training at Glasgow, his work in electrostatics, the Cambridge period, his work on electric images, absolute units, electric oscillations, peristaltic induction, the Atlantic cable, sparking distances, vortices, the diffusion of heat, the cooling effect produced by a covering, age of the earth and sun, high-frequency resistance, and the activity of Kelvin as electrical engineer and as a teacher.—London *Electrician*, Nov. 17, 1916.

Electrification of Wool.—A discovery of some scientific interest is announced by Dr. S. A. Shorter, of Leeds University, who has been working on the electrification of fibers. Hitherto it has been generally assumed that such electrification, which is a source of trouble in textile processes, is due to friction. Dr. Shorter has established the fact that electricity can be evolved as a result of drying, accompanied by a subsequent lowering of the temperature. Among the suggested methods of getting rid of such electrification is the use of metallic discharging points or of ultro-violet light.—London *Electrician*, Nov. 17, 1916.

Photometer.—H. E. HOWE.—A paper on a modification of the Hilger sector photometer method for measuring ultra-violet absorption and its application in the case of certain derivatives of fluoran.—*Phys. Rev.*, December, 1916.

Bonding of Electric Cables.—An article on the bonding and anchoring of electric cables with special reference to mining practice. A series of twenty-one sketches is given illustrating the different methods in use.—London *Elec. Review*, Dec. 8, 1916.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

John B. Taylor of Watertown, N. Y., has been appointed president of the Wetmore Electric Company of Lowville, N. Y.

J. H. Gillis of Gloucester, Mass., has been appointed line superintendent of the Worcester Suburban Electric Company of Uxbridge, Mass.

T. S. Morrison of Asheville, N. C., has been elected president of the North Carolina Electrical Power Company of Asheville to succeed Captain W. T. Weaver, recently deceased.

E. L. Sellers, superintendent of the Kentucky Public Service Company at Frankfort, Ky., for the past three years, has been appointed manager of the Oneonta (N. Y.) Light & Power Company.

W. E. Brewster has resigned from the engineering department of the National Lamp Works of the General Electric Company, Nela Park, Cleveland, Ohio, to take up work with the Sperry Gyroscope Company of New York City.

P. A. E. Armstrong, who has been manager and chief engineer of Quasi-Arc Weltrode Company since its organization, has recently taken a managerial position with the North American Company with offices in New York City. He will take up new development work in an electro metallurgical line. Before being with the Quasi-Arc Company, Mr. Armstrong was steel expert for Bohler Brothers Styrian Steel Works, Sheffield, England.

R. G. Carroll, recently acting manager of the Eastern Texas Electric Company at Beaumont, Tex., has been appointed manager of the Key West (Fla.) Electric Company, to succeed I. M. Stover. Mr. Stover was recently assigned to the management of the Baton Rouge (La.) Electric Company which operates the electric-lighting, gas and street railway systems in Baton Rouge. Mr. Carroll has been in the employ of the Stone & Webster Company of Boston, Mass., for the past fourteen years, holding positions in Jacksonville, Tampa and Pensacola, Fla.; Boston, Mass., Minneapolis, Minn., and Fort Worth and Beaumont, Tex.

James D. Callery has resigned the presidency of the Pittsburgh (Pa.) Railways, but will continue to serve as chairman of the board of directors. The vacancy caused by Mr. Callery's resignation as president will be filled by Sumner L. Tone, now vice-president of the Duquesne Light Company, one of the subsidiaries of the Philadelphia Company, of which the Pittsburgh Railways also is a part. Mr. Callery has purchased a seat on the New York Stock Exchange and will associate himself with N. K. McMullin in the brokerage business. Mr. Callery has been president of the consolidated street railways of Pittsburgh since 1902. He is also vice-president of the Philadelphia Company and its subsidiaries, president of the United Traction, the Southern Traction Company, the Allegheny Light Company, the Pittsburgh Railways and subsidiary companies, and director of the Westinghouse Electric & Manufacturing Company.

F. B. Yamnicky, formerly vice-president and general manager of the Vacuu-Rite Lamp Company of Chicago, Ill., has severed his connection with that company.

Frank Hussey has been appointed general manager of the East Haddam Electric Light Company of East Hampton, Conn., succeeding J. T. Sherlock, who has been transferred to a similar position in Hadlyme, Conn.

George E. Squier has been appointed fuel engineer of the United Electric Light Company, of Springfield, Mass. His immediate duty will be to study the fuel supply of the company with the purpose of improving its quality.

Martin F. Coyne, of Portsmouth, N. H., who for several years has been connected with the Rockingham County Light & Power Company of Portsmouth, N. H., has been appointed manager of the New Market (N. H.) Electric Company.

Samuel B. Mott has been appointed manager of the Noblesville (Ind.) Heat, Light & Power Company, to succeed John T. Kester, who resigned on Sept. 1. For seven years Mr. Mott was superintendent of the Noblesville company, and prior to that time he was the chief engineer at the Noblesville power plant of the National Carbon Company.

Walter P. Schwabe, who has just been elected a director and vice-president of the Northern Connecticut Light & Power Company of Thompsonville, Conn., has for the past eight years been general manager of the Connecticut company, and prior to taking that office he was employed by the Public Service Corporation of New Jersey in the capacity of district superintendent and agent.



W. P. SCHWABE

H. M. West has been appointed commercial manager of the Harrisburg (Pa.) Light & Power Company.

J. W. Ostertag has been promoted to the position of assistant commercial manager of the Harrisburg (Pa.) Light & Power Company.

T. D. Montgomery has been appointed manager of the New York office of the Cutler-Hammer Manufacturing Company, of Milwaukee, to succeed W. C. Stevens, who has taken up new duties as sales manager of the company at Milwaukee.

J. H. Sturge, assistant superintendent of the southern division of the Public Service Electric Company, at Trenton, N. J., has been appointed superintendent, succeeding Paul Lüpke, whose headquarters will hereafter be at Newark, N. J.

Emil A. Bechstein, for a number of years general manager of the Sandusky (Ohio) Gas & Electric Company, has been elected second vice-president of that company, succeeding P. A. Staples. Mr. Bechstein is also president of the Ohio Electric Light Association.

L. A. Nott, who for twelve years has been associated with the Pacific Coast sales department of the Standard Underground Cable Company, has become identified with the K-P-F Electric Company of San Francisco, manufacturers of high-tension pole-top switches, transformer and disconnecting switches.

E. W. P. Smith, who has been city electrician of Cleveland, Ohio, for the past three years, has resigned to become consulting engineer with the Elliott Electric Company, 322 Champlain Avenue, Cleveland. Mr. Smith was graduated from Colorado College in 1908. After a year of operating experience in the West, he entered the employ of the Westinghouse Company, at East Pittsburgh, in the railway engineering department. Early in 1914, he was appointed city electrician of Cleveland. During his term of office, a revision of the Electrical Code was prepared, and passed by the Council. Mr. Smith is chairman of the Cleveland Section of the American Institute of Electrical Engineers.

J. Walter Allen has been appointed electrical engineer of the Boston (Mass.) Elevated Railway, effective on Jan. 1, 1917. Mr. Allen is well known in New England electrical circles. He is a native of Newtonville, Mass., and after graduating in 1899 from the Massachusetts Institute of Technology entered the employ of the Boston Elevated Railway, spending four years in the cable testing department. In 1906 he was appointed assistant to the company's electrical engineer, and since Nov. 1, 1915, has been acting electrical engineer. Mr. Allen has had a close connection with the development of the electrical equipment of the Boston rapid transit and surface lines, and the establishment of the alternating-current system of generation and transmission, which to-day forms the backbone of the larger service rendered the metropolitan community.

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Overload Relay for Compensators

The Condit Electrical Manufacturing Company of South Boston, Mass., has developed the overload relay shown here in which the contacts are separated by the movement of two armatures whose actuating coils



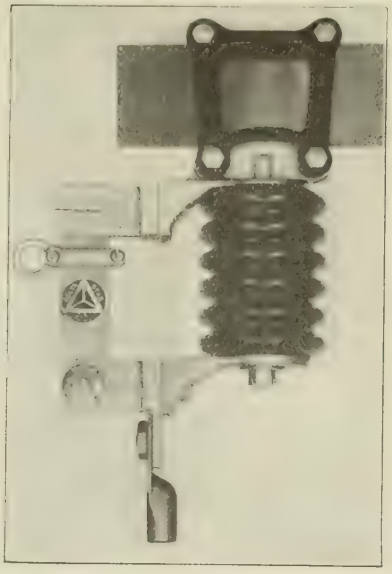
OVERLOAD RELAY FOR USE WITH COMPENSATORS ON SQUIRREL-CAGE MOTORS

are connected in series with the line when the compensator is in the running position. Upon the occurrence of an overload or a sustained short-circuit, the coils of the relay are energized, causing the armatures to be drawn up, thereby separating the relay contacts and opening the circuit of the under-voltage coil of the compensator, thus automatically throwing the compensator to the "off" position. The entire device is inclosed in a neat dull-black, dustproof metal case which also serves as a protective covering for the contacts, series coils, calibration tubes and time-limit attachments. The upper portion of the case is removable for inspection of the contacts. By removing the lower part of the casing which incloses the calibration tubes, the relay may then be adjusted for any value of current within its rated range.

The series coils of the relay are covered by the central section of the casing. The ends of the coils are brought out through the slate base and terminate in lugs to which the line wires may be attached. Each coil is fitted with an oil dashpot time-limit attachment which prevents the relay from operating on momentary fluctuations of load, but which does not interfere with its operation on a short-circuit or sustained overload.

Bus-Type Disconnecting Switches

Disconnecting switches placed in series with the busbar side of high-tension oil circuit breakers or switches that enable the operator to adjust or inspect the breaker mechanism without



DISCONNECTING SWITCHES FOR BUSBAR SIDE OF HIGH-TENSION OIL SWITCHES

danger are shown in the accompanying illustration as made by the Delta-Star Electric Company of Chicago, Ill. This switch is designed for clamping or mounting directly on the bus, thus securing a high space factor. Attention is called to the fact that the adjustable contact and holding clamp enables the switch to be so located that a short run is secured to the oil switch terminal. Another useful feature is that in case the oil circuit breaker proves defective or develops short-circuits within itself, the trouble can be localized by opening the disconnecting switches.

The description of the "Tungar" rectifier built by the General Electric Company was erroneously headed "mercury arc rectifier" in the issue of Dec. 23, page 1258. As the text showed, rectification of the current does not depend on mercury.

Potentiometer for "Hot Spot" Temperature Measurement

For measuring the temperature of the hottest part of electrical machines where a thermo-electric couple is installed the Westinghouse Electric & Manufacturing Company has developed the potentiometer shown here for use therewith. This instrument balances the electromotive force of the couple under test against that of another couple at known temperature. This avoids all errors due to variation in leads, etc., and as all indications are on the "null" or zero reading principle, very accurate readings are obtained. The reading is given directly in degrees Centigrade. By using a dial switch, any number of thermo-couples on one machine or on several can be read at will with one potentiometer at any desired location. The potentiometer can also be employed for general testing work, such as resistance measurements in which electromotive forces of 5 milli-volts or less are to be measured; the determination of temperature in other than electrical apparatus, such as bales of cotton or tobacco in course of curing, and for determining the internal temperature of coal storage piles and similar uses.

The potentiometer shown is made in portable and switchboard types, and combines in one case all necessary parts with the exception of the thermo-couple



POTENTIOMETER FOR USE WITH THERMO-COUPLE INSTALLED IN MACHINES

circuit. The switchboard type of instrument is mounted in a metal case with black finish. In both types, the scale range is 0-150 or 0-200 deg. C.

A simple operation suffices to measure the temperature at the point where

the thermo-electric couple has been installed. The emf. of the thermo-couple is proportional to the difference in temperature between the cold couple and the hot one. The indication on the scale, however, is the actual temperature in degrees of the hot couple, as the setting of the lower pointer on the scale at the temperature of the cold couple (indicated by the mercury thermometer) mechanically adds this temperature to the potentiometer measurement. A simple method of checking the apparatus is to make a direct comparison with a standard thermometer by placing the test couple, furnished with the apparatus, in an oil bath with the standard thermometer and comparing the potentiometer readings.

Gas Protector for Manhole Work

The Gasco Protector Company of Waukegan, Ill., has developed a gas protector for use in manhole work which consists of a mask, flexible tubing, intake funnel and head straps. The outfit is made very light so as not to be burdensome or to interfere with the work of the wearer. The mask is constructed of rubber and aluminum. When put on the face, it is held in place by adjustable head strips, making an air tight fit, as the rim of the rubber mask is inflated through an air valve blown up by the mouth. The flexible rubber tubing that is connected to the inlet of the protector is also water and gas proof. This tubing is 12 ft. long and is equipped with an intake funnel. When the breathing is natural, there is no pressure of any kind connected to the equipment, pure air being drawn through the intake funnel and tubing to the mouth and nostrils and the



GAS PROTECTOR OUTFIT IN USE

vitiated air expelled through the exhaling valve in the ordinary process of respiration. The protector is put on as shown in the illustration and, it is claimed, that a man can enter any manhole, no matter how much gas is present, without feeling ill effects.

Electrically Illuminated Fireplaces

The Universal Stage Lighting Company, 240 West Fiftieth Street, New York City, has developed a line of imitation wood fire logs made in several sizes and designs, consisting of three or more logs, naturally grouped for interior fireplaces and outdoor campfires. The logs are made of a translucent material and asbestos, reinforced with metal and made hollow for the insertion of electric lamps. The bark and cut ends of the logs are artistically designed and hand painted to give the natural appearance of partially burned logs.

Large imitation wood logs with an imitation ash heap are made for old-fashioned open fireplaces. Both the wood logs and ashes are properly illuminated to give the natural effect.

The coal fireplace designs are identical to the modern coal baskets or grates used in open fireplaces. Electric bulbs are concealed in the coal beds which consist of actual coal mixed with lumps of glass to give transparency. When illuminated this gives the appearance of a burning coal bed. To make the scene or effect more realistic

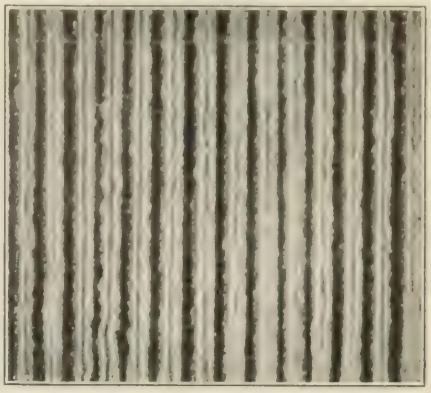


IMITATION COAL GRATE ELECTRICALLY ILLUMINATED

a chemical smoke can be used with either the wood logs or grates. Heating units are also made for use when the fire logs or grates are desired as a heater and ornament combined.

Chemically Pure Planté Positive Plate

The type of plate known as the "chemically pure" which has recently been placed on the market by the Gould Storage Battery Company, 30 East Forty-second Street, New York City, has been designed with a view toward greatly increasing the life of the positive plate and making it more nearly approximate that of the negative plate. The manufacturers state that the process of formation of the plate is entirely different from the electro-chemical processes hitherto employed in the manufacture of Gould Planté plates. The new chemically pure Planté positive was designed with a view to obtaining, if possible, the pure active material in a highly condensed form in the initial process of plate manufacture. The chemically pure active material of the new plate, with a higher capacity per square inch surface than the old electro-chemically formed plate, it is pointed out, now makes it possible to obtain normal battery capacity with a smaller plate sur-



MAGNIFIED SECTION (5 DIAMETERS) OF THE SURFACE OF THE POSITIVE PLATE

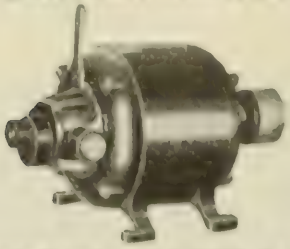
face than formerly. This permits the use of heavier ribs and wider acid space between the ribs. Where formerly the plates were made with .0020-in. ribs and .0016-in. space, the new plates are made with .0024-in. ribs and .0024-in. space, which evidently provides more reserve lead and wider space between ribs for quick and easy diffusion of electrolyte.

Attention is called to the fact that in this new construction there are apparently two distinct advantages obtained. First, there is a somewhat heavier section of reserve lead in the ribs of plate which is made for future conversion of peroxide (when there is no more reserve lead left in the ribs of the plate), the battery is about at the end of its life. Therefore, the more reserve lead provided, the longer will be the battery life. The second advantage is found in that the active material being formed in a thin but very dense skin over the surface of the ribs, the grooves between the ribs are left open clear to the bottom, permitting free circulation of electrolyte. This it is believed will remove one of the chief causes of battery sulphation, that due to highly concentrated acid becoming pocketed in the depths of the plate, as may sometimes occur where the active material is formed to such a thickness as to completely fill the space between the ribs. Moreover as the wider spacing of the new plate allows a free circulation of the electrolyte, the diffusion of the acid out of the active material on charge and into it again on discharge will be very materially assisted. Accordingly, the battery gives a somewhat higher voltage on discharge and reaches a full state of charge at a slightly lower voltage than is experienced with the older type of plate.

Another advantage of the new plate is that even if it may become badly sulphated, the active material never completely fills the space between the ribs and accordingly cannot set up expansion strains to cause buckling of the plate.

Variable Speed Motors

The R. P. Warner Electric Company of Kalamazoo, Mich., is now offering the trade a line of variable speed, single phase motors which it is claimed

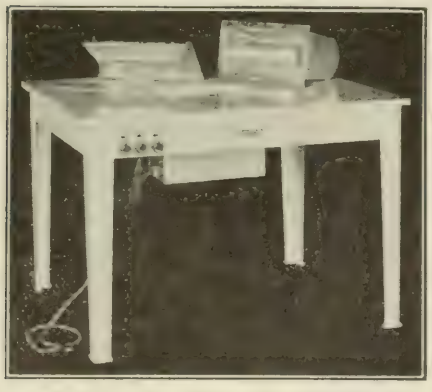


VARIABLE SPEED MOTOR THAT HAS LOW STARTING CURRENT

require no greater current for starting than an ordinary direct-current motor. The speed ranges are gradual when the rocker arm is moved back and forth. The efficiency is the same throughout the entire range of speed, because the principle used is that of varying the point of commutation, with reference to the field coils; thus getting a range from 0 to 1500 r.p.m. in some types and 0 to 4000 r.p.m. in other types. The motors are especially adapted for printing presses, ventilating fans, sewing machines, moving picture machines and running of machine lathes.

Table for Melting Chocolate Electrically

The International Electric Company of Indianapolis is manufacturing a table equipped with a heater for melting chocolate or similar material used in making candy. The table illustrated herewith consists of a ⅞-in. by 35.5-in. by 43.5-in. Italian marble top with bevelled edges mounted on a white enameled steel frame which makes the table stand 29⅞ in. high overall. In the center of the table-top is a galvanized container large enough to hold 30 lb. of chocolate. In another compartment underneath this container are located three heating elements with a total rat-

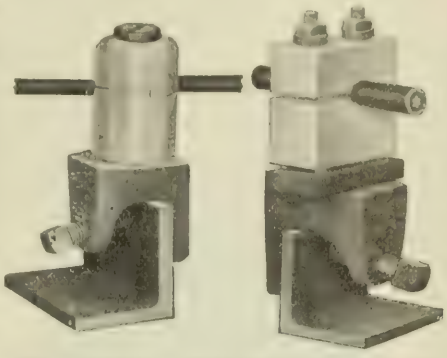


HEATER FOR MELTING CHOCOLATE OR SIMILAR MATERIAL

ing of about 300 watts. These elements are controlled by three switches on the front of the table to give high, low and medium temperatures. When the heaters are all in use, it is claimed that this device will melt about 30 lb. of chocolate in thirty minutes. The chocolate can then be maintained in its molten state by use of either the medium or the low temperature unit. The heating elements are made for any potential from 100 volts to 250 volts.

Insulator Supports

Insulator supports of malleable iron for securing insulators to open steel framework for wiring mills, foundries, shops, bridges and similar structures are now made in four sizes by the Steel City Electric Company, 1207 Columbus Avenue, Pittsburgh, Pa. These supports can be used in any position on the flanges of any standard rolled steel structural shape such as beams, angles, channels, Z bars, pipes, etc. For double-knob work a separate sup-



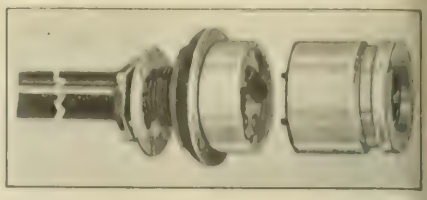
TWO TYPES OF INSULATOR SUPPORTS OF MALLEABLE IRON

port is used for each insulator. Cup-pointed case-hardened set screws are used on these supports. Where the support is subjected to constant vibration a sharp blow on the head of the set screw embeds the point in the steel and an extra turn prevents slipping or loosening.

Lighting Unit Fitting

Lighting units for shops, freight sheds, factories, etc., that consist of a combination of one-piece porcelain enameled steel reflector and a porcelain socket with lamp grip, assembled by means of a special holder, are being marketed by the Central Electric Company of Chicago, Ill. The fitting consists of a substantial malleable-iron reflector seat with a neck at the top threaded both inside and out, the inside to receive conduit and outside to receive the locknut as shown in the accompanying illustration. The reflector is held solidly between a lead washer and the locknut above and a special cork washer on top of the reflector seat below. A split porcelain socket is employed, the upper half, as shown in the figure, being fastened to the reflector seat. Two porcelain lugs are cast in the upper half of the porcelain socket and these fit into corresponding slots in the lower half of the socket and so align the two parts accurately.

Two long contact screws shown projecting above the lower half of the socket make connections both electrically and mechanically between the two parts of the socket. The lamp-base shell is so constructed as to prevent these screws from falling out and being lost when the socket is being in-



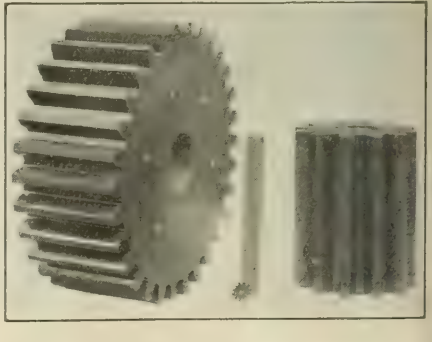
FITTING FOR USE WITH GAS-FILLED LAMPS

stalled overhead. A thin rubber gasket between the two parts of the porcelain socket makes this waterproof and where desired an additional rubber gasket at the lamp-base can be added. This protects all metal parts of the socket from both water and acid fumes such as might be experienced in roundhouses.

These fittings are made to accommodate all the standard types of reflectors up to 1000 watts. With lamps of 300-watt capacity and larger a mogul base socket is supplied.

Large Noiseless Pinions

An interesting example of what may be accomplished with Bakelite Micarta-D gear material is pointed out by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., in the gears of the accompanying illustration. As will be seen by comparison with the foot rule at the right of it, the pinion in the center is 21 in. in diameter and has an 8-in. face. It is designed to transmit 100 hp. at 425 r.p.m. One of the particular features of this pinion, in addition to its large size, is the fact that no metal shroud was employed, or needed. Bakelite-Micarta-D gear material is a product of heavy duck bonded together with Bakelite by heating while under an enormous pressure, and is said to be as strong as cast iron. It is unaffected



PINIONS WITHOUT METAL SHROUD

by atmospheric changes, cannot be destroyed by rats, is vermin-proof and can be stored indefinitely without shrinking or other deterioration. It has been used for gears that operate in oil without signs of swelling.

Chronicle of Events of the Industry and of Important Movements in the Field

NEWS OF THE WEEK

Reports of Conventions and Meetings of Electrical Associations and Societies

$3,000,000 BOND ISSUE AUTHORIZED IN SEATTLE

Ordinance Passed Is Part of General Scheme for Making Enlargements of Present Municipal Light and Power Plant

As a part of a general scheme for making enlargements of the present municipal light and power plant, an ordinance was passed at a meeting of the City Council on Dec. 18 authorizing the issuance of $3,000,000 utility bonds for the purpose of purchasing a completed hydroelectric plant. The board of public works is authorized to advertise for bids for a completed plant, with a connection into the city, for the generation of 13,000 kw. of continuous energy, capable of generation of 25,000 kw. for a period of five hours each day. Authority is also lodged in the board of public works to accept any bid in its discretion complying with the general requirements outlined in the ordinance. Several weeks ago the City Council voted a condemnation of the property immediately north of the present steam auxiliary on Lake Union as a site for the construction of an additional unit to the present steam plant. Unprecedented action was taken by the Council when it followed the passage of the above ordinance with a conference with Corporation Counsel Hugh M. Caldwell, at which time he was directed to test in the Supreme Court the validity of such a bond issue made without a vote of the people.

RESTORATION OF EDISON DIFFERENTIALS A POSSIBILITY

President Edgar of the Boston Edison Company Tells Massachusetts Commission of Conferences in New York to That Effect

President C. L. Edgar of the Edison Electric Illuminating Company of Boston appeared before the Massachusetts Gas and Electric Light Commission recently as a witness in connection with the street lighting rate arbitration, being conducted by the board. He was examined at length by Corporation Counsel John A. Sullivan, on behalf of the City of Boston, relative to the license agreement with the General Electric Company and its predecessors which has been in vogue for the past thirty years. A review of the company's relations under this agreement as previously filed with the board was published in the ELECTRICAL WORLD of Dec. 23, 1916, page 1233.

Mr. Edgar said that the Boston Edison company had never paid any royalties in connection with the development of the alternating-current system. There are five Edison licensees in Massachusetts—Boston, Brockton, Fall River, New Bedford and Lowell. No municipal plants are operating in the State under Edison license, to the witness's knowledge. The Boston company has abandoned extending the Edison tube system unless to complete a street already thus equipped. At the time the Edison tube system was developed there was no underground cable in existence. The company attempted to install some underground cable in 1887, but it was a failure. License fees are not being paid on any specific item connected with the license, anything paid being based on the general patent system. Under the agreement no stock was issued to the parent company on account of the Massachusetts prohibitory law, but the proceeds of the stock sale were given the former. In other states the parent company was a proportionate stockholder for a long time and may be so to-day. As a result of a decision of the Commission (Report of 1898, pages 21 and 22), the licensee payments were transferred from capital to earnings.

The discount allowed the licensee has been gradually decreasing with the increase in the size of the competitors of the parent company and its successors and the ability of these competitors to do business. In actual practice the licensee purchased apparatus at the so-called shop cost and the parent company sold to non-licensees at an increased price. Machinery purchased by the Edison company was capitalized at the actual net price to the latter. Mr. Edgar said that the 5 per cent General Electric discount to Boston took the place of the former 3 per cent discount as the result of protests that other companies, notably in New York and Chicago, were getting the larger reduction. From the beginning there was a general understanding that the smaller companies did not get quite as liberal treatment as the big companies, because they were not buying in anything like the same quantity. The witness said he has never been interested in any of the parent organizations as a stockholder.

The percentage of royalty was cut down in recognition of the prospect of diminishing differentials between licensee and non-licensee companies. If it had not been for competition the prices to licensee and non-licensees would probably have remained in the original proportion. There was nothing in the agreement that prevented the manufacturing company from selling to a non-licensee at as low a price as to the licensee, but a non-licensee in reality could not buy directly from the manufacturing concern in the early days, the output of the latter being restricted to the parent company, the isolated company and the licensees. The non-licensee was obliged to buy from the subsidiaries of the parent company, which had to make its own profit. At the time of the consolidation forming the General Electric Company the entire outside interests probably did not sell 10 per cent of the material, but to-day probably 50 per cent of the material is sold by outside interests.

About four or five years ago as a result of governmental agitation the General Electric Company informed the licensees that it would have to discontinue the differential. The latter threatened suit, but no suit has ever been brought. Within three weeks at a conference in New York it was expected that the differential would be restored, but such action has not been taken. The next move is uncertain, stated the witness, but it will never be a large differential at Boston. No license fee has been paid by the Boston company for nearly ten years and none will be paid until some sort of final agreement is reached. The Chicago Edison company is in the same position. A number of three-party conferences have been held, but no headway has been made and no money paid. No reserve has been set aside for license fees, pending a settlement. No license has

been paid at Boston for the last $12,000,000 of capital issued. Mr. Edgar said that he thought it would be very foolish for the Boston company to break the contract. He thought a nominal payment to the licensor would be satisfactory from the Boston company's standpoint. Commissioner Schaff said that he hoped in the interest of the consumers no further license payment would be made, but Mr. Edgar said that he could not agree with this viewpoint, believing that the license agreement still has merit. "The relations between the General Electric Company and the Westinghouse company do not influence my judgment a particle in this matter," said the witness, "the question merely being one of *quid fro quo*."

MERGER OF MASSACHUSETTS UTILITY COMMISSIONS

A Single Board of Seven Members to Serve Seven Years Proposed, with Four Sub-Boards Appointed by the Chairman to Deal with the Various Utilities

Representative J. Weston Allen of Newton, Mass., has filed a bill in the House calling for the reorganization of the Public Service Commission and the Gas and Electric Light Commission. The new plan contemplates a board of seven members, to be appointed for terms of seven years, the salaries to be $7,500 each, with the exception of the chairman, who is to receive $8,000. It is contended by Representative Allen that a saving of about $30,000 a year to the state would result from the merger. According to the bill, four sub-boards of three members each are to be appointed by the chairman to deal respectively with steam railroads and steamships, electric railways, gas and electric lighting companies and telephone and telegraph service. It is proposed that each of the six members, who with the chairman constitute the board, will serve on two of the sub-boards. The chairman and secretary of the commission are to be appointed by the governor, and the chairman will have power to appoint the sub-boards and the chairman and secretary of each. A clause in the bill declares that the decision of the sub-board shall be the decision of the commission. A vigorous contest over the bill is anticipated in the present session between interests favoring conservative and radical regulative practice.

CANADIAN ENERGY EXPORTED TO THE UNITED STATES

Report to Canadian Parliament by Inland Revenue Department for Year Ended March 31, 1916, Gives Total of 1,021,780,359 Kw.-Hr.

In view of the agitation from a number of manufacturing interests that depend upon Niagara hydroelectric power for a further diversion of Niagara water owing to the limitation by the Canadian government of the amount of power that can be exported to the United States, a statement showing the quantities of electrical energy generated for export and for consumption in Canada by certain Canadian hydroelectric companies is timely. The figures shown in the accompanying table were prepared by the electrical branch of the Canadian Inland Revenue Department and were presented by Deputy Minister J. V. Vincent in his report to Parliament for the year ended March 31, 1916.

In commenting upon the export situation Mr. Vincent said:

"Under the circumstances a yearly reduction in the quantities to be exported might be deemed a reasonable method of putting an end to the export."

Of the total output, 2,250,747,089 kw.-hr. for the nine companies reporting, it will be noticed that 1,021,780,359 kw.-hr., or more than 45 per cent, was exported.

ENERGY GENERATED AND EXPORTED BY NINE CANADIAN CENTRAL STATIONS

Name of Company	Units Produced for Export, Kilowatt-Hours	Units Produced for Use in Canada, Kilowatt-Hours	Total Output of Generating Station or Other Sources, Kilowatt-Hours
Canadian Niagara Power Company	400,521,090	11,178,910	411,700,000
Electrical Development Company	34,652,000	295,346,500	429,998,500
Ontario Power Company	199,135,160	616,834,440	815,969,600
Ontario and Minnesota Power Company	13,144,070	11,789,534	24,933,604
Cedar Rapids Power Company	358,753,000	56,031,000	414,784,000
Sherbrooke Railway & Power Company	230,820	8,605,200	8,836,020
Maine & New Brunswick Power Company	3,075,893	242,437	3,318,330
Western Canada Power Company	11,937,700	60,468,020	72,405,720
British Columbia Electric Railway Company	330,626	68,470,689	68,801,315
Totals	1,021,780,359	1,228,966,730	2,250,747,089

RADIO MONOPOLY ADVOCATED

Secretary of Navy Pleads for Government Ownership of All Radio Communication as a National Safety Measure

An absolute government monopoly of radio communication as a measure of national safety was advocated Tuesday by Secretary Daniels in a letter to the commerce and marine committees of the Senate and House, outlining the Navy Department's views on the pending radio control bill drafted by an interdepartmental conference.

"The bill covers the purchase of coastal stations only, that is only those used to communicate with ships, and by permitting the Navy Department to open all of its stations to commercial business would discourage the extension of any existing commercial systems or the organization of new systems."

The Secretary wrote: "The department strongly recommends that the committee provide for the purchase of all stations used for commercial purposes. The value of existing stations is constantly increasing, and decisive action at this time will result in a saving of public funds."

In connection with Secretary Daniels's advocacy of Government monopoly of radio communication as a measure of national safety, as proposed in the pending Radio Control bill, Edward J. Nally, vice-president and general manager of the Marconi Wireless Telegraph Company of America, gave out a statement on Wednesday in which he said:

"The Marconi Company vigorously protests against the proposed legislation, not only because it will effectively stifle the growth of wireless telegraphy, but because it amounts practically to the confiscation of private interests.

"There are already ample laws and regulations on the statute books, giving the United States Government the necessary power for absolute control of all radio stations, in times of war or public peril. In fact, all ship and shore stations are now, and have been since 1912, operated under the control and supervision of the Department of Commerce of the United States Government.

"In time of emergency, the Marconi Company has repeatedly offered to place at the disposal of the nation not only all its operators, but the equipment of the company, and the services of the entire staff.

"Mr. Marconi is an alien, and the bill undertakes to shut out 'any company of which any officer or more than one-third of the directors are aliens, or of which more than one-third of the capital stock is owned or controlled by aliens.' All that Mr. Marconi has received for his great invention, which has been the means of saving thousands of lives, is a stock interest in the American Company, and were this bill to become law, the Government would prevent him from continuing as an officer in the management of his own company, and deprive him, as a shareholder, of his just reward. Another result of it would be to deprive this country of the benefit of Mr. Marconi's future inventions."

RECORD COPPER PRODUCTION

Output Increased About 40 Per Cent and Value Increased 100 Per Cent During 1916

The production of copper in the United States in 1916 surpassed all previous records, according to the United States Geological Survey Department of the Interior. At an average price of about 27 cents a pound the output has a value of $520,000,000, compared with $242,900,000 for the output for 1915 and with $189,790,000 in 1913.

According to the statistics and estimates received the output of blister and Lake copper from domestic ores was 1,928,000,000 lb. in 1916, against 1,388,000,000 lb. in 1915 and 1,224,000,000 lb. in 1913. The output of refined copper (electrolytic, Lake, casting and pig) from primary sources, domestic and foreign, for 1916, is estimated at 2,311,000,000 lb., compared with 1,634,000,000 lb. in 1915 and with 1,615,000,000 lb. in 1913.

The production of copper from the mines of the United States for 1916 was more than double that of ten years ago and more than four times that of twenty years ago.

NIAGARA POWER SITUATION

Niagara Falls Power Company Plans to Rebuild System and Double Output as Soon as Diversion Question Is Permanently Settled

Although the Senate on Dec. 20 passed a resolution providing for further diversion of 4400 cubic feet of water per second at Niagara Falls, the House of Representatives has not yet acted on the resolution. The measure will come up shortly and will without doubt be passed.

A permanent federal tax on power taken from the Niagara river will be a feature of a Niagara power bill which will be reported by the foreign affairs committee of the House this month, according to Chairman H. D. Flood of the foreign affairs committee. "Niagara power is the cheapest power in the world," said Chairman Flood, "and the Niagara power companies should be required to pay more for it than they are paying now. The bill will be reported about the middle of January."

Members of the Niagara Falls delegation who were in Washington urging the passage of legislation authorizing the additional diversion of water to offset large blocks of power formerly imported from Canadian Niagara companies but upon which the Ontario Hydro-Electric Commission has placed an embargo, have returned somewhat disappointed by the prospects of having a federal tax imposed upon all water taken from the river for power development. There is every indication that there will be vigorous opposition to any federal tax joker being included in the power bill.

Not satisfied with the federal tax joker, other members of Congress have hurled a broadside at several American power companies, charging them with being responsible for the serious power shortage now being experienced throughout the American Niagara frontier district. Representative Charles Bennett Smith, although advocating increased diversion until permanent legislatio ncan be agreed upon, resents asperations cast upon the federal government for failure to anticipate rapidly increasing demands for power along the Niagara frontier.

"The Niagara Falls Power Company has been more responsible than any other influence for the existing embarrassment. Its power plant and equipment is obsolete. By reconstruction it could get 100,000 additional horsepower from the water it is now diverting from the river. That would be sufficient to meet this emergency," said Representative Smith.

Replying to these assertions of Representative Smith and other members of Congress, is the announcement that plans and specifications have been completed by the Niagara Falls Power Company for rebuilding and extending its plant, involving an expenditure of more than $11,000,000. Many of the company's plans are awaiting the enactment of permanent Niagara power legislation before being carried into execution. When the plans now under consideration are carried into execution, the Niagara Falls Power Company, instead of generating 90,000 hp., will be able to develop upward of 180,000 hp. The capacity of its plant will be more than doubled. Additional transmission lines will be constructed between Niagara Falls and Buffalo and other western New York cities and towns and some of its lines will be extended into central New York and Pennsylvania.

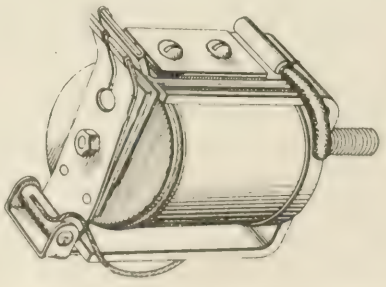
Commission Orders Contracts Filed

The Massachusetts Gas and Electric Light Commission has ordered the sixty-seven electric lighting and the fifty gas companies under its jurisdiction to file with the board before Jan. 15, copies of all contracts in force with any engineering or management corporation.

REVERSE CURRENT RELAY

By Means of Flat Spring of Non-Magnetic Material "Freezing" of Armature Is Prevented

A reverse current relay for automobile work which is "non-freezing" has been made the subject of patent No. 1,206,699 by Charles E. Harthan, of Lynn, Mass. After the engine has been started electrically and attained its



REVERSE CURRENT RELAY FOR STORAGE BATTERY WORK

normal speed the dynamo may be driven by the engine and run as a generator to charge the storage battery. In systems of this description it is desirable that the generator should be connected to the battery only when its voltage exceeds that of the battery. Heretofore this desired result has not always been attained, due to the fact that the armature of the controlling relay when

once attached is very apt to "freeze" on the once magnetized core and thereby not be enabled to perform its proper function of opening the circuit when the voltage is diminished below the critical value. A flat spring of non-magnetic material is fastened to the armature to normally hold the latter away from the magnet and keep the two contact members separated. This spring bears upon the end of the magnetic yoke and thus serves as a non-magnetic spacer between the armature and the yoke, thereby preventing "freezing" of the armature when it is attracted by the magnet.

PRIVATE OWNERSHIP SAFER AND MORE EFFICIENT

B. E. Sunny Scores Government, State and Municipal Control of Public Utility Properties and Operation

Public utilities in the hands of private owners and stockholders spread over a wide area are, according to B. E. Sunny, president of the Chicago Telephone company, safer, sounder, and more efficient than if they were in the hands of the federal government, the state, or the municipality.

Government ownership of railways has proved itself a failure in the conduct of the postoffice, said the speaker. He cited the pork barrel methods of the congressmen, and told of various legislative abuses.

"Think of the grand chain of railway stations the country might have if the railways were run by the government," said Mr. Sunny.

"One of the worst results of the campaign against the corporations," he said, "was the putting of the government into commerce. Through its most recent marine legislation the government has killed, practically, international shipping, the parcels post has ruined the express business, and now the government is building its own railway in Alaska."

UNION ELECTRIC LIGHT & POWER PROPERTY VALUATIONS

Company Submits Total of $32,586,362—Missouri Commission Experts Place Value at $22,757,409, Disallowing Many Charges

The Union Electric Light & Power Company, in a return made to the Missouri Public Service Commission, at Jefferson City, on Monday, values its plant at $32,586,362. This sum it places as the cost of reproduction Dec. 31, 1916, and it estimates the plant to be of the same value to the company. The original cost it places at $23,914,149.

Following are some of the main items in the report of the company: Cost of reproduction, $32,586,362; going value, $4,500,000; overhead charges, $3,762,940; working capital, $1,200,000; overhead system, $2,312,857; underground system, $4,156,484; original capital, $23,914,149.88; charter stock, $14,000,000.

For some fifteen months the experts of the commission have been making a valuation of this property. They completed their report this week.

The valuation of the plant and operating valuation fixed by the experts as a basis for rate making as filed with the commission, is about 30 per cent or $10,000,000 less than the value sworn to by officials of the company. The state experts say the property is worth only $22,757,409. The commission's valuation does not allow items of $5,833,102 charged to working capital, organization expenses and promotion charges.

Public Service Commission News

Idaho Commission

After investigation of the complaint that the service of the Meadows Light & Power Company was inadequate, especially during the periods of low water and extreme cold weather the Public Utilities Commission ordered the company to lay before the commission within thirty days a plan for an extension or enlargement of its present plant, sufficient to furnish electrical services to meet present demands and reasonable demands in the future. In making this decision the commission said in part:

"It is absolutely necessary that the defendant enlarge and extend its present plant and better its service to protect the investment it already has in the plant. The commission believes that if the present plant is enlarged or extended so as to give good service, the revenues will be sufficient to render a reasonable return upon the total value of the improved plant.

"On the other hand we do not mean to say that, after the defendant makes the necessary extensions, the officers can sit idly by and wait for the business to come to the company. What we mean to say is that the field is sufficiently large and the demand for electrical energy sufficiently great, under reasonable rates, to warrant such an expenditure, but the company must make an honest effort to develop the field, and the officers must by their conduct gain the confidence of the public, rather than act in an arbitrary and overbearing manner."

Alabama Commission

The Birmingham Railway, Light & Power Company will be permitted to make a general reduction of 5 per cent in its rates for electricity in Birmingham, but will not be permitted to change the rules under which it will operate in that city, it was decided by the Public Service Commission.

The lighting company presented the schedule carrying the reductions with several new rules which it proposed to put into use. These proposed changes in the rules were opposed on the ground that they would operate against the interests of Birmingham. One rule, which the company sought to invoke, provides that the company cannot be forced to supply electricity to any person living more than 150 ft. from its wire unless the person constructs a transmission line for the distance at his own expense. At present the company is forced to bear the expense of laying the lines. Through the decision of the Public Service Commission the reduction in lighting rates will become effective without the granting of any concessions by the consuming public.

Colorado Commission

Exclusive and original jurisdiction in all cases involving rate making and service of public utilities rests solely with the Public Utilities Commission under a decision of the State Supreme Court, which denied a rehearing in the case brought by the Denver & South Platte Railroad against the town of Englewood.

The Supreme Court ruled the lower court had no jurisdiction where the question of a contract between a city and a public utility corporation was involved. The railway company contracted to supply transfers to a Denver line. Later it repudiated this contract. When Englewood went into court to force the company to give transfers the utility commission intervened, claiming the courts had no jurisdiction. The high court upheld the commission's contention. It also ruled that the utilities board has the right to set aside contracts entered into between a municipality and a public utility corporation.

Largest Pelton Wheel in England.—What the London *Electrical Times* reports to be the largest Pelton water wheel constructed in England has been built by James Gordon & Company, British manufacturers, for the Kinlochleven station of the British Aluminum Company The machine has a speed of 300 r.p.m., and is rated at 3000 to 3500 b.hp.

Silvanus P. Thompson Memorial.—A fund is being raised in England to purchase the very valuable scientific library of the late Dr. Silvanus Thompson, who died June 13 last, and to present it to the British Institution of Electrical Engineers as a memorial of his life and work, the library to be accessible to the public on the same conditions as the Ronalds library.

Los Angeles $12,000,000 Bond Issue Feb. 2.—On Feb. 2 citizens of Los Angeles will vote on the question of issuing $12,000,000 in bonds with which to acquire the distributing systems of the Pacific Light & Power Corporation and of the Southern California Edison Company. Vote will also be taken at this election on a charter amendment which must be passed before these purchases could be legally made.

Heavy Increase in Quicksilver Production.—The domestic output of quicksilver in 1916, according to preliminary estimates of the United States Geological Survey, was 28,942 flasks, valued, at the estimated San Francisco average price of $125.90 a flask, at $3,643,800. This was the greatest output in quantity since 1904 and not only the greatest in value since 1875, but, excepting the value of $4,228,538 for that year, was the greatest in the history of the industry, which dates back to 1850. The figures for 1916 show an increase over 1915 of 38 per cent in quantity and 99 per cent in value.

Massachusetts Water Supply Report.—A report of the United States Geological Survey (Water Supply Paper No. 15) by C. H. Pierce and H. J. Dean, engineers, covering surface waters in Massachusetts, has recently been issued. The volume contains much data of interest from the hydroelectric standpoint and consists of 430 pages of text and tables, with eighteen illustrations. It sets forth the results of an exhaustive investigation of stream flow conditions in Massachusetts with a compilation of the available records for many years in the basins of the Hoosatonic, Connecticut, Millers, Deerfield, Chicopee, Westfield and Merrimac rivers. The report contains an introduction by N. C. Grover outlining the uses and development of water resources in the State, an article on Massachusetts topography, and a valuable gazetteer of streams and ponds, with convenient tables for the conversion of discharges into run-off depth and gallons, velocities into miles per hour, and second-feet into theoretical horsepower per foot of fall. A valuable contour map drawn to a scale of 1 in. to 4 miles shows the principal drainage basins and gaging stations. Long-term records of the flow of the Merrimac River at Lowell are a notable feature of the report.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Topeka May Close Municipal Plant.—W. G. Tandy, one of the commissioners of Topeka, Kan., who is in charge of streets, has proposed that the city make a contract with the Topeka Edison Company whereby the company will provide the energy for the street lighting system in lieu of the proportion of earnings of the company, $4,000 to $5,000 a year, which it is claimed the company is to pay. Under this arrangement, the city would discontinue its municipal light plant which serves only the street lights, and would not make necessary expenditures for additions and improvements.

New Million Dollar Plant for Arizona Power Company.—Announcement is made by the Arizona Power Company that it has awarded the contract for the construction of an additional electric power station which will cost approximately $1,000,000. The proposed plant will be operated by steam and will have a capacity of 10,000 hp. This electrical energy will supplement that which the company is already obtaining from its hydroelectric plants at Fossil Creek on the lower Verde River. It is stated that the transmission systems of the two plants will be connected and that when the additional power of the new station is available, a transmission line will be constructed to Jerome for the purpose of providing power for operating the machinery of the local mines and ore mills.

Sanitary District May Not Get Additional Joliet Water Power.—A decision handed down by the Supreme Court of Illinois, Dec. 21, places an obstruction in the path of the Sanitary District of Chicago in its endeavor to obtain control of a dam and power site at Jackson Street, Joliet, Ill. It will be remembered that on July 17 of this year Governor Dunne of Illinois decided to lease this site, which for sixty years has been held by the Economy Light & Power Company, to the Sanitary District of Chicago (see ELECTRICAL WORLD, Aug. 5, 1915). But as soon as this decision was made a suit was begun to restrain the district from signing the contract. In the Circuit Court the injunction was denied, but the Supreme Court overruled that decision and remanded the case with directions for a verdict in conformity with its findings. The basis of the decision was a ruling that the bill which established the Sanitary District expressly states that it shall confine its operations in the manufacture and sale of electricity within a prescribed territory. The Economy site lies just beyond the limits of this territory. It is now understood that the Sanitary District will go before the Legislature in an endeavor to have its grant extended so that its territory will include the power site.

Los Angeles Appropriates Street Lighting Load.—The Los Angeles Gas & Electric Company was recently notified by the Board of Public Works of that city to discontinue street lighting service in the Highland Park and Garvanza districts north of Avenue Fifty. Beginning Dec. 20 these districts were to be supplied by electrical energy furnished under contract to Los Angeles by the municipal power plant at Pasadena. The power bureau has installed about 225 street lights in the districts on the east side of Los Angeles.

Two Years Before Cleveland Municipal Plant Can Extend Service Into New Districts.—Light Commissioner Davis has explained that surveys of the city are now being made to see where the municipal plant will secure the most patronage when it is in position to extend its service into new districts. When this is completed, the Council will be asked to decide which will be the first districts to receive the service. However, he estimates that it will be almost two years before any new districts can be served. Delivery on a new generator just ordered could not be promised under thirteen months. About six months would be required to install the generator and an additional boiler and get them into operation. The capacity then will probably take care of those only who have had applications on file for months.

Record Output of Lead.—The United States Geological Survey has just published the new year estimate of the production of lead in 1916. In the production of lead ore there was a gain of 10 per cent over the preceding year, the lead content of ore mined in 1916 being estimated at 622,000 short tons. Missouri had the largest production and also made a gain of over 25,000 tons. Good gains were made by California, Idaho, Nevada, Utah and New Mexico. The production of refined lead, desilverized and soft, from domestic and foreign ores, was approximately 579,600 tons, worth at the average New York price $73,826,000, as against 550,055 tons, worth $51,705,000 in 1915. The output of antimonial lead was about 21,800 tons. worth about $4,283,000. The domestic production was made up of 324,000 tons of desilverized lead and 234,200 tons of soft lead, worth in all about $75,915,000, and the production from foreign ores is estimated at 21,400 tons. The imports of lead in all forms were about 35,800 tons, and the exports were about 117,550 tons, of which 108,200 tons were derived from domestic ores. The total exports of lead were valued at about $15,832,000. The consumption of lead, as near as it can be calculated, disregarding stocks of domestic lead, was 471,200 tons, as against 426,751 tons in 1915. The price of lead was nearly 50 per cent higher in 1916 than during the preceding year, the average of spot quotations at New York being 6.8 cents a pound, as compared with 4.7 cents in 1915.

Institute of Radio Engineers.—A meeting of the Institute was held on Jan. 3 in New York City, when a paper on "United States Radio Development," by Robert H. Marriott, was presented.

Rochester Engineering Society.—At the next meeting of the society, to be held on Jan. 12, David L. Lindquist, chief engineer, Otis Elevator Company, will speak on "Modern Electric Elevators and Elevator Design."

Dallas Electric Club and Jovian League.—At the weekly meeting, on Dec. 22, a three-reel film, "The King of the Rails," a moving picture of the development of locomotives, was shown. These films showed construction and operating features of the Chicago, Milwaukee & St. Paul Railway electrification.

New Applications of X-Ray.—At the 180th meeting of the Schenectady Section of the A. I. E. E. held on Jan. 4, 1917, Dr. W. P. Davey and Dr. A. W. Hull of the research laboratory of the General Electric Company addressed the meeting on "New Applications of X-Rays" and "X-Rays—A Key to the Structure of Matter."

Date of Indiana New Business Meeting Changed.—The new business committee of the Indiana Electric Light Association, of which O. M. Booher of Kokomo, is chairman, will hold the first of its two 1917 conventions at Muncie, Ind., on Jan. 23. At this meeting plans for the 1917 state-wide range campaign will be discussed.

Washington Electrical Contractors.—As the result of a recent conference the electrical contractors in Central Washington will abide by the working agreements of the Eastern Division of the Washington Association of Electrical Contractors and Dealers. The association has for its aim the protection of contractors and their customers in business deals. Owing to different working conditions in the eastern and western parts of the State, it is divided into two sections. One of the agreements made at the meeting was that all bids on electrical jobs should be based on set specifications, in the absence of which time and materials should be the basis.

New York Electrical League Holds Annual Meeting.—The annual meeting of the New York Electrical League was held Wednesday, Jan. 3, at Stewart's restaurant, New York. There were 125 members present. James M. Wakeman, Jovian Statesman-at-Large, presided. The reports of the committees were read and approved, and the election of officers for the ensuing year resulted as follows: President, Arthur Williams; treasurer, A. F. De Veau; secretary, H. E. Cleland; board of directors, James M. Wakeman, James R. Pollock, George Williams and Fred Hartman. An amendment was presented to be discussed at the next regular meeting suggesting that the constitution be changed so as to provide for a vice-president and two more directors. Past-Jupiter Frank Watts addressed the meeting, giving a sketch of Jovianism from its inception and dwelling upon the necessity for well-organized local leagues, working in co-operation with the national Jovian Order.

Associations and Societies

The Directory of Electrical Associations, which is regularly printed in the first issue of each month, appears on page 63 of this number.

Pittsburgh Meeting, A. I. E. E.—The 328th meeting of the institute will be held at the Fort Pitt Hotel, Jan. 12, under the auspices of the Pittsburgh section of the traction and transportation committee. The morning and afternoon will be devoted to various committee meetings, to a number of inspection trips to points of electrical interest, and to the board of directors meeting. At 6.30 p. m. an informal dinner will be served. The technical session will be held at 8 p. m., the general subject of the meeting being "Regenerative Braking." A paper entitled "Regenerative Braking of Electric Vehicles" will be presented by R. E. Hellmund of the Westinghouse Electric & Manufacturing Company. Technical trips will be made to the following: Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.; Duquesne Light Company, Brunot's Island power plant; Pittsburgh Railways Company, Homewood shops; Pittsburgh Railways Company, Taggart Street Substation; Bell Telephone Company, Grant exchange. The Pittsburgh Railways Company will furnish special cars for the trips to its plants.

The Electrical Man's Responsibility to His Country.—H. M. Byllesby addresserd the Electric Club-Jovian League of Chicago, at its weekly luncheon Dec. 28, at the Hotel Sherman, on the above subject. In the course of his address on preparedness, he said: "If the perils to our country, now so ominously emerging, are overcome it will be because we citizens calmly and with spiritual uplift immediately consecrate ourselves to that service to the state which each of us is best able to discharge. In this rising to the defense of our beloved country, which has showered so many opportunities upon us, the electrical man must be, and naturally will be, a factor of the first importance. The electrical man has had an experience of unique value which he can place at the disposal of his country. Modern defense against aggression, and modern war itself, resembles previous periods and conditions only in the fundamentals of devotion and inflexible resolve, of physical fitness and heroism; in all other details it has become a matter of headwork, of the closest kind of mental concentration, and application of engineering, and largely electrical engineering—a matter of resource and adaptation of means to an end. The electrical man, imbued with the inspiration of his great achievements and the inspiration he has inherited from the great founders and leaders of the industry, is peculiarly prepared for his share in the defense of his country."

Winter Meeting Western New England Electrical Inspectors.—There will be held at the City Hall, Northampton, Mass., on Jan. 10, the winter meeting of the Western New England section of the National Association of Electrical Inspectors. The open session will start at 11 a. m. A. W. Hopkins, presiding. Mayor A. J. Morse will deliver the address of welcome, to which response will be made by Past National President Thomas Henry Day. Following there will be an open forum at which the subject, "The National Electrical Safety Code" will be discussed from the following angles:

What was the need for such a code? Is a single safety code to be preferred to many in various jurisdictions? Was the U. S. Bureau of Standards the proper body to take the initiative and responsibility in preparing such a code? What are the principles of protection involved? Are they sound? Do the rules of the code represent present practice? Are they reasonable? Will the application of the code promote or retard the use of electricity? How can the code be introduced into use most helpfully?

This subject, together with questions presented during the forum, will be discussed by W. J. Canada, U. S. Bureau of Standards, Department of Commerce, Washington, D. C. E. A. Braddell, of the Sprague Electric Works, New York City, will preside during the forum.

An exhibit of the methods used by several inspection departments for keeping their inspection records will be in charge of Richard J. Forsyth.

At the afternoon session, with Vice-president L. N. Heebner in the chair, there will be another open forum. This one on "The Grounding of Alternating-Current: Secondary Distribution Systems." There will be considered the following:

Its purpose and object? Does it reduce the fire hazard? Does it safeguard the life hazard? Does it injure water piping? Under normal conditions is there a flow of current along water mains thus making possible accidents to men repairing water pipes in ditches and elsewhere? What is the best method of maintaining an efficient and a permanent ground?

This subject will be explained and the above questions, and a score of others like them, will be answered by William H. Blood, Jr. of Boston, Mass., insurance expert of the National Electric Light Association and chairman of the grounding committee, National Electrical Code. W. K. Tuohey, Springfield, Mass., first vice-president National Electrical Contractors' Association, will preside during this forum. The spring meeting will occur on April 11, in Holyoke, Mass. At this meeting the changes which will have been made in the National Electrical Code will be considered. Any one desiring an invitation to attend this meeting will kindly send his name and address to the secretary, Richard J. Forsyth, 247 Wells Street, Greenfield, Mass.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

INDUSTRIAL ACTIVITY DURING PAST YEAR TREMENDOUS

Production of Electrical Goods Passes the $500,000,000 Mark—Unfilled Orders Amount in Value to an Additional $200,000,000

At no time in the history of the world has industry been carried on so tremendously as during the twelve months of the year that has just passed. The new year is ushered in to the music of a record of production difficult not only to surpass but even to equal. In this flood of business prosperity the electrical industry was swept along with the leaders. Electrical manufacturers and jobbers have produced and sold to the last ounce that was physically possible, and yet the market is unsatisfied. The production of electrical goods in 1916 went beyond the $500,000,000 mark, while the unfilled orders at the beginning of 1917 were probably well over $200,000,000. There was placed, therefore, in 1916 a volume of orders for electrical equipment of $750,000,000, a most stupendous total for an industry that has practically grown up within the present generation.

Along with the immense volume of business went all of the customary features that accompany the economic condition when demand exceeds supply and also many others that were entirely new. Problems arose daily the solution to which could not be found in the pages of experience and on which decisions had to be made quickly.

A Seller's Market

Here was a clear-cut case of a seller's market, and it came on the heels of just as clear-cut a case of a buyer's market. It came so suddenly and gained momentum with such rapidity that the majority of electrical manufacturers were unprepared. Stocks were soon depleted and manufacturing facilities at the beginning of 1916 were generally insufficient. A large amount of factory space that ordinarily was devoted to the manufacture of electrical products had a few months previous been turned over to the manufacture of war munitions. When manufacturers tried to enlarge their equipment they were faced by a machinery market already flooded with orders. But little provision had been made generally by electrical manufacturers toward securing a large stock of raw materials until they were suddenly faced with a condition of practically empty bins and then the spot supply had been contracted for.

Prices naturally advanced. Raw materials were soaring rapidly and other production costs as well and manufacturers were forced to make frequent advances in price in order to insure a profit.

Here are shown some of the raw-material prices that prevailed at the beginning and ending of 1916. No attempt is made to show how high prices went in 1916.

	Dec. 28, 1915 Selling Prices Bid	Asked	Dec. 26, 1916 Selling Prices Bid	Asked
Copper, Prime Lake	21.75	to 22.00	31.00	to 31.50
Copper, electrolytic	21.75	to 22.00	31.00	to 32.00
Copper, casting	20.87½	to 21.12½	29.50	to 30.00
Copper wire base	22.75	to 23.25	37.00	to 38.00
Lead	5.40		7.50	
Nickel	45.00	to 50.00	50.00	
Sheet zinc, f.o.b. smelter	22.00		21.00	
Spelter, spot	17.42½	to 17.67½	9.80	to 10.00
Tin, straits	39.12½		40.62½	
Aluminum, 98 to 99 per cent	53.00	to 55.00	60.00	to 64.00

And although the prices were higher, the profit made by electrical manufacturers in 1916 while larger in gross amount than in previous years due to the increased volume of business was in actual per cent less than in 1915. Greater prices could have been had for the buyer was prepared to pay almost any price within reason; but the distributers of electrical goods had the best interests of the industry in mind and made every effort to keep prices down.

Labor Conditions

Labor was a particularly difficult problem to handle in 1916 and is to-day. Not counting bonuses, it is estimated that wages advanced during the year over 25 per cent. At the same time it was particularly hard to obtain sufficient and efficient labor. Offers of higher wages enticed men from shops all the time, and as a result the men always going to new jobs were grossly efficient. Labor had advanced to such an extent in prices and was so inefficient, it was estimated by the Electrical World, that only about 60 per cent as much actual labor could be had for $1 in 1916 as in 1915.

In addition to the insufficiency of labor there was a scarcity of raw products. The war curtailed and in some cases stopped the supply of many products for which electrical manufacturers of this country had depended on the rest of the world: Dyes, chemicals, rubber, certain glassware, etc., and at the same time took for munition manufacture a very large portion of the raw products having origin in the United States.

Such was the condition of the labor and raw materials market that had to be faced by the electrical manufacturers in 1916, and yet, under these conditions the output of electrical products exceeded by millions of dollars that of any previous year. Demand for motors began in the fall of 1915 and was the first to feel the upward swing of business. Stocks were quickly depleted, and by the first of 1916 it was impossible to secure quick delivery except on orders for standard sizes in lots of one and two. Larger orders had to wait their turn, and deliveries were promised from six weeks to six months and ofttimes longer, depending on the size of the order and the type of motor desired. It was practically impossible to supply the demand for fractional horsepower motors. In fact, some manufacturers of small motor-driven equipment had to take their products off the market because of their inability to secure fractional horsepower motors. A case is brought to mind where a washing-machine manufacturer had a sufficient supply of washing machines in stock to supply all customers but could not fill an order for months because he could not secure the motors.

Steam and Water Turbine Production

Production of turbines, both steam and water, was very large, especially the former, of which the 1916 output was about 3,000,000 kw. The output of the latter, it is conservatively estimated, was 500,000 hp.

Owing to the sales of such a large amount of power-consuming equipment and also as a protection against the future the volume of generator buying also was large.

Wire and cable mills for the past year, excepting periods during which the men were out on a strike, have been working to capacity limit and yet local stocks are practically gone. In some sizes of stranded wire there is practically no stock in the country. Magnet wire is so scarce that motor users have been warned to use the greatest care with motors there being no stock with which to effect repairs.

Lamp manufacturers started the year with practically a three months' reserve stock on hand; but this is now about gone, and orders are now being filled from daily production with demand in excess of supply. Electric range manufacturers started the year expecting a $1,000,000 demand and soon found that the 1916 output would exceed $2,000,000 in value.

Hot, sultry weather in July and August, with no rain for

weeks in the Middle West, brought about a record demand for fans. Large stocks had been carried over by the trade from 1916, but these plus what the manufacturers had produced for the 1916 season were insufficient. So great was the demand for glassware that the mills, contrary to a well established custom, did not shut down in the summer months.

Orders were piling up on the books at such a rate that it became useless to attempt to obtain more business, and toward the latter part of the summer salesmen began to be called in. They were kept at work, many of them, explaining to customers why goods ordered for August or September delivery probably would be received by the first of 1917, or perhaps later. New business was discouraged.

With one or two exceptions the orders placed in 1916 were not particularly large. In the first few days of 1916 a $1,000,000 order was placed for the electrical equipment of a steel mill, and in the last few weeks of the year a prominent holding company placed a $1,000,000 contract for electrical equipment for its various plants. As a rule, however, the orders were not of a size to create comment.

On the other hand, there was a marked tendency toward the purchase of units larger than ordinary rating. Orders were received for a number of 15,000-hp., 12,000-hp. and 8000-hp. motors. The 15,000-hp. size is the largest ever built. Turbo generator sets passed the 60,000 hp. mark early in the year, when a 73,000-hp. set was ordered. There have been other orders for sets in the neighborhood of 50,000 hp., which rating was unattained until a few months previous to the placing of the order for the 73,000 hp. set.

As a year of broken promises 1916 will long be remembered. Deliveries promised for four months might be delivered in eight. Nor was it altogether due to conditions over which the manufacturer had any control. First, the manufacturer had difficulty in getting machinery, help and raw materials. His deliveries were delayed and to that extent his orders were held back. In the spring, railroad lines became congested and roads had to place embargoes on practically everything except foodstuffs and fuel. Strikes were numerous, lasting generally over a month. Deliveries, therefore, grew worse as the orders piled up. As this condition became apparent to the trade, buyers began to withdraw from the market, and late in the summer a decided sloping off on incoming orders began to be noticed. Since then deliveries have been slowly getting better until at the end of 1916 they were again normal in many lines.

This condition of delayed deliveries occasioned the use of a number of new business methods each with its own problem. To save time, raw materials in small lots were ordered shipped express, thereby increasing transportation charges, and when deliveries of the finished product were delayed the buyer received his goods by express. There arose, therefore, the question of who should pay the excess charges of express cost over freight, shipper or receiver. Materials and goods were ordered by telephone that formerly were ordered from a salesman or by letter.

Previous to this past year a number of foundries were engaged in manufacturing electrical products such as lamp-posts, boilers, condensers, steam and water turbines, etc. Many of these foundries during 1916 discontinued the manufacture of all electrical products. These were taken up originally as a side line, and as soon as regular work was great enough to take up the entire foundry space the side lines were abandoned.

Few New Products Developed

Few new electrical products were developed during 1916. Probably about half as many new wiring devices were placed on the market in 1916 as in 1915. Manufacturers were too busy during the past year to devote the time or necessary factory space to the development of new products. Furthermore, it was with great difficulty that raw and manufacturing materials could be had in quantities sufficient for the manufacture of products then on the market. Instances are recalled where the sale of new products brought out during the year was not pushed because of the impossibility of obtaining the necessary manufacturing materials.

Credit conditions in 1916 were excellent. Credit terms were generally tighter than had been the rule. This was made possible by the excess of demand for electrical goods over the supply. Trade acceptances were more generally in use by the electrical industry. Collections were excellent. A larger number of buyers took advantage of the discounts for prompt payment.

Buyers' stocks were large, particularly those of jobbers. In many instances stocks were 100 per cent greater than normal, not because of a 100 per cent increase in demand, but because of delayed deliveries. In order to protect customers larger stocks were necessary, for should stocks get low the jobbers knew that it would be months before they could be replenished. This heavy increase in stocks caused manufacturers considerable apprehension particularly as a credit risk. Where it was thought that a buyer had overstocked, particularly stringent credit terms were imposed.

Electrical Jobbing Business in 1916

The jobbing business was exceptionally large in 1916. Jobbing picked up in the fall of 1915 and has continued large since then. The 1916 jobbing business was at least 50 per cent greater than in 1915.

The more extended use of electricity in the past year brought a large demand on the jobber. Wire, conduit, fittings, fans and household appliances sold very well. Better factory lighting brought about the sale of large quantities of lighting materials, such as reflectors, lamps, shades, etc.

Jobbers' expenses have been growing steadily heavier and out of proportion to the increase in business. Owing to the large sale of small lots of electrical merchandise at wholesale prices jobbing overhead has rapidly increased. Particularly has this been true of the local jobber, and late in the year there was begun a movement towards eliminating this evil from the jobbing trade. One of the suggestions was the institution of a standard package for each article of merchandise. This package would then be the jobbing unit, no sale to be made at wholesale prices of part of a unit.

The movement to simplify discounts in the electrical trade found favorable action in 1916. This was in large part due to the existing trade conditions. Rather than raise list prices one or two of the trade discounts were lopped off when a price increase became necessary. When it became apparent that discounts were becoming simpler, a number of manufacturers took the final step and made but a single basic discount. In most cases this final discount is equal to the combined old first and second discounts.

As the year wore on the number of electrical factories under construction increased. Plans were laid for one $7,000,000 factory and many separate plants at over $1,000,000 valuation. In looking forward to the coming months of the new year this large building plan is significant, meaning, as it must, that the manufacturers have confidence in the months to come.

Also a surprisingly large number of new companies were organized during the year to engage in electrical manufacture. None of these companies, however, was particularly large.

In the second-hand market for electrical goods conditions in 1916 were without precedent. Poor deliveries and necessity for immediate shipment continued to reduce the second-hand stock, particularly of motors, from one of large dimensions to a very few pieces. Direct-current motors that had been replaced by alternating-current motors again went on the lines.

As a direct result of the May Chicago N. E. L. A. convention electric vehicle manufacturers offered under different plans special discounts to central stations on truck sales. Although the plans have been in effect but a few weeks the number of sales resulting has been quite appreciable.

There was noticed late in 1916 a tendency toward more popular prices of passenger electrics. Two well known companies put out models to sell under $2,000, while a $700 model has been announced as ready for exhibition.

The movement for standardization received in the past year a great impetus. The Electric Power Club, the Associated Manufacturers of Electrical Supplies and the Electrical Supply Jobbers' Association have all been busy in promoting standardization of different lines.

A number of important patent matters that had been hanging fire for some time were taken up and agreements made. The General Electric Company in February won its suit against the Laco-Phillips Company for infringement of the Just and Hanhaman patent for a tungsten incandes-

cent lamp. Since that time a number of independent lamp manufacturers have been licensed to manufacture their lamps under the patent. Licensee arrangements were made by the General Electric Company and the Hoskins Manufacturing Company, owners of the Marsh patent for nickel chromium as a resistance element, with the several manufacturers of heating appliances. Under the terms of the license there will now be a minimum selling price for all classes of appliances. In December the Kenny patent owned by the Vacuum Cleaner Company was sustained in the portable electric class.

Based on the government returns for the first ten months of the past year the value of electric exports of American manufacture reached a new high record in 1916. Estimates made by the ELECTRICAL WORLD put the 1916 electrical exports at between $37,000,000 and $40,000,000. The year was notable in the large increase in the value of the exports of insulated wire and cables, metal filament lamps, motors and miscellaneous merchandise.

Much of the increase in exports has been to England, France and Russia to supply the markets formerly supplied by Germany.

SUPPLY JOBBERS STOCKS AT BEGINNING OF NEW YEAR

Reports from Different Sections of the Country Show Buying for 1917 to Be Regulated Generally by Both Deliveries and Demand

Electric supply jobbers are very uncertain regarding the prospects for 1917, according to reports received by the ELECTRICAL WORLD from most of the important jobbing centers of the country. Jobbers were asked to report concerning the present condition of stocks and the manner in which 1917 buying would be regulated.

The reports show that stocks are generally large, with a shortage in wire. Jobbers seem to be divided in regard to buying for 1917. Some will place large orders far in advance to offset poor deliveries, while there was also a decided tendency to be very conservative in buying. This element of jobbers are fearing a peace negotiation, when it is expected that prices will fall. A satisfactory profit has already been taken on the rising market. No desire is felt by these jobbers to sacrifice these profits in a falling market.

Following are the conditions as they exist locally:

NEW ENGLAND

Boston, Mass.—Large stock being carried at present as result of heavy volume of trade and efforts to anticipate demand. Large stock on hand of lamp cord, insulated wire, cable, conduits, lamp sockets and fittings, heating appliances, lighting fixtures and miscellaneous supplies. Fan supply low; shortage of incandescent lamps.

No special stocking up is planned, but the policy is to maintain a steady patronage of the manufacturers; purchases responsive in volume to demand anticipated. No let-up in demand apparent for next few months.

Demand will be a larger factor than deliveries as 1917 comes in. Some difficulty expected in obtaining iron conduit.

Worcester, Mass.—In the main, stock is about normal. Deliveries are good, 90 per cent of recent orders being delivered within about thirty days. Another 10 per cent advance in manufacturers' prices is hinted. More lamps could have been sold had they been obtainable. Less-than-normal supply of lamp cord; normal supplies of insulated wire, cable, lamp sockets and fittings, wiring supplies and fittings; extra supply of fans, normal supplies of fractional horse-power motors, heating appliances, lighting fixtures and miscellaneous electrical equipment.

Delayed shipments of iron conduit due to railroad congestion are causing trouble. Very small demand for fans for winter uses in Worcester; mercantile field for winter fan service pretty thoroughly filled.

The buying in 1917 will be influenced by both delivery and demand. It is hoped that improved deliveries can be had on items at present handicapped, thereby tending to reduce overhead costs necessitated by attempting to carry stock large enough to offset delays in filling orders.

ATLANTIC STATES

New York, N. Y.—Stocks are large on almost all items because jobbers anticipated poor deliveries. Buying in 1917 will be governed by both deliveries and demand, particularly the former, should the market hold up.

Philadelphia, Pa.—Stock on hand at present is worth more than usual at this time of the year, due mostly to increased value of items. Great delays experienced in getting all standard items. Buying will be for requirements, and will stop as long as possible after the slightest consideration of peace abroad. Because losses on electrical supply stocks are likely to be terrific when prices fall stocks are being kept down.

Richmond, Va.—Value of stock in excess of normal, but unbalanced, being large in some items and small in others. Stock normal in lamp cord, conduit, fans, heating appliances (short on some items) and lighting fixtures; below normal on all other standard goods, and large in miscellaneous items. Fractional horsepower motor stocks practically depleted, lamp deliveries very uncertain and unsatisfactory. Purchases for 1917 will be governed by both delivery and demand, but owing to market conditions delivery will probably be the most important factor.

CENTRAL STATES

St. Joseph, Mo.—Shortage in asbestos covered wire, rubber covered wire and transmission line material. Buying will be cautious in view of a possible slump in future prices.

Birmingham, Ala.—Present stock is large but the supply on hand of lamp cord, fans, fractional horsepower motors and lighting fixtures is small. Owing to a fear of the market breaking future buying will be light, and will be governed principally by delivery.

St. Paul, Minn.—Large stocks on hand because of poor deliveries. Provided materials can be secured 1917 stocking will be heavy. Delivery will be more important than demand in regulating 1917 buying.

Memphis, Tenn.—At the present time merchandise stock is practically normal. An effort has been made to increase the stock in anticipation of slow shipments from manufacturers, and to take advantage of the rising market by investing as much capital as possible in the purchase of goods. These efforts, however, have been largely negatived by the inability of factories to make shipment in accordance with promises. Buying in 1917 will be influenced both by delivery and demand, but more largely by the former unless some radical change occurs in conditions.

New Orleans, La.—Stock is large and will be kept so provided deliveries can be had. Long time orders are being placed.

San Antonio, Tex.—Stocks are larger and buying heavier. Stocks of insulated wire are small because of poor deliveries.

PACIFIC COAST STATES

Los Angeles, Cal.—Stock is about average. Future requirements were anticipated and stocks laid in accordingly. Stocks are small in lamp cord, insulated wire, cable, lamp sockets and fittings, wiring supplies and fittings, fans, fractional horsepower motors, incandescent lamps. This is mostly due to a shortage on the Pacific Coast. As long as the market remains in an unsettled condition stocking will be light. Buying for 1917 will be equally influenced by demand and delivery.

San Francisco, Cal.—Stock small of lamp cord, insulated wire, cable, fans (out of season), due generally to poor deliveries. Other stock is normal. Buying will be guided by demand.

Seattle, Wash.—Very small stocks of lamp cord, insulated wire and cable, lamp sockets and fittings, wiring supplies and fittings. Other stocks are generally satisfactory or large. On account of poor deliveries business is being anticipated by ordering from two to six months ahead.

Tacoma, Wash.—Stock is small in lamp cord, insulated wire and cable, but generally satisfactory or large in other items. Business in 1917 is expected to be larger than in 1916. Larger stocks will be laid in.

Manufacturing and Industrial

Stanley M. Tracy, until recently Western district manager in the Chicago office of the Driver Harris Wire Company, is now assistant general sales manager at the main office and works of the company, Harrison, N. J.

The American Lighting Company, which has been conducting a business in flood-lighting equipment, after Dec. 31, 1916, will change its name to the Davis Lighting System. Its address will continue to be 1422 West Randolph Street, Chicago.

F. H. Poss became sales manager of the Benjamin Electric Manufacturing Company on Jan. 1. He was formerly Pacific Coast manager for the same company, having opened that office in 1905. Between 1905 and 1912 he also represented the Holophane Company.

Page & Hill Company, Minneapolis, Minn., announces the addition to its sales force of Buford Adams, who will act in the capacity of sales engineer. Mr. Adams is well known, particularly through the Southwest, as a practical engineer and manager of public service properties.

Goulds Employees Get Bonus.—Each of the 900 employees of the Goulds Manufacturing Company, Seneca Falls, N. Y., on Dec. 23 received a bonus of a full month's pay. The action was taken because of the increased cost of living and as a token of appreciation of the endeavors of the members of the organization.

The American Conduit Manufacturing Company, Pittsburgh, Pa., announces that beginning Jan. 1, M. B. Austin & Company of 700 Jackson Boulevard, Chicago, Ill., will be its sales agents in Chicago for the following products of its manufacture: "Wiremold," the new surface wiring material, and "Wireduct," a non-metallic flexible conduit.

Hughes Company Insures Employees.—As a token of its appreciation of their services and to demonstrate that it is interested in the welfare of the families of its employees, the Hughes Electric Heating Company of Chicago, gave insurance policies to all workers who had been employed by the company more than ninety days. The amounts of the individual policies range from $500 for the employees who have been only a short time in the service of the company to $1,000 for those who have been employed five years or more.

Harry Pickhardt has severed his connection with the Phœnix Glass Company for which he has been assistant sales manager during the past eight years to enter business at 98 Park Place, New York City, as sales agent, handling lighting specialties, having bought out the business of L. D. Hatton, deceased. Mr. Pickhardt will handle the line of John Dunlap Company, Carnegie, Pa., manufacturers of enameled steel reflectors, and in time expects to add other lines. Mr. Pickhardt was with the Holophane Company for two years as sales engineer, and previous to that was in the electrical business in New England.

NEW YORK METAL MARKET PRICES

	Dec. 26 — Selling Prices Bid	Dec. 26 — Selling Prices Asked	Jan. 3 — Selling Prices Bid	Jan. 3 — Selling Prices Asked
	£ s d		£ s d	
London, standard spot Copper	141 10 0		133 10 0	
Prime Lake	31.00 to 31.50†		29.00	to 29.50†
Electrolytic	31.00 to 32.00†		28.00	to 29.00†
Casting	29.50 to 30.00†		27.00	to 28.00†
Copper wire base	37.00 to 38.00		36.00	to 38.00
Lead	7.50		7.50	
Nickel	50.00		50.00	
Sheet zinc, f.o.b. smelter	21.00		21.00	
Spelter, spot	9.80 to 10.00		9.67½	to 9.92½
Tin, straits	40.62½†		42.75†	
Aluminum, 98 to 99 per cent.	60.00 to 64.00†		55.00	to 58.00†

OLD METALS

Heavy copper and wire	27.00 to 27.50†	24.00	to 25.00†
Brass, heavy	15.00 to 15.50†	14.50	to 15.50†
Brass, light	10.50 to 11.00†	10.50	to 11.00†
Lead, heavy	6.50 to 6.75†	6.50	to 6.62½†
Zinc, scrap	7.50 to 8.00†	6.00	to 6.25†

COPPER EXPORTS

Total tons to Jan. 3 323

†Nominal.

LIGHT AND POWER UTILITY FINANCING DURING 1916

Analysis of Bond, Note and Stock Issues Reported Offered for Investment During the Past Twelve Months

Electric light and power companies in 1916 faced a market for investment securities that seemed bottomless, and a market for construction materials in which prices had passed all former bounds. This was exactly the opposite condition to that met with during the two previous years with the exception of the latter part of 1915.

At the outbreak of the war money became very tight and investors were unwilling to part with it except at very high prices and short time. As a result there sprung up in 1914 and 1915 a vast amount of short-term financing such as one, two and three-year notes. Because of the sale price, the high interest rate and the short life such a mode of financing was exceedingly costly.

When the investment market again opened there seemed to be no limit to the amount of securities it could absorb. Money became more plentiful and easier and better rates were offered. Security prices accordingly rose and at the same time the margin of profit for the bond merchant became less. There was such a buying competition that it cost utilities much less to market their securities.

The time was ripe, therefore, to begin long time permanent financing. Very little temporary financing was evident during the year. Of eleven note issues reported nine were new issues. The maturities of the eleven note issues were as follows: Two years, two issues; three years, five issues; five years, two issues; ten years, one issue and twenty years, one issue. Most of the issues bore interest at 6 per cent and the remainder at 5 per cent; but few were convertible. The total amount reported issued was $22,650,000 for which the average price was 99 with 100.5 high and 95 low.

The bulk of the financing was in bonds, of which there was reported from the electric light and power field for investment fifty-nine issues with a total value of $115,472,300. Of these twenty-six were new issues. Forty-two issues were first mortgage, two convertible debentures and seven general mortgages. Of fifty-six bonds the maturities were as follows: Thirty-year, twenty or 35.8 per cent; forty-year, ten or 17.9 per cent; twenty-five-year, seven or 12.5 per cent; ten-year, six or 10.7 per cent; twenty-year, five or 8.9 per cent, and the rest at odd years. Thus two-thirds of the bond issues offered to investors in 1916 would mature in twenty-five years or longer.

The average price of the bonds was 97.03 with 104.25 high and 89 low. The new bonds were sold at an average price of 98 and the old issues at an average price of 96.3, a total of 65.5 per cent of the bonds bore interest at the rate of 5 per cent, and 33.4 per cent at the rate of 6 per cent.

Nine stock issues were reported for investment totaling $14,699,500. All were cumulative preferred issues with 6 and 7 per cent dividends, more however being in the 6 per cent dividend class.

Corporate and Financial

Counties Gas & Electric Company, Norristown, Pa.—The company has received permission from the Pennsylvania Public Service Commission to acquire the outstanding stock and control of the Lansdowne Construction Company, operating electric properties at Lansdowne, Delaware County, and vicinity.

Lorain (Ohio) County Electric Company.—The Ohio Public Utilities Commission on Dec. 29 gave the Lorain County Electric Company authority to close a lease for the plant of the Citizens Gas & Electric Company for a term of twenty-five years at a total consideration of $250,000. Many improvements and extensions have been planned.

Northern Idaho & Montana Power Company, Sandpoint, Idaho.—Elmer Dover, president of the company, has been named receiver for the corporation by Judge Rudkin of the United States District Court at Spokane. It is stated that this action is preparatory to a friendly reorganization whereby the capitalization will be reduced and the company equipped with funds for the construction of immediate

and future extensions. For several years the Northern Idaho & Montana Power Company has not earned its full bond interest charges, due to the failure of the communities served in Oregon, Washington, Montana and Idaho to develop in population and industries as rapidly as was expected when the original investments were made in the physical properties. With the return of prosperity to the lumber industry and the resumption of agricultural development a considerable quantity of profitable new business may be obtained by making extensions which the company is unable to finance in its present condition. In order to best conserve the interests of security holders and to properly serve its field reorganization is deemed necessary by the management, H. M. Byllesby & Company. Northern Idaho & Montana Power Company and its subsidiary, The Oregon Power Company, operate in territories with about 50,000 population, centering at Kalispell, Mont.; Sandpoint, Idaho; Newport, Wash.; and Albany, Eugene and Marshfield, Ore.

Robbins & Myers Company, Springfield, Ohio.—The company has announced that it will increase its capital stock from $1,000,000 to $5,000,000, to take care of needed improvements and plant extensions. The company increased its capitalization from $500,000 to $1,000,000 about two years ago, but the rapid increase in its business has necessitated further capital. An issue of preferred stock amounting to $1,500,000 has been taken at $105. The company is now employing 2400 persons, and expects to increase this number to 3000 shortly.

Washington-Idaho Water, Light & Power Company, Clarkston, Idaho—An issue of $600,000 first mortgage sinking fund 6 per cent gold bonds, due May 1, 1941, is being offered at par and interest.

New Utility and Industrial Companies

The Laverne (Okla.) Light, Power & Ice Company has been chartered with a capital stock of $30,000 by W. H. K. Lewis, E. R. Lewis and M. Lewis of Laverne.

The Newton (N. J.) Electric & Gas Company has been incorporated by F. W. Hills, A. H. Atterbury and Morgan Colt. The company is capitalized at $125,000 and proposes to supply electricity and gas in Newton and vicinity.

The Huntsville (Utah) Power & Light Company has been incorporated with a capital stock of $1,000 by Joseph L. Petersen, Alma L. Petersen, O. L. Petersen and others. The company proposes to supply electricity in Ogden valley towns.

The Car Lighting Improvement Company of Milwaukee, Wis., has been incorporated by Julian Olds, John A. Dietrich and T. H. Spence. The company is capitalized at $25,000 and proposes to manufacture and sell the Watson car lighting device.

The South American Electric Smelting Company of New York, N. Y., has been incorporated with a capital stock of $50,000 to do a general mining, smelting and refining business. The incorporators are: C. W. Whittlesey, J. B. Pruyn and W. P. Martin, 17 Battery Place, New York, N. Y.

The Aurora Battery Corporation of Buffalo, N. Y., has been incorporated with a capital stock of $25,000 to manufacture primary and secondary electric batteries for automobiles. The incorporators are: H. H. Servis, L. A. Brahler and E. Linck, 364 Connecticut Avenue, Buffalo, N. Y.

The Best Electric Wire Company of Jamesville, N. Y., has been incorporated by E. C. Spencer, G. A. Cowles and A. A. Reed, 136 Cortland Avenue, Syracuse, N. Y. The company is capitalized at $250,000 and proposes to manufacture and deal in wire, wire rope, cable, conduits, etc.

The Hartland (W. Va.) Power Company has been incorporated by John B. Hart, Osman E. Swartz, E. B. Templeman, R. O. Fallon and W. G. Swathers, all of New York, N. Y. The company is capitalized at $700,000 and proposes to generate and transmit electricity for public use.

The Kellogg-Burlingame Company of Grand Rapids, Mich., has been incorporated by Robert B. Kellogg, M. V. Burlingame of Grand Rapids, and Charles J. Davis of Lansing, Mich. The company is capitalized at $10,000 and proposes to deal in pumping machinery and power plant equipment.

The Arkansas Utilities Company of Heber Springs, Ark., has been incorporated with a capital stock of $20,000 to construct and operate electric light and power plants. The officers are: Dr. A. R. Amos of Little Rock, president; R. N. Case of Heber Springs, vice-president; Guy A. Watkins of Little Rock, secretary and treasurer.

The Augustus A. West Automobile Invention Company of New York, N. Y., has been chartered with a capital stock of $50,000 to manufacture devices and to do electrical work. The incorporators are: A. A. West, 32 Ross Avenue, South Ozone; S. Nelson, 423 Fifty-seventh Street, Brooklyn, and A. J. Cahill, 544 Summit Avenue, Jersey City, N. J.

The Bailey Non-Stall Differential Corporation of Millbrook, N. Y., has been incorporated with a capital stock of $105,000 to manufacture autos, taxicabs, aeroplanes and carry on a general electrical and mechanical engineering business. The incorporators are: H. S. Perrigo, 660 St. Nicholas Avenue, New York City; F. H. Butchorn, 764 St. Johns Place, Brooklyn, N. Y., and E. A. Gingras, Englewood, N. J.

Trade Publications

Lighting Fixtures.—The Macbeth-Evans Glass Company of Pittsburgh, Pa., has issued an illustrated folder descriptive of Macbeth-Evans lighting equipment for store lighting.

Control Devices.—The Rowan Electric Manufacturing Company, Inc., of Baltimore, Md., has prepared a loose-leaf booklet on its Automatic Protective and Control Devices for Electric Motors.

Batteries.—"Automobile Starting and Lighting with the Cincinnati Battery" is the title of a bulletin recently prepared by the Cincinnati Storage Battery Company, 228 Stark Street, Cincinnati, Ohio.

Rotary Converters.—The British Thomson-Houston Company, Ltd., Rugby, England, has prepared descriptive list No. 2420-A descriptive of rotary converters. This bulletin goes into the general description of these rotary converters.

Push Sockets. — An eight-page pamphlet has been published, including descriptions and illustrations of C-H push sockets manufactured by the Cutler-Hammer Manufacturing Company of Milwaukee. This folder is of the type furnished to dealers and jobbers, carrying imprint for distribution.

Electrical Supply Year Book.—The Western Electric Company, Inc., of New York, is distributing its 1917 Year Book on electrical supplies. This 1917 Year Book follows the plan of uniform list prices that was inaugurated in the Year Book of 1915. This 1310-page volume is well illustrated and has been carefully prepared in such a manner as to make things easy to find for the prospective purchaser.

Starters.—Automatic starters for squirrel cage induction motors are described and illustrated in descriptive leaflet No. 1660 just issued by the Westinghouse Electric & Manufacturing Company. These starters are used with single-phase and polyphase squirrel cage induction motors of all commercial ratings where it is desired to start from a remote point and where automatic acceleration is necessary on account of unskilled operators. The construction details are given in full and illustrations of component parts are shown.

Push-Button Specialties.—Catalog No. 8, a new 48-page booklet describing and listing C-H push button specialties, is now being distributed by the Cutler-Hammer Manufacturing Company of Milwaukee. This revised catalog contains 138 illustrations of sockets, switches, plugs, receptacles and other wiring devices as well as fourteen diagrams of the wiring connections for the C-H automobile lighting switches. Among other new products listed and described are the C-H 6-amp. pull switches, the new C-H "Standard" plug, that has a riveted blade construction and is interchangeable with plugs and receptacles of six other manufacturers; the remote control switch; composition feed-through switch; standard attachment receptacles; and new current tap. There is a complete index of catalog numbers in this edition, making it of greater use to contractors and others requiring C-H wiring devices.

New England

AUGUSTA, ME.—The Central Maine Power Company has recently taken over the plant and distributing system of the Hartland (Me.) Electric Light & Power Company and also the system of the Newport (Me.) Light & Power Company, which will be connected with the main transmission line running through to toward Moosehead Lake. It is reported that the Central Maine Company has also purchased the controlling interest in the Skowhegan Pulp Company, which would give it 4011 hp. out of 5588 hp of the present development of the Skowhegan company on the Kennebec River.

BRATTLEBORO, VT.—The Twin State Gas & Electric Company is planning to install an ornamental lighting system on Main Street to replace the present system of incandescent lamps strung across the street.

MILTON, VT.—The water power rights on the Lamoille River at Milton, formerly owned by H. O. Clark, have been purchased by the International Paper Company of New York, N. Y.—The new owners, it is understood, will develop the water power to generate electricity.

HUNTINGTON, MASS.—The Selectmen of Huntington, Cummington, Chesterfield and Worthington have petitioned the Legislature to pass a bill granting the Westfield River Railway Company a charter to construct an electric railway along the Westfield River and Major Brook; also to generate electricity to operate the proposed railway and to supply energy to adjacent towns for lamps, heaters and motors. The capital stock is placed at $182,000. Leonard F. Hardy of Huntington is interested.

LEOMINSTER, MASS.—The J. G. White Engineering Company, 43 Exchange Place, New York, N. Y., has been awarded a contract by the Leominster (Mass.) Electric Light & Power Company for designing and construction work in connection with the erection of a new electric transformer substation of the outdoor type, with distribution lines in Leominster.

WATERTOWN, MASS.—Plans have been completed for improvements to the power plant at the Arsenal Grounds of the United States Government at Watertown, to cost about $12,000. Monks & Johnson, 78 Devonshire Street, Boston, are engineers. M. T. Carney of Watertown is purchasing agent.

PACKER, CONN.—The stone mill at Packer, it is reported, is being considered by a Plainfield firm as a power site for an electric power plant.

Middle Atlantic

BUFFALO, N. Y.—Work will soon begin on the construction of a power plant, a 200-ton ice manufacturing plant and a machine shop for the Schoellkopf Aniline & Chemical Works, at Abbott Road and the Buffalo River. The John W. Cowper Company of Buffalo has the contract for erection of buildings and also for equipment, which includes battery of six 1000-hp. boilers for power plant; coal bunkers, coal and ash-handling machinery, stokers, air compressors, and a 200-ton ice plant and machine shop equipment.

BUFFALO, N. Y.—The Public Service Commission has granted the Niagara & Erie Power Company, of Buffalo, permission to erect additional electric generating plants and extend its transmission lines in several sections of western and southwestern New York. A 60,000-volt transmission line will be erected from the company's station in Lackawanna through towns and villages along the lake shore as far west as Dunkirk. This will involve an immediate expenditure of approximately $30,000, with an ultimate development, costing more than $150,000. A second new transmission line will be built from Fredonia to Cassadaga, at a cost of about $6,000; a power plant will also be erected in the town of Stockton.

COBLESKILL, N. Y.—Bids will be received by D. D. Frisbie, president board of trustees, Agricultural Hall, State and Lodge Streets, Albany, until Jan. 9, for construction, heating, plumbing and drainage and electric work for dairy building at Schoharie State School of Agriculture, Cobleskill. Drawings, specifications and blank forms of proposal may be obtained at the Department of Architecture, Capitol, Albany. Drawings and specifications may be consulted at the Schoharie State School of Agriculture, Cobleskill; New York office of Department of Architecture, Room 1224, Woolworth Building, and Department of Architecture, Capitol, Albany.

DUNKIRK, N. Y.—Not being able to obtain sufficient coal to keep the municipal electric plant working at its full capacity, the city authorities are considering a proposal to purchase a block of power from the Niagara & Erie Power Company, of Buffalo to enable the municipal plant to meet the increasing demands made upon it. The city has ordered an additional turbo-generator, but delivery will not be made for 18 months.

EDMESTON, N. Y.—The installation of an electric lighting system in Edmeston is under consideration.

LOCKPORT, N. Y.—A committee has been appointed to make investigations relative to the installation of a municipal electric-light plant in Lockport.

NEW YORK, N. Y.—Bids will be received by Robert Adamson, fire commissioner, eleventh floor, Municipal Building, New York, N. Y., until Jan. 12 for furnishing wire and metals. Blank forms and further information may be obtained at the office of the Fire Department, Eleventh Floor, Municipal Building.

NEW YORK, N. Y.—The general contract for the construction of a 16-story telephone exchange and office building for the New Telephone Company, to be erected on Broad Street, between Pearl and Water Streets, has been awarded to the Cauldwell-Wingate Company, 381 Fourth Avenue, New York City. The cost of the building is estimated at $1 200,000.

NEW YORK, N. Y.—Bids will be received by William Williams, commissioner of water, gas and electricity, Room 2318, Municipal Building, New York, until Jan. 9 for furnishing and maintaining electric lighting units for lighting public streets, parks and places from Jan. 10 to Dec. 31, 1917, both inclusive, in the first, second, third and fourth wards of the borough of Queens. Blank forms, etc., can be obtained at Room 2324, Municipal Building.

PANAMA, N. Y.—The town of Harmony has granted the Panama Traction Company a franchise to construct and operate an electric railway between Ashville and Panama.

QUOGUE, N. Y.—Work has been started by the Suffolk Light, Heat & Power Company of Southampton on the erection of an electric transmission line to Quogue, to supply electrical service here.

ANGELICA, PA.—Plans are being prepared by W. H. Dechant & Son, Bear Building, Reading, for the reconstruction of the plant of the Angelica (Pa.) Water & Ice Company, to include filtration plant, pumping station and complete hydroelectric development of the water power rights owned by the company on Angelica Creek. Post office address, Angelica, R. F. D. from Mohnton.

DU BOIS, PA.—The City Council is considering a proposal submitted by J. E. Du Bois, owner of the local electric-light plant, offering to sell the plant to the city of Du Bois for $30,000. Under the terms of the franchise the city has the privilege of purchasing the plant at the end of the ten-year period, which will expire next August.

PHILADELPHIA, PA.—Plans have been filed by the Hutlon Printing Company for an addition to the boiler plant at its factory, on Frankford Avenue.

PHILADELPHIA, PA.—Contract has been awarded by the Philadelphia Rapid Transit Company for extensions and alterations to its Kensington power plant.

PHILADELPHIA, PA.—Extensive additions and improvements are contemplated to the building of the Philadelphia Electric Company at Tenth and Chestnut Streets, involving an expenditure of about $500,000. The plans provide for the erection of a nine-story addition adjoining the building to the west and the erection of three additional stories on the corner property. John T. Windrim is architect. The John R. Wiggins Company has been awarded contract.

SOUTH BETHLEHEM, PA.—The Third Street Business Men's Association has been organized in conjunction with property owners on Third Street and Northampton Avenue for the purpose of raising funds ($15,000) for the installation of an ornamental street-lighting system along these thoroughfares.

BAYONNE, N. J.—The City Commissioners are considering a petition presented by property owners for the installation of an electric-lighting system along upper Broadway, extending to Fortieth Street. The installation will be made by the Public Service Electric Company.

JERSEY CITY, N. J.—The City Commission is negotiating with the Public Service Electric Company for the installation of a new street lighting system on Monticello Avenue, to be maintained by underground wires.

JERSEY CITY, N. J.—Estimates of cost for a new electric lighting plant for maintaining the boulevard street-lighting are being prepared for the City Commission. The present station has been in service about 20 years, and it is proposed to replace it with a new plant. Edward Cahll is president of the commission.

NEWARK, N. J.—Additional capital stock to the amount of $3,000,000, at par, has been sold by the Public Service Electric Company, the proceeds to be used for proposed betterments and extensions to its system and power stations.

TRENTON, N. J.—The Trenton Specialty Engineering Company is planning to install a new boiler plant at its factory.

WASHINGTON, N. J.—Bids will soon be called for by the electric-light committee for furnishing electricity for street-lighting. The five-year contract with the Washington Electric Company expires in February.

CUMBERLAND, MD.—The municipal electric-light plant and water-works station was completely destroyed by fire on Dec. 20, causing a loss of about $60,000. Electrical service has been furnished by the Edison Electric Illuminating Company since July 1, 1916.

PETERSBURG, VA.—An appropriation, it is reported, has been made by the City Council for improvements to the electric-lighting system.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, War Department, Washington, D. C., until Jan. 12, under proposal 896, for furnishing five power switchboards. For further information address Charles S. Wallace, Major, Signal Corps, U. S. Army.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, War Department, Washington, D. C., until Jan. 20, for furnishing 400 telephones and a quantity of telephone supplies. For further information address Alvin C. Vorhis, Captain, Signal Corps, U. S. Army.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations the following supplies; Schedule 565—four blowers, 5000 cu. ft. of air per minute capacity; Schedule 568—furnishing and installing one water tube boiler; Schedule 566—furnishing and installing insulation system; Schedule 578—50 electric heaters; Schedule 575—miscellaneous lighting and power wire, 110,000 ft. telephone wire, 3800 ft. triplex cable; Schedule 578—7000 ft. single-conductor wire, 120,000 ft. ½-in. galvanized steel conduit. Pensacola, Fla., Schedule 562—two transformers. Philadelphia, Pa., Schedule 574—150 steel boiler tubes. Newport, R. I., Schedule 563—1000 lb. copper tubing. Charleston, S. C., Schedule 577—646 brass compression grease cups. Mare Island, Cal., Schedule 582—six oiler sets. Norfolk, Va., Schedule 573—miscellaneous galvanized steel wire rope sockets; Schedule 584—miscellaneous bar copper. Applications for proposals should designate the schedule desired by number

North Central

DETROIT, MICH.—Bids will be received by the Detroit Library Commission until Feb. 15, to be delivered at the Herbert Bowen Branch Library, West Grand Boulevard and Dix Avenue, for the general construction and mechanical equipment of the new main library building. Plans and specifications may be obtained upon application to Cass Gilbert, 11 East Twenty-fourth Street, New York, N. Y., upon deposit of $200, which will be returned less $28, which will be deducted for cost of reproductions, upon return of plans.

CINCINNATI, OHIO.—The Allis-Chalmers Company is planning to enlarge its Bullock works in Norwood, near Cincinnati, at a cost of about $50,000. Five separate buildings will be erected.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, Cleveland, until Jan. 16, for furnishing cross arms to the department of light and heat. Specifications may be obtained at the office of the division of light and heat, Room 204, City Hall.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, Cleveland, until Jan. 16, for furnishing weather proof copper wire for the division of light and heat. Specifications may be obtained at the office of division of light and heat, Room 204, City Hall.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

CLEVELAND, OHIO.—The Allen, Osborne Company, architects and engineers, Rose Building, Cleveland, it is reported, is asking for bids for the construction of an ice rink, hotel and store buildings, market house and power and refrigerating plant, to cost about $600,000 for the Euclid Doan Company, of which A. J. Harvey, the Arcade, is president.

CLEVELAND, OHIO.—The report of the National Board of Fire Underwriters (in connection with an inspection of the electric power at the pumping station in Cleveland, made at the request of the Chamber of Commerce and the Cleveland Credit Men's Association) recommends that an additional source of electric power be secured, in order that the plant may be ready to operate at any time. They also recommend that two additional pumps, with proper electrical equipment, be installed in the plant and that substation equipment be separated from the pump rooms by a solid wall. Energy to operate the pumping station is supplied from the municipal electric plant.

COLUMBUS, OHIO.—The power house and restaurant at Indianola Park was recently destroyed by fire, causing a loss of about $4,500.

IRONTON, OHIO.—The Ironton Electric Company has increased its capital stock from $15,000 to $150,000. Of the proceeds $15,000 will be used to take up outstanding indebtedness, and $120,000 to purchase the local power house and substation of the Ohio Valley Electric Railway Company. The Ohio Valley Electric Railway Company has entered into a contract with the Consolidated Light, Heat & Power Company of Kenova, W. Va., the Boyd County Electric Company of Ashland, Ky., and the Iron Electric Company for energy to operate its traction lines.

MASSILLON, OHIO.—Bids will be received by State Board of Administration, Oak and Ninth Streets, Columbus, until Jan. 29 for construction of cottage for the Massillon State Hospital, near Massillon. Separate bids to be submitted on electric elevator equipment. Harry C. Holbrook, 44 East Broad Street, Columbus, is architect.

MILFORD, OHIO.—Plans, it is reported, have been outlined for a hydroelectric development on the Little Miami River by the officers of the Little Miami River Light & Power Company to supply electricity for lamps and motors in this section. J. W. Hill is consulting engineer; Louis Dolle, Mercantile Library Building, Cincinnati, is interested in the company.

REPUBLIC, OHIO.—At an election held recently the proposal to issue $10,000 in bonds for the installation of an electric-lighting system was carried. Electricity to operate the system will be supplied by the Ohio Light & Power Company of Newark. Part of the proceeds of the bond issue will be used to erect a transmission line to Bloomville, a distance of 4½ miles, where it will connect with the Tiffin-Shelby transmission line of the Ohio Light & Power Company, and the remainder for local distribution system.

BOONEVILLE, KY. — Bonds to the amount of $10,000 have been voted for the installation of an electric light plant. Construction work will begin about Feb. 1.

OWENSBORO, KY.—The installation of an additional 1500-kw. turbo-generator set, to cost about $26,000, has been approved by the City Council. Westinghouse equipment, it is understood, will be purchased.

KEWANNA, IND.—The local electric-light plant has been purchased by Martin Oedekerk of Lebanon.

MADISON, IND.—The Tower Manufacturing Company has secured a much larger building for its plant than the one which was destroyed by fire on Dec. 14. The output of the new plant will be nearly double that of the old plant. The company is in the market for rivet-heading machines, tack machines, transmission and power equipment. For further information address the Cincinnati, Ohio, office. W. F. Robertson of Cincinnati, Ohio, is president.

NOBLESVILLE, IND.—The capital stock of the Noblesville (Ind.) Heat, Light & Power Company has been increased from $100,000 to $250,000.

ALBION, ILL.—The Albion Electric Light & Gas Company is reported to be contemplating the purchase of additional equipment for its plant.

CHICAGO, ILL.—Bids will be received by the Commission on Buildings and Grounds, Board of Education, 730 Tribune Building, Chicago, until Jan. 24 for construction of the Lindbloom High School Building, including general construction work, steam boilers, heat regulation, electric work, ash conveyors, dumb waiters, etc. A. F. Hussander is architect, and John Howatt is chief engineer, 714 Tribune Building.

GIBSON CITY, ILL.—Plans are being considered by the Board of Local Improvements for the installation of an electric lighting plant and for improvements to the water works system, at a cost of about $30,000. Bids, it is understood, will be received about April 1. Melluish & Broyhill, Unity Building, Bloomington, is engineer.

NORMAL, ILL.—The installation of an ornamental lighting system in the business section of the city is under consideration.

SPRINGFIELD, ILL.—A proposition for placing all overhead wires in underground conduits, to be owned by the city and to be leased to the public utility companies, has been submitted to the City Council by A. D. Mackie, general manager of the Springfield Railway & Light Company. The cost of the installation of conduit system is estimated at $390,000.

PLYMOUTH, WIS.—Preliminary surveys are being made by Jeremiah Donohue, civil engineer, Sheboygan, for the construction of a dam across the Mullett River in Plymouth, for the Milwaukee & Fox River Valley Railway Company of Sheboygan. Dr. George Brickbauer, president of the company, which built the electric interurban railways from Plymouth to Elkhart Lake, purchased by the Sheboygan Railway & Electric Company some time ago, retained the franchise for furnishing electricity for lamps and motors in the villages of Elkhart Lake. Glenbeulah and St. Cloud. He is now contemplating extending his transmission line to Mount Cavalry and to build a new power plant. It is estimated that 150 hp. can be developed. At present he is purchasing energy from the Sheboygan Railway & Light Company.

FARIBAULT, MINN.—A petition is being circulated asking for the installation of a municipal electric-light plant in Faribault.

PINE RIVER, MINN.—The Pine River Lighting Company is contemplating extending its transmission lines to Walker.

SPOONER, MINN.—The Minnesota, Dakota & Western Railway Company of International Falls contemplates the erection of an electric transmission line from Spooner to Goodridge, where it will be connected with the Thief River Falls electric lines.

ST. PAUL, MINN.—Plans are being prepared by the St. Paul Gas Light Company for addition to pumping station, to cost about $30,000. Paul Doty is vice-president and general manager.

ST. PAUL, MINN.—The City Council is considering an ordinance requiring the St. Paul Railroad to equip its railroad from Chestnut Street to the west city limits for electrical operation.

BURLINGTON, IOWA.—The Burlington Railway & Light Company has applied to the State Railroad Commission for permission to erect electric transmission lines in Louisa and Des Moines Counties.

GRINNELL, IOWA.—The Iowa Light, Heat & Power Company has applied to the State Railroad Commission for permission to erect an electric transmission line in Carroll County.

MAQUOKETA, IOWA.—Improvements to the local electric system are contemplated by the Iowa Railway & Light Company.

SIOUX CITY, IOWA.—Proposals will be received by William L. Steele, United Bank Building, Sioux City, until Jan. 15 for elevator equipment, including one electric passenger elevator, push button control, and one dumb waiter for St. Vincent's Hospital, Sioux City.

SIOUX CITY, IOWA.—Preliminary plans are being prepared for the construction of a county home for Woodbury County, to include main building and power house, to cost about $75,000 and assembly building, to cost $25,000. William L. Steele, United Bank Building, Sioux City, is architect.

SIOUX CITY, IOWA.—Bids will be received until Feb. 5 for three electric elevators for public use, two for jail use, three for private use, two dumb waiters, two sidewalk lifts and jail equipment of about 100 cells, for the new court house now in course of construction, at a cost of about $100,000. William L. Steele, United Bank Building, Sioux City, is architect.

SPENCER, IOWA.—The contract for improvements to the municipal electric-light and power plant has been awarded to the Northwestern Electric Equipment Company, of St. Paul, Minn., at $38,705. W. Skinner, Plymouth Building, Minneapolis, Minn., is engineer.

TORONTO, IOWA.—The City Council is contemplating the installation of an electric-lighting system, for which an appropriation has been made.

CARROLLTON, MO.—The Water, Light & Transit Company of Carrollton is contemplating extensive improvements to its system if granted an extension of franchise.

FULTON, MO.—The Fulton State Hospital has petitioned the State Legislature for an appropriation for the installation of a new power plant.

GRANDVIEW, MO.—The installation of a municipal electric-light plant in Grandview is under consideration.

JEFFERSON CITY, MO.—Preliminary surveys, it is reported, have been made by the Illinois Traction System of Peoria, Ill., for the construction of an electric interurban railway from Jefferson City to Mexico, via Fulton, a distance of about 45 miles.

KANSAS CITY, MO.—Contract has been awarded by the Hospital Board for construction of addition to the City Hospital, to cost about $90,000, to J. E. Taylor, Ridge Building, Kansas City. Heating and lighting will be supplied from the main plant.

SPRINGFIELD, MO.—At an election to be held Feb. 20 (an extension of date from Dec. 12) the proposal to issue $100,000 in bonds for the construction of a municipal electric-light plant will be submitted to the voters.

WINFRED, S. D.—The contract for the installation of a street-lighting system and the erection of an electric transmission line to Howard has been awarded to the Northern Electric Company of Minneapolis, Minn.

BEATRICE, NEB.—All bids submitted for construction of power house for the municipal electric-light plant and water-works system have been rejected.

LINCOLN, NEB.—The Lincoln Traction Company contemplates the construction of an extension from Lincoln to Omaha, 49 miles long, during 1917.

WEST POINT, NEB.—The property of the West Point Electric Light & Power Company, it is reported, has been purchased by the Continental Gas & Electric Corporation, which controls the Nebraska Gas & Electric Company of Norfolk, Neb.

HIAWATHA, KAN.—The question of closing down the generating station of the municipal electric-light plant and purchasing energy from the Hiawatha Light, Power & Ice Company is under consideration by the City Council.

LENORA, KAN.—Plans are being prepared by George P. Taylor, consulting engineer, Stockton, for the installation of a municipal electric-light plant in Lenora, to cost about $10,000.

McCRACKEN, KAN.—The City Council is considering calling an election to submit the proposal to issue bonds for the installation of an electric-light plant and water-works system to the voters. The cost of the plant is estimated at $30,000. W. B. Rollins & Company, Railway Exchange Building, Kansas City, Mo., are engineers.

MORAN, KAN.—All bids received Dec. 18 for construction of water and light plants have been rejected. New bids will probably be asked for in January. W. B. Rollins & Company, Railway Exchange Building, Kansas City, Mo., are engineers.

QUINTER, KAN.—An election will soon be called to submit to the voters the proposal to issue $10,000 in bonds for the installation of a municipal electric-light plant. George P. Taylor of Stockton is engineer.

SALINA, KAN.—The Salina Light & Power Company, it is reported, contemplates the installation of an additional 2500-kw. generating unit at its plant.

WICHITA, KAN.—The Arkansas Valley Interurban Railway Company has applied to the Public Utilities Commission for authority to issue $2,000,000 additional in bonds and $900,000 additional in capital stock, for the purpose of making extensions into other countries, including Sumner, Butler, Cowley, McPherson, Marion, Rice, Saline and Dickinson.

Southern States

ALBEMARLE, N. C.—W. L. Cotton of Albemarle, representing capitalists, it is reported, is securing land and riparian rights with a view of constructing a power dam across Yadkin River for a hydroelectric power development.

SUMMERVILLE, GA.—Steps have been taken by local business men to organize a company to install and operate an electric-light plant in Summerville. The cost is estimated at about $5,000. C. C. Cleghorn, S. C. Martin and others are interested.

PLANT CITY, FLA.—The Plant City Public Service Company has been granted permission to extend its electric transmission lines out on the Thonotosassa Road, the Hopewell Road, the Midway Road and the Tampa-Plant City Road.

FRANKLIN, TENN.—Plans are being prepared by Thomas J. Davis of Franklin for construction of administration building, to include main dining hall, kitchen, bakery, refrigerating apparatus, domestic science

rooms, office, heating plant for this and six adjoining buildings; engine room equipped for generating electricity for lamps and motors for all the buildings. The cost of building, including equipment, is estimated at $36,000.

THOMAS, ALA.—The Republic Iron & Steel Company contemplates the construction of an electric plant to supply energy at Tales, Warner and Sayreton. C. T. Fairburn of Birmingham is manager of the Southern district.

JONESBORO, ARK.—Bids will be received by A. E. Lockhart, secretary of school board, until Jan. 16, for construction of a high school building, including heating, lighting and plumbing, etc. Plans may be obtained from the secretary upon deposit of $10.

NEW ORLEANS, LA.—Plans are being considered for extensive improvements for Canal Street, which will include an ornamental lighting system. Probably nothing will be done until early in 1918.

NEW ORLEANS, LA.—Extensive improvements and extensions are contemplated by the Trans Mississippi Terminal Company of New Orleans to its terminal facilities, especially for mechanical loading and unloading devices. The cost of the work is estimated at about $350,000.

SHREVEPORT, LA.—The Southwestern Gas & Electric Company, it is reported, contemplates extensions to its power house, involving an expenditure of about $100,000. A. G. Curtis is manager.

CRESCENT, OKLA.—The installation of an electric-light plant in Crescent is under consideration.

DUKE, OKLA.—The installation of a municipal electric-light plant in Duke is under consideration.

LAVERNE, OKLA.—The Laverne Electric Light, Power & Ice Company, recently incorporated, contemplates the construction of an electric plant to develop 75 hp., at a cost of about $30,000. W. H. Lewis & Son are managers.

NORMAL, OKLA.—Plans are being considered for the installation of a municipal electric-light plant in Normal.

WEWOKA, OKLA.—An election has been called to submit the proposal to issue $8,000 in bonds for improvements and extensions to the municipal electric-light plant.

BALLINGER, TEX.—The Ballinger Electric Light & Power Company has filed amendments to its charter changing its name to the Ballinger Light, Power & Ice Company and changing its purpose.

COLLEGE STATION, TEX.—All bids for construction of laboratory building and power house and domestic arts building at Prairie View, at College Station for the Agricultural and Mechanical College, have been rejected and new bids will be received until Jan. 8. The cost of the laboratory building is estimated at $96,000; the power house, $55,000, and the domestic arts building, $50,000. All lighting and heating will be supplied from a central plant.

DALLAS, TEX.—Negotiations are under way for the consolidation of the Texas Traction Company, which operates an interurban railway between Dallas and Dennison, and the Southern Traction Company, which operates an interurban car line between Dallas and Waco and Dallas and Corsicana. It is proposed to extend the Waco railway south to San Antonio, via Austin, a distance of about 185 miles, soon after the merger goes into effect.

FORT WORTH, TEX.—Plans have been prepared by Sanguinet & Staats of Fort Worth for the construction of a high school building on the old Fort University site, 300 ft. by 236 ft.; to be equipped with electric lamps, vacuum cleaning system, automatic clock and bell system and intercommunicating telephone system.

KEMP, TEX.—The installation of an electric-lighting system in Kemp is under consideration.

SAN ANGELO, TEX.—Bids will be received by C. C. McBurnett for the erection of a seven-story hotel with 110 rooms and about 75 baths; also to include refrigerating plant, elevators, vacuum cleaning system, etc., to cost about $150,000.

SAN ANGELO, TEX.—The San Angelo Water, Light & Power Company has filed an application with the State Board of Water Engineers for permission to build a reservoir for the purpose of impounding 380,000 acre ft. of the flood waters and natural flow of the Concho River to supplement the water supply of San Angelo.

UVALDE, TEX.—Negotiations are under way between the Uvalde Electric Light & Power Company and W. H. Wiss of Kansas City, Mo., and associates for the purchase of the local plant. The new owners, it is said, contemplate extensive improvements to the system.

Pacific States

EDMONDS, WASH.—The Edmonds Electric Light & Power Company has closed a contract (for a term of years) with the Shell Oil Company of California to supply electricity for lamps and motors at its large distributing plant at Richmond Beach. Work will begin at once on the erection of a 2300-volt transmission line to Richmond Beach. A. A. Cobb is superintendent.

KEYPORT, WASH.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Jan. 15 (extension of date from Dec. 18) for a telephone cable connection between the Pacific coast torpedo station, Keyport, Wash., and the Puget Sound navy yard, Wash., also an electric power transmission line from the Olympic Power Company's pole line to the radio building at the above-named torpedo station.

CHICO, CAL.—A proposal for the installation of a municipal electric plant, to cost about $750,000, has been submitted to the Business Men's Association by Denny Murphy. The plans provide for utilizing water rights on Deer Creek, owned by Mr. Murphy.

WILLOWS, CAL.—Preparations are being made by the Sacramento Valley Colony Company of Willows for the installation of 70 electrical pumping plants for irrigation purposes.

WILLOWS, CAL.—The Glenn-Cadora, Prince Districts, have recently voted to issue bonds for the construction of two pumping stations for pumping water for irrigating about 18,000 acres; one to be located at Sidds Landing and the other north of Princeton, to cost about $144,000.

CALDWELL, IDAHO.—The Caldwell Traction Company contemplates equipping its railway between Caldwell, Greenleaf and Wilder, 10 miles in length, for electrical operation. The road is leased from the Oregon Short Line and now operated by steam.

SALT LAKE CITY, UTAH.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Jan. 25 for the installation, complete, of a hoistway, hydraulic freight lift, etc., in the United States post office and court house at Salt Lake City. For details see proposal columns.

FLAGSTAFF, ARIZ.—Plans are being considered by the Arizona Lead & Zinc Company for the construction of a large hydroelectric plant at Mooney Falls on Cataract Creek. Energy developed at the plant will be transmitted to the mines of the company to operate machinery and other equipment. The company also proposes to erect a large mill for the reduction of ore by the electrolytic process.

GLOBE, ARIZ.—Application has been made to the City Council by C. H. Munson for a franchise to enter the city of Globe with an interurban railway which he proposes to build between Globe and Miami.

JEROME, ARIZ.—The Arizona Power Company, it is reported, has awarded contract for the construction of an additional electric generating station, to cost about $1,000,000. The proposed plant will be operated by steam power and will have an output of about 10,000 hp. This energy will supplement that which the company now obtains from its hydroelectric plants at Fossil Creek on the lower Verde River. The transmission systems of the two plants, it is stated, will be connected, and that when additional power from the new station is available, a transmission line will be erected to Jerome to provide energy to operate the machinery of the mine and ore mills here.

NOGALES, ARIZ.—The International Gas Company, it is reported, contemplates extending its transmission lines to Cananea and other mines and towns in northern Sonora, Mex.

WILCOX, ARIZ.—The Council has granted Neil McMillan a franchise to construct and operate an electric-light plant in Wilcox.

YUMA, ARIZ.—Contracts have been signed by which the Southern Sierras Power Company of Riverside, Cal., will supply electricity for lamps and motors and domestic purposes in the city of Yuma from El Centro, Cal. The plans provide for the erection of a high-tension transmission line from El Centro, Cal., to Yuma, a distance of about 70 miles, at a cost of about $200,000. The proposed line will also supply energy to enable the ranchers in Imperial Valley to irrigate about 500,000 acres of land, and it will also supply power to operate two dredges at Hanlon's Heading, the main intake of the Colorado River of the Imperial canal system.

DILLON, MONT.—Bids, it is reported, will be received by Jesse M. Warren, Daily Bank Building, Butte, until Jan. 15, for construction of hotel, three stories and basement, 75 ft. by 115 ft., including heating, electric lighting, plumbing, etc., to cost about $75,000, in Dillon.

AUSTIN, NEV.—An electric-light franchise has been granted to Messrs. Berg & Rice of Austin to install an electric-light plant here. The equipment of the plant will include a 25-kw. generator driven by a crude oil engine.

FALLON, NEV.—The Fallon Electric Railroad Company is contemplating the construction of an electric railway from Fallon to Stillwater, a distance of 41 miles, during 1917.

Canada

DRUMHELLER, ALTA.—The Northwestern Engineering & Supply Company of Calgary has been granted a franchise to operate an electric-light and power plant in Drumheller. With the agreement for street-lighting the company also takes over the pumping service for the waterworks system.

BATHURST, N. B.—The Bathurst Lumber Company contemplates a 10,000 hp. power development at Grand Falls on the Nepisigut River, about 18 miles from Bathurst, in connection with the construction of a paper mill.

AYLMAR, ONT.—The installation of two gas engines at the municipal electric light and water-works plant is under consideration.

HEPWORTH, ONT.—The ratepayers have approved a by-law authorizing the Hepworth Heat, Light & Power Company to install a distributing system to supply electricity in Hepworth.

MICHIPICOTEN HARBOR, ONT.—The Michipicoten Power & Paper Company, recently incorporated with a capital stock of $6,500,000, contemplates the construction of a 150-ton news mill at Michipicoten Harbor, about 120 miles west of Sault Ste Marie, and also a 125-ton ground wood pulp mill. The cost of the mills and the water power development is estimated at about $6,000,000. Lewis Miller Wood, of Toronto, president of the Standard Chemical Iron and Lumber Company, is at the head of the new company. The headquarters of the Michipicoten company are in Toronto.

TORONTO, ONT.—Tenders will soon be called by the Provincial Hydro-Electric Power Commission for a 13,000/2200-volt distribution system to supply electricity to Mimico, New Toronto, the Mimico Hospital for the Insane, numerous brick yards and other industries. The initial installation will provide for an output of about 4000 hp. F. A. Gaby is chief engineer.

QUEBEC, QUE.—The Dominion Iron & Wrecking Company of Quebec has taken over the plants of the Standard Steel Foundries at Outremont and the Consolidated Brass Foundries at Point aux Trembles, Que. The plants, it is understood, will be consolidated for the purpose of manufacturing munitions. New equipment, including 15 electric furnaces, will be installed at the Consolidated Foundries' plant.

ARCOLA, SASK.—The purchase of the local electric-light plant to be owned and operated by the municipality is under consideration.

Miscellaneous

PANAMA.—Bids will be received at the office of the purchasing officer of the Panama Canal, Washington, D. C., until Jan. 12, under circular No. 2097, for furnishing cable and switch ties. For further information address Major Earl I. Brown, general purchasing officer.

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal Commission, Washington, D. C., until Jan. 11 for furnishing galvanized steel, sheet brass, copper tubing, cable thimbles, drills, bits, pipe cutters, steel clamps, clocks, detonators, etc. Blanks and general information relating to the circular (No. 1109) may be obtained at the above office or at the offices of the assistant general purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Jan. 16 for electric cable, wire, transformers, panel boards, ammeters, voltmeters, electric fixtures, electrical attachments, fire alarm boxes, gasoline torches, drill points, lamp carbons, pliers, insulating paper, pothead compound, etc. Blanks and general information relating to this circular (No. 1111) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; Whitney-Central Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

Directory of Electrical Associations

Printed in the First Issue of Each Month

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, Arthur Kneisel, 29 South LaSalle St., Chicago, Ill.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Permanent Secretary, L. O. Howard, Smithsonian Institution, Washington, D. C.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 8 West 40th St., New York.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS. Secretary, F. A. Molitor, 35 Nassau St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

AMERICAN PHYSICAL SOCIETY. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio.

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ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, John F. Kelly, McKeesport, Pa.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Jos. A. Andreucetti, Chicago & Northwestern Railway, Chicago.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, 112 West Adams St., Chicago.

BRITISH COLUMBIA ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary-treasurer, E. Brettell, Electric Supply Company, Ltd., Vancouver, B. C.

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CANADIAN ELECTRICAL ASSOCIATION. Affiliated with N. E. L. A. Secretary-treasurer, Alan Sullivan, Excelsior Life Building, Toronto, Can.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, T. F. Kennedy, 900 15th St., Denver, Col.

COMMERCIAL SECTION, N. E. L. A. Secretary, F. D. Beardslee, Union Electric Light & Power Company, St. Louis, Mo.

EASTERN NEW YORK SECTION N. E. L. A. Secretary J. E. Kearns General Electric Company, Schenectady, N. Y.

ELECTRICAL CONTRACTORS' ASSOCIATION OF CONNECTICUT. Secretary, George M. Chapman, Waterbury, Conn.

ELECTRICAL CONTRACTORS' ASSOCIATION OF MASSACHUSETTS. Secretary, H. D. Temple, 30 Foster St., Worcester, Mass.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, A. J. Burns, 318 West Tenth St., Kansas City, Mo.

ELECTRICAL CONTRACTORS' ASSOCIATION OF THE STATE OF PENNSYLVANIA. Secretary, M. G. Sellers, 1518 Sansom St., Philadelphia.

ELECTRICAL CONTRACTORS' ASSOCIATION OF WISCONSIN. Secretary, Albert Petermann, 626 Lloyd St., Milwaukee, Wis. Next meeting, Hotel Wisconsin, Milwaukee, Jan. 15 to 17.

ELECTRICAL DEALERS' AND CONTRACTORS' ASSOCIATION OF ONTARIO. Secretary E. A. Drury, 45 Murray St., Toronto, Can.

ELECTRICAL MANUFACTURERS' CLUB. Secretary, H. B. Crouse, Crouse-Hinds Co., Syracuse, N. Y.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General Secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, 34 Ellis St., San Francisco, Cal.

ELECTRIC POWER CLUB. Secretary, C. H. Roth, 1410 West Adams St., Chicago.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Affiliated with the N. E. L. A. Secretary, A. Jackson Marshall, 29 West 39th St., New York.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 29 West 39th St., New York.

GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA. Secretary-treasurer, Prof. H. V. Bozell, Norman, Okla.

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ILLINOIS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, M. L. Blumenthal, 179 West Washington St., Chicago, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, G. H. Stickney, 4th and Sussex Sts., Harrison, N. J. Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston. Annual convention September.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donahue, Lafayette, Ind.

INDIANA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, George Skillman, Indianapolis, Ind.

INDUSTRIAL ELECTRIC HEATING ASSOCIATION. Secretary, Homer Kunz, Toledo Railways & Light Co., Toledo, Ohio.

INSTITUTE OF OPERATING ENGINEERS. Secretary, L. Houmiller, 29 West 39th St., New York.

INSTITUTE OF RADIO ENGINEERS. Secretary, David Sarnoff, 111 Broadway, New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General Secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

IOWA SECTION N. E. L. A. Secretary-treasurer, L. E. Caldwell, Iowa City, Iowa.

IOWA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, M. T. Humphrey, Waterloo, Iowa.

JOVIAN ORDER. Jupiter (president), Henry L. Doherty, New York City; Mercury (secretary), E. C. Bennett, Syndicate Trust Building, St. Louis, Mo.

KANSAS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. A. Mercer, 108 West Eighth Ave., Topeka, Kan.

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KENTUCKY ASSOCIATION OF ELECTRICAL CONTRACTORS. Secretary, Herbert E. Ottenheimer, Louisville, Ky.

LOUISIANA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. J. Zeigler, 227 Bourbon St., New Orleans.

MAINE ELECTRIC ASSOCIATION. Secretary-treasurer, Walter S. Wyman, Waterville, Maine.

MICHIGAN SECTION, N. E. L. A. Secretary, Herbert Silvester, 18 Washington Boulevard, Detroit, Mich.

MINNESOTA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, G. M. Jones, 14 Seventh St., N., Minneapolis, Minn.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary, F. R. Porter, St. Cloud, Minn.

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NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, William L. Smith, Concord, Mass.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, 33 West 39th St., New York.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, George H. Dutheld, 41 Martin Building, Utica, N. Y. Next meeting, New Orleans, October 1917.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1343 Marquette Bldg., Chicago, Ill.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass. Biennial meeting New York City, March, 1917.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, B. E. Egan, Room 201, Union Pacific Building, Omaha, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 60 State St., Boston, Mass.

NEW ENGLAND SECTION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, E. A. Thiele, Roswell, N. M. Annual convention, Albuquerque, N. M. Feb. 12-14.

NEW YORK ELECTRICAL CREDIT ASSOCIATION. Secretary, Franz Neilson, 120 Broadway, New York.

NEW YORK ELECTRICAL SOCIETY. Secretary, George H. Guy, 29 West 39th St., New York.

NORTHWEST SECTION, N. E. L. A. Secretary, J. F. Farquhar, Washington Water Power Company, Spokane, Wash.

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PUBLIC SERVICE ASSOCIATION OF VIRGINIA. Secretary, W. J. Kehl, Virginia Railway & Power Co., Richmond, Va.

PUBLIC UTILITIES ASSOCIATION OF WEST VIRGINIA. Secretary, W. C. Davisson, West Virginia Water & Electric Co., Charleston, W. Va.

RADIO CLUB OF AMERICA. Secretary, David S. Brown, 206 West 86th St., New York.

RAILWAY SIGNAL ASSOCIATION. Secretary-treasurer, C. E. Rosenberg, Times Building, Bethlehem, Pa.

ROCKY MOUNTAIN ASSOCIATION OF MUNICIPAL ELECTRICIANS. President, Lawrence Stone, Denver, Col.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. General manager, J. M. Wakeman, 29 West 39th St., New York.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

SOUTH DAKOTA ELECTRIC LIGHT ASSOCIATION. Secretary, A. H. Savage, Dakota Light & Power Co., Flandreau, S. D.

SOUTHEASTERN SECTION N. E. L. A. Secretary treasurer, George H. Wygant, Tampa, Fla.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex.

TEXAS STATE ASSOCIATION OF ELECTRICAL CONTRACTORS. Secretary, Eugene Ashe, Dallas, Tex.

TRI-STATE WATER & LIGHT ASSOCIATION. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, C. H. West, Rutland, Vt.

VIRGINIA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, E. M. Andrews, Richmond.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 Jackson Bldg., Chicago, Ill.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, 1410 First National Bank Building, Milwaukee, Wis.

Record of Electrical Patents

Notes on United States Patents issued on Dec. 26, 1916

1,209,909. Lamp-Socket; Clarence A. Vetter, Pittsburgh, Pa. App. filed Dec. 26, 1913. Incandescent lamps.

1,209,910. Lamp Socket; Clarence A. Vetter, Pittsburgh, Pa. App. filed Jan. 16, 1915. Enables the cap and shell to be connected in any position relative to each other.

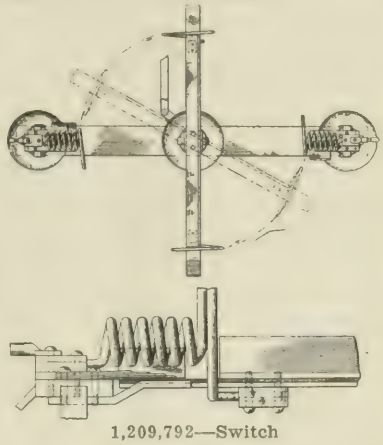
1,209,932. Hand-Generator; Charles P. Bradley, Pemberton, N. J. App. filed Nov. 24, 1914. Lamp may be operated.

1,209,944. Pneumatic Pump; Charles A. De Rigne, Los Angeles, Cal. App. filed Feb. 28, 1916. Designed for inflating the tires of automobiles, bicycles and the like.

1,209,961. Electrically-Operated Typewriter; Ernest Hausberg, Charles City, Iowa. App. filed July 25, 1912. Mechanically operated parts of the machine are reduced to a minimum.

1,209,992. Dynamo-Electric Machine; Henry V. Nye, West Allis, Wis. App. filed Nov. 9, 1910. For coiling such devices.

1,210,017. Electrolytic Recovery of Zinc From Ores and Other Zinc-Bearing Materials; Urlyn Clifton Tainton, Johannesburg, Transvaal, South Africa. App. filed Aug. 10, 1915. Improvements.



1,209,792—Switch

1,210,018. Curling-Iron; Samuel Trood, Edgewood Park, Pa. App. filed Feb. 4, 1913. Embodying a resiliently supported heater element for preventing breakage, and a swiveling attachment whereby the iron may be rotated with respect to the supply conductors.

1,210,024. Auto Tail-Lamp Signal; George F. Wakefield, San José, Cal. App. filed Dec. 27, 1915. Rear end of automobiles.

1,210,027. Signal-Lamp; Lee H. Wilbur and Walter F. Wilbur, Dunkirk, N. Y. App. filed March 5, 1915. In case the bulb is extinguished by burning out, a second bulb will automatically swing into place.

1,210,029. Brush for Dynamo-Electric Machines and Method of Attaching Conductors Thereto; Carl B. Auel, Wilkinsburg, Pa. App. filed Sept. 28, 1912. Improvement.

1,210,036. Terminal Block for Electrical Measuring Instruments; William M. Bradshaw, Wilkinsburg, Pa. App. filed Feb. 19, 1914. For watt-hour meters.

1,210,049. Electrical Protective Device; Almon W. Copley, Wilkinsburg, Pa. App. filed Dec. 14, 1915. Actuated only when the temperature of the translating device to be protected reaches a predetermined value.

1,210,058. Electrical Protective Device; Charles Le G. Fortescue, Pittsburgh, Pa. App. filed Sept. 21, 1915. Protecting electrical translating device in accordance with the temperatures thereof.

1,210,062. Electrically-Heated Culinary Apparatus; William S. Hadaway, Jr., East Orange, N. J. App. filed June 25, 1910. Utilized with any of the usual forms of chafing dishes and similar devices without necessitating any structural change therein.

1,210,068. Cable-Terminal Plug Retainer; Ellsworth A. Hawthorne, Bridgeport, Conn. App. filed June 22, 1914. For lamps and other apparatus having socket members, or the like.

1,210,078. Adjustable Support for Electric Lamps; Knut F. M. Landblad, Everett, Mass. App. filed Feb. 26, 1916. Adjustable pendant.

1,210,086. Electric Water-Heater; James C. Leitch, Los Angeles, Cal. App. filed July 6, 1915. Portable.

1,210,094. System of Distribution; Charles McL. Moss, Pittsburgh, and Henry A. Travers, Wilkinsburg, Pa. App. filed Dec. 4, 1915. Automatically-controlled means for absorbing the excess-regenerated energy produced by devices operating in such systems.

1,210,110. Universal Cable-Tip; Frank W. Smith, Kansas City, Mo. App. filed March 29, 1915. For electrically connecting cables to spark plugs of explosive engines on automobiles.

1,210,112. Electric Prod-Pole; William A. Smith, San Angelo, Tex. App. filed Aug. 9, 1915. Poles to be used in the place of the ordinary prod pole for driving or controlling animals on ranches, stockyards, and similar places.

1,210,176. Duplex Receptacle; George P. Knapp, Bridgeport, Conn. App. filed June 19, 1915. Adapted to receive a plurality of (in the present instance two) connecting caps.

1,210,204. Weighing-Scale; Orwell C. Reeves, Toledo, Ohio. App. filed March 4, 1915. Articles may be separately weighed without necessitating the removal of any of them from the scale platform.

1,210,214. Sparking Indicator; Herbert J. Sass and Oliver H. Shaw, Chicago, Ill. App. filed Feb. 29, 1916. Plugs of an engine may be readily and quickly tested to determine whether or not the same are operating.

1,210,225. Flash-Light Device; Paul C. Smalley, Newark, N. J. App. filed Feb. 13, 1915. Lens with reflector-positioning means formed on its inner face, which may consist of an annular recess.

1,210,245. Electric-Bell Attachment; Thomas C. Williams, Washington, D. C. App. filed June 2, 1916. Used on street cars.

1,210,262. Lamp-Lock Socket; Reuben B. Benjamin and James Imboden, Chicago, Ill. App. filed April 3, 1914. Lock the lamp in the socket in such a manner that the same will not jar loose due to vibration.

1,210,283. Signaling Apparatus; Carl G. Ender and Guy A. Barber, Wilkinsburg, Pa. App. filed Feb. 18, 1916. For vehicles.

1,210,290. Incandescent-Lamp Socket; George Herbert Feick, Baltimore, Md. App. filed Nov. 29, 1915. For allowing the proper amount of flexibility between the cord and the protector.

1,210,314. Telephone Toll System; Alfred U. Hoefer, East Orange, N. J., and Henry M. Bascom, New York, N. Y. App. filed Oct. 30, 1914. Improvements.

1,210,316. Depilatory Apparatus; William B. Hollingshead, Mount Vernon, N. Y. App. filed Nov. 23, 1912. Electric current may be conveniently controlled and guided.

1,210,331. Thermal Circuit-Controller; Frank Kuhn, Detroit, Mich. App. filed March 8, 1913. Automatic cutouts for electric circuits.

1,210,335. Lighting System for Motor-Vehicles; Charles T. Lemon, Ripley, Ohio. App. filed Jan. 12, 1916. Circuit-closing device.

1,210,336. Traffic-Signal; James A. McIntosh, Portland, Ore. App. filed Feb. 16, 1916. For use upon automobiles and other motor vehicles.

1,210,356. Circuit-Closing Device; Edward Paul, New Bremen, Ohio. App. filed April 3, 1916. For use in electric street-lighting systems wherein a plurality of arc lamps are connected in series.

1,210,365. Lamp Attachment for Cells; Michael C. Regan of the United States Army. App. filed Jan. 7, 1916. Whereby miniature or other electric lamps may be attached to dry or other cells and supportd thereon to swing into and out of engagement with one terminal or connector for lighting or disconnecting the lamp.

1,210,386. Automatic Telephone System; William Kaisling, Chicago, Ill. App. filed June 5, 1911. For use in connecting a calling line with an idle trunk circuit or first selector switch upon initiation of a call.

1,209,356. Line Switch; John Newberry Reynolds, Greenwich, Conn. App. filed March 16, 1915. Telephone switch.

1,209,655. Lamp-Socket; William F. Anklam, Detroit, Mich. App. filed Aug. 31, 1914. For use in connection with vehicle lamps.

1,209,680. Method of and Apparatus for Detecting the Presence and Location of Submerged Metallic Bodies; Patrick B. Delany, South Orange, N. J. App. filed April 20, 1915. Such as submarines, floating mines.

1,209,689. Telephone System; Francis W. Dunbar, Chicago, Ill. App. filed May 28, 1909. Apparatus by which the busy and idle conditions of a telephone line are established.

1,209,704. Method of and Apparatus for Electric Welding; Charlie L. Hawes, Ashtabula, Ohio. App. filed April 6, 1914. Manufacture of metallic tubes of comparatively short length and more particularly still to tapered ferrules such as are employed on the handles of rakes, hoes and like implements.

1,209,710. Wire Electrode for Electrolytic Purposes; Max Huth, Charlottenburg, Germany. App. filed July 7, 1916. Wire electrodes are arranged so that the individual electrode wires, which are connected to a common conductor of the current supply, hang freely from this conductor and are weighted at their lower ends in order to put the individual wires under mechanical tension.

1,209,735. Registering Recording and Computing System; George W. Lorimer, Piqua, Ohio. App. filed July 12, 1912. Concerning sales or other business transactions.

1,209,744. Electric Switch; Harry J. Morey and Fay A. Brogden, Syracuse, N. Y. App. filed Nov. 29, 1912. Pendant push-button switches.

1,209,766. Apparatus for Measuring the Maximum Values of Alternating-Current Voltages; Clayton H. Sharp, White Plains, N. Y. App. filed Oct. 26, 1914. A suitable electric valve or rectifier is used to charge a condenser to the peak value of an alternating wave.

1,209,775. Dynamo-Electric Machine; Charles W. Starker, Pittsburgh, Pa. App. filed April 1, 1915. Improvement.

1,209,776. Dynamo-Electric Machine; Charles W. Starker, Pittsburgh, Pa. App. filed April 1, 1915. Motor frame of the split type.

1,209,792. Switch; Herbert W. Young, Chicago, Ill. App. filed Dec. 11, 1913. Adapted for outdoor use by reason of which the switch may be readily opened when desired regardless of the snow and ice which may be gathered thereon.

1,209,793. Signal-Lantern; Alfred A. Ziegler, Boston, Mass. App. filed Nov. 6, 1915. Improvement.

1,209,825. Telephone System; John Erickson, Chicago, Ill. App. filed Dec. 18, 1908. Improvement.

1,209,826. Telephone System; John Erickson, Chicago, Ill. App. filed Dec. 18, 1908. Substations are provided with rotary calling dials, and especially to systems in which the said dials are used for controlling the operations of switches that have one motion to select groups and another motion to connect with a line in any selected group.

1,209,834. Telephone-Exchange System; Charles L. Goodrum, New York, N. Y. App. filed May 10, 1915. Automatic ringing systems for party lines connected with an automatic telephone exchange.

1,209,835. Process of Treating Materials Electrolytically; William E. Greenawalt, Denver, Col. App. filed May 13, 1913. Improvements.

1,209,842. Wire-Connector; Ormond E. Hunt, Detroit, Mich. App. filed Feb. 24, 1914. Water proof.

1,209,852. Illuminating Device for Talking-Machine Records; Chester A. Kotterman, Washington, D. C. App. filed June 12, 1916. Improvements.

1,209,862. Electric Heating Appliance; Tiodolf Lidberg, Chicago, Ill. App. filed Jan. 19, 1916. Adapted for heating a liquid bath.

1,209,871. Method of and Apparatus for Electric Welding; Frank H. Neff, Cleveland, Ohio. App. filed June 15, 1915. Comprises a plurality of contacting surfaces or arcing points to which the high-voltage pressure is successively momentarily applied.

1,209,892. Electrical Connector; August J. Seemann, Milwaukee, Wis. App. filed Nov. 22, 1915. For connecting the railway cars of a train.

1,209,908. Lamp-Socket; Clarence A. Vetter, Pittsburgh, Pa. App. filed Dec. 26, 1913. Improvements.

Electrical World

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Costs and Its Problems

NO question is more momentous for the industry during the coming year than the one of costs. Costs of raw material, of manufacturing, of labor, of supplies—these will influence all operations. How long the European war will continue, how extensive will be the ante-peace and the post-peace demand from Europe for raw and manufactured products, what economic and financial conditions will prevail in this country, how far liquidation in labor and materials will extend, what the new alignments in world trade relations will be—these are broad problems whose answers will affect every manufacturer, jobber, central station, dealer and contractor. In this number we present a symposium of views from representatives of the different branches of the industry. With large issues in the background, these experienced observers of facts and tendencies do not hesitate to express their own convictions as a guide to others. The role of prophet is hazardous, but the truth is that every responsible executive of a business organization must act in planning for the future; and it is to aid in the constructive formation of necessary policies that these contributors are giving their ideas.

Educational Value of Local Meetings

THE tendency toward localizing the activities of several of our national associations, including the National Electric Light Association and the American Institute of Electrical Engineers, seems a most profitable movement. Recent meetings of the American Institute at Philadelphia and Boston and the meeting this week at Pittsburgh are typical gatherings of this sort. The greatest value of the interchange of ideas in papers comes through discussion. The more the department men in central stations and the engineers in a local community can take part in such discussions the greater is their own interest in the work. There is a second value in local activity which should not be overlooked. Not only do men associated together locally get a more direct benefit from the discussion of their every-day problems, but the community itself, under an enthusiastic leadership in such a local association, comes to realize better the civic relations of the electrical group in the community to the community at large. In several cities, in Cleveland to mention only one, the coming together of all the electrical men in an electrical league has given a unity and a sense of direction to all the electrical men in the city. Not only does the league with its permanent headquarters provide a suitable meeting place for different groups of electrical men, but general meetings on special topics of civic interest broaden the contact of the electrical men with the civic problems of the town, and the public, in its turn, looks to the local organization for advice on municipal engineering problems that touch the electrical industry. There should be more local leagues.

The Course of Copper

PARTICULAR interest is felt in the spectacular decline in the nominal market quotations for copper which followed the first talk of peace. The abrupt shifting in price to a slightly lower level suggests possibilities of great importance to the electrical industry. It is estimated in some quarters that the proportion of copper production which has gone abroad under war conditions is three-quarters of the total output. Bearing in mind the conservative calculation that in normal times one-half of the total is shipped abroad and that one-half of the balance, or one-quarter of the total, enters into the electrical industry, it will be seen that there is room for an adjustment of large proportions. However, there are several considerations against too hasty an assumption that radical curtailment in production will follow, with corresponding shrinkage in price: First, countries which have been buying heavily for war purposes will be in the market for supplies for peaceful purposes (although their enormous purchases in advance of actual needs will leave a surplus which in fact may be so large that part of it will be resold); second, nations shut off from us will need supplies, although they probably have bought and stored great quantities in anticipation of restoration of normal conditions; and, third, a reduced price level will stimulate construction at home which has been deferred by the scarcity and high cost of the red metal.

The Economics of Transformer Practice

MANY central station men will do well to consider and act upon the analysis of economic life of transformers in relation to their use as given by T. B. Morgan in this issue. It is the result of a careful analytical study of the results of continuing the use of transformers of old design on a distribution system. The history of transformer design has been one of steady improvement in design, in construction, and particularly in the quality of the iron used, the aging of iron so as to cause increase in the hysteretic losses being a familiar fact. The improvement in iron has in

later years helped out the situation amazingly, yet even at the present time there is none too much information regarding the actual extent to which this has gone. In the beginning practically all alternating-current plants in this country were operated either at 125 or 133 cycles. With the beginning of power transmission, and modern motor-bearing alternating circuits generally, a lower frequency was imperative and the first stage of hopeless obsolescence overwhelmed existing transformers when the standard frequency dropped to 60 cycles. In a measure this frequency was determined by the somewhat futile hope that the old transformers might still prove serviceable. Fortunately they burned out rapidly enough to prevent their continued use in any large quantity, but the lingering remnants of the old class (Mr. Morgan's class X) provide a horrible example of inefficiency.

As hysteretic losses increase as the 1.4 power of the magnetization, the iron losses in these transformers when operated at the lower frequency, rose to something formidable, made all the worse by the aging of the iron customarily in use twenty years ago. The next classes of transformers brought into service were those made for the right frequency but for the early standard voltage of 2080, long since replaced by 2200 volts for actual service. Here again the transformers necessarily displayed heavy iron losses, made all the worse by the lack of suitable iron. A little later the iron began to improve, the transformers were designed for the proper voltage and frequency, and the situation began to clear. As time has gone on a steady improvement in iron has brought about a great change for the better. Some of the losses found in Mr. Morgan's tests are truly prodigious and when applied to the small house transformers of the earlier days, operating under light load, show losses of energy so serious as actually to convert the customer into a losing proposition.

One interesting point brought out in these tests, however, was the comparatively small differences in results due to the use of generators of somewhat varying wave form. So far as this particular matter is concerned, within the comparatively small range of forms now found, it need hardly be given serious consideration. Another matter which appears conspicuously in this study is the better adjustment of transformer units to the distribution system. Here perhaps is the greatest gain which can be made in an alternating-current service of long standing. Even the best transformers misapplied lead to low efficiency, and the steady tendency is to replace the small units as far as possible by larger ones, feeding longer secondaries, yielding through the diversity factor a better and steadier load ratio. Rearrangements of the transformers and of the secondary circuits go hand in hand, and the general principle is that bigger and better transformers with a larger proportion of secondary copper are certain to give the best ultimate economy. The data presented show very plainly the need for overhauling the transformer equipment of a great many systems on which antiquated apparatus and methods of distribution still linger. The temptation is sometimes strong to let what is apparently well enough alone, but the truth is that in such matters nothing is well enough unless it is proved to be so. Usually, a comparatively small sum spent in intelligent testing will lead to very important economies, to say nothing of that improved service which is so important an asset of an electrical service company.

Insulating Properties of Transformer Oil

OIL has become a valuable insulating material to the electrical engineer. Being a very mobile liquid, it readily permeates crevices, to the exclusion of moisture. It has a high dielectric strength, and is chemically stable. When used in circuit breakers, it rapidly fills the gap left between the separating electrodes, in such a manner as to suppress the following arc. It is well known, however, that the insulating oils are very avid of moisture, and that they absorb moisture from the air into any free oil surface. The dielectric strength of oil containing moisture in suspension is often much less than that of pure oil. For this reason, oil insulated transformers, breakers, and other devices are kept closed from the air. The oil is also preferably filtered at regular intervals, in order to remove adventitious traces of moisture. In some laboratories relying upon oil-insulated devices, it is customary to test samples of the oil for dielectric strength at regular intervals, and to keep a record of the results.

Dust in oil is also known to exert deleterious effects on the dielectric strength. Filtering the oil removes or tends to remove both dust and moisture; so that it is often difficult to say how much of a known defect is attributable to one or the other impurity. In either case, the cause of the reduction in dielectric strength is believed to be twofold. First, the individual particles of dust or moisture, floating scattered through the oil, tend to align themselves under the stresses of an impressed electric field, thereby tending to make a conducting bridge through the mass of the oil. This is the principle of the self-building discharge path. Secondly, each separate particle either of dust or moisture in the electric field serves to condense and convey the electric lines of force toward its center. All such convergent pencils of force necessarily involve and are accompanied by increased local dielectric stress; so that the oil near to a particle tends to be ruptured much sooner than in oil regions remote from such particles. This is the principle of weakness by non-homogeneity.

A research by Messrs. Hirobe, Ogawa and Kubo on oil tests, has recently been published by the Electro-Technical Laboratory of Japan, and was abstracted in our Digest of Dec. 30. The authors point out that in cleaning the spherical electrodes of the test gap, after the passage of rupturing discharges in oil, fibers of the cleaning cloth are apt to adhere to the metallic surfaces, and in later tests to produce a bridge discharging path through the oil, so that the average dielectric strength of the oil, after cleaning, may be less than before cleaning, or the last state of the oil may be worse than the first. The moral of the story is, therefore, to use only

as electrode cleansers textile materials that do not readily impart dust or fibers to the rubbed surfaces.

The same report gives comparisons of rupturing voltages for different gap lengths in certain oils for spheres, disks and needle point electrodes. The disks had a diameter of 1.27 cm. and the gap lengths were carried up to 5 mm. with spheres and disks, and 13 mm. with needles. The curves obtained differ strikingly. It must be remembered, however, that electrical rupture between opposed sphere or disk electrodes is ordinarily a very sudden phenomenon, completed perhaps in one microsecond; whereas breakdown between needlepoints is usually a result of corona, and is a progressive phenomenon, that may occupy a much greater length of time. Consequently, the curves of volts against gap length must be expected to be different under these two different conditions.

Combining Central Station and Isolated Service

IN this issue a practical study of an extremely interesting problem is presented, namely, the relative economy of central station and isolated plant service as affected by the seasons. The scene of the experiment was a great Chicago department store and an adjacent eighteen-story office building, where power could be obtained on favorable terms from the Commonwealth Edison Company in co-operation with the building plant in its varied service. The existing conditions are not uncommon, an isolated plant using throughout the winter months large amounts of low-pressure steam for heating purposes, and all the year round carrying a lighting and motor load.

In this case there was a large group of hydraulic elevators for which the pressure was furnished by steam pumps, partly compound and partly simple. Now a steam pump even at the best is not a very efficient machine, and when the call for steam for heating falls off the net loss chargeable to inefficiency becomes a very grave one only to be endured during the months of the year when the demand for steam is very large. Even when a great quantity of steam is required for heating it is sometimes an open question whether inefficient engines are not more of a burden than a help. In this instance a careful investigation of the conditions showed that during a considerable part of the year purchased electric service for driving elevator pumps was distinctly advantageous. The smaller generating sets of the system were soon supplanted by central station service, and during the months when artificial heat is not required the load of the elevators is transferred from the steam pumps to electric pumps. When, however, enough steam is required for heating to justify the operation of the steam pumps utilizing the exhaust, the pump service is shifted over to its original form. The result has been very gratifying, for the large amount of purchased power is for a season when the central station loads are not at their highest, and the period of efficiency for the local steam plant is during the mid-winter load, so that the steam plant works at its best efficiency and throws no burden on the annual peak of the central station.

Similar conditions are not uncommon in the numerous cases where building plants have been installed not for high efficiency but with reference to the use of exhaust steam. A plant so organized must obviously be inefficient, considered merely as a power producer, and particularly so during the months of light load. Its first cost, however, is relatively small, so that under favorable circumstances the value of the exhaust steam together with the lessened overhead on the plant may make up the losses. We have a well-defined suspicion, however, that considering the rates at which electrical energy can now be purchased from the large central stations, instances of this kind are considerably more scarce than is popularly supposed, and the Chicago experience looks very much as if many an isolated plant might well consider the advantages of shutting down, at least for the period when steam heating is not required, and thus escaping the grave lack of efficiency during the periods when the load is light and the plant operates at its very worst. In many cases, too, it is extremely difficult to install a high efficiency steam plant in a building even if one were anxious to do so. Hence, all the more is it desirable to inquire carefully into what can be done with a central station service in spite of the need for steam during the winter months. The subject is one which deserves much further study, with the article mentioned a suggestive introduction.

The Coming Issues

IN the next issue of the ELECTRICAL WORLD dated Jan. 20, the number for the month devoted to scientific and engineering topics, a leading article by John L. Hogan, Jr., will review the developments of 1916 in radio engineering and communication by wire. Another article will present the fundamental features and some technical considerations in present-day transformer design. A feature of the fourth or commercial number of the month will be an article on customer growth and rate reductions, detailing the experience of two Middle-West central station companies in revising their rates for electric service along a prearranged schedule as the number of customers increases from time to time. The first issue of February will deal largely with matters of public policy in the management of central station properties, and the second number, bearing date of Feb. 10, will contain engineering articles on the different phases of station and operating practice. Among the leading articles will be one discussing the engineering and operating features of a Connecticut transmission system. ELECTRICAL MERCHANDISING, the new monthly magazine for the electrical business man, salesman, dealer and contractor, includes among its leading articles for January, an account of the work and aims of the "synchronizing" committee of the N. E. L. A., by which it is proposed to concentrate the advertising and selling efforts of the industry on one particular appliance each month.

Chronicle of Events of the Industry and of Important Movements in the Field

NEWS OF THE WEEK

Reports of Conventions and Meetings of Electrical Associations and Societies

FLOOD-LIGHTING WASHINGTON MONUMENT CONTEMPLATED

Announcements Expected to Be Made During the Coming Week—Success of the Proposition Indicated by the Interest Aroused

A movement is on foot in Washington to electrically light the Washington Monument in much the same way that the Statue of Liberty in New York Harbor was recently lighted. Announcements are expected to be made in regard to the proposal the middle of the coming week. It is possible that the engineering commission which will have charge of the electric illumination of Washington during Inaugural Week, beginning March 4, will be consulted and take part in the proposal, although no definite plans have been made.

It is understood, however, that sufficient interest in the proposal has been aroused in Washington to make the project a successful one if there are no legal difficulties in the way. In Washington the federal government owns the public parks, such as the Monument Grounds, near the Mall, in which the Washington Monument is situated. These grounds are under the charge of the War Department. Army engineers, particularly Col. W. W. Harts, U. S. A., engineer officer in charge of public buildings and grounds, would naturally be consulted, and the Commission of Fine Arts, which is composed of nationally-known artists, and which must pass on all subjects of public improvements in Washington, would pass on the final plans. It might be that Congress would have to be consulted, especially if there is an appropriation to be provided.

COMMISSION REGULATION OF LABOR SUGGESTED

New York Public Service Commission Intends to Present Drafts of Proposed Legislation to the State Assembly

Although there is commission regulation on matters of rates, operation and financial activities of public service companies in most of the States of the Union, no legislation has yet been enacted calling for regulation of wages, hours of work or any of the other problems connected with labor.

That the State of New York will have an opportunity to incorporate some such legislation into its laws is mentioned in the annual report of the Public Service Commission for the First District to the State Legislature made on Jan. 10. In reviewing the railway labor disturbances of last summer in New York City, in which the commission, being determined to assert all its powers to bring about an end to the strike, instituted a public inquiry into the causes of the strike, summoned railroad managers and labor leaders before it and took their testimony, but was unable to bring the contending parties to terms, the commission said:

"This experience clearly demonstrated the lack of power in the Public Service Commission adequately to serve the public in an emergency of this nature. The commission believes that it can be an effective and powerful agency for the State in settling labor disturbances upon public utilities under its jurisdiction if the Legislature will strengthen the public service commissions law so as to bring such matters within its purview. Accordingly, the commission will present to the Legislature drafts of bills for such amendments as, in its judgment, seem necessary."

HOLDING COMPANIES LIABLE FOR SPECIAL TAX

Commissioner of Internal Revenue Rules That They Are Subject to Excise Tax Like Other Corporations

According to a decision just issued by the Commissioner of Internal Revenue under the capital stock tax law, holding companies organized in the United States for profit are subject to the special excise tax and should file their returns.

The commissioner is of the opinion "that a 'holding company,' organized in the United States for the purpose of acquiring and holding capital stock of subsidiary companies, and actually engaged in holding such stock, voting thereon, receiving dividends thereon, and distributing money among its own shareholders, is engaged in business within the meaning of the act of Sept. 8, 1916, and is subject to the special excise tax imposed under Sec. 407.

"A ruling to this effect will be published in the weekly edition of *Treasury Decisions*, and will be followed by the department until the Supreme Court decides to the contrary.

"This ruling applies to all 'holding companies' organized in the United States for profit, even though the subsidiary companies operate exclusively in foreign countries.

" 'Holding companies' will be required to file returns on Form 707, the same as other corporations, and will be held strictly liable to the penalties imposed for failure to make such returns within the time prescribed by law."

$10,000,000 TO DEVELOP ORO HYDROELECTRIC PROPERTIES

Pacific Gas & Electric Company Seeks Purchase Approval from Railroad Commission, Disclosing Plans for Future

That an ultimate expenditure of from $8,000,000 to $10,000,000 will be made in development of the hydroelectric properties of the Oro Electric Corporation by the Pacific Gas & Electric Company was disclosed at the hearing by the California Railroad Commission when approval of the purchase was sought. From the streams in Tehama and Plumas Counties on Deer, Mill and Yellow Creeks, 130,000 hp. is finally to be developed, it was stated. In reply to a question by Max Thelen, president of the commission, A. F. Hockenbeamer, vice-president and treasurer of the Pacific Gas & Electric Company, who was the chief witness, said that in return for the grant of approval by the State of this proposed purchase his company would give a better and more

extended service with the aid of the Oro properties. Mr. Thelen indicated by his questions that the commission considered the Pacific company was about to acquire the Oro properties at an extremely good bargain. Mr. Hockenbeamer said the total cost of the properties to the Pacific company would be $1,596,334.35. The value of the properties in excess of this sum, Mr. Hockenbeamer testified, was at least $1,200,000. It might be considered a good bargain to one who had sufficient money to develop the properties, Mr. Hockenbeamer said, and on account of the way the properties of the seller and buyer fit in together his company would be able to operate them more economically and to the benefit of the consuming public. Two-thirds of the Oro properties are operative, he said, and their present total value is $2,981,740.14. The net income to be expected, including the savings to be made by Pacific company management, Mr. Hockenbeamer said, was $143,551.83, and that there would be left, after deducting annual charges, a balance of $17,755.83.

TRIBUTE TO HUGH M. WILSON BY McGRAW COMPANY STAFF

First Vice-President of the McGraw Publishing Company, Inc., Retiring from Business Connection, Is Guest at Dinner

Hugh M. Wilson has resigned as first vice-president of the McGraw Publishing Company, Inc., and will give his time to his personal interests. As a tribute to Mr. Wilson a dinner was given to him by the staff of the company at the Engineers' Club, New York, on the evening of Jan. 9. Those who were present expressed their best wishes for his health and welfare. The work of Mr. Wilson in this company involved executive responsibilities in all departments of the various papers —ELECTRICAL WORLD, *Engineering Record, Metallurgical and Chemical Engineering, Electric Railway Journal, Electrical Merchandising* and *The Contractor.* It was constructive and forceful throughout the time of his connection with the organization. His standards as a publisher were high and his strong personality has left a marked impression upon the papers which serve so many engineering, public utility and industrial activities of the country.

Mr. Wilson has devoted the greater part of his business career to newspaper work. Not long after he was graduated from Illinois College he became city editor of the *Daily Journal* in Jacksonville, Ill., his home city. From there he went to the *Minneapolis Evening Star,* but in 1889 he became identified with the *Mississippi Valley Lumberman,* and since then the greater part of his very active and successful business career has been given to trade and technical newspapers. In 1891 he was made associate editor of the *Northwestern Railroader,* and he soon enlarged his interest and activities to include duties in the business department. In 1891, when the *Northwestern Railroader* was consolidated with the *Railway Age,* Mr. Wilson was made secretary and treasurer of the new company and moved to Chicago. Later, in addition to these responsibilities, he was made manager and associate editor. In 1899 he was elected president of the company. In May, 1906, with the organization of the Wilson Company, of which Mr. Wilson was president, the business was enlarged by the purchase of the *Electric Railway Review.* This publication was changed from a monthly to a weekly, making, with the *Railway Age,* two weekly publications.

During his direction of the Chicago publications Mr. Wilson continuously exercised both editorial and business supervision. Although much of his time was necessarily absorbed in business policies, he rarely let anything interfere with weekly staff editorial meetings on both papers. These gatherings were fine sources of inspiration for the staff, promoting clear thinking and writing. Moreover, Mr. Wilson made time to write editorials himself which were models of clearness and strength for the younger members of the organization.

In 1908 Mr. Wilson sold the *Railway Age,* which was consolidated with the *Railroad Gazette.* At the same time the McGraw Publishing Company bought the *Electric Railway Review,* which was consolidated with the *Street Railway Journal* as the *Electric Railway Journal.* Mr. Wilson went to Europe for an extended



HUGH M. WILSON

tour and, returning in June, 1909, was elected vice-president of the Barney & Smith Car Company of Dayton, Ohio. He retired from that company in 1910 in order to become first vice-president of the McGraw Publishing Company.

In fields allied with his publishing work Mr. Wilson has always been active. He has supported the activities and organizations of the supplymen and for four years acted as secretary of the Railway Supply Manufacturers' Association. For his publication, through the *Railway Age,* of a daily paper at the International Railway Congress in Washington in 1905, the official journal of the congress, he was decorated a Chevalier of the Order of Leopold by the King of the Belgians.

ELECTRIC RATE CASE OF QUEENS BOROUGH COMPANY

Proposal for a Reduction Based on Idea That Gas and Electric Rates Shall Be Considered Together

In the rate case of the Queens Borough Gas & Electric Company, which is now before the New York Public Service Commission of the First District, the question of whether there shall be separate action upon electric rates or whether gas rates shall be considered at the same time is involved.

Dr. Milo R. Maltbie, city chamberlain, stated before the commission that, after a discussion of the electric rates among various parties, including Charles A. Brodek, representing the Progress Society of the Rockaways, a plan was agreed upon for submission to the commission. This involved the reduction of the electric rate from a maximum of 13 cents per kilowatt-hour to 12 cents, effective on Jan. 1, 1917. He added a suggestion that the commission make an investigation

including an appraisal and accounting analysis, of all of the property and accounts of the company, both gas and electric.

President Carleton Macy of the company stated that the consent of the company to a reduction in electric rates was based upon the condition that, when rates were taken up, both gas and electric should be considered.

Dr. Maltbie suggested that, pending the preparation and submission of an analysis and appraisal, the hearing before the commission should be adjourned for, say, three months. He said that practically all of the energy of the company, outside of street lighting and that used for municipal purposes, was sold at approximately 13 cents per kilowatt-hour.

Commissioner Whitney said that the commission would hardly be justified in considering the electric and gas business together.

Mr. Macy said that he felt that it would not be exactly fair to the company to take up electric rates and ignore the gas rate. He felt that at present the gas rate is not as high as it should be; in fact, he felt that it should be materially increased. He thought that consumers would prefer to have the rates stand as they are rather than have a reduction in electric rates and an increase in gas rates.

Dr. Maltbie said that it was his understanding of the law that what Commissioner Whitney held regarding the impossibility legally and probably the inadvisability from other standpoints of using any profits from electricity to offset any deficit on gas was correct; that each one must be decided upon the facts that apply to that particular part of the company's business.

Mr. Macy decided that under these conditions he would like to withdraw the suggestion of a lower electric rate pending further consideration and a later hearing.

TARIFF REVISION TO BE CONSIDERED BY CONGRESS

Expected to Be a Factor in the Calling of an Extra Session—President Having Difficulty Selecting Tariff Commission

The march of events in Washington, according to the best obtainable reports, serves to show that the question of a possible revision of the tariff will be one of the principal considerations to come before Congress. President Wilson has yet to name the board which will constitute the tariff commission which was provided for by Congress, and he is having difficulty in doing so not only because of his anxiety to obtain the most suitable men but because many representations are being made to him which make possible tariff legislation dovetail in with recommendations that are to be made by the business men of the country at the coming convention of the Chamber of Commerce of the United States.

This convention will be held in Washington on Jan. 31, Feb. 1 and Feb. 2. It is reliably reported that the Cleveland Chamber of Commerce is urging that the commission be composed not only of tariff experts but shall also include at least one representative business man who has had experience in foreign trade, a representative of banking interests engaged in foreign trade, and one or more men who have had diplomatic experience. The Cleveland Chamber of Commerce is endeavoring to create sentiment in behalf of restricting by tariffs the importation of goods which will affect the establishment of industries created by the war. Other chambers of commerce, it is reported, believe that the salaries of $7,500 per annum each provided for in the act creating the tariff commission are inadequate to obtain the services of suitable members. Some chambers of commerce and boards of trade of the country are advocating reciprocity treaties between the United States and Latin-American countries. The Cleveland Chamber of Commerce is also urging tariff agreements with European countries and Canada such as will permit United States manufacturers to obtain equal rights in their markets with those of other countries and to protect United States interests at all times without discrimination.

These divergent views are being brought to the White House and it is believed in Washington that the President is giving consideration to them in connection with his possible selection of the personnel of the commission.

In view of the enormous deficit in the Treasury, as expected by the Secretary of the Treasury in his official statements, there is hardly any question in Washington but that the possible revision of the tariff will contribute to create an extra session of Congress.

BRITISH TUNGSTEN LAMP PATENT DECISION FILED

Broad Patents for Treatment of Metallic Tungsten and Manufacture of Lamp Filaments and for Improved Method of Drawing Tungsten Wire Not Sustained

Details of a patent suit before the Chancery Division of the High Court of Justice in England over tungsten filaments for electric lamps have just come to hand. The suit was brought by the British Thomson-Houston Company, Ltd., against Durand, Ltd. The plaintiff is the registered legal owner of two patents, the first, dated 1906, for an invention of a "process and apparatus for the treatment of metallic tungsten and the manufacture of electric lamp filaments therefrom," and the second, dated 1911, for an improved method of drawing wire by the use of graphite as a lubricant. The plaintiff alleged that the defendant had infringed both patents and asked for an injunction and for an inquiry as to damages.

Until recently the large and important industry of the manufacture of tungsten filaments for electric lamps was almost entirely carried on outside of England; in Germany by the Allegemeine Elektricitäts Gesellschaft, the Siemens & Halske Aktiengesellschaft, the Deutsche Gas-glühlicht Aktiengesellschaft, all of Berlin, in Holland by the Philips Metallic Glass Lamp Works, Ltd., of Eindhoven, and in the United States by the General Electric Company, the Westinghouse Lamp Company and the Franklin Electric Manufacturing Company and a number of independents.

The plaintiff claims to have discovered a commercial process for the working of tungsten and incidentally to have discovered that when tungsten is heated to 2000 deg. C., a heat which could not be obtained until the invention of the electric furnace, it undergoes remarkable molecular changes and becomes so ductile that it may be easily worked while hot and drawn through dies into wire. It said that before 1900 there was no commercial working of tungsten nor had it ever been in a form in which it could be worked, though it had been known since 1899 that if tungsten wire could be produced it could be very useful for the filaments of incandescent lamps, and that until 1904 tungsten as a metal filament, except in the form of a squirted filament, was unknown.

The defendant said that the plaintiff's claim was bad because it was too wide. It included all working of tungsten hot, and was therefore a claim to a bare prin-

ciple. What it claimed was mere routine, and no one could filch for his own monopoly one of the workman's tools. It had been anticipated by the French chemist Moissan, who had shown how to produce pure coherent tungsten in an electric furnace and had informed the world of its high point of fusion, its specific gravity and its malleability, and had pointed out that it was not affected by exposure to a moist atmosphere. In view of the state of existing knowledge there was no subject matter. With regard to the second patent the defendant said that "there was nothing new in it, for the use of graphite as a lubricant had been known for a hundred years." The trial lasted ten days.

Justice Astbury gave judgment for the defendant with costs. With regard to the first patent of 1906, relating to an apparatus for the treatment of metallic tungsten and for the manufacture of electric lamp filaments therefrom, the justice said an admission had been made which rendered it unnecessary to consider the question, except on a very narrow consideration, and the real question was the validity of the patent—want of novelty, want of subject matter, and insufficiency being alleged against it. The substantial invention, if there was one, made by the patentee was the production of a wire-drawn electric lamp filament of tungsten, but he had not been content to so limit the claim. The claim was a wide one for the working of pure coherent tungsten hot, and was not limited to any specific degree of working to any defined end provided the working was commercial working for commercial purposes. The description coherent tungsten included other forms in addition to that produced by the patentees' process. The patent was therefore bad for want of subject matter, and was invalid. As to the second patent of 1911 for improved methods of wire drawing, the justice said, on the objection of prior user, he had come to the conclusion that it was impossible to escape the consequences of the user of Messrs. Brown & Company, Preston, which was proved to have taken place in 1905 and 1906. This patent was also invalid.

FINANCING HOUSE-WIRING CONTRACTS DEFENDED

Massachusetts Gas and Electric Light Commission Hears Discussion of Commercial and Engineering Policies of Boston Edison Company

President Charles L. Edgar of the Edison Electric Illuminating Company of Boston, Mass., defended the engineering and commercial policies of New England's largest central station at a hearing before the Massachusetts Gas and Electric Light Commission on Jan. 5. The company had recently been criticised for letting contracts for construction work instead of carrying on such activities within its own organization, and its financing of house-wiring campaigns for electrical contractors had also been attacked. Mr. Edgar stated that from the beginning of his administration thirty years ago the policy of the Boston company has been to confine itself so far as possible to supplying electrical service. The company has never attempted to build its own generating plants or substations, install its own machinery, build its underground conduit or pull in its own cable. Doing such work by contract is by all odds the most economical way to handle it, the speaker pointed out. Mr. Edgar said that the New York Edison Company has only recently admitted that it would have been better if it had confined itself exclusively to the problems of electrical supply, and that the Commonwealth Edison Company of Chicago at times had been embarrassed to find work for its house-wiring organization within its own territory. "Our people get better work out of contractors than they would out of their own associates, in my judgment," he said.

The necessity for an engineering organization to check up the work, however, was fully recognized in Mr. Edgar's remarks to the commission. He stated that the engineering problems of a big company are more important in proportion to its size than are those of a smaller company. The latter can copy the work of the former to a greater or lesser degree, but the large company must make original studies and cannot copy anyone in securing the best solution of its problem. Mr. Edgar said that this is particularly true in the case of the extension of the L Street turbine plant now in progress at South Boston, and that the independent and original thought expended upon this installation will make it a superior one with many unique features.

Turning to the house-wiring campaign of the company, Mr. Edgar said that this was begun two or three years ago with the primary object of adding unwired houses to the company's system. Practically all the new houses erected within the company's territory are wired as a matter of course. More money is probably expended in interior wiring in Boston than in any other contract work, and the policy of the Boston company, which leaves the installation of such equipment to the electrical contractor, has been a tremendous asset. From 200 to 300 wiring contractors in Edison territory are in this way virtually added to the soliciting staff. The application of the installment system to house wiring has resulted in a vast number of new patrons who never otherwise would have become Edison customers. It is the biggest thing for the customer that has ever happened in Boston. Mr. Edgar said that the consumer pays the cost of securing this new business just as certainly as he meets the expense of running the sales department. The house-wiring customer costs the company less than the average because of the soliciting done by the contractors. About $100,000 is being used to finance the campaign, and the consumers meet the interest charges on this money just as properly as they provide for other commercial costs. Mr. Edgar implied that through the development of new business and resulting prosperity of the company more favorable rates are gained by the consumer. The best of relations exist between the company and the contractors as a result of its policy in the house-wiring campaign, and in the matter of fixture sales the policy of leaving these to ouside establishments is working out equally well. The Boston company sells appliances but does not carry fixtures.

Before the hearing closed Mr. Edgar stated that at some future time he desired the opportunity to present to the commission his views upon the capitalization of welfare equipment and the relation of the latter to efficiency of personnel. He conceded that some minor items which the company believes should be capitalized may be charged to operating expenses or funded in permanent loans, from some viewpoints, but said that he did not despair of convincing the commission that the general investment of the company in welfare structures and also in transportation equipment for its own service may properly be capitalized. The construction of the welfare group of buildings at the Massachusetts Avenue property by Stone & Webster instead of by the Edison company was brought up, and Mr. Edgar said that there was no question that the policy of having this work done outside was the better.

"We believe in letting the other fellow carry the overhead charges," said the witness. "The Stone & Webster organization, doing work of this kind in many parts of the country, was in a far better position to undertake the work than we were. They did the work

on a day basis, and although they do not bid upon such jobs, the result to us was unquestionably better than it would have been had we attempted the task ourselves." Mr. Edgar said that the work of the Edison company's engineering organization is charged entirely to construction.

NATIONAL OPPORTUNITIES OF THE ENGINEER

Importance of Research as Factor in Preparedness Program Emphasized at the Annual Banquet of the Massachusetts Technology Alumni

That engineers must learn to think nationally was the keynote of the speeches at the annual banquet of the alumni of the Massachusetts Institute of Technology at Boston on Jan. 6, when a number of distinguished speakers including Charles A. Stone, president of the American International Corporation, Dr. W. R. Whitney, director of the Research Laboratories, General Electric Company and a member of the U. S. Naval Consulting Board, and President Richard C. Maclaurin of the Institute, emphasized the importance of engineers and of research in solving the mighty problems before the country at the present time. An abstract of Dr. Whitney's address will appear in a later issue.

Mr. Stone, the retiring president of the alumni association, voiced the importance of preparedness as the great need of the hour. That preparedness requires technical training is not always appreciated, but the fact remains that technical training is the foundation for both military and industrial preparedness. Besides fighting, the technically trained man to-day is showing the way for maintaining the industries in the war-stricken countries, and even in the countries at peace he is more than ever before in demand, for it is he who must devise ways and means of providing substitutes for the many things no longer imported.

Every one of the belligerent countries has already made provision for rebuilding such works as have been destroyed by war and more than that in many cases elaborate preparations have been made for re-establishing foreign and domestic commerce and industry at the close of hostilities. More than ever before our foreign neighbors are on the alert to develop their own resources and turn to their advantage those of other countries.

Prompt action is essential on the part of our scientific and technical men in pointing out the things that America most needs in order to maintain and develop her industrial activities, and showing how help may be secured. We are practically without nitrogen in America and if our supply of nitrates from Chile was cut off we would be without nitric acid and hence without powder and high explosives. The government has awakened to the importance of this and has appointed an excellent commission to study the subject and show the way for producing nitrogen electrically. It is not enough, however, Mr. Stone stated, that the scientist should discover the means, but technical men must push the discovery to complete and practical development.

Closing, Mr. Stone said that there are countless problems in which the technically trained man can be of untold service to the government and to the country. The scientific and technical men of any country more than any other class can prepare the way and help develop those things which make a nation great, advance her prosperity and prepare for the future.

President Maclaurin declared that there is no part of the United States that does not urgently need and will not continue to need a large supply of men with a sound scientific training, and this demand will grow greatly in the near future. All over the country there must grow up in connection with almost every great industry large departments of research, and one of the problems of scientific education to-day is to prepare an adequate supply of men for such work. These departments of research will become absolutely indispensable to progress and even to existence in view of the competition with other nations which will surely follow the war.

Closing, Dr. Maclaurin pointed out that the countries at war are going through a priceless discipline of stern experience and that the United States is in danger of being ruined by a largely accidental prosperity which encourages a spirit of thriftlessness and extravagance. Technically trained men must devote their best energies to saving wastes and to enable the country to compete with those now in the thick of war through the exercise of economy and careful forethought.

PACIFIC COAST SECTION OF THE N.E.L.A. FORMED

Territory Covered Embraces California, Nevada, Arizona and New Mexico and Represents Over $200,000,000 of Invested Capital

At a meeting held Jan. 6, in the Edison Building, Los Angeles, the New Pacific Coast Section of the National Electric Light Association was organized. The meeting was called by Vice-President R. H. Ballard, of the N. E. L. A., and was attended by about thirty men prominently identified with the central station companies of the Southwest. The territory embraced in the new section includes the states of California, Nevada, Arizona and New Mexico. In this area there are thirty-eight Class A companies, representing a combined capital investment of more than $200,000,000, with an annual income in excess of $35,000,000. Mr. Ballard explained at length the necessity for a geographical segregation of the companies on the Pacific Coast, the objects and aims of the new section and the undoubted advantage it will give to all branches of the electrical industry.

The meeting was earnest and enthusiastic, and there was evidenced a determination eventually to make the youngest section of the N. E. L. A. the largest and most aggressive branch of the parent organization. There were several matters discussed at considerable length, among which were the giving of more equality to Class D members, particularly to manufacturers, the limiting of the number of committees and the necessity for quicker action in reporting on some engineering problems in which member companies may have particular interest. The officers elected were President, R. H. Ballard, Los Angeles; Vice-Presidents, H. F. Jackson, San Francisco, and Samuel Kahn, Stockton; Secretary, A. H. Halloran, San Francisco; Treasurer, A. W. Kemp, Los Angeles.

The personnel of the executive committee is Harry Bostwick and W. W. Briggs, San Francisco; William Baurhyte and E. R. Davis, Los Angeles; George S. Campbell, Reno, Nev.; W. P. Southard, Albuquerque, N. M.; F. S. Viele, Prescott, Ariz.; A. E. Wishon, Fresno, Cal., and A. B. West, Riverside, Cal. The public policy committee consists of John A. Britton, W. A. Brackenridge, H. H. Jones, S. M. Kennedy and A. S. Wishon.

The first convention of the new section will be held in April, the date and place to be determined later. After the meeting those present were entertained at a luncheon given in their honor by W. A. Brackenridge, vice-president and general manager of Southern California Edison Company.

Tendencies of Electrical Development in 1916

Progress Made in the Art—Effects of Higher Material and Labor Costs—Phenomenal Output of Apparatus and the Future Outlook

WHILE the year 1916 was very productive commercially it will not be noted in history for technical advances so far as the United States is concerned. All branches of the electrical industry have been taxed to the uttermost to meet the unprecedented demand for standard material and apparatus; and under such circumstances, technical development is checked or held in abeyance.

Conditions of manufacturing have also been very much unsettled. Electrical manufacturers have not only had to contend with the much higher cost of material but with a very high degree of instability in cost, the latter feature being worse than the first. This instability has been due to two factors; the changing market prices and the difficulties of securing material deliveries, entailing heavy additional cost in keeping adequate quantities on hand.

The inability of the steam railroads to sustain their part in the promotion of the material interests of the country has worked havoc not only with manufacturers but with central stations as well. Whether from shortage of freight cars, inadequate motive power or insufficient trackage, the outstanding fact remains that the railroads have conspicuously fallen short of meeting the requirements of industrial establishments.

In the midst of enormous peak loads central stations in various sections of the country have been handicapped on coal deliveries. Production had to be curtailed in many cities by cutting out of circuits at definite times, and in an endeavor to meet the conditions many central station companies have gone into the open market and bought coal at advances of many hundreds of thousands of dollars, all because the railroads were unable to bear the strain.

Labor Market

The labor market has been an exceedingly difficult one. The demand for skilled labor has vastly exceeded the supply and some electrical manufacturers have been confronted with the necessity of putting on a large percentage of unskilled labor. This has resulted in a reduction of shop production efficiency and has greatly increased the difficulty of maintaining standards of quality.

Although machinists in the large electrical manufacturing plants are now working from fifty to fifty-five hours a week, the immediate goal of union labor officials is a forty-four-hour working week for machinists, that is, eight hours a day for five days and four hours on Saturday. A reduction of hours to forty-four for the entire industry would mean a reduction of productive capacity of approximately 20 per cent or an increase of plant investment of 25 per cent to maintain the same output. It would also mean a distribution of overhead over a very substantially smaller volume and a very heavy increase in the cost of production entirely aside from any question as to the payment of fifty-four-hour wages for forty-four and forty-eight hours labor.

It certainly would be exceedingly unwise at this time with the industry facing in all probability very serious disturbances at the conclusion of the European war to make radical economic departures in our industrial life. While the efforts of organized labor to force a shorter working day have met with considerable success in machine shop practice devoted to turning out munitions, their success in other fields has been rather meager. In 800 plants east of the Mississippi River, St. Louis included, over 98 per cent of the shops work between forty-eight and fifty-four hours a week. Of these 54 per cent work fifty-four and fifty-five hours a week and 22 per cent work over fifty-five hours a week.

Aside from a few linemen's strikes here and there, the central-station industry has been free from any serious labor disturbance during 1916.

Regulation and Rates

Very little legislation affecting public utilities was enacted during 1916. Measures granting the Georgia Railroad Commission additional powers and giving the city of New Orleans, La., the right to regulate public utilities were defeated. The principle that a public utility so long as it gives adequate service at reasonable rates will be protected against competition has been more firmly established than ever. During the year, several important valuation cases have been filed, notably, the Portland (Ore.) Railway, Light & Power Company, the Southern California Edison Company, Los Angeles, Cal., the Edison Electric Illuminating Company of Brooklyn, N. Y., and the Union Gas & Electric Company of Cincinnati, Ohio. In the case of the Southern California Edison Company, for the first time in the history of regulation in this country, severance damages were awarded for taking that part of the power company's property within the city of Los Angeles.

There has been a very noticeable drift during the year toward compromises in rate and valuation cases between the commissions, the utilities, and the public which not only avoid high cost in valuation work but expedite general reductions, or readjustments in rates, so far as the public is concerned. Within the year, there has also been a measurable movement within the industry toward improvement and simplification of rate schedules. The trend toward the Hopkinson form of rates for all kinds of power service is very well developed. The recognition of the reasonableness of a minimum bill or service charge is now general and even in those cases where class rates are not definitely co-ordinated with class costs, the rate maker, now prepares to prove that no class rate imposes a burden upon other classes of service.

From the point of view of the engineer, the progress of class cost analysis in the last twelve months is most evident. From the point of view of public policy, the offer of relatively lower rates to the small consumer in large cities and particularly to the residence consumer is almost frequent and may become fashionable. From the commercial point of view the most notable progress is that central-station companies throughout the country are reaching out for and obtaining by means of closely calculated but profitable rates the very large power business which in former years was abandoned almost without an effort to isolated plants. Simplification of rates for the sake of simplicity without regard to the equity; that is, straightforward meter rates, finds its chief proponents outside of the industry rather than within it.

Public ownership of public utilities shows a tendency to increase especially on the Pacific Coast. The city of Los Angeles has arranged to take over the electric dis-

tribution systems of the Southern California Edison Company and the Pacific Light & Power Corporation just merged with it. The development of the Hetch Hetchy waterpower project for San Francisco will probably add San Francisco and other bay cities to those operating electric systems. Seattle and Tacoma already possess municipal systems and Portland, Ore., is inclined to plunge into municipal ownership also, according to latest reports. California has had many municipally-owned and operated electric plants for a considerable period.

The recent reflections of the Illinois and Massachusetts commissions on holding companies and syndicate control may mean much or little depending on the attitude of the class of corporations referred to.

Steam Station Design

Owing to the high cost of money and of material, and of the inability to get machinery ordered, very little new power station work has been completed during 1916. However, in those systems which have been completed and in others which are now in course of erection, very notable tendencies manifest themselves.

There is a strong trend toward steam pressures as high as 350 lb. in water tube boilers and to superheat as high as 250 deg. and above. The drift toward boiler units of 1200 and 1400 hp. has not been material, most engineers being satisfied with boilers of standard size. In large stations with good load factors, the tendency is to operate boilers at higher capacity and to install economizers. The newer stations of size indicate a decided leaning on the part of designers and operators toward the underfeed type of stoker.

Of the notable steam power stations completed during the year, the Essex plant of the Public Service Electric Company of New Jersey is reputed to be the most efficient steam station so far built, although the tests have not been completed and the data on the actual performance are not yet available. Part of the new steam station of the Buffalo General Electric Company at Tonawanda, N. Y., was placed in operation before the close of the year. Great results are expected of this plant which will have a load factor in excess of 60 per cent and which it is expected will be able to generate electricity from coal cheaper than it can be generated from water at Niagara Falls.

There have been, of course, notable additions to existing steam stations. Where applicable, there has been a perceptible movement toward larger sizes of steam turbines. Single turbo-generators with ratings as high as 45,000 kw. and three-cylinder, two-stage, three-generator units rated at 70,000 kw. have been ordered. The steam consumption of these huge units will be only slightly better than that of a 30,000-kw. unit and may in practice approximate 10.5 lb. per kilowatt-hour. Steam consumptions as low as 10 lb. per kilowatt-hour have been reported, but so far as we can learn have not been authenticated.

The high cost of material has had its effect on the design of turbo-generators. In turbo-generators of medium size the manufacturers have been able to reduce the cost somewhat below those previously designed, partly by reduction in diameter which reduces the weight of dead material and to a more limited extent the active material; and partly by the use of slightly less expensive steel in the rotors when a considerable reduction in peripheral speed is permissible.

In large turbo-generators the designs have become so difficult that only the best material can be employed especially in the rotating element. Every effort is made to secure for the rotor materials which are as reliable as possible, especially as regards homogeneity. An extension of the cross-compound unit scheme has permitted of building generators up to 70 and 75,000 kva. capacity, the gain being chiefly in the steam end, in that a large number of paths are provided for the flow of the low-pressure steam. This permits of a somewhat improved steam consumption.

In design, it is generally considered inadvisable materially to alter proportions because of increased cost of labor and material inasmuch as machines which would be best proportioned for the present market price of material would probably not be best proportioned when normal conditions again exist. Radical changes in design require considerable length of time and outlay of capital and by the time the changes would have gone into effect entirely different market conditions might exist. Nevertheless, efforts are continually being made to cheapen the product, keeping in mind what is believed to be a general average market condition of labor and material.

Manufacturers are so stocked up with orders that it is almost impossible to obtain any machinery for power plant work short of six months. The boiler manufacturers have been deluged with work chiefly from public utilities during the past six months and deliveries extend all the way from six months to one year. Very large sizes of steam turbines cannot be had short of eighteen months to two years. Smaller sizes of turbines may be obtained in from six months to one year. Similar conditions prevail among the manufacturers of reciprocating engines. Many of these are so stocked with work that they have seriously considered instructing their sales departments not to take any more orders.

Hydroelectric Developments

Owing to the high price of coal and of oil, many engineers have turned their attention to hydroelectric projects but owing to government inactivity, not much has been done in that line. The designers, however, have not been idle and the last year has shown an average increase in runner efficiency of 1 per cent over the previous year as evidenced by runner tests at Holyoke and turbine tests in the power house setting. Improvements in connection with turbine settings have probably been of lesser extent than this as the design of spiral casing and penstock settings in general has been very thoroughly analyzed heretofore.

Very notable advances have been made in connection with draft tube design which offered possibly the largest field for improvement. In connection with runner design, improvements have been made in the direction of obtaining higher speed so that it is now commercially economical to develop lower heads than have been considered practical heretofore.

From a mechanical standpoint, very notable advances have been made over designs of the preceding year. These advances have been in connection with size of units, details of design and the greater consideration given to unifying the component parts of the hydroelectric unit. For size of units, the past year has witnessed the design, construction and erection of single runner turbines of 31,000-hp. capacity under a head of 188 ft., which is the largest hydroelectric unit of any type ever installed. This installation has been made at the historic aluminum plant on the Yadkin river in North Carolina. Several other plants break previous records of capacity as follows: Three 27,000-hp. units under 180-ft. head, one 25,000-hp. unit under 450-ft. head, five 20,000-hp. units under 175-ft. head. These installations are all of the Francis runner type. In the im-

pulse field, no new units have surpassed the previous record of 23,000 hp. under 2000-ft. head.

As an indication of the tendency toward larger units, it may be mentioned that units 100,000 hp. in capacity under 320 ft. head have been worked out in considerable detail and their installation may be expected in the near future. These units have been studied on the basis of the single-runner, vertical-shaft, plate-steel, spiral-case type.

In connection with design, the extensive use of plate-steel circular-section spiral casings, the installation of governor flyballs directly on the main shaft, the rearrangement of vertical units to permit of dismantling the working parts from underneath the turbine, the tying together of hydraulic and electrical parts within a single rigid casting mounting within this casting a conical brake support so designed as to form a closed casing for generator fans so as to build up air pressure for circulation, and the general practice of mounting individual exciters directly on each unit above the Kingsbury thrust bearing, comprise the significant improvement. There has also been a tendency toward the use of water lubricated bearings both of the steady and thrust type, toward the use of a mixture of oil and water for oil pressure governor systems of large capacities, and for the use of mechanically-operated pressure regulators in place of the hydraulic type more generally used heretofore.

The effects of increased cost of labor and materials have resulted in increased cost of waterwheels and of many developments depending on these. For instance, a 400,000-kw. hydroelectric power project involving a 200-mile transmission to the San Francisco Bay market at decidedly higher voltage than the highest now in use would be now partly under way instead of being still on paper had conditions remained normal. Another small plant could have been built for about $120,000 but because of the advance in prices of material an additional $60,000 had to be secured to complete the installation.

A number of economies have been effected in small hydroelectric plants in the far West through the use of chain type impulse wheels with water economizing governing devices. There, the small companies whose demand curve has risen above installed capacity have avoided the necessity of new developments which would bring them under the scope of the proposed federal laws by this means. Such rebuilding affects three improvements. (1) Slight increase in efficiency; (2) ability to handle a greater amount of water with a given unit thus materially increasing the power output; (3) a material decrease in the amount of water wasted in governing, thus permitting the development of more kilowatt-hours for a given water shed. In some instances, the yearly kilowatt-hour output from a given water shed has been thus increased as much as 25 per cent.

Transmission Lines

No new records were made or no notable transmission lines constructed during the year 1916. Here and there, owing to favorable market conditions, aluminum has been taken down and copper substituted with profit to the transmission company. The maximum transmission voltage remains at 150,000 volts, and one large system has started to use copper cable with a steel core to limit corona. Steel-core aluminum cable for this purpose has already been in use for a few years.

There has been a great advance in the percentage of transformer installations that are made out of doors rather than within generating stations or substations. The percentage of outdoor installations has become so great that many manufacturers find it advantageous to make all of their products suitable for outdoor installation regardless of how it is actually ordered. No decrease in the reliability of transformers so installed has been observed.

Progress has been made on insulators mostly in the way of improving the factory product but some radically new types are appearing. A rather elaborate series of tests on insulators made a short time ago shows a distinct difference between the ordinary insulators strung together and called a suspension insulator on the one hand and the properly designed insulator connected in series on the other. The first arrangement appears to be just a string of resistance whereas the string of properly designed insulators takes the character of a condenser.

So far as the manufacture of insulators is concerned, it has been rather firmly established that well-made insulators of good design are practically lightning or puncture proof. The problem then of manufacture is to make the life of the insulator as long as possible. This calls for a low rate of depreciation, for the operating hazard increases rapidly with the percentage of defective material. Hence, the real problem of manufacture at the present time is not so much the question of design to meet abnormal electrical conditions, but one of keeping down depreciation to an exceedingly small value for a period of years. The material works on a comparatively low margin of safety for the internal mechanical stresses set up during operating conditions. These stresses are usually much higher than those set up by the working loads and usually determine the life of the insulator. This has necessitated considerably more care in the small details of design and assembly so as to keep down internal stresses and thereby reduce the danger of cracking.

One great advance has been in the attention given to vitrification. Where formerly ware was considered acceptable over a range of from 80 to 100 deg. C., the present acceptable range in some factories is approximately half this value. Those familiar with the manufacture of porcelain will realize what this improved standard means in the way of improved manufacturing conditions. Insulators have been so improved in manufacture and design and the cost is relatively so small that there is little need of operating a line which causes considerable trouble. Many of the older lines have been reinsulated simply as a matter of good business. There is a general realization that to obtain successful performance, the manufacture has to be carried on very carefully. Otherwise, the best designs will cause trouble through defects or poor material and no amount of testing or inspection can make up for deficiencies in manufacture. Equipment costing large sums of money has been placed in some of the factories to insure that the standards of quality will be maintained and improved with the increasing production required.

The co-operation of power companies on the Pacific Coast in financing research in a well equipped laboratory under the direction of an eminent authority in such matters is a commendable move.

Transforming Apparatus

The year in transformer production has, as in most other lines, been principally noteworthy for large production rather than development. That is, there has been so much production, that engineers have had to devote their attention to this, to the exclusion of development work. On the other hand, the large production has given an excellent opportunity to take advantage of the large amount of development work that had

been carried on during the quiet times of the preceding eighteen months.

The large production has been principally noteworthy because it has not been the result of any great demand for transformers for new power developments, but rather for the tremendous demand for power on the part of manufacturers who could not in most cases put in additions to their own power plants in short enough time to take care of their increased demands for power. A very great increase in the demand for transformers for electrochemical processes has also been noted which, of course, is the result of great effort which America has been making to produce chemicals which were formerly produced abroad.

There has been but little that is radically new introduced in transformer design during the past year. Not much improvement was to be expected in the quality of sheet steel and what little improvement there was, was utilized. There has been, however, considerable improvement in insulation as a result of the careful study of insulation, its properties and methods of application.

The maximum primary voltage remains at 150,000 volts although transformer designers stand ready when called upon to produce good transformers for 200,000 volts as well. Probably about the most striking trend to be noted is the rather rapid increase in the size of units. There has been a marked elimination of any hesitation on the part of the customers' engineers to buy large units. Transformers of high voltage and large capacity have so established their reputation for reliability that practically no one hesitates to have the transformer units as large as the generator units from which they receive their power.

There are under construction at the present time 14,000 kva. 150,000-volt single-phase transformers which are the largest high-voltage single-phase transformers that have ever been built. There have also been built during the past year self-cooled transformers of 8000-kva. rating. Of course, combined self-cooled and water-cooled transformers were built in small numbers previous to 1916 but their use has been increased very rapidly of late. With the increased use of outdoor installations, there has come naturally the demand for increased capacities of self-cooled transformers; first, because artificial cooling is applied with somewhat greater difficulty outdoors, and, second, because there is no difficulty in disposing of the heated air coming from self-cooled units. To meet this demand, there has been developed methods of building transformer tanks and movable radiators which admit of economically building self-cooled transformers in any designed capacity. There has been but little change in performance; the efficiency, of course, increasing slightly with increase in size. A strong tendency toward comparatively high reactance in order to assist in protecting the transformer and other apparatus from the destructive effects of short-circuits on large power systems has manifested itself.

Rotating transforming apparatus has of course kept pace with developments in other lines; the most noteworthy achievement being the erection of synchronous converters with a continuous rating of 6825 kw.

Electric Motors

The demand for electric motors of all kinds has been phenomenal. Manufacturers have been unable to keep pace with developments, and as a result the second-hand market has been emptied of most of the motors it possessed. These were needed for taking care of vast industrial loads because of the inability of manufacturers in industrial lines to obtain prime-mover equipment in time to take care of their increased orders.

In the fractional horsepower motor field, a great deal has been accomplished during the year toward developing special motors for special purposes. The problems have been largely of an application nature and have involved the modification of standard designs to meet special conditions. A number of companies, for instance, have developed motors particularly adaptable for the operation of domestic washing machines and pumps. There has also been a very broadening influence in the use of very small series-wound universal motors for a large number of devices. Motors have been developed for operating musical disk machines and a number of little devices used in the home, the office and the shop. Many advances have been made in the processes of manufacture of these small motors which have tended to increase their uniformity and particularly their reliability in operation, which has been one factor in their increased use.

The increased price of material has not only affected the price of these motors but has also played a very important part in the design of them. The designing engineer in this country has now been forced closer to European practice and every bit of surplus material is being done away with.

The year has shown an increasingly large demand for small low-voltage generating equipment for farm and country residence lighting. Most of these units are supplied with storage batteries. Their use has been promoted to a certain extent by the use of the automobile and the lighting system therewith, for the farmers are very large users of automobiles. This is opening up a field for the use of low-voltage, direct-current motors for operating small household appliances, and, of course, the sale of such appliances themselves will be increased.

It is surprising to what extent small electric motors are being used. A very large number of toy motors are sold and also little motors used in connection with automobile horns, small portable vacuum cleaners, etc. Some manufacturers of these devices are building their own motors as are also manufacturers of vibrators, hair dryers, etc. Without doubt, the so-called fractional horsepower motor manufacturers are turning out from 200,000 to 300,000 motors a year aside from those manufacturers who build small motor-driven devices themselves and make the motors to be used in connection with them.

The outlook for 1917 is certainly very bright for fractional horsepower motors. This applies particularly to the sale of motor-driven domestic appliances. Domestic labor conditions are a very large factor in forcing the use of small motor-driven machines, as is evidenced in the case of the electrically-driven washing machine, etc. Undoubtedly, a large future exists for the motor-driven domestic dish washer and the motor-driven domestic refrigerating machine.

There has been very little constructive standardization undertaken by the motor manufacturers during the past year. The bulk of the work has been in perfecting some of the details of the standardization which had already been accomplished. The only important change of the year has been the recognition of two ratings for open-type motors having continuous time rating. The old standard of a 40 deg. temperature rise with a two-hour 25 per cent overload guarantee at 55 deg. C. is maintained, but a new rating has been added covering a motor with a 50-deg. temperature rise guarantee under continuous operation without any overload temperature guarantee. The 50-deg. rating utilizes the maximum temperature rise possible under the limit for impreg-

nated insulation recognized under the rules of the American Institute of Electrical Engineers, but does not take into account the fact that under off-rated conditions in actual operation these temperature limits can very readily be exceeded. It is for that reason that some manufacturers still feel that in cases where the load conditions are not accurately known or determinable, it is advisable to use the 40 deg. rating which offers the greater factor of safety. In addition to the standardization of motors and generators, the manufacturers through the Electric Power Club have now started the commercial standardization of transformers and industrial control.

Storage Batteries

So far as we have been able to ascertain, there have been no radical improvements in storage-battery work during the year. The gasoline automobile industry utilizes an immense quantity of storage batteries in connection with electric ignition and lighting sets. The increased use of farm lighting sets has also been of great benefit to storage-battery manufacturers. In fact, the sale of storage batteries for ignition and low-voltage lighting work far exceeds in amount the sales of storage batteries for all kinds of electric vehicle work.

Electric Vehicles

There was a very perceptible increase in the output of electric vehicles during the year, particularly of pleasure cars. The gross sales of both pleasure and commercial vehicles approximated $13,000,000, of which $9,000,000 represents the sale of pleasure cars and $4,000,000 the sale of commercial vehicles. In the case of pleasure vehicles this is a gain of considerably over 40 per cent during the year.

Illumination

Incandescent lamps of both the gas-filled and regular types have found wider application during 1916 than ever, and the output of low-voltage and battery lamps has been phenomenal. While the gas-filled lamp has shown a tendency to supplant the arc lamp for street lighting in large cities in the East, the luminous arc still continues to hold its own. West of the Rockies the year has witnessed a number of notable installations of luminous arc lamps for street lighting purposes and the tendency in big cities there seems to be toward the luminous arc lamp rather than the gas-filled incandescent lamp for public lighting. During the last few months incandescent lamps of any kind have been very difficult to obtain.

The indirect and semi-indirect lighting fixtures have increased greatly in popularity and flood-lighting of buildings, statues and natural wonders has never before been so widely applied. The manufacture of a 50-watt tungsten is of more than passing interest to central station companies particularly in the larger cities where an equivalent substitute of the old carbon incandescent lamp has been sought.

Electrochemistry and Metallurgy

Progress in all branches of electrochemistry during the year has been phenomenal. The great electrochemical industries located in Niagara Falls, N. Y., have been seriously handicapped for want of power and as already indicated, there has been a great demand for transformers for electrochemical purposes. Electric furnaces particularly for refining steel have shown an increase in the United States during 1916 of almost 50 per cent; the total now in use in this country being 136 Other features of electrochemical and electrometallurgical growth were outlined in these columns last week.

Industrial Research

There has been considerable progress made during the year in industrial research, but it has of necessity been devoted more to application work in connection with the vastly increased business of the corporations rather than in putting out notable and epoch-making inventions. Investigation shows that the functions of industrial research laboratories have been to a very considerable extent those of assisting and helping production at a time when many of the ordinary materials in use before the war have practically disappeared from the market and substitutes have had to be found and processes modified to produce a satisfactory product with the changed material and tremendously increased production.

One of the most notable occurrences of the year so far as research is concerned has been the organization of the National Research Council. All branches of science and industry are becoming fully alive to the necessity of thorough advance research work in order to put the United States to the forefront of progress. Undoubtedly the European war has had a great deal to do in focusing attention on this general subject and much to do with the feeling in industrial circles generally that they must be alert in looking to their interests in this way. A number of the universities are represented in the National Research Council and there is a very evident desire on the part of the universities so to order their work that it will be better co-ordinated with the type of work which must of necessity be carried out by the industrial corporations. One large electrical manufacturing company has built during the year a laboratory for advance research work sufficient to accommodate when fully equipped approximately 100 men. The general idea back of it is that advances must be made in working out fundamental principles and that this work must not be hampered by the necessity of solving daily commercial research problems.

Central Station Output and Outlook

The central stations of the country, particularly in the East and Middle West, have been prosperous during 1916 and the outlook for 1917 is bright. Not only is this true of output of electrical energy but also of sales of electrical apparatus and appliances on the part of those companies engaged in such business. Commercially the notable feature of the year, aside from the increased motor load, has been the development of the electric range field.

Increases in the price of coal and oil and the inability to obtain that which was contracted for have kept down earnings somewhat and those central station companies that were forced to make extensions and additions were compelled to pay advanced prices for the equipment. Copper is still very high and although the output of the large producers has been sold for 1917, there will be a sufficient quantity available for the needs of manufacturers and central stations at a somewhat lower price during the year. A considerable break in the price of copper occurred when the first peace rumors were circulated in this country, and it is certain that if peace does come during the year copper will drop considerably. This will not be true of coal, however, and the indications are very clear that advances in coal even on yearly contracts will reach 50 per cent and above. This will probably be felt worse by isolated plants than by central stations, and it is reasonable to expect that wideawake central station managers can, by taking advantage of the situation, add vast isolated plant loads to their systems.

Effect of High Costs on the Industry

Opinions as to the Influence of Unprecedented Material and Labor Prices Upon the 1917 Activities of Consulting Engineers, Central Stations, Manufacturers, Jobbers and Dealers and Contractors

By Herbert A. Wagner

President National Electric Light Association



HERBERT A. WAGNER

WITH other industries the electric central station companies have shared in the great prosperity which has blessed the business of the country during the past year. Great increases have been secured in the sale of electric energy for manufacturing purposes. Whether these increased sales will be duplicated during the year to come depends partly upon the probability of increased output by manufacturing concerns, but largely upon taking advantage of certain unusual phases of existing conditions. It would seem to be assured, at least, that the business already secured would be retained, for a large proportion of the industrial users of power have their factory output sold for at least a year ahead.

The difficulty of obtaining machinery and machine tools may be a serious obstacle to further expansion, but even this may work to the advantage of the central station. The situation as to deliveries is especially bad with the manufacturers of electrical generating apparatus and steam engines and turbines. The impossibility of getting deliveries of power plant equipment within a year or more after placing orders is practically prohibiting the installation of isolated or factory power plants, and forcing power users to consider central station service.

In spite of the fact that central station service is usually cheaper and more convenient than isolated plant service, a considerable proportion of large industrial power users have refused to give it fair consideration in the past and have complacently continued to make their own power without any exact knowledge of its cost. During the past year, however, many manufacturers have been obliged to add to their power facilities with the least possible delay. The central stations were ready to supply the increased demand, and in many cases with the result that the whole power question was opened up for fair debate and the isolated plant abandoned.

With the increasing costs of fuel and wages the central station, with its power rates unchanged, has a new advantage in isolated plant competition. While it is true that the advancing cost of fuel and labor affects the central station company as well as the manufacturer, increased output acts to offset to some extent the threatened increase in operating expenses per unit.

From all indications I cannot but believe that the coming year holds the brightest prospects for great increases in central station power load, with the largest earnings yet attained. The opportunity for the practical elimination of the isolated plant, with its attendant smoke, dirt, heat and inconvenience, for the benefit of the community as well as the central station, is with us as never before and I would urge all managers to awake to the fact and take full advantage of it.

By H. W. Buck

President American Institute of Electrical Engineers



H. W. BUCK

THE high cost of materials prevailing at the present time is a matter with which the consulting engineer is vitally concerned. The success of all engineering undertakings must be gaged to a great extent by financial units, and initial cost is one of the factors of controlling importance. Not only have material costs risen to figures unknown for many years, but labor is high, scarce and inefficient, and deliveries on material and products of all kinds can only be secured after almost prohibitive lengths of time.

All of this operates as a retarding influence to new enterprise, which is the field in which the consulting electrical engineer finds his greatest field of usefulness. Very little new construction is being undertaken at the present time, except that which is absolutely necessary, or in cases where abnormal construction costs may be justified by special commercial conditions.

A manufacturing or a mining enterprise may find it good business to enlarge its plant under present conditions, because the high cost of construction is offset by the high cost at which the product can at this time be sold. Profits may be so large that construction costs can be written off from one year's earnings.

A central station may extend its plant under present conditions of high cost as a public service obligation, to meet the demands of its customers, or as a matter of policy rather than accept the alternative of having the customer install a plant of his own.

The great industrial activity in this country at the present time can be identified largely with special conditions of this kind.

Separate and distinct new enterprises, which must be founded financially on normal peace conditions, cannot afford to burden their future with the interest charges resulting from present high construction costs, and very few of such undertakings seem now to be in progress or in contemplation in the near future. The great delay in obtaining machinery or equipment of any kind is also a discouraging influence.

Necessity, however, is the mother of invention, and the high cost of materials should serve as a stimulus to the engineer to devise ways and means of economizing in the use of materials or in the substitution of new materials of lower cost. New processes and methods can and will be devised for producing and utilizing ma-

terials more economically. Much work along this line has already been accomplished.

In the field of electric power transmission, the high cost of materials has brought about unprecedented conditions. This field of electric enterprise seems to have been given temporarily a knockout blow—copper has doubled in cost since the beginning of the war, aluminum is almost unobtainable at any price, and even iron wire galvanized, which has been a serviceable conductor for use at the highest voltages, has trebled in cost. Galvanized steel for transmission tower fabrication, has risen to over three times its original cost. Corresponding increases apply to all of the miscellaneous supplies entering into line construction. Underground cables have been similarly affected in combination with the rise in the cost of lead.

Such increases are prohibitive, and upset all of the economics of power transmission as previously accepted. If these conditions are to continue for any considerable length of time, power transmission engineers must resort to new transmission methods with higher voltages than have ever before been considered commercial, as one possible means of reducing the quantity of material required. Possibly the hardships from costs now prevailing may in the long run prove a benefit to this branch of electrical engineering in stimulating new developments and inventions.

The high cost of coal should work as an indirect advantage to the central power station. While it increases of course, the operating expense, it also increases, to a relatively higher degree, the cost of operation of the competitive isolated plant.

Any permanent increase in the cost of coal, and some such increase now seems probable, should give the water power companies a new lease of life, and should lead to the establishment of new plants, which under former conditions of coal cost could not figure any economy over steam-turbine operation.

Apparently the consulting engineer must make the best of the high cost conditions as he now finds them, and wait in patience until the world has cleared itself from its present chaotic condition and settled down to a reasonably definite and secure outlook toward the future.

By Albert Lincoln Salt

Vice-President Western Electric Company



ALBERT LINCOLN SALT

THERE is no precedent in the history of this country for the high prices and scarcity of supplies from which manufacturers have suffered during the past year. The demand for raw materials at increasing prices, which has always obtained in times of intense industrial activity heretofore, lacked the powerful stimulus of the present war. The enormous volume of orders from Europe, the resulting prosperity of the nation and the inability to get material from belligerent countries have, in my opinion, combined to produce the conditions of 1916. Accepting the war as the basic factor in the abnormal state of affairs with which manufacturers are contending, it follows that a change in such conditions (that is, the coming of peace) will modify the status in price as well as the supply and demand conditions. The acute stage, which appears to have been reached in 1916, was the climax of conditions which evolved very rapidly. The year 1914 was divided into three distinct periods:

First: Before the commencement of the war industrial depression was pretty general.

Second: The condition bordering on panic, the result of the actual declaration of war, which lasted about two months from Aug. 1, 1914; foreign markets ceased to exist and the local market was weak or shattered.

Percentages of Increase Over Prices Prevailing on Aug. 1, 1914	On June 1, 1916	On Oct. 24, 1916	On Dec. 15, 1916
Acid, Sulphuric	175	63	63
Aluminum	108	145	145
Antimony	533	121	137
Batteries, Dry	68	68	68
Brass, Rod and Sheet	174	174	185
Copper	126	116	166
Fiber	113	113	113
German Silver	105	105	114
Crossarm Bolts	175	175	175
Crossarm Braces	274	274	274
Guy Clamps	160	160	160
Lead, Pig	94	81	94
Paper, Cable	70	60	71
Platinum	98	109	133
Rings, Aerial, 2 in	39	13	13
Rubber, Para	...	10	14
Silk, Spun	65	57	57
Silk, Tussah	36	35	64
Spelter	216	80	113
Steel, Bess. Billets	123	135	177
Strand, 10,000 lb	77	92	123
Thread, Linen	158	200	200
Tin, Pig	66	33	38
Tinsel	25	25	29
Vermillion	167	167	167
Vitriol, Blue	329	174	233
Wire, Iron Telegraph, 10 Ex. B. B.	50	55	76
Wire, Outside Distributing	19	36	47
Wire, Bridle	35	59	86
Wire, Inside	27	57	144
Yarn, Fine Cotton	...	20	105

Third: This period began with the rapid adjustment of our industries to the altered outlook, and indications of the true nature of this adjustment began to be very apparent in the increased prices of various commodities, although some items either failed to advance or actually declined to lower levels.

It was in 1915 that the real upward movement in cost reached commodities of every character. Substantially all orders placed in the fall of that year involved higher prices and delayed deliveries.

Even in normal times the expenditures of the Western Electric Company amount to millions of dollars annually, while at present, when costs are 100 per cent greater than those of two years ago, its expenditures are double the sum of ordinary years. In a great many commodities it is the largest buyer in the world; and no other organization, I believe, has so many ramifications in its purchasing connections as this company, the scope of its requirements being so great that they reach practically every legitimate source of supply in the United States and Europe. Necessarily, we analyze at all times the conditions covering every commodity.

In view of the great number of producers and manufacturers from whom we buy and in consideration of the large investments we are obliged to make for our regular requirements, we are carefully studying the situation for 1917. In my judgment, the war, or its aftermath, will be the controlling factor, and if the

beginning of the end of the terrible conflict is in sight, as it now seems, I believe that liquidation is bound to develop; and it will certainly be better for business if it comes without a sudden and severe shock and proceeds in an orderly way to a return of more normal conditions. The prospect that the coming readjustment will be gradual is strengthened substantially by the fact that the manufacturing capacity of the country is sold ahead for a year.

By Robley S. Stearnes

President National Electrical Contractors' Association



ROBLEY S. STEARNES

IT is my firm conviction that prices of building commodities have little effect upon the amount of construction. But one branch of the building public is possibly controlled by these influences, and that is the rich estates, which do their building when all commodities are at lowest ebb, but this is not a very serious or important factor. When commodity prices rise, due to well-known economic causes, they do not affect one industry alone, but spread from one to another, and from one section of the country to the other; all manufacturing enterprises are stimulated and real estate investments advance, offering opportunities for speculation which are not overlooked.

One can look to the future with reasonable assurance and, even though an early peace in Europe is declared and Eastern munition industries are disarranged, all the other industries of the country will retain the impetus which has brought greater activities to this country than ever before. I fear the outcome if the manufacturers continue to raise the already "high enough" prices on everything, and more particularly on some articles that should remain as at present or be at lower prices.

In the smaller work of construction the buyer knows little of the intrinsic value of the commodities we sell, and his idea of a cheap price is gained merely from a comparison of the bidder's figures.

In my judgment the time is too early to contemplate or prepare for lower values. The apex of higher commodity values and wages, I fear, has not been reached, and if we follow the history of the past there is no justification for anticipating any early decline.

Bright Prospects in the South

As to the prospects for the Southland in 1917, it is not mere optimism to say that the general business outlook was never better. Prices of its agricultural and other products are higher on an average than at any other time in forty-three years, and the purchasing power of the people has been greatly increased. Confidence has been restored. The people, encouraged and enabled to proceed with their plans, are building the foundations of permanent prosperity. Agricultural and business methods are being improved, diversification practised as never before, and there is a more rapid development of our rich agricultural and other resources. There is reason to believe that good times in the South have come to stay.

By J. C. Schmidtbauer

Vice-President Julius Andrae & Sons Company



J. C. SCHMIDTBAUER

NEVER before in the history of this country has the farmer received such high prices as he now enjoys, or the wages paid for labor reached the height at which they are now found. And so long as this general era of prosperity is prevalent there will be no perceptible decrease in the electrical business. The industrial plants, central stations and electric railways will continue to be active, although building operations may be retarded to a slight extent by the fact that smaller residences will not be built on account of the advanced prices. With the railroads spending $83,000,000 for car equipment during the month of November, it would seem as though we have not as yet reached the apex of this era of prosperity which is upon us. Reports are constantly coming to us that mills and factories are in a very congested condition, and with the amount of business which has been booked there is no reason why we should expect an immediate and staggering reaction after the European war. Many central stations are specifying their copper requirements for delivery well into the middle of 1917, and from the observations which we have made we cannot foresee any decline in the prices of metals, but it is felt that on account of the shortage in the market, prices will continue to soar.

In this connection the one vexatious problem confronting the electrical supply jobber to-day and demanding serious consideration, is the reduction of overhead costs. One of the first steps to be taken toward reducing the overhead cost lies in the education of the dealer to anticipate his requirements as much as possible and to buy staple articles in standard or unit packages. Orders are usually received in piecemeal fashion and clearly show from the manner in which they are made out that materials are purchased from hand to mouth without any attention being paid to standard package or unit quantities. Naturally, the cost of unpacking and reshipping orders specifying from twenty to fifty different articles is very materially increased.

Then, there is the question of returned goods and the expense connected with handling them, which is one of the largest items entering into the jobber's overhead cost. Many electrical jobbers find that the amount of goods returned during the year represents from 3 per cent to 5 per cent of the total of their gross business. The necessity for returning goods could be obviated in fully seventy-five out of 100 cases if the dealer would only communicate with his jobber and ask for suggestions as to how to dispose of them, or if he made an earnest effort to move them.

Costly mistakes are made frequently through the failure of the manufacturers to pack and properly label cartons containing their products. The day when the manufacturer can assign a catalog number to each article placed on the market will be welcomed by the electrical jobber, for it will prevent considerable confusion and lessen expense.

It is now admitted that the electrical jobber is a permanent factor in the distribution of merchandise, and everything that helps him reduce his costs must necessarily also aid the trade he serves.

Factors that Determine Economical Life of Transformers

Considerations Involved in an Investigation to Ascertain Whether It Is Economical to Continue in Service, Hold in Reserve or Condemn and Junk Long-Used Transformers

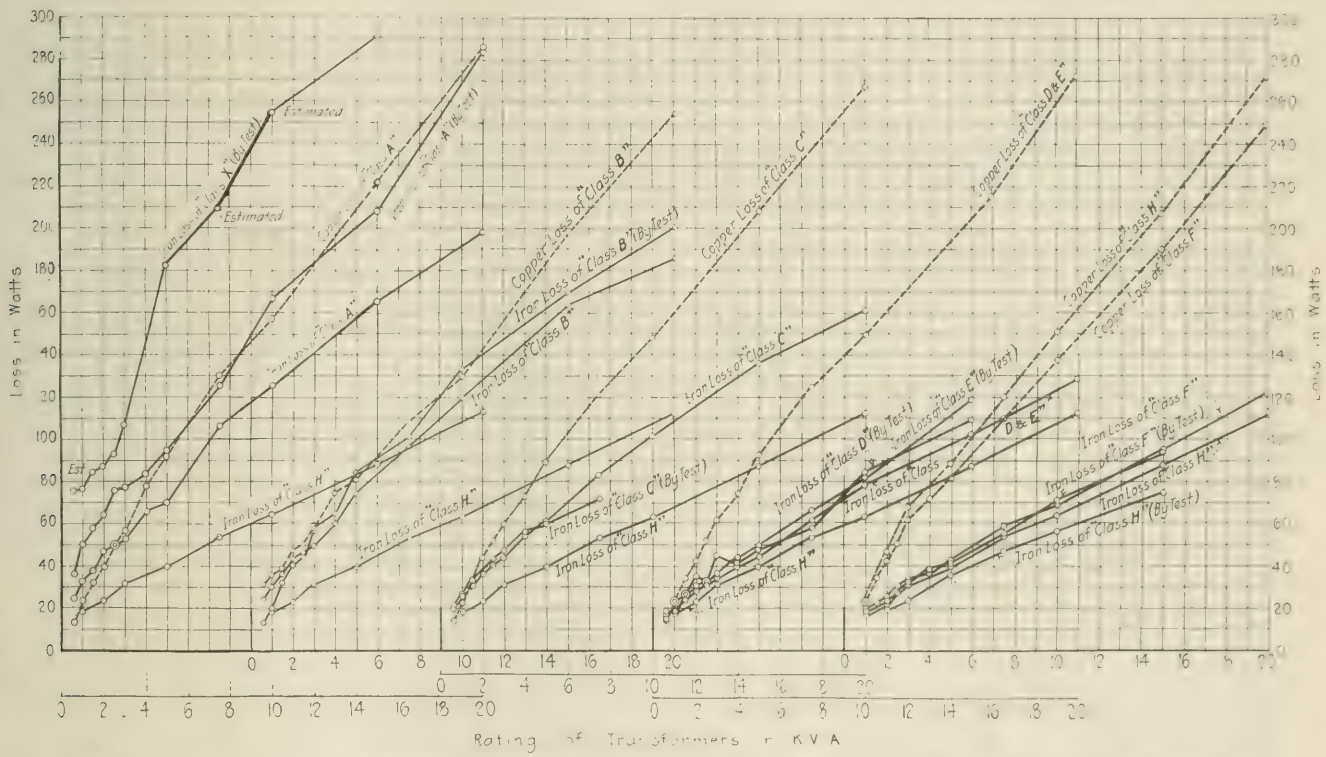
BY THEODORE B. MORGAN

UNLESS steps are taken occasionally to weed out inefficient or antiquated transformers from distribution systems certain units will be found which have become uneconomical to operate as compared with newer designs. This is especially true of "old timers," since as a rule they age more rapidly than modern types. According to manufacturers' statements and judging from results of tests to force aging, recently designed transformers do not age appreciably. It is doubtful, therefore, whether future developments in this apparatus will permit sufficient reduction in losses to justify the replacement of modern units for this reason alone. It should be emphasized, however, that only future experience can prove this contention.

To determine whether it is economical to continue in service, hold in reserve, or condemn and junk transformers which have been in service several years the writer has conducted extensive investigations, part of the results of which are presented in what follows. In arriving at conclusions it was considered advisable to take the following conditions into account: (1) Unit cost of energy at the switchboard; (2) number of hours per day normal and maximum load is liable to last; (3) relation of transformer rating to connected load; (4) iron loss; (5) copper loss; (6) kva. drawn from feeder by transformer for exciting at no load; (7) cost of new transformer to replace one in service; (8) size of wire and load carried by feeder giving service; (9) distance of transformer from station; (10) power factor of feeder load; (11) profit that can be realized by central station by change; (12) service characteristics; (13) better regulation given to secondary distribution system.

Data included under the first item were readily obtained from the company's operating accounts, while information on items 2 and 3 was secured by making tests in typical districts and by comparing the ratings of transformers in service with statistics secured from the commercial department. Tests on thirty-odd transformers rated at 0.6 to 5 kva., and which had been in service for different periods up to seventeen years, were made to secure data for items 4 and 5, these being facilitated by the replacement of the units shortly before the tests by transformers of large rating.

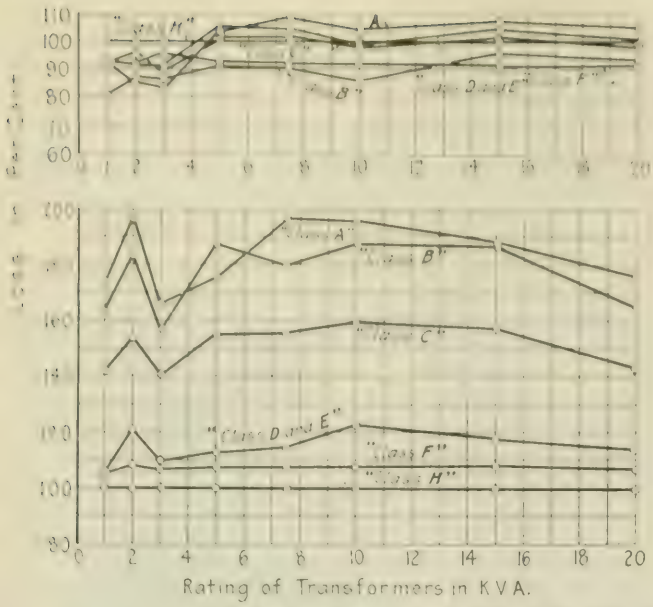
These tests as well as all subsequent ones were conducted to show the losses under operating conditions, voltage being applied to the low-tension coils of the transformer at the rating given by the manufacturer. No attempt was made to insure pure sinusoidal waves. On the other hand, it was most desirable to have the wave formation identical with that supplied to the system under operating conditions, otherwise the tests would have been valueless or would have given erroneous results when applied to distribution problems later on.

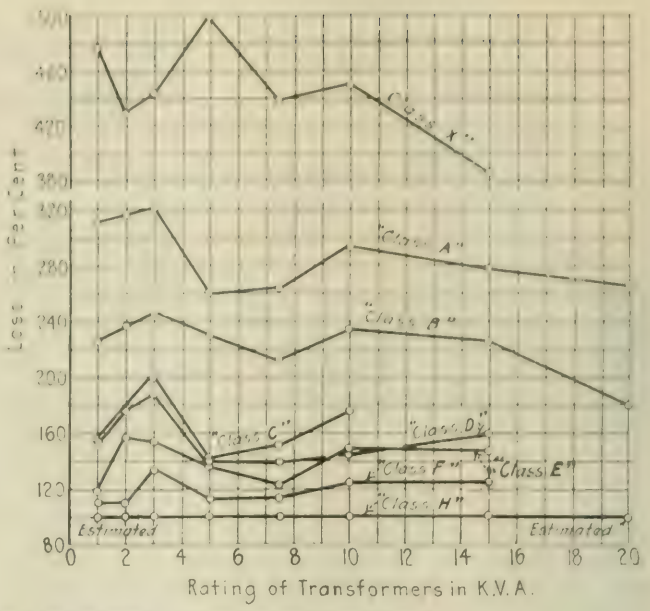


FIGS. 1, 2, 3, 4 AND 5—COMPARISONS OF TRANSFORMER LOSSES AT TIME OF MANUFACTURE AND AFTER OPERATION

Preliminary tests were made to determine what apparent changes might be expected under varying conditions. When generators producing different wave forms were paralleled on the system the difference in loss was apparent, but to such a small degree that it was not appreciable. Operation of generators on two other systems caused a greater variance, but at no time greater than 2 per cent.

Other tests made to determine the variation in loss when the rated voltage was impressed upon the transformers with and without additional external variable





FIGS. 6 AND 7—COMPARISONS OF THE IRON AND COPPER LOSSES OF TRANSFORMERS

All of the curves are plotted with the assumption that the losses of class H transformers are 100 per cent. The curves of Fig. 6 are based on the average losses at time of manufacture while those of Fig. 7 are based on actual test data. The upper curve of Fig. 6 represents copper losses and lower one iron losses. Fig. 7 also represents iron losses.

resistances indicated that when a lamp bank or meter-testing rheostat was used the error introduced by the change of voltage wave was not sufficient to be more than discernible by the tester.

When the iron and copper loss data had been tabulated, however, the results for transformers of the same rating varied so greatly that it was hopeless to attempt any conclusions without securing information that would permit classification of the data. Consequently, manufacturers were asked for the history of transformer design and for such data as would be used to classify the transformers into groups, each group to represent a distinct departure from the preceding group as regards iron and copper losses. Lists of these losses were also secured. From this information all of the 900 transformers tested to date and having ratings from 0.6 kva. to 600 kva. were classified as follows:

TABLE I—CLASSIFICATION OF TRANSFORMERS*

Class X	Designed for 133-cycle, 1040/2080-volt primary, 54/108-volt secondary, about nineteen years old.
Class A	Designed for 60-cycle, 1040/2080 volt primary, 54/108 or 108/216-volt secondary, nineteen to eleven years old.
Class B	Designed for 60-cycle, 1040/2080-volt primary, 54/108 or 108/216-volt secondary, eleven to nine years old.
Class C	Designed for 60-cycle, 1100/2200-volt primary, 110/220-volt secondary, nine to six years old.
Class D	Designed for 60-cycle, 1100/2200-volt primary, 110/220-volt secondary, six to five years old.
Class E	Designed for 60-cycle, 2200-volt primary, 110/220-volt secondary, five to four years old.
Class F	Designed for 60-cycle, 2200-volt primary, 110/220-volt secondary, four to one years old.
Class H	Designed for 60-cycle, 220-volt primary, 110/220-volt secondary, less than one year old.

*All transformers operating on 60-cycle, 2200-volt, with 110 and 220-volt, two and three-wire secondaries.

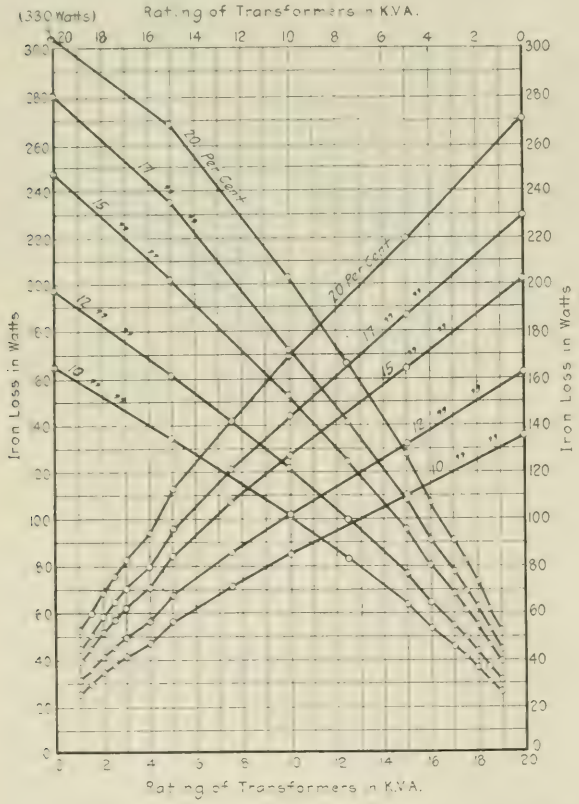


FIG. 8—RETURN ON INVESTMENT WHICH CAN BE REALIZED BY SUBSTITUTING NEW TRANSFORMER FOR ONE HAVING CERTAIN IRON LOSS

The curves sloping upward to the right are based on the values given in the right-hand column of Table II, while those sloping to the left are based on the figures in the second column of the table. An energy cost of 1 cent per kilowatt-hour is assumed.

With this classification as a guide, cards were selected from the transformer files for four transformers of each size in each class. By routing a regular testing crew according to these cards it was possible to make a large number of tests with the least amount of travel, 118 tests being made in one district. The exciting currents were determined at the same time for item 6. Since some of the transformers of each class were miles apart or could not be disconnected for testing, and as certain sizes of some classes were rare or were not in use at all, it was impracticable to carry out the initial intention of testing four transformers of each size. However, enough tests were made so that data were secured for about 23 per cent of the total number of units installed, the smallest percentage for any class being about 18 per cent for Class E. Where data could not be secured for certain sizes of any class, where the data were insufficient for making satisfactory averages, or where the tests were not as accurately conducted as desired the losses were estimated.

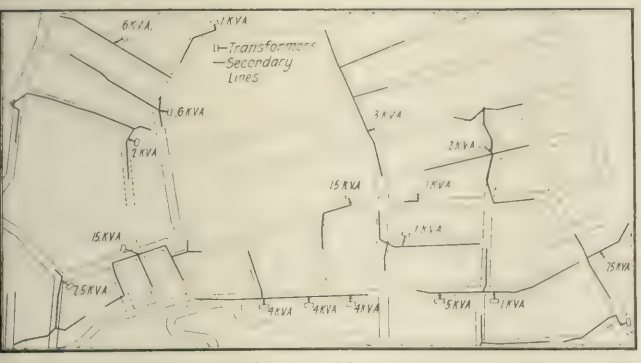
While test data were secured under operating con-

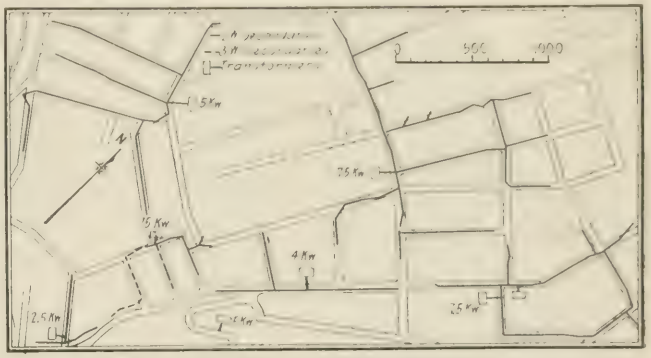
ditions for transformers rated as high as 600 kva., only that for sizes (up to 20 kva.) which are most common on all systems have been plotted, since it is by the proper selection of these units that the largest saving can be made. The curves are based on the average losses as found by over 500 tests made during a period of four years, and are shown in Figs. 1, 2, 3, 4 and 5, with curves plotted from the data furnished by manufacturers on losses at the time of manufacture. The manufacturers also gave data on what the losses should be at the time of test, but the values were much below those actually measured, due probably to differences which exist between theoretical and actual conditions. For instance, wave form in commercial may not and is usually not sinusoidal, the transformer may be overloaded in kilovolt-amperes but not in kilowatts, and the oil used for heat radiating purposes may be lacking or not in the proper operating condition, thus permitting the iron cores to age.

While Class X and some of Class A transformers were operated for a time without oil as a heat-radiating medium, this condition was corrected in 1902-1903. The oil in many of the older types had reduced from one-third to two-thirds of its original bulk, thereby becoming thick and sluggish. Several cases were found where the oil and insulating compound had combined into a thick, sticky mass covering part of the laminations and coils. These conditions were taken into consideration after making the tests on the transformers, it being decided that the iron loss had not been affected except where excessive load in comparison to the radiating capacity had been carried. The averages of test results can therefore be used only as a guide for transformers of the class tested, as the losses of each individual transformer are liable to change. For estimating purposes, however, the curves will be found fairly accurate. It may be pointed out that for the period of transformer development represented, the iron losses of similar size units have been gradually reduced and the ratio of copper loss to iron loss gradually increased from 1:1 to about 2:1, thus permitting a higher all-day efficiency when the load factor is low. Figs. 6 and 7 compare the iron and copper losses of modern transformers with those of older types in percentages.

From the manufacturers' list prices and discounts for different size units figures (Table II) were obtained on which to base the cost of replacing transformers. The cost to set transformers on lines includes freight, cartage, etc., and is an average for removing and setting a number of transformers when arrangements have been made to carry on the work systematically. The junk values are based on prices that have been paid in the past for good transformers with high iron loss. These figures are necessarily arbitrary, as it is impossible to arrive at true costs for a great number of points where freight, cartage and labor conditions differ from those assumed. From this data and the assumption that energy at the switchboard costs 1 cent per kilowatt-hour curves slanting upward to the right in Fig. 8 were plotted. On account of the different methods used in computing depreciation and the fact that many companies set aside a reserve fund rather than figure depreciation on small items, depreciation is not considered, although it may readily be introduced and results worked up for individual cases with the figures and curves given. A comparison of the curves of Fig. 8 with those of Figs. 1, 2, 3, 4 and 5 shows that the substitution of a modern type transformer for a Class X transformer will pay 20 per cent on the investment, while the replacement of Classes A, B, C, etc., will permit gradually smaller returns. The curves in Fig. 8 which slope upward to the left show smaller returns from the substitution of modern transformers, since they are based only on the cost of the new transformers and not on the replacement cost.

Additional advantages are often secured by changing transformers, such as increasing the feeder rating, improving power factor and regulation, since two or more transformers can often be replaced by one and the conductor combined to serve as one circuit.





FIGS. 9 AND 10—PORTION OF DISTRIBUTION SYSTEM BEFORE AND AFTER REARRANGEMENT

When the iron loss of transformers is relatively high and the consumer's consumption small the cost of energizing the units will sometimes exceed the actual income received. Such a case was found where a 5-kva. transformer of the X class was serving a single customer whose bill never exceeded the minimum charge of 50 cents per month except one month of the year. The income was $9 a year while the cost of service, including $7 interest on fixed charges and $17.50 for energy consumed by the transformer, made a total yearly cost of $24.50 without charges for consumer's energy, bookkeeping, meter reading, billing and the like. With an iron loss of 180 watts the power factor was 20 per cent at no load. Since 900 kva. was supplied to the transformer the greater part of each day the line loss was way out of proportion to the energy sold and the rating of a 9-mile section feeder was considerably reduced.

While all central stations endeavor to keep their dis-

TABLE II—ULTIMATE COST OF NEW TRANSFORMERS ASSUMED FOR ESTIMATING PURPOSES

Size of Transformers in Kva.	Cost at Factory	Cost Set on Lines	Junk Value of Old Transformers	Ultimate Cost of New Transformers on Lines
1	23.00	26.00	3.00	23.00
1.5	27.00	30.00	4.00	26.00
2	32.00	35.00	5.00	30.00
2.5	36.00	39.00	6.00	33.00
3	40.00	43.00	7.00	36.00
4	47.00	50.00	9.00	41.00
5	56.00	59.00	10.00	49.00
7.5	73.00	76.00	14.00	62.00
10	89.00	92.00	18.00	74.00
15	118.00	121.00	25.00	96.00
20	145.00	148.00	30.00	118.00

tribution systems from becoming loaded with networks of wire or over-rated transformers, points can invariably be found where there is too much wire and too little transformer capacity or too much capacity for the size of the installation. Such conditions cause a loss to the operating company, and unless careful supervision is maintained in making extensions or installing transformers, thousands of dollars may be uneconomically strung in the air instead of being used to better advantage elsewhere.

In working on secondary distribution systems, it has been found that iron losses are often rated far below the actual figures. For instance, an excitation current of 0.5 per cent to 10 per cent of the unaccounted for current, as sometimes claimed, is entirely too low. Tests show that a system furnishing twenty-four-hour service must be in perfect condition to show a loss as low as 20 per cent, while for sparsely populated residential districts the loss is seldom as low as 40 per cent. Analyzation of the unaccounted for current in a number of systems indicates that distribution transformers take up anywhere from 38 to 60 per cent, estimators usually overlooking the fact that iron loss is continuous for the twenty-four hours in the day and for 365 days in the year. Another item which is usually overlooked is that old transformers have the greater losses and should be considered separate from the more modern types, which have very low losses by comparison.

TABLE III—COST OF SETTING TRANSFORMERS AND VALUE OF THOSE REMOVED FROM CONNECTICUT SYSTEM

Kva.	Transformers Set	Cost of Transformers Set (Table II)	Transformers Removed	Value of Transformers Removed if Purchased at this Time (Table II)	Transformers Removed from Lines in Excess of those Set of Same Size	Value of Excess Transformers if Purchased New
0.6	1	$23.00	6	$138.00	5	$115.00
1	2	46.00	12	276.00	10	230.00
1.5	4	108.00	9	243.00	5	135.00
2			5	160.00	5	160.00
2.5	3	108.00	6	216.00	3	108.00
3	3	120.00	7	280.00	4	160.00
4			4	188.00	4	188.00
5	4	224.00	7	392.00	3	168.00
7.5	8	584.00	10	730.00	2	146.00
10	1	89.00	1	89.00		
15	2	236.00	5	590.00	3	348.00
20			3	435.00	3	435.00
25			3	576.00	3	576.00
30	1	219.00				
40	1	270.00				
Total	30	$2027.00	78	$4313.00	50	$2769.00

As an example of a case where the foregoing considerations were taken into account in rearranging a distribution system the accompanying maps and data of Table III are presented. The map in Fig. 9 shows distribution conditions in a section of a Connecticut town before changes were made and where the system had grown with the demand for service.

In rearranging the system seventy-eight of 141 transformers were removed and thirty hung on the lines, making ninety-three transformers with a total rating of 1487 kva. instead of 141 with a total rating of 1709 kva. About the only transformers purchased for the change were a 30-kva. unit and a 40-kva. unit, since a sufficient number of various sizes were secured by rearranging to fit in places where transformers were needed. In general the secondaries were not run more than nine sections from their corresponding transformer. When it was possible to form loops, however, twenty to twenty-five section secondaries could be employed on fairly heavily loaded circuits.

In addition to other wire removed and run as noted elsewhere about 6000 ft. of No. 6 new weatherproof wire, which cost 30 cents a pound, was removed and substituted by copper-clad wire equivalent to No. 10 copper that cost 15 cents a pound two years before. This substitution was permitted by making one long run with a 1-kva. transformer at the end, the copper-clad wire being obtained from a suburban line where the increased load had demanded a change to a larger size of conductor.

For the benefit of companies contemplating changes similar to those outlined, attention is called to a few of the many difficulties encountered. For instance, after the primary and secondary system have been mapped and comprehensive tests made on the feeders, transformers and secondary system, the value of the results may be entirely lost because infrequent loads have not been taken into consideration. If some evasive load of this nature crops up it may be necessary to change conductors and transformers, making the expense about double the initial or estimated expense. Such occurrences can often be avoided, however, by conferences with the line superintendents and foremen, who are usually acquainted with the characters of the loads. Better teamwork will usually be obtained, too, if their confidence is secured, since they do not generally take kindly to reconstruction of work which they have spent time and money to perfect. Another point to recognize is that the good will or enmity of the community will be secured depending on whether the rehabilitation is attended with improved or unsatisfactory results. Under no consideration should anyone undertake extensive readjustments unless he has a knowledge of local conditions, good engineering training, practical experience, and testing and mapping facilities.

TABLE IV—SAVING DUE TO REMODELING OF CONNECTICUT DISTRIBUTION SYSTEM

Transformers removed from lines	78
Kva. capacity	421.1
Value if purchased new	$4,313.00
Transformers set on lines	30
Kva. capacity	199.1
Value if purchased new	$2,027.00
Saving in kilowatt-hour per year in reduced iron loss	36,667
Valued at 1 cent per kilowatt-hour	$366.67
*Added rating of 11,000-volt feeder in kva	20.50
Pounds of base wire removed, 2313 (junk), valued at	$578.25
Pounds of weather-proof wire run, 2150, valued at	$602.00

*Due to increasing power factor of exciting current.

Methods of Preserving Insulation on Wires Crossing Railroad Tracks

Insulation on wires crossing steam railroad tracks are subjected to severe treatment when an engine happens to stop under the line and gives off heat and gas. While asbestos insulated wire seems best suited for such installations it has been suggested that a coating of water-glass on the outside of the insulation would very materially lengthen its life, if something besides asbestos should be necessary. This coating is best applied just before or after stringing the wires. The ordinary water-glass solution would be satisfactory and two coats are recommended.

Where experimentation with different insulating compounds is not feasible, and the number of conductors and climatic conditions permit, it would eventually be least expensive to elevate all conductors beyond the range of influence of the locomotives. The practice of some companies is to place conductors underground at railroad crossings within city limits. This practice has advantage in that it eliminates friction and disputes with railroads and civic bodies, practically removes life hazard and the possibilities of legal disputes, while at the same time the cost of maintenance and the likelihood of service interruptions are reduced.

Joint Use of Central Station Service and an Isolated Plant

Alternate Seasonal Use of Central Station Energy and Isolated Plant Steam Has Proven Most Economical Arrangement for a Chicago Department Store

WHEN negotiating for the sale of central station energy to replace an isolated plant, attempts are often made to displace all steam-driven units by electric motors. This is not always advisable or even expeditious, as will be shown by the considerations which were brought out when arrangements were being made to make use of central station energy from the system of the Commonwealth Edison Company in Hillman's department store in Chicago. Here, the broader policy of the power company, which has as its aim the development for the customer of the most economical plant for his conditions, resulted in the recommendation of a combination use of existing equipment and central station energy. The power company's engineers made a thorough study of this particular situation and equipped a power plant in a manner which involved a minimum first cost and has produced an annual saving in operating expenses of a large sum.

The change-over hinged principally about the water pumping for nine hydraulic elevators, although the change in the plant included the discarding of four small steam-driven generator units, a steam-driven ice machine and a number of other small engine units. Live steam is required in rather large quantities for the candy shop, bakery, lunch counters, steam tables, coffee urns and various kitchen apparatus the year round, and hence the boiler plant could not be dispensed with. A few of the auxiliaries, the house pumps, drinking-water pump, sprinkler pumps, etc., have been continued on steam operation during all seasons to supply what exhaust steam can be absorbed in the feedwater heater and for hot-water requirements in the building. In addition, steam for heating and hot water is furnished to an eighteen-story building adjacent, owned by the same interests. Live steam is also furnished this building the year round for steam pumps for four hydraulic elevators, house pump, two ejectors and a 30-cu. ft. air compressor. With the eighteen-story building and the six-story department store building to heat in winter, large quantities of low-pressure steam are required. This is admirably furnished by the exhaust from the Laidlaw-Dunn-Gordon 14-in. by 20-in. by 9-in. by 18-in. compound pump, and the 18-in. by 9-in. by 19-in. simple

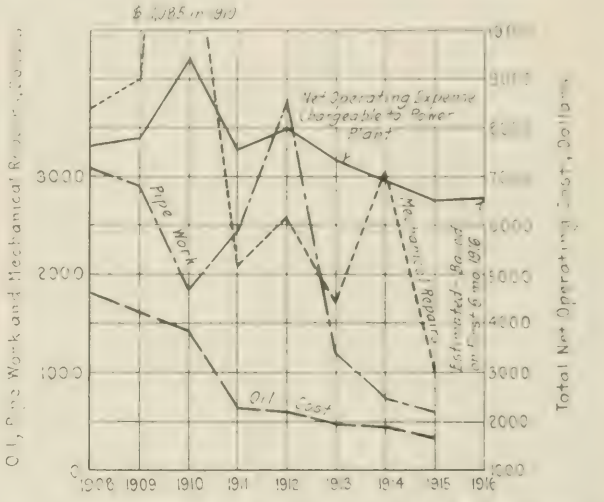


FIG. 1—OPERATING EXPENSES CHARGEABLE TO CHICAGO DEPARTMENT STORE POWER PLANT

pump operating the nine hydraulic elevators in the department store building, but in warmer weather there is no demand for heating steam, and the steam pumps, if operated then, must be run with a gross waste of energy. It was therefore decided to install three automatically controlled 55-hp. direct-current, motor-driven, 400-gal. per minute, three-stage turbine pumps and connect them into the high-pressure water system to supply the water during non-heating months.

To suit the conditions of the weather, the elevator

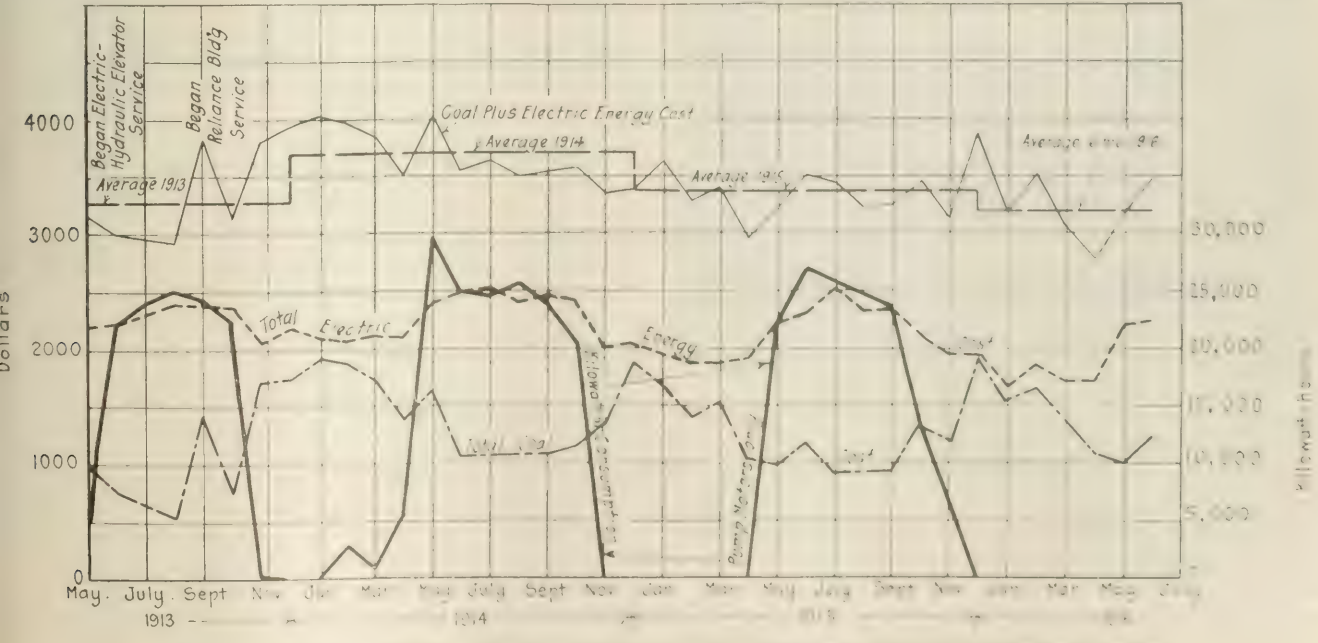


FIG. 2—PURCHASED ENERGY AND ISOLATED PLANT COAL COSTS FOR CHICAGO DEPARTMENT STORE

water pressure is supplied by the steam pumps or the electric pumps, with a resulting saving as indicated by the curves of Fig. 1. Here the cost of the mechanical repairs, of pipe work, and of lubricating oil are plotted in curve form to show the general downward tendency of some of the items which go to make up the total operating expense and give it a downward trend—due to the use of the electric equipment. During the years 1908 and 1909 the old steam equipment was in use. During 1910 the old boilers were replaced with new ones and the whole plant rebuilt, thus accounting for the high peak in the mechanical repairs cost curve for that year. In March, 1911, the company began to use central station service for lighting and for driving some small equipment, and discarded the small steam-driven generators, etc., mentioned above. This, of course, eliminated a large part of the mechanical repairs and a large part of the oil consumption, as indicated by the 1911 points on these two curves. In December, 1912, the ice machine and brine pump were electrified, and in April, 1913, the lighting of the first floor and basement of the adjacent building was put on the department store meters, which, of course, makes the points of the curve higher by $35 a month than is justly chargeable to the department store plant for this comparison. In May, 1913, the electric pumps for the nine hydraulic elevators were installed and the downward trend of the operating expense curve since then is continuous in spite of higher unit coal and labor costs.

The curve of kilowatt-hour consumption of the electric-driven pumps in Fig. 2 shows how the steam and electric units are alternated with the seasons, and the total energy and coal cost curves show the variation of these with the seasons in inverse relation to each other. The costs of power and coal are added together and their sum plotted in a curve to show the downward trend of their joint cost as the result of alternating the steam and electric pump equipment. The monthly figures vary considerably because of the irregularity in receipt and payment of coal, but the average-for-the-year curve shows a consistent downward trend. The installation of the electric elevator pumps, of course, added considerable to the kilowatt-hour consumption

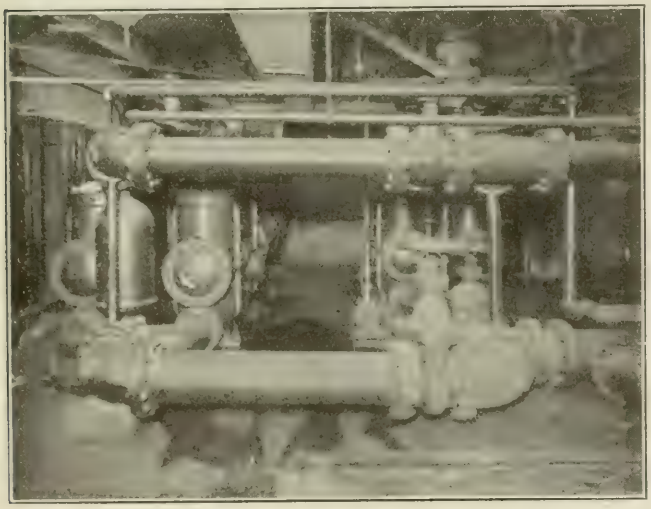


FIG. 3—STEAM PUMPS OPERATED DURING WINTER TO SUPPLY WATER PRESSURE FOR HYDRAULIC ELEVATORS

of the department store plant, but the cost of this is not proportionate to the increase for the reason that, due to the diversity factor, the pumps added only 35 or 40 kw. to the maximum demand and helped to earn a better rate for the entire plant consumption.

The coal cost curve includes the requirements of the adjacent building for heating and equipment mentioned above, and for this service the department store receives $500 a month, which was the actual coal cost of the adjacent building plant before it was shut down. This $500 a month, then, being bare cost and no profit, should be credited to the coal cost curve and the coal and electrical energy cost curve to make that much better showing for the combined winter and summer

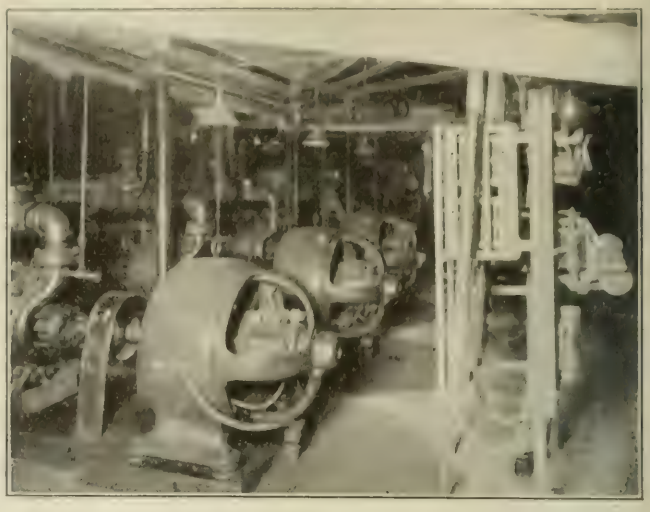


FIG. 4—THREE MOTOR-DRIVEN PUMPS FOR HYDRAULIC ELEVATOR OPERATION IN SUMMER AND FOR EMERGENCY USE

operation of the department store steam-electric plant. Since the end of the period included in these curves the condensate has been brought back to a hotwell from all traps and condensation points, whereas none of it was returned to the boilers before and all this heat was lost. This has also greatly assisted in reducing the amount of coal required.

The combination use of the steam and electric pumps has several advantages in a plant of these characteristics. The first, of course, is the substantially better economy. The second is that a standby equipment is thus always ready for emergency. A third advantage is that by shutting down the steam pumps in summer a large part of the heat thrown out into the basement and radiated throughout the whole store is eliminated, while in winter the reverse is true.

The data contained in this article and presented in curve form were supplied by G. J. L. Janes, general manager of the Hillman department store, Chicago, Ill. The engineering of the installation was done by C. J. Carlsen of the Commonwealth Edison Company and Fred Below, chief engineer of the department store.

Separating Underground Cables from Steam Lines

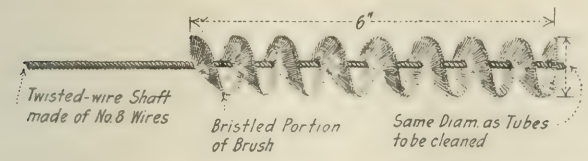
When electric cables must be installed in the vicinity of underground steam lines care should be taken to lay them as far above and to one side of the latter as possible. This is important since heat radiation from the steam lines will reduce the current carrying capacity of the cables or may disintegrate the insulation. Furthermore steam blowing against fiber conduit not incased in concrete tends to render it soft and pulpy. When the temperature of paper insulated cables has exceeded 100 deg. C. for a considerable time it has been found that the insulation will fall off in a fine powder if the sheath is removed. By placing the cables to one side of the steam line the probability of disturbance is minimized when the steam mains must be repaired. A separation of 2 ft. or 3 ft. from steam lines has been found very satisfactory by J. A. De Remer of New York City.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Cleaning Condenser Tubes with Fiber Brushes

Fiber brushes have been found very satisfactory by the Hartford (Conn.) Electric Light Company for cleaning condenser tubes, according to F. M. Wilbraham, power superintendent of the company, since they are stiff enough to remove slime and yet do not wear out the tubes like metal brushes or a sand blast. These brushes are constructed like ordinary gun-cleaning brushes, being made of fiber bristles held radially by a central shaft made of twisted No. 8 wires. The bristled portion of the shaft is 6 in. long and has a



CONSTRUCTION AND DIMENSIONS OF CONDENSER TUBE BRUSH

diameter equal to that of the tubes cleaned. When the condensers are cleaned once a week with these brushes, as much as 10,000 sq. ft. of tubes can be scrubbed in a day and a half by two men. Some idea of the quality of the circulating water may be obtained from the fact that about 4 tons of suspended matter pass through the 10,000-sq.-ft. condensers per hour, according to rough tests. Probably a considerable part of this deposit is sewage, as an intercepting sewer discharges above the plant into the river from which circulating water is obtained. During high water the tubes do not have to be scrubbed so often, as the suspended matter is more diluted.

How a Kite Was Used in Stringing Conductors Over Rapids in Mohawk River

BY LOUIS C. HYATT

In the construction of one of its 12,000-volt transmission lines, the Cohoes Company, of Cohoes, N. Y., found it necessary to run a line across the Mohawk River at a point about a quarter of a mile below the Cohoes Falls. The width of the river at this point is approximately 800 ft. and the banks on both sides are nearly perpendicular walls of rock about 100 ft. high, commonly referred to as the Palisades of the Mohawk. The rapids at this point of the river make the water ordinarily swift and unnavigable and on account of the high water the river was even more dangerous so that the usual method of carrying a line across in a boat was not considered feasible. The nature of the banks and their condition due to ice and snow made the method of crossing at a point above or below and then carrying the line along the banks to the desired point impractical, and as the line had to be built at once it was necessary to devise some other means of carrying conductors across the river.

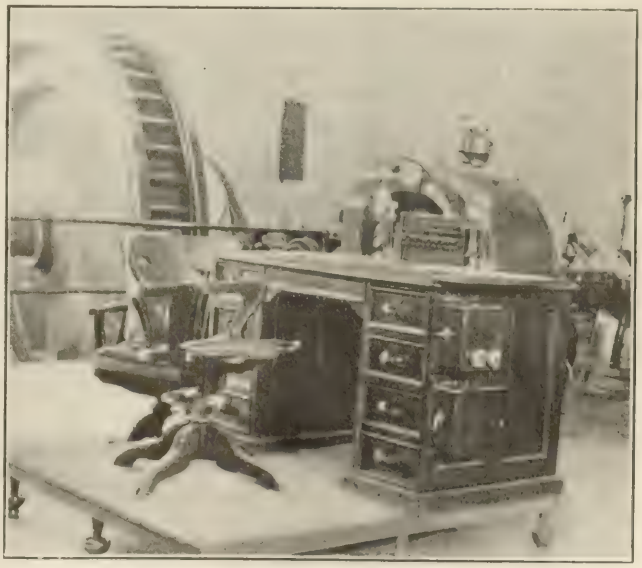
The use of a kite was suggested by S. F. Allan, superintendent of the company, and proved most satisfactory. After a few preliminary experiments to determine the type and proportion of kite that would give sufficient lifting capacity and least trouble in flying, the following construction of a box-kite was employed: The frame was made of wooden strips 0.25 by 0.25 in. in cross-section cross braced and firmly guyed with stout fish line. Unbleached cotton 12 in. wide was used for the covering. The dimensions of the kite were 42 in. long, 29 in. wide and 14.5 in. high.

This kite was taken to the roof of a long factory near the river bank and a running start was made with about 75 ft. of line, as it was found that at about that distance above the roof there was a steadier current of air. A neighboring smokestack indicated when the wind was blowing in the right direction to carry the kite directly across the river. Only a gentle breeze was blowing, but as soon as the kite struck the steady current of air above, it was carried across without any difficulty.

Two linemen on the opposite side of the river waited on the edge of the cliffs until the line sagged within reach. About 1000 ft. of chalk line was attached to the kite and in order to make this sag within reach of the linemen a few hundred feet of cotton banding was fastened to the end of the chalk line and allowed to be carried over the river. As soon as the line was caught by the linemen it was a comparatively simple matter for them to draw the cotton banding across the river and with this to pull over a 0.25-in. hemp line. This hemp line was used to draw over a 0.25-in. messenger cable which in turn was used to draw over the 4/0 copper cable for the transmission line.

A Scheme That Makes Telephoning Safe for Hydroelectric Plant Operator

By mounting the chief operator's desk on a platform carried on eight pin-type line insulators, as shown in the accompanying illustration, safe telephoning is



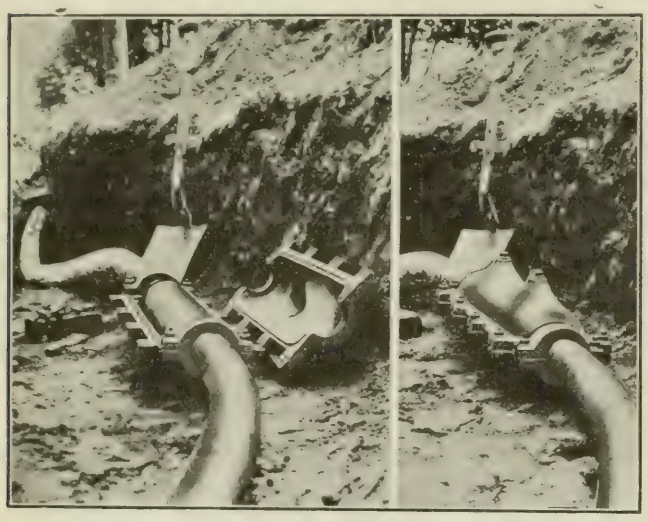
OPERATOR'S DESK MOUNTED ON INSULATED PLATFORM

greatly furthered in a Maine hydroelectric plant near Portland. By this arrangement no rubber mat was required, and as little noise is made by the machinery when the plant is in service, it was not considered necessary to provide a booth for system telephone communication. This scheme might be carried out in substations where the operator must use a telephone connected to telephone circuits carried on transmission line towers and there is trouble occasionally from induced voltages.

UNDERGROUND TIE-LINE LAID IN BARE EARTH

How a Saving of 42 Per Cent Was Made by Massachusetts Company by Laying Cable Without Ducts

An interesting underground tie-line of two circuits has recently been completed by the Greenfield (Mass.) Electric Light & Power Company between its steam plant in Greenfield and the hydroelectric station of the Turner's Falls Power & Electric Company at Montague City. This line is composed of two 3-conductor cables, each 11,100 ft. long, having a rating of 2,800 kw. at 80 per cent power-factor and 13,200 volts, and of 5300



CABLE JUNCTION BOX USED ON TIE-LINE SHOWN OPEN AND CLOSED

kw. at 80 per cent power-factor and 25,000 volts. When the operating pressure is raised to 25,000 volts, the cable rating may be increased to a total of 10,600 kw. The line was laid under the streets of Greenfield and through a trench across a rugged hill on the southern side of the town, thence to the Connecticut River, where a crossing was made in the river bed to the generating station of the Turner's Falls company. It forms a cut-off route compared with possible overhead routes between the two stations. The cables are at present operated at 13,200 volts.

Each cable consists of three No. 10 stranded copper conductors, each conductor being insulated with 9/32-in. varnished cambric, the three insulated conductors then being laid together and incased in 9/32 in. of varnished cambric overall. This overall insulation is incased in ⅛-in. lead sheath, which is inclosed in ¼ in. of jute, surrounded by two thicknesses of steel-band armor, the whole being wrapped in ⅓ in. of jute. The river crossing, which is 1,500 ft. long, required submarine cable. This is similar to the land line except that thirty-six No. 4 galvanized steel armor wires are used on the cable in place of the flat steel bands as extra armor and to give the cable more tensile strength.

On land the cable was laid without ducts in a trench 2 ft. deep and 18 in. wide in ordinary earth, and 18 in. deep and 18 in. wide where it passed through rock. In crossing the river a trench 2 ft. deep was dug in the bottom of the stream, and the cable covered with gravel and sand. At both banks the cable was anchored with concrete and buried anchors.

The total investment in the installation was $32,419.88, which is about $2.92 per foot of double circuit, or $1.46 per foot of cable. The cost of using ordinary lead-covered cable in concrete conduits would have been about $13,875 in excess of this amount, or about 42 per cent more. In addition, it was possible to lay the cable in 1,000-ft. lengths, whereas cable laid in conduit could not have been laid in more than 250-ft. to 300-ft. lengths, so that there would have been at least three times as many joints had the conduit method been used. By the use of the new line the Greenfield steam plant need not be operated except at a good load-factor.

Generation and Distribution Expenses of a Middle West Company

The data in the accompanying tables show the annual generation and distribution expenses of an electric service company operating in a Middle West city of 50,000 inhabitants, and having 5500 consumers. Last year the maximum demand was 4400 kw. and the annual output 11,920,000 kw.-hr.

TABLE I—GENERATING COSTS FOR MIDDLE WEST STEAM STATION

Generation Expenses	Amount	Per Cent of Total Operating Expenses
Superintendence	$2,109.16	1.63
Boiler labor	5,287.06	4.11
Engine labor	4,042.77	3.13
Miscellaneous labor	59.06	0.05
Fuel	47,224.39	36.65
Water	8.60	0.01
Lubricants	327.63	0.25
Production supplies	309.87	0.24
Station expense	611.97	0.48
Repairs steam equipment	10,008.49	7.76
Repairs electrical equipment	209.96	0.16
Repairs station, buildings, structures and miscellaneous	303.92	0.24
Total generation expenses	$70,502.88	54.71

TABLE II—EXPENSES OF THE DISTRIBUTION SYSTEM

Distribution Expenses	Amount	Per Cent of Total Operating Expenses
Superintendence	$100.05	0.08
Wages	165.65	0.13
Setting and removing meters	969.45	0.75
Setting and removing transformers	437.70	0.34
Supplies and expenses	1,500.73	1.16
Repairs overhead lines	7,436.87	5.77
Repairs underground system	197.02	0.15
Repairs services	1,035.24	0.80
Repairs distribution transformers	308.97	0.24
Repairs customers' meters	3,549.51	2.75
Total distribution expense	$15,701.19	12.17

The utilization, commercial, general and miscellaneous expenses amounted to about 5, 14 and 14 per cent of the total, respectively. Fuel (36.65 per cent), repairs to steam equipment (7.76 per cent), boiler labor (4.11 per cent), and engine labor (3.13 per cent) constituted the larger items under generation expense, while repairs to overhead lines (5.77 per cent) and repairs to customers' meter (2.75 per cent) made up the principal part of distribution cost as shown by the data of the accompanying tables.

Results of Ground Tests Made on Distribution System

Under the supervision of J. E. Gossett, engineer of distribution for the Topeka Edison Company, a number of ground tests have recently been made in various districts of the company's distribution system where 1.25-in. by 6-ft. ground rods were spaced from 500 to 900 ft. apart. In districts remote from city water service, with no underground metallic pipe except private water systems extending from wells to buildings, fourteen readings were taken at various points along the line and the lowest resistance found was 8 ohms at a distance of about 100 ft. from a ground rod. The highest resistance was 4 ohms with the reading taken about 700 ft. from a rod and No. 6 secondary. The average of all the readings was 19 ohms. From fifty-five readings taken in districts in the city where city water service was available, the average resistance was about 4 ohms. The highest and lowest readings were respectively 13 ohms and 1 ohm.

The conclusions drawn from these data are that for districts remote from city water service the secondary should be grounded at the customer's premises in addition to the ground on the main. The result from districts with city water service showed a fair condition, but better efficiency of grounds could be secured by driving rods to a greater depth and spacing them at more frequent intervals.

Inexpensive Method of Utilizing Electricity to Prevent Water Tanks Freezing

Several stock raisers and dairymen at Goshen, Ind., have overcome the trouble they have experienced in cold weather with water tanks freezing by operating the pumps used in raising the water from wells just fast enough so that the warmer water of the supply source will maintain the water in the tanks at a temperature above freezing. Enough water is allowed to discharge from the bottom of the tank where the cold water settles to offset that added by the pump. This method of using electricity for operating a motor-driven pump has been found much less expensive than using electric heaters, as can be seen from the following computations:

Assume that a 1-hp. motor with 79 per cent full-load efficiency and a pump with 50 per cent efficiency are employed to raise water at 60 deg. Fahr. against a head of 40 lb. per square inch. Under these conditions, 0.5 of 33,000 ft.-lb. per minute (equivalent of 1 hp.) is available for raising water. Against the pressure mentioned, which is equivalent to a head of 92.3 ft., the pump will therefore discharge (disregarding pipe friction) $(0.5 \times 33{,}000 \div 92.3) = 178.6$ lb. of water per minute. If the water in the tank is maintained at 40 deg. Fahr., supplying water at this rate will add $178.6 \times (60 - 40) \times 60$ B.t.u. per hour, or 214,000 B.t.u. At the motor efficiency assumed this heat is added with an energy consumption of 746/0.79, which is 945 watt-hours or 227 B.t.u. per watt-hour. By using electric heaters only 3.4 B.t.u. could be added per watt-hour of energy consumed, thus showing that the motor-pumping method costs 1.5 per cent of heating by electricity.

In the above computations the value of the water wasted is disregarded. The pumps have to be used under any conditions for filling the tank, so that the interest on the investment and maintenance expense can also be neglected in comparing the total expense of preventing freezing by the pumping method and by the use of electric heaters.

This heating scheme for overcoming consumers' difficulties was devised by the Hawks Electric Company, which supplies electric service in and around Goshen, Ind.

Changes in Boiler Piping That Improved Steam Heating Service

At the Chase Court substation of the Worcester (Mass.) Electric Light Company a battery of four horizontal return tubular boilers aggregating 500 hp. supplies both live and low-pressure steam for local heating service in adjacent buildings formerly served by a block

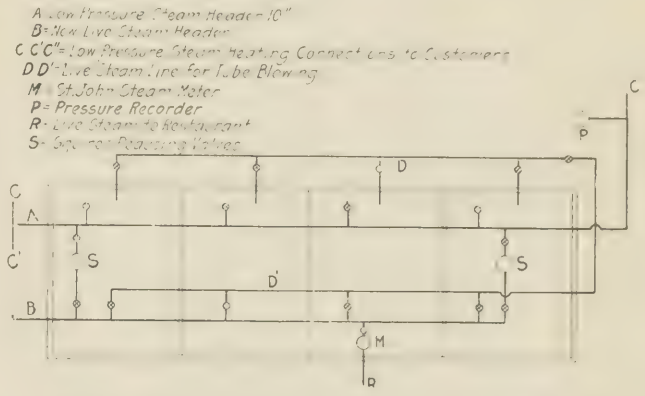


FIG. 1—PIPING OF BOILERS FOR HEATING SERVICE

plant. Some months ago the lighting company installed substation equipment at this point, shutting down the former high-speed non-condensing engine plant and utilizing the location as one of the most important downtown distribution centers on the heating system.

A recent demand for live steam from a new department store restaurant arose, and the lighting company was asked to set aside one entire boiler for this service.

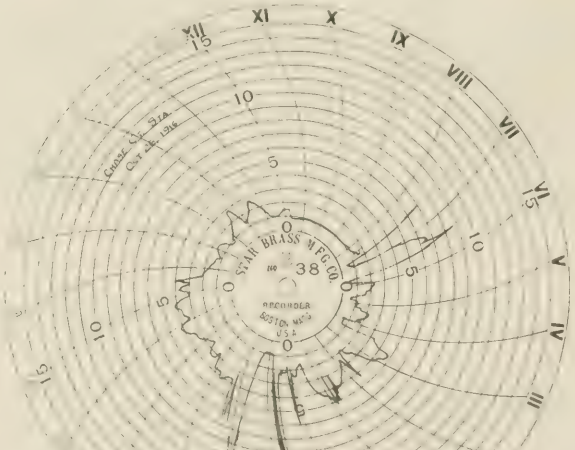


FIG. 2—VARIATIONS IN STEAM PRESSURE BEFORE INSTALLING NEW STEAM HEADER

The customer estimated his average steam heating load at 40 hp. Tests with a St. John steam meter have shown this load to be 27 hp. The lighting company did not feel that it could reserve a single boiler for so small a load, as the unit could be used to advantage in supplying the low-pressure steam heating service of the block at the same time. The problem was solved by

installing a new 4-in. main along the rear of the boilers, as shown in Fig. 1, and cross-connecting this at each end through a 4-in. Squires reducing valve with the 10-in. header which had been in service over the boilers in the past. By this arrangement live steam at 30-lb. pressure can be fed to the restaurant and to any future customers desiring it, while steam at 2-lb. or 3-lb. pressure, or less, is available for heating at all desired points. Under normal conditions a single boiler can supply the two classes of service and at maximum efficiency. Appropriate stop valves as indicated are installed to secure flexible operation.



FIG. 3—PRESSURE ON HEATING MAIN AFTER CHANGES IN BOILER PIPING

Before the new main was installed, and after the engine plant was shut down, the boilers were operated at low-pressure only and the variations in pressure were serious, as shown on the chart reproduced in Fig. 2. Since the installation of the reducing valves and new header, the pressure regulation on the old heating main has been greatly improved, the results being indicated in Fig. 3. Hand firing is employed throughout, as before the change. The discharge from the reducing valve system is used as boiler make-up water, and city water at 140-lb. pressure is used as a balance on the auxiliary valve, this being helpful in maintaining steady pressure on the heating lines.

An Accident Due to Incorrectly Set Brushes

BY R. L. HERVEY

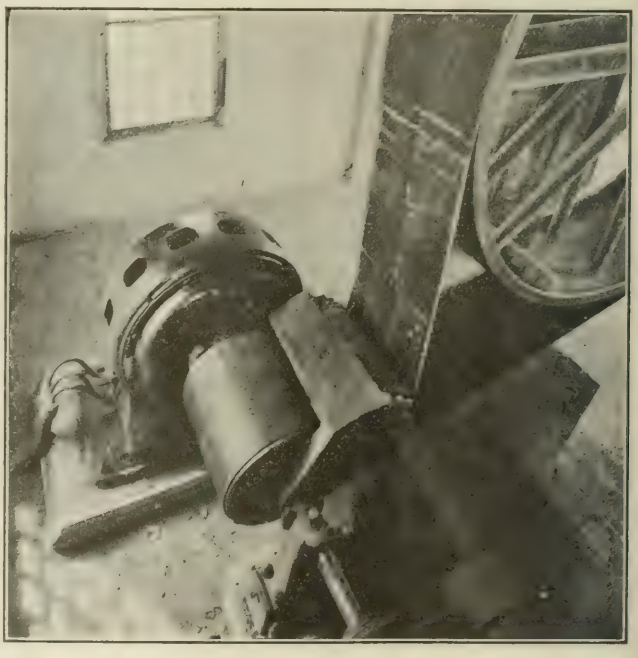
In a case where an isolated plant was furnishing a meat packer with electric power at 110 volts for a 10-hp. motor, in order to provide emergency service connections were made to the central station's 220-volt mains. The higher voltage required the installation of an additional motor with its separate starter. When the new 220-volt motor was installed no electrical test was made until the work had been completed and the belt put on the pulleys. With all the machines connected to the line shaft, the motor was started. One man observed that the speed was excessive and ran to the switch box, missing by about 6 in. a piece of the rim of a 36-in. iron pulley; another piece went through the roof. Before the motor stopped the line shaft was bent and the boxes thrown out of line by the unbalancing of the pulleys. The dealer who sold the motor was held responsible for the damage, and therefore had an examination made. The connections were found correct, but the rocker-arm was loose and the brushes were about 60 electrical degrees back of the neutral position.

Before the motor was started the brushes were set as closely to the neutral as could be by tracing out the armature leads. The line and armature wires were taken off the starter to test the magnetic switches, which were found to be working properly. The line wire was then reconnected and the shunt field tested and found complete by observing the flash when the switch opened and by holding an iron bolt against the field poles to test the pull of each pole. With the belt off, the brushes set approximately correct and a current in the shunt field, the armature connection was made and the switches closed, the motor started and ran as nicely as could be wished for. This little bit of carelessness in not testing the motor before putting on the belt caused a shutdown for seven hours, an expenditure of $24 in repairs and endangered the life of one man. It is needless to say that the dealer was relieved of all blame for the damage.

Short-Center Belt Drive and Emergency Control Arrangement

The accompanying illustration furnishes a striking example of how a belt drive can be used even when the distance between the rims of the pulleys is less than the radius of the larger one. This particular drive is installed in the plant of the Oregon Portland Cement Company at Oswego, Ore., and is used to operate a 22-ft. tube mill. Measured center to center the driving pulley and flywheel are only 7 ft. apart. The motor is a 250-hp. Westinghouse unit and with the Lenox drive employed a 24-in. belt is used.

Wiring for the motor is run in conduit buried in the floor. For starting the motor a dustproof compensator with an ammeter is used. This is mounted on a structural steel frame-work with switches controlling other motors in the same department. It may be pointed out that a 600-volt snap switch is provided on the cable terminal at the motor and connected with the low voltage release coil of the compensator by No. 14 duplex cable so that the motor may be stopped without the attendant going to the control panel. This emergency stopping arrangement is provided on all motors in the plant.



METHOD OF DRIVING PULLEYS ONLY 7 FT. APART

COMMERCIAL AND BUSINESS POLICY

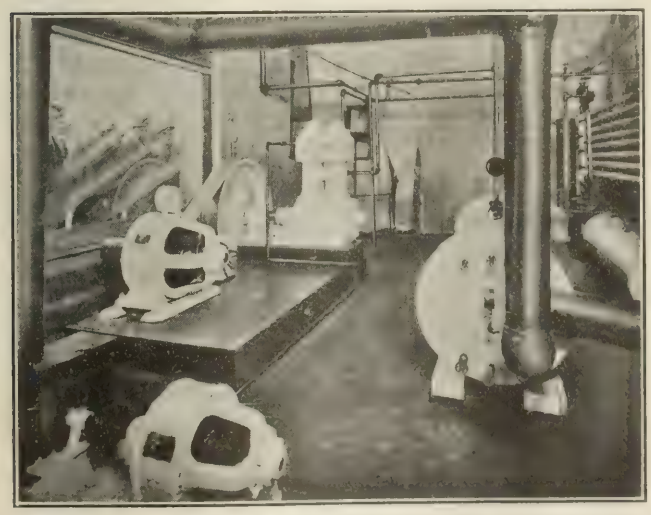
A Department of Plans and Methods for Widening the Application of Electricity and for Extending Electric Service

Realty Firms Equipping New Houses with Electric Ranges at Akron, Ohio

The Sumner Realty Company of Akron, Ohio, has contracted for the construction of sixty houses which will be built in what is known as the Lakewood Heights allotment, a new residential section of the city overlooking Summit Lake. In each of the thirty houses which have been completed to date, there is a Standard electric range and an automatic electric water-supply system. While the district is one which has not had utility service in the past, both the Northern Ohio Traction & Light Company and the telephone company have extended lines into the territory to serve the sixty houses covered under this contract as well as those built by other individuals. H. B. Bixler, superintendent of the lighting department for the central station company of Akron, declares that this is the first attempt that has been made in the city to install electric ranges when houses are built. The venture is meeting with such great success, however, that several other real estate firms have plans well laid for adopting the same scheme for speeding up house sales.

Portable Motor-Driven Ice Plant for Theater Skating Scene

It is one thing to stage an ice ballet in the New York Hippodrome, where the show runs for an entire season, and quite another thing to transport a skating rink around the country with only a short run in each place. When it was decided to send the Hippodrome Company



THIS PORTABLE REFRIGERATING MACHINERY MAKES IT POSSIBLE FOR A THEATRICAL COMPANY TO PRESENT ICE BALLET SCENES WHILE ON THE ROAD

on the road, keeping intact the entire spectacles of "Around the World," including the ice-skating scenes, one serious drawback was the problem of furnishing a suitable ice pond. The adoption of the ice plant shown by the illustration proved to be the solution. The various units of this plant are transportable, each being mounted on a skid or stand, so that when the show closes it is only necessary to take down the piping, haul the different pieces of apparatus, on a truck, pack them into a car and ship to the next showing place. To avoid the loss of time required to erect the plant and freeze the water, which takes twenty-four hours, duplicate outfits are used. While one is working in one city the other is being set up at the next point, so that everything is in readiness when the company arrives. The first plant then goes to the next succeeding point.

Each plant consists of a 10-ton York compressor, with two cylinders each 6.5 by 6.5 in., driven by a 20-hp. direct-current Westinghouse motor, and a 60-kw. Westinghouse motor-generator set. Where direct current is available, the motors are operated from the power-circuit, but since usually only alternating current is to be had, the motor-generator set is used to transform the alternating current into direct current for the operation of the motors.

The brine tank has a capacity of 1900 gal. The ice pond formed on the stage is 45 ft. long, 20 ft. wide, and 4 in. deep. While being frozen, the water is held in place on the stage by a canvas tub.

CO-OPERATIVE CAMPAIGN SUCCESSFUL IN INDIANA

Eight Solicitors Working Four Weeks in Six Communities Sell 1006 Appliances, Having Connected Load of 516 Kw., Which Will Produce Revenue of $7,200 a Year

At Newcastle, Shelbyville, Columbus, Seymour, Bloomington and Bedford, Ind., cities served by the Interstate Public Service Company, a co-operative campaign recently conducted proved to be a great success. In this campaign one of the large manufacturers arranged for the solicitors, and in return was paid by the Interstate Public Service Company a certain portion of the discount on the merchandise which in turn was used to pay the solicitors. The Interstate Public Service Company also paid for the advertising incidental to the campaign.

At the outset, the solicitors received specially prepared data cards containing the names and addresses of all of the company's patrons. From these cards, which were made on the company's addressograph, the commercial customers were eliminated, and the cards were arranged so that the solicitors could follow the meter readers' routes. This offered a quick and convenient way of covering all of the territory. Each man was expected to handle eighty data cards per day, and it was found that a solicitor could very easily take care of this amount of work. The solicitors worked one week in each of the larger cities, and for the smaller towns the crew was divided with four men to a town, so that the entire six communities were handled in four weeks.

CAMPAIGNS USUALLY BEGUN ON MONDAY

On the Thursday before a campaign was begun letters were mailed to the residence customers announcing that a solicitor, representing the electrical manufacturer and the local lighting company, would call. No mention was made of the Interstate Public Service Com-

pany for the reason that it is not believed to be good policy to use the name of the general utility company when dealing with the patrons in an individual town. The announcement of the campaign was also made in advertisements on Thursday, Friday and Saturday.

When the campaign began each solicitor carried a black traveling bag in which was a sample iron, toaster, percolator, curling iron and toaster stove. The solicitors were instructed to say upon arriving at the customer's house, "I am a representative of the Westinghouse company and the lighting company from which you received a letter last week. I have come to demonstrate the electrical appliances mentioned in the letter." The solicitors found no trouble in securing audiences.

LARGE SALES MADE, FEW GOODS RETURNED

As a result of this rapid-fire campaign 1006 pieces of merchandise were sold in the six towns, which produced a net connected load of 516 kw. It is estimated that the revenue from these devices during the first year of their use will amount to $7,200. A large part of the equipment sold was toaster stoves and irons. All goods were sold at list, time payments being offered to customers with good credit.

O. F. Abrahamson, new-business manager for the Interstate Public Service Company, said that in his opinion the campaign had been a success simply because all details were carefully worked out and because the crew manager was an expert in his work and had made wise selections in choosing solicitors. It was a notable fact that from each town no more than three appliances were returned after the campaign was finished. That there was no dissatisfaction is attributed to the fact that each appliance was delivered on the day following its sale. Strict observance of this principle reduced cancellations to a minimum, and imparted to the customers the idea that the company was giving real service. The campaign has also had the effect of stimulating sales of other devices not made a part of the campaign.

To fully capitalize the interest created, each customer was sent a letter containing five coupons just after the sale was over. Each of these coupons entitled the purchaser to a 10-per cent discount on the purchase of other goods, if presented at the time of the purchase. The letter also stated that if the appliance purchaser could induce a neighbor to buy an appliance, she herself would be entitled to the 10-per cent discount on the friend's purchase. The campaign is the first electrical appliance sale which has been a complete financial success in these cities.

Twenty-One Hundred Baltimore Customers Hold 13,000 Shares of Company Stock

At Baltimore, Md., in the spring of 1915 the Consolidated Gas, Electric Light & Power Company announced a plan to offer stock to its customers and so give them a closer interest in the activities of the company. Accordingly letters were sent out describing a plan which offered one to twenty shares of stock to customers on a basis of time payment. For each share purchased a monthly payment of $4 was to be made with the electric bill. The company promised 6 per cent quarterly compounded interest on the payments, and in case a subscriber desired to withdraw from the plan at any time interest was promised on his payments to date of withdrawal at 4 per cent per annum.

During the first month of this offer 720 consumers signed for 3019 shares at $106.50 a share. Since that time 1380 other customers have taken advantage of the offer. In all 13,767 shares have now been subscribed for in this way, individual customers taking from one to the maximum allowance of twenty shares.

The aim of the company is to offer the stock to customers at or about market prices, and the price is ordinarily fixed on the 10th of each month for a thirty-day period. On Nov. 10, 1916, for example, the announced price was $120 per share, and although the market price of the stock rose 10 points after the announcement, the company continued its offer until the 29th, when an advance was announced.

Placing the Engineer of the Superseded Isolated Plant

A central station salesman in a Kentucky city was recently enabled to sell motor drive and central station service to a packing house which had been using a private steam plant by finding a way in which the owner could profitably retain his engineer.

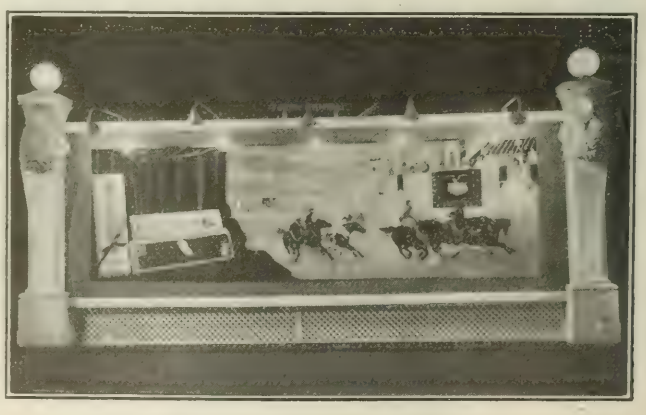
The packing-house proprietor operated a 5-ton steam-driven refrigerating machine, a 10-kw. steam-driven generator and a steam pump. The salesman succeeded in convincing the owner of the economy of electric drive, but as the daily run of the plant was only about five hours, the owner felt that it would not pay to keep the engineer to start and stop the motors and handle the little maintenance work connected with them.

The salesman found, however, that the packing house had in use a fleet of motor trucks and so he proposed the installation of a work bench in the former engine room and suggested that the ex-engineer be given complete charge of the truck repairs as well as the handling of pipe-cutting and threading jobs about the plant.

This scheme worked out to the complete satisfaction of all concerned, and instead of being laid off the engineer was given a raise with his new duties. In the words of the power salesman, "While the slide-rule played a part in paving the way for the deal, common sense was the factor which closed it."

The Electrically-Lighted Billboard as a Long-Hour User

The electrically-lighted outdoor sign offers a long-hour load which is being developed by many central stations. The sign illustrated is a particularly high class of signboard work in which the color and detail



ELABORATE ELECTRICALLY-LIGHTED SIGNBOARD AT TACOMA, WASH.

have been worked out with great care. This sign is in constant use in Tacoma, Wash., and carrying as it does two pedestal lamps in addition to its five flood-lamps, the sign represents an appreciable addition to the annual income of the lighting company.

Lighting a Wallpaper Display Room

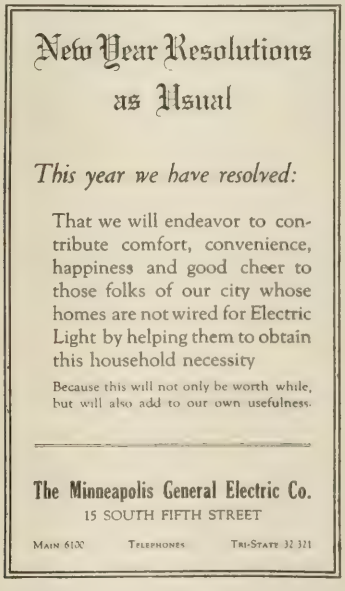
Until recently the salesroom of "the store which sells Cincinnati its wall paper" was lighted by gas. But through the efforts of the lighting squad of W. A. Wadsworth of the Union Gas & Electric Company, this has all been changed. The gas-mantle lamps which formerly supplied the general store illumination as well as lighting for the swinging display panels have been removed, and the general lighting is now done by 300-watt lamps in 12-in. round diffusing globes, and localized lighting is employed for the movable display panels. One of the units for the latter service is shown herewith alongside the gas lamp which was displaced. The effect of the scoop reflector in directing the light on the swinging display panels is apparent from the picture. These units, each equipped with a 100-watt lamp, are placed along the wall on about 12-ft. centers. Each is controlled by a pull-chain switch so that as the prospective customer moves from panel to panel, the wallpaper clerk can keep the illumination focused on the particular display which interests the purchaser.



SCOOP REFLECTORS USED TO LIGHT WALLPAPER DISPLAY PANELS

Mailing New Year Resolutions to House-Wiring Prospects

On the last day of 1916 each of 1000 carefully selected house-wiring prospects in Minneapolis, Minn., found a green postcard in his mail. The address side of the card carried New Year greetings in a neat panel. On the back of the card a New Year resolution set forth the company's ambition to bring convenience to all dwellers in unwired houses by installing electric service for them.



New Year Resolutions as Usual

This year we have resolved:

That we will endeavor to contribute comfort, convenience, happiness and good cheer to those folks of our city whose homes are not wired for Electric Light by helping them to obtain this household necessity

Because this will not only be worth while, but will also add to our own usefulness.

The Minneapolis General Electric Co.
15 SOUTH FIFTH STREET

MAIN 6100 TELEPHONES TRI-STATE 32 321

Company's Sign Preceded Launching of Local Sign Campaign

In undertaking an electric-sign campaign the United Illuminating Company of New Haven, Conn., adopted as its first move the installation of a sign of its own on the roof of the Chamber of Commerce Building. The sign measures 50 ft. by 24 ft. and has a total rating of 16,240 watts.

It was not until this sign had been in operation two weeks that the general sign campaign was actively launched. The merchants were thus given an opportunity to discuss the sign and think of its application to their own businesses. To this feature alone the company attributes much of the success of the campaign. The added load already secured through the installation of new signs will pay the cost of the campaign, including the cost of the company's own sign, in less than a year. Much value is attached by the company to the fact that the business men of the city have thus been led to discuss the proposition among themselves.



AS A FIRST STEP IN ITS SIGN CAMPAIGN, THE NEW HAVEN COMPANY PUT UP THIS DISPLAY OF ITS OWN EQUIPPED WITH 1624 10-WATT LAMPS

Electric Immersion Heaters Used in Oil Bath for Lumber

One of the unique electrical installations for which the Commonwealth Edison Company of Chicago furnishes service is a set of electric heaters in an oil tank used for treating lumber. The tank measures 10 ft. by 8 ft. by 12 in. wide and carries an auxiliary oil reservoir above the main tank, which has a capacity of 15 cu. ft.

The 100 gal. of oil contained in the main tank are heated by six 4800-watt immersion heaters placed at the bottom of the container. By means of automatic temperature control any desired degree of heat can be maintained in the tank, and heat economy is obtained by the placing of the auxiliary reservoir above the main tank to absorb the radiation. Fifteen 6-in. by 4-in. timbers may be treated simultaneously, and the outfit has a capacity of sixteen pieces an hour.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

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RELATION BETWEEN TENSION AND MAGNETIC PERMEABILITY

Abstract of a Paper Presented Before the Engineering Section of the American Association for the Advancement of Science at New York, Dec. 29, 1916

BY JAMES THERON ROOD
Professor Electrical Engineering, Lafayette College, Easton, Pa.

THE permeability curve found for a given magnetic material is commonly assumed to hold for that material irrespective of the conditions under which the given material is to be used. Is this correct? For example, will the permeability curve found for a certain armature or transformer iron hold when the material is in actual use in an armature or transformer? The armature iron in use is subjected to (1) compression along the armature between the end plates; (2) tension acting radially outward, produced (*a*) by centrifugal force arising from rotation, (*b*) by magnetic pull between field poles and armature. The transformer laminations are subject to mechanical compression, and doubtless also to extensional strains due to magnetic pulls. In each case there exists one or more mechanical forces acting upon the given material.

Three questions at once arise: 1. Does mechanical strain affect the magnetic permeability of a material? 2. How does this change with the kind or quality of the magnetic material? 3. What is the order of magnitude of it?

Again, curves between magnetizing force and magnetic induction for ferrous materials are strikingly similar in form to the curves between unit mechanical stresses and unit deformation for the same materials. The first parts of both curves are alike; that is, stress is proportional to the deformation producing it, magnetic induction is proportional to the magnetizing force bringing it into existence. Above a certain point each curve bends abruptly, forming a knee, indicating that great increases in deformation are required to produce relatively small increases in stress, and large increases in magnetizing force are required for relatively small increases in magnetic density. The comparison may be carried further with cast iron and wrought iron. For wrought iron both curves have a steeper slope from the origin than the corresponding curves for cast iron. The same conditions hold true beyond the knee.

From this it would appear that there must be some similarity, relation or connection between mechanical tension and magnetic permeability. The relation seems, however, to fail when non-ferrous materials are considered. These have stress-deformation curves similar to those of ferrous materials, but do not have the same $B-H$ curves. The explanation, when found, will doubtless be a molecular one.

In order to study the influence of tension upon the magnetic properties of cast iron, wrought iron and steel, the writer has had a number of tests made in order to secure data that would provide answers to each of the three questions propounded. A 100,000-lb. Riehle machine was used for loadings. The elongations were determined with a Riehle extensometer. The specimens had a standard section of 1.32 sq. cm. The Hopkinson ballistic-reversal method was employed. A U-shaped yoke, 5 by 5 cm. in section, was used to carry the magnetizing coil, being firmly clamped to the specimen by two end pieces, each carrying four wing nuts. The magnetizing coil carried 2000 turns of No. 20 wire. The test coil was wound on brass tubing and was held concentric with the specimen by three set screws. The turns on this coil could be varied from five to eight. The yoke was calibrated with a known specimen.

The conclusions from these tests are as follows:

Cast iron is unaffected in its magnetic properties by stresses.

Wrought iron and steel are greatly affected in their magnetic properties by extensional stresses. This effect, however, is not a constant but varies in both sign and magnitude, according to amount of stress and to degree of saturation. Below the knee of the $B-H$ curve, permeability of wrought iron and steel is increased by all stresses below a certain maximum, this maximum varying with the material. This increase may be as high as 20 per cent. For stresses beyond this maximum, the permeability is decreased up to the elastic limit of the material. This decrease may reach 15 per cent.

Above the knee of the $B-H$ curve permeability of wrought iron and steel is decreased by any extensional stress. This decrease may reach a value of 8 per cent or more. Its value diminishes as the degree of saturation increases. With rolled material the effect of tension on magnetic properties increases as the elasticity decreases. Cast iron is an exception.

Considered from standpoint of the free and combined carbon present in the material, the results of the tests made fall naturally into the ascending scale of cast iron, steel, wrought iron. The carbon molecules or particles may act as filler or cement, thus preventing the free action of the pure iron molecules.

If it is assumed that the effect of tension is, first, to twist the molecules so as to bring their axes toward parallelism with the direction of the stress; second, to tend to separate the molecules, the reversal effect at low stresses can be accounted for. The results here given cover certain specimens under tension. It would be desirable to extend the list of specimens and to study their action under compression as well as under extension, and I trust that those having the facilities may carry on this work and extend its scope.

Generators, Motors and Transformers

Manufacture of Armature Coils.—D. W. PERRY.—An article comparing the relative advantages of molded, formed and pulled coils. The cost of the coils is reduced by the use of the puller and shorter delivery dates are possible. Further, the puller permits the use of shapes of conductors that are impractical on the molds and formers. Soldered joints inside the coils may be avoided in many cases by the use of the pulling machine. On the other hand, the former gives a more accurate coil, requiring a slightly shorter mean length of turn, thereby saving in copper. Irregular-shaped coils can be

made on a former that would be impossible on the puller. The mold must be used for one-coil-per-slot windings and for concentric windings. It is also used to an advantage on very small coils for small motors. It is generally advantageous to use a former or a puller for all other cases.—*Elec. Journal,* January, 1917.

Lamps and Lighting

Hue Difference and Flicker Photometer Speed.—HERBERT E. IVES.—A brief account of an investigation carried out in the physical laboratory of the United Gas Improvement Company of Philadelphia. The critical speed of the flicker photometer at its equality setting has always been considered and treated by the author as a function of the hue difference. Critical speeds for the spectrum, compared with a carbon lamp standard, published some years ago, showed a minimum in the yellow, which was ascribed to the hue distance between the yellow carbon lamp and spectrum at that point being smaller than at any other point. Recently Troland has obtained similar curves which he interprets as being reciprocals of the luminosity curve, on the ground that the low critical speed means greater whiteness, which he identifies with brightness. The present author has developed the exact relationship between speed and hue difference on the basis of the theory recently developed and confirmed by experiment. It follows from this theory that the minimum critical speed in comparing the spectrum against any colored light occurs at the wave-length, which is distant from the spectrum the least number of hue steps. If the comparison lamp is red, the minimum speed is in the red, if blue, in the blue, if yellow-white, in the yellow, but with a much higher speed at the blue than at the red end, while for a true white (5000 deg. black body) the curve is symmetrical about a minimum in the green. The hue distances were worked out from the color sensation and hue difference data of Koenig and Steindler. The experimental work was carried through with the new polarization flicker photometer, fitted to a constant deviation spectrometer. Curves of the predicted type were found in each case. Since the luminosity curve remains fixed, no matter what the color of the comparison lamp, these speed curves, with their minima occurring at any point one desires in the spectrum, show the "reciprocal of the visibility curve" idea erroneous.—*Journ. Franklin Inst.,* December, 1916.

Units, Measurements and Instruments

Measuring Feeble High-Frequency Currents.—BELA GATI.—For measuring feeble currents of high frequencies, such as used in telephonic or wireless telegraphic work, barretter coils, B and B_1 in a balanced bridge circuit are useful, as shown in Fig. 1. The high-frequency current to be measured is applied from the terminals CC to one of the two barretter coils B_1 only, while a weak direct current from the batteries AA passes through both barretters B and B_1 in series. The inductances DD prevent the high-frequency current from passing through other parts of the circuit except B_1. R and R_1 are a coarse and a fine rheostat for producing balance at the beginning of the test. When the high-frequency current is then closed on CC (through a condenser preventing the direct current from passing into the high-frequency circuit), the balance of the bridge is disturbed by the heating of B_1 and the deflection of the galvanometer G is a measure of the high-frequency current. Barretter wires, 0.0005 mm. in diameter, can be used without difficulty, but are too fragile for transportation by mail. The barretter wires are mounted in metallic capsules from which the air is not exhausted. Small tungsten-filament lamps are suitable for "wireless" measurements. Fig. 2 shows the connections of an apparatus in which a number of barretters is employed. When using the tungsten barretters, only the latter must be connected in each half of the bridge. It is not difficult to manufacture tungsten and other resistances with such accuracy that the microammeter shows no deflection in a bridge initially balanced, when the position of the barretter selector switch is changed. Barretters not in use should be short-circuited (Fig. 2) unless very high frequencies have to be measured; in this case there is a danger of current being induced by higher harmonics in short-circuited barretters; the solution indicated by Fig. 3 may then be used. Coils 1, 2, 3, etc., are of small inductance sufficient to obstruct the flow of very high-frequency current such as is used in wireless work. Connections are made to the barretters by jacks I, II, etc.—From *L'Industrie Elec.,* translated in London *Electrician,* Dec. 15, 1916.

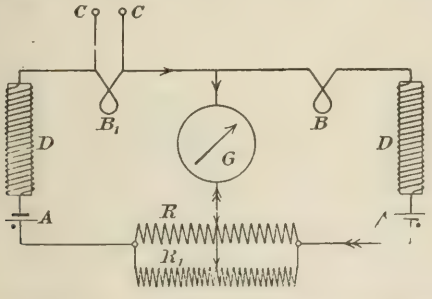


FIG. 1—METHOD OF MEASURING FEEBLE HIGH FREQUENCY CURRENTS

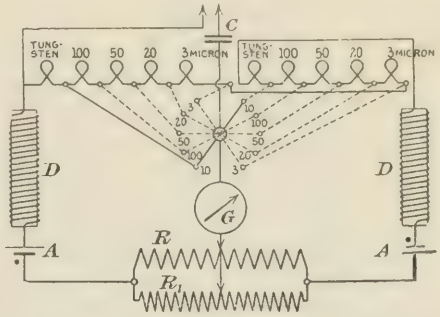


FIG. 2—USE OF TUNGSTEN BARRETTERS

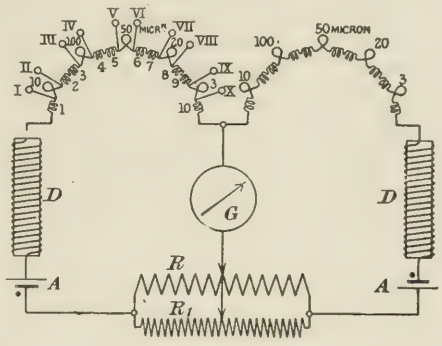


FIG. 3—METHOD OF CONNECTING BARRETTERS BY JACKS

Telegraphy, Telephony and Signals

High versus Low Antennæ in Wireless Telegraphy.—EDWARD BENNETT.—Present practice is to mount the extended capacity of an antenna, or at least a large part of it, at a great elevation above the earth. The author subjects this practice to a critical examination. The electric and magnetic forces set up at a great distance from an extended horizontal network of wires are discussed. It is shown that if the radius of an antenna

consisting of a horizontal network of wires is two or three times as great as the height of the network above the ground, the electric and magnetic forces at a great distance from such a radiator are practically independent of the height of the network above the ground, provided the frequency of oscillation and the operating voltage from the network to ground are kept the same for the different mounting heights. That is to say, an extended network of wires charged to a given voltage and allowed to discharge to earth through an inductance tuned to give a frequency of say 100,000 cycles per second sets up the same electric and magnetic forces at distant points whether mounted 10 ft. or 200 ft. above the ground. In these two cases the rate of radiation (in kilowatts) from the two antennæ is the same, but the initial store of energy in the case of the 10 ft. mounting height is about fifteen times as great as in the case of the 200 ft. mounting height. Therefore, the oscillation in the former case is much more persistent than in the latter; in fact, the oscillation becomes so persistent for low mounting heights that the power condensers and coupled circuits at present required in spark systems of wireless telegraphy may be dispensed with and a simple series circuit comprising capacity area, tuning inductance and spark gap may be used. Such a circuit has the merit of oscillating at a single frequency, whereas the coupled circuits have two frequencies of oscillation. Passing them to a comparison of the receiving properties to two stations with networks at different elevations, the author shows that if the radius of the network is large as compared with any feasible mounting height, then both stations are ultimately able to abstract energy at the same rate from passing electromagnetic waves, provided these waves are persistent and not rapidly damped. The high antenna is shown to abstract energy at a greater rate than the low antenna during the initial stages (first few swings) of the oscillation. The high antenna will, therefore, respond much more readily to highly damped waves than will the low antenna. This means that when receiving undamped or slightly damped waves the high antenna will be subject to greater interference from atmospheric disturbances than the low antenna. To reduce this interference in the case of stations with high antenna additional capacity is used in the "interference preventer" circuits. In other words, the low antenna is to be regarded as the equivalent of a high antenna and "interference preventer" combined. Finally the bulletin contains the calculated constants of a low antenna whose radiation "figure of merit" equals the estimated figure of merit of the government naval station at Arlington, D. C. The network of the Arlington station is suspended at an elevation of about 500 ft. from three steel towers which contain 1000 tons of steel. These towers are placed at the vertices of an isosceles triangle whose over-all base length is 475 ft. and whose over-all altitude is 488 ft. The low antenna whose constants are given is a circular network having a radius of 540 ft. It thus covers a greater ground area than the Arlington station, but the assumed mounting height for the network is only 33 ft. The advantages of low over high antennæ for high-power stations are as follows: lower first cost (except where the cost of land per acre is very high); no necessity of power condensers; single frequency of oscillation; apparent possibility to obtain a smaller decrement than where power condensers are necessary; less likelihood of damage by lightning; probably less interference from "atmospheric." On the other hand, high antenna have the following advantages over low antennæ: small antenna current (which may be of considerable advantage where arc generators or high-frequency alternators are used); a smaller number of insulators; less likelihood of interruption due to insulator failures. *Bulletin Univ. of Wisconsin*, No. 810 (Engin. Series, Vol. 8, No. 4).

British Loaded Telephone Cable.—An article on the Birmingham-Sheffield cable which is at present loaded for side-circuit working only, but the electrostatic capacity of the circuits in the cable has been specially balanced to permit of loaded phantom circuits being

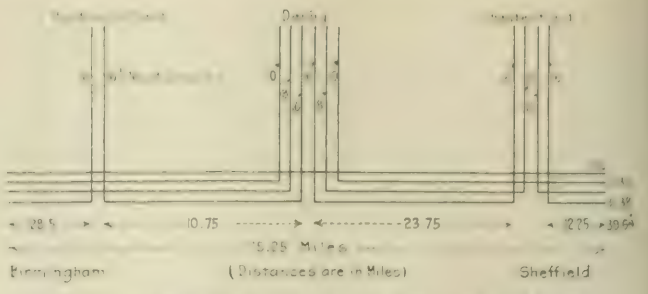


FIG. 4 ARRANGEMENTS OF CABLES AND MILEAGE

obtained when required. This is the longest loaded cable in the United Kingdom in which phantom coils are not yet actually installed and the cable scheme embraces provision for serving three intermediate towns which are situated along the cable route, viz., Burton-on-Trent, Derby and Chesterfield. The allocation of the cable is as shown in Fig. 4, which also gives the cable mileage between the towns in question. The cable and the loading scheme were designed by the engineer-in-chief of the British Post Office. The cable specification provided that the cable should be manufactured, laid and balanced by the contractor in lengths of 2.5 miles (at which points loading coils are inserted). Each 2.5 miles cable length was afterwards tested by the engineers of the post office for capacity and resistance balance, insulation, etc., before the lengths were accepted from the manufacturers. The cable is a lead-covered one of multiple twin formation, and it consists of twenty-seven quads or fifty-four pairs of copper conductors; each wire weighs 70 lb. per mile, and is insulated by paper and air. The final tests consisted of direct-current measurements of the electrical constants of the circuits in the cable, and, in addition, standard cable measurements and cross-talk tests were made. The measured constants of the conductors in the cable gave the following average results:

MEAN RESULTS PER MILE

Weight per Mile per Wire, Pounds	Diameter of Wire		Resistance, Ohms (Loop)	Inductance, Henrys (Loop)	Insulation Megohms Wire to Earth*	Capacity, Farads (Loop)	Attenuation Constant (Calculated)
	In.	Mm.					
70	0.0662	1.681	26	0.053	8440	0.0655×10^{-6}	0.0159

*Between Birmingham and Sheffield.

The standard cable tests gave a result near to the calculated attenuation constant. The terminal loss was equivalent to 5 1/5 miles of standard cable. Cross-talk tests were made in all possible combinations, including side to side, phantom to side, side to phantom, and phantom to phantom circuits.—*Post-Office Elec. Engrs. Journ.*, October, 1916.

Miscellaneous

Pressure Oil Film Lubrication.—H. T. NEWBIGIN.—A long abstract of a paper read before the British Association in which the author reviews the developments of theory and practice of lubrication, with special reference to pressure oil film lubrication and the work in this line done by Osborne Reynolds and by A. G. M. Mitchell.—London *Electrician*, Oct. 6, 1916.

Alfred Schoellkopf of Buffalo, N. Y., has been elected secretary of the Hydraulic Power Company of Niagara Falls, N. Y. The new secretary is a member of the Schoellkopf family which has large interests in Niagara Falls power generating companies and transmission lines.

Arthur C. Cobb, for the past three years new-business manager of the Worcester Suburban Electric Company, Uxbridge, Mass., has been appointed commercial manager of the Commonwealth Electric Company, Summit (N. J.), Lakewood (N. J.) Electric Company, and Point Pleasant (N. J.) Electric Company.

J. O. Montignani, distribution engineer of the Rochester (N. Y.) Railway & Light Company, has been appointed general manager of the Despatch (N. Y.) Heat, Light & Power Company, to succeed Royal Parkinson, recently resigned. Mr. Montignani is a graduate of the University of Edinburgh. In 1914 and 1915 he was chief inspector for the Utilities Mutual Insurance Company.

Edward K. Hall has resigned as vice-president of the New England Telephone & Telegraph Company, and effective Feb. 1 will become vice-president of the Electric Bond & Share Company, with headquarters in New York City. Mr. Hall is widely known in the telephone field, which he entered from the legal side, having been for many years a partner in the firm of Powers & Hall, of Boston, and serving as counsel for the company prior to his election as vice-president. For a number of years Mr. Hall has given personal attention to the public relations of the company and has continuously represented it at legislative and commission hearings, where his discussions of telephone affairs have contributed an unusually interesting and illuminating body of testimony to quasi-judicial proceedings. Mr. Hall was educated at Dartmouth College, and recently declined the presidency of that institution. His legal education was obtained at the Harvard Law School. He was elected vice-president of the New England company in 1912 and resides at Newton, Mass.



E. K. HALL

Men of the Industry

Changes in Personnel and Position— Biographical Notes

A. H. Ackerman, vice-president and general manager of the United States Light & Heat Corporation of Niagara Falls, N. Y., has resigned.

Joseph Pratt, in charge of the meter, arc lamp and trouble department of the Blackstone Valley Gas & Electric Company of Worcester, Mass., has been appointed superintendent of the distribution department, to succeed P. F. Hodgkins.

W. J. Gilson, until recently assistant superintendent of the Houghton County Electric Light Company at Houghton, Mich., has accepted the position of superintendent of the Calumet division of the Houghton company, with headquarters in Calumet.

Royal Parkinson of East Rochester, for several years general manager of the Despatch (N. Y.) Heat, Light & Power Company, has resigned to take the position of employment manager of the American Optical Company of Southbridge, Mass.

A. P. Broadhead, formerly superintendent of the Drummondville Division, Southern Canada Power Company, has been transferred to St. Johns, Quebec, as superintendent of the St. Johns Electric Light Company, which is operated by the Southern Canada Power Company.

F. R. Farmer, who has been vice-president and manager of the Beardslee Chandelier Manufacturing Company of Chicago, has resigned that position to take charge of the accessories division of the Gibson Company, an Indianapolis (Ind.) automobile supply house. Mr. Farmer will, however, remain a director of the Beardslee Chandelier Manufacturing Company.

Day Baker, formerly New England manager of the General Vehicle Company, and lately associated with its headquarters sales organization at Long Island City, N. Y., has returned to his former territory and established a new organization to be known as the Day Baker Motor Truck Company, with headquarters at 110 State Street, Boston, Mass. At this address he will become the New England distributor for the Atlantic Electric Vehicle Company of Newark, N. J., and the C. H. Hunt Company, West New Brighton, N. Y., manufacturers of the Hunt electric industrial truck. Shortly before his return to Boston Mr. Baker was made chairman of the electric vehicle committee of the New England section of the National Electric Light Association, as evidence of his welcome back to the New England field, where he has been a pioneer enthusiast and indefatigable worker for the electric vehicle cause.

Chauncey L. Lane, who for several years has been secretary of the United States Light & Heat Corporation of Niagara Falls, N. Y., has been elected vice-president and general manager, to succeed A. H. Ackerman, resigned.

Edwin E. Witte, a member of the faculty of the University of Wisconsin, and an expert in economic and industrial research, has been appointed secretary of the Wisconsin Industrial Commission to succeed Paul J. Watrous, who recently resigned.

L. H. Knapp, for several years in charge of the St. Louis, Mo., substation of the Mississippi River Power Company of Keokuk, Iowa, has accepted a position as commercial agent for the Houghton County Electric Light Company, Houghton, Mich., with headquarters at Houghton.

Edward N. Hurley of Chicago, who was appointed a member of the Federal Trade Commission at the time of the formation of the commission, two years ago, and who for the last year has been the chairman of the commission, has resigned that office in order to resume his business connections in Chicago as presiding officer of the Hurley Machine Company and other corporations in which he is interested.

J. G. Menut has been appointed manager of the Claremont (N. H.) Power Company, succeeding J. D. Whittemore, who recently became associated with the Reading (Pa.) Traction & Light Company. Mr. Menut has been assistant superintendent of the Claremont company since Oct. 1, 1915, and was formerly superintendent of the Colonial Light & Power Company of Springfield, Vt.

C. Nesbit Duffy, vice-president and general manager of the Manila (P. I.) Electric Railroad & Light Company, has been spending a few days in the United States visiting friends and business associates. It is understood that Mr. Duffy will sail for Manila from Vancouver on Jan. 25. Mr. Duffy has been with the Manila company since November, 1913, and has been active in civic improvement work in the Philippines.



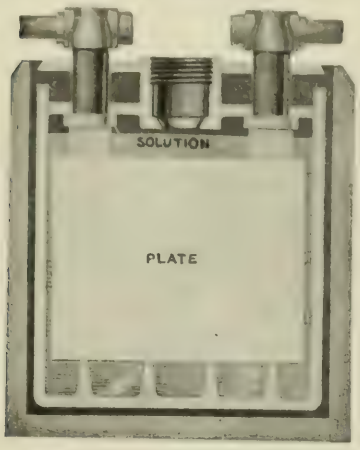
C. N. DUFFY

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Improved Types of Starting Batteries

The Willard Storage Battery Compage, of Cleveland, Ohio, has improved its cell connections for automobile starting batteries. The connection is made wide and flat with the name "Willard" cast in raised letters. It is



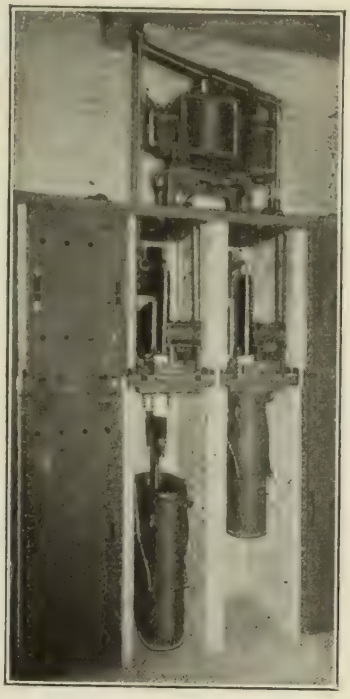
INTERIOR CONSTRUCTION OF BATTERY

pointed out that this connector contains more lead than heretofore used and is consequently more expensive, but has the merit of carrying current with less drop in terminal voltage. Attention is also called to another improvement made by this company in its batteries in which the size of the plates are somewhat different. The accompanying illustration shows the interior construction of the cell.

Oil Circuit Breakers for Cell, Wall and Pipe Mounting

Types E-6 and E-7 oil circuit breakers are part of a complete line recently developed by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., as a modification of the flexibility E-2 and E-4 types of breakers. The new types range in capacities from 300 to 1200 amp. at 23,000 volts, and from 1600 to 2000 amp. at 16,500 volts. The type E-6 is for cell mounting, and the type E-7 for wall or pipe mounting. Operation may be manual, by bell cranks, or electric by solenoids, control in both cases being from the switchboard. All steel construction is used, thus providing breakers exceptionally compact for their rupturing capacity, which ranges from 35,000 to 40,000 kva. at maximum rated voltage with proportionately higher capacities for lower voltages.

These breakers are of the unit pole type, made up by combining single poles mechanically connected for control by single hand lever or electric solenoid, which permits spacing according to local conditions. Attention is called to the fact that for cell mounting, one of the features is a convenient arrangement by which the steel base of each pole unit is held in channel irons built into the cell walls. These units are, therefore, easily slid in and out of these channels, and when in service are tightly clamped in place by set screws. Another new feature that is pointed out in the standard arrangement of electric operating solenoids for cell-mounting breakers, is the mounting of the single pole solenoid complete with its mechanism on a plate and



OIL CIRCUIT BREAKERS

channel frame fastened to the top of the cell structure. In the pipe or wall mounting form of breaker, the pole units are mounted on horizontal pipe supports. Manually operated breakers are full automatic in operation, and the electrically operated breakers can be made full automatic by special arrangement.

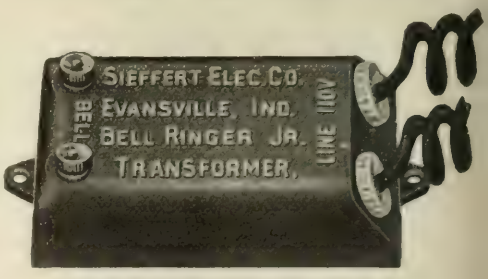
To break the arc as quickly as possible after the breaker starts to open, the types E-6 and E-7 breakers are provided with accelerating springs. An adjustable air cylinder dash pot is furnished to take up the shock of the moving parts at the full open position. The contacts open by gravity, assisted by the accelerating spring referred to above. The moving contacts are of the laminated brush type amply protected from arcing by butt type arcing contacts of increased size. The tanks are elliptical in form, of double lap-welded sheet steel, conveniently arranged for mounting and dismounting.

Tire Inflater Outfit

The Black & Decker Manufacturing Company, 105-115 South Calvert Street, Baltimore, Md., has developed an automatically operated tire inflater tank outfit for automobile air service. This outfit starts working immediately on turning the switch and will keep on until the pressure in the tank reaches 150 lb., then the automatic pressure switch of this inflater outfit comes into action and stops the machine. To inflate a tire, the Romort air chuck on the end of the hose is pressed over the tire valve and the pressure in the tire will rise instantly, it is claimed, to any number of pounds desired. When enough air has been used to cause the pressure in the tank to drop to 120 lb., the automatic switch starts the device again and brings the pressure back to 150 lb. Attention is called to the fact that the device has no exposed mechanism, electrical or mechanical, so that it is impossible for anyone to be injured through coming in contact with moving armatures, gears, rods or shafts. A cover is furnished for the automatic switch which completely encloses all mechanical and electrical parts. These machines can be used on 110 volts direct or alternating current of from 25 to 60 cycles.

Bell Ringing Transformer

The Sieffert Electric Company of Evansville, Ind., has developed the bell ringing transformer shown in the accompanying illustration for use in residences on 110-volt, 60-cycle circuits. The secondary voltage is from 6 to 10

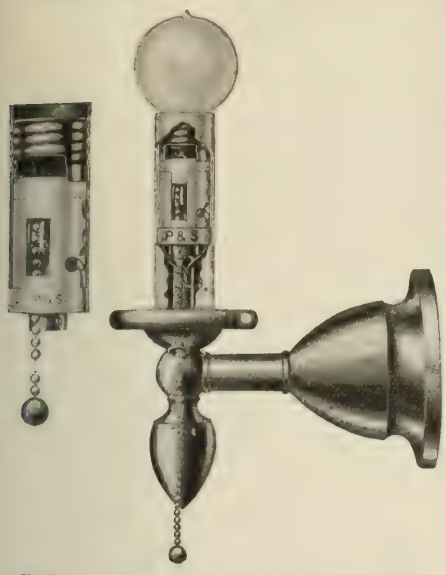


TRANSFORMER FOR RESIDENCE BELL CIRCUITS

volts. It is claimed that this transformer is so efficient that its losses will not register on the average watt-hour meter. The case is of cast-iron, and arranged for easy mounting.

Candle Fixture Socket

Chain pull candle fixture sockets designed to work smoothly in standard fiber or glass candle sleeves, yet of sufficient diameter to fit snugly within the candle have been developed by Pass



CHAIN PULL CANDLE FIXTURE SOCKETS

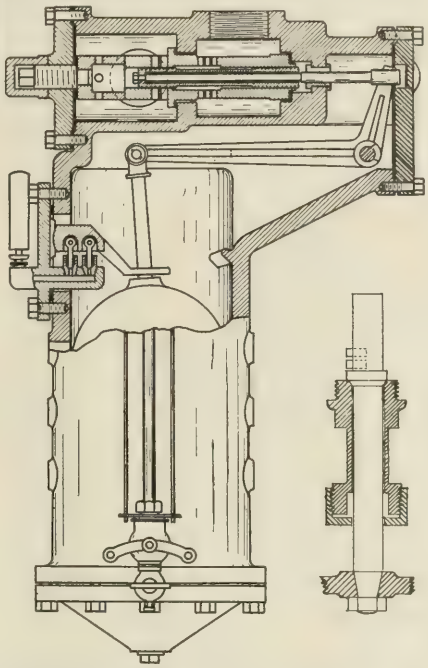
& Seymour, Inc., of Solvay, N. Y. All live parts are concealed within the body with the exception of the terminal plates, so that a short-circuit, from careless wiring, it is claimed, is impossible. The nipple is seated deep in the body of the device and affords a solid connection for the pipe and socket. It is fitted with the standard set screw to prevent turning on the pipe. The chain may be easily removed, making it handy to refinish or to slip through the bobeche, when assembling the fixture. The screws are of large and of sufficient length to accommodate the wires, and the raceways for the wires are deep enough to prevent crowding or bulging of the fiber casing.

Continuous Flow Feed-Water Regulator

The accompanying sketch shows a combined safety water column and a continuous flow feed-water regulator which has been developed by the Ray Manufacturing Company of Louisville, Ky. The principle employed consists of a perfectly balanced valve operated by a float, the feed water being admitted to the valve on its center and discharged on one end. The water passes through the valve in a continuous flow in exact ratio to the evaporation. These regulators are made in 2-in., 2.5-in., 3-in., 3.5-in. and 4-in. sizes, the only difference in construction being in the size of valve and bushing and pipe connections which are made to compare with the capacity needed.

A high and low-alarm whistle is operated by the same float that operates the regulating valve by having two contact points on the float rod engage with the whistle lever. The whistle lever is counterbalanced so that it holds the whistle valve closed when the pressure is off the boiler.

Several mechanical detail improvements that have been made in this regulator are pointed out as follows. The valve bushing, which was originally pressed into the head, is now made loose in head and held in place by a jack screw in the valve chamber head. This construction allows the bushing to be easily removed, it is claimed. The valve bushing now serves the double purpose of a cylinder for the valve to work in and as a strainer to prevent the foreign matter entering the valve. The admission ports are small drilled holes which will not admit any foreign matter that would interfere with the operation of valve. Each regulator is equipped with a testing device so that the high and low-water alarm whistle can be made to blow regardless of the height of water in column or the work that the boiler is doing. This is accomplished by extending the bearing pin for the bell crank to the outside through a stuffing box. This pin has a bar handle and a stop pin on it that works in a slot in the bell crank. In the normal working of the bell crank it will not touch this stop pin but when a test is to be made the bearing pin is turned until it engages the bell crank and the float and valve are made to move their full travel and the whistle to operate. Lugs are cast on the back of the regulator so that the machine can be mounted on a bracket fastened to the front of the boiler and in this way all strain is kept off the piping.



COMBINED SAFETY WATER COLUMN AND CONTINUOUS FLOW FEED-WATER REGULATOR

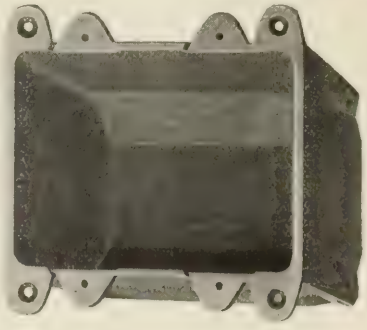
Magnetic Contactor

A single pole direct-current magnetic contactor has been developed and placed on the market by the Industrial Controller Company of Milwaukee, Wis. The same design is also used for double pole contactors. The frame is of heavy cast iron and so constructed as to allow the contactor to operate at an inclination of 30 deg. in either direction. The contact finger tips are of heavy copper forgings, the moving and stationary tips being identical. The design of the contact finger is such that a slight rolling instead of a sliding action is obtained, thus avoiding excessive wear, and at the same time confining the arc to the upper end of the finger tip and maintaining a clean contact surface. The contacts are of liberal proportions and close under heavy pressure, giving ample current capacity and rendering the use of auxiliary brush contacts unnecessary.

The magnet coil is designed for continuous duty without the use of protective resistances. A powerful blow-out magnet is used and the arcing shields can be readily thrown back out of the way when it is necessary to renew the arcing tips. The switch has been designed particularly for heavy duty and is especially suitable for crane and hoist work and steel mill duty.

Cast Iron Switch Box

The Sieffert Electric Company of Evansville, Ind., has developed the cast-iron switch box shown in the accompanying illustration for knob and tube work, and make them in one, two, three and four gangs. These switch boxes are reversible; that is, they can be installed on either side of a stud. They do not need a hanger board or side support across studs for new construction. All that is necessary, it is claimed, is to drive an eight-penny



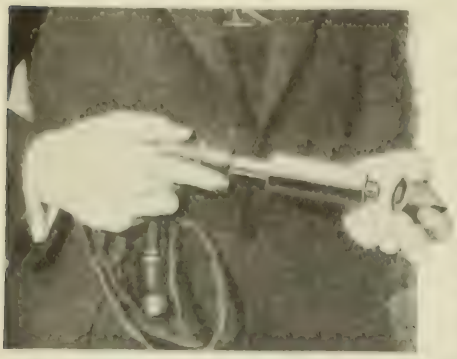
SWITCH BOX MADE IN ONE, TWO, THREE AND FOUR GANGS

nail or to insert a screw in each of the openings and fasten the box directly to the side of the stud. This eliminates fully three-fourths of the work required to secure the boxes in position and insures permanency and rigidity. For old construction these switch boxes are provided with ears for ease of installation.

Electric Soldering Iron

The heating unit of the electric soldering iron shown in the accompanying illustration is hermetically sealed inside the body of the iron. This, it is claimed, prevents moisture, heated solder or flux from penetrating a joint and coming in contact with the heater wire. Steel only is used throughout the structure of the body to eliminate the liability of opening of seams due to unequal expansion. The copper tip is such a design that a threaded core ex-

tends from the body and over this the tip is screwed. The heated core of the body therefore passes directly into the copper tip leading the heat in and concentrating it where it is required. Five standard sizes of this soldering iron are

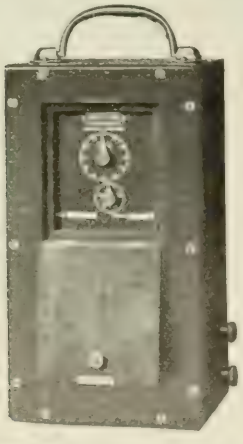


SOLDERING IRON HEATING UNIT HERMETICALLY SEALED

made by the Cutler-Hammer Manufacturing Company of Milwaukee. The sizes vary in diameter from $\frac{5}{8}$ in. to 1.75 in. Besides being used for all soldering purposes, it is claimed that they may be used for melting wax, for branding, etc.

Cycle Counter or Timing Device

A cycle counter or timing device for checking the time elements of high-accuracy relays and of circuit breakers, is shown here as developed by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa. This device indicates definitely the number of cycles required for a relay to close its contacts. The mechanism of this timing device consists essentially of an electric self-winding clock, the escapement of which is operated by an alternating-current oscillating magnet instead of a pendulum or balance wheel.



DEVICE FOR TESTING TIME ELEMENTS OF HIGH-ACCURACY RELAYS AND BREAKERS

At each cycle, one tooth of the escapement is released.

In operation, the cycle counter is connected in series with the relay on a circuit adjusted to give the current value at which it is required to test the relay. When the circuit is closed, the cycle pointer begins to revolve, one step per cycle, and continues to do so until the contacts are closed. The instrument, it is claimed, acts as though it has no inertia; that is, it starts the instant power is applied and stops the instant power is off.

Although primarily designed for use in testing or adjusting time element relays, this instrument is suitable for a great variety of testing. Its particular field of usefulness is for measuring elapsed intervals of time too short to be satisfactorily observed with a stop watch where readings in steps of one alternation are sufficiently accurate, obviating the use of complicated and expensive, apparatus such as chronographs or oscillographs.

Given a known frequency, the readings can be reduced to seconds, if desired. Conversely, by connecting the instrument to a circuit for a definite period of time, the frequency can be determined. By adding contacts to machine tools, elevator machinery, etc., the time required for various functions can be determined. It may also be adapted for use in many laboratories and test rooms for timing purposes.

Electric Garage Pumps

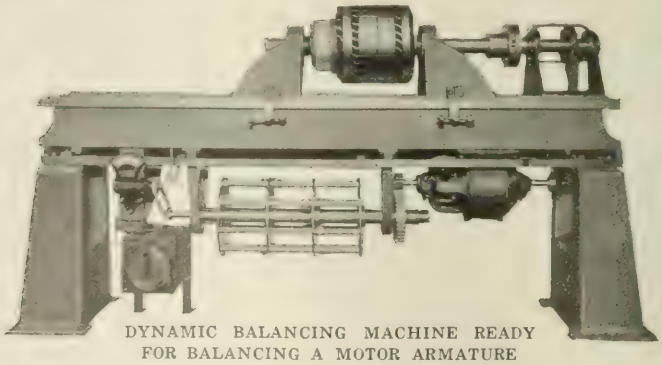
The Hartford Machine Screw Company of Hartford, Conn., has added two new designs to its line of electrically operated garage pumps known as models W and Y. Model W is a two-cylinder pump which may be furnished either on a truck or stationary and is designed for use in the larger public garages where continuous demands are made for tire inflation and quick service must be delivered. It may be used either as a direct pump for supplying air directly into the tires or in connection with a compressed air tank installation in order to maintain a supply of air "on tap." This model is driven by a 0.5 hp. General Electric motor. Attention is called to the fact that in every model of pump no piston rings are used. It is claimed that by eliminating the piston rings and by using extra long pistons, all chance of any oil getting through into the delicate inner tubes of the tire is eliminated. As an added precaution, however, a small expansion chamber is attached to each pump which serves to clarify the air.

The model Y is a stationary belt-driven pump built for garages which are equipped with a power unit and shafting. This eliminates the necessity of an extra motor. In connection with the development of these pumps, this company has adopted the R. S. A. type of electric motor for all alternating current outfits. This type motor, it is claimed, starts and accelerates the load under the low-voltage conditions more easily than the single-phase motor of the straight induction type.

Dynamic Balancing Machine

The machine shown in the accompanying illustration has been perfected by N. W. Akimoff, chief engineer of the Dynamic Balancing Machine Company of Philadelphia, Pa., as a means for determining the amount of unbalance in a rotating machine. This dynamic balancing machine furnishes a means for determining easily and correctly the magnitude and plane of a couple which develops vibrations by the establishment of another couple, which, while maintaining the static balance, counteracts the couple which produces dynamic unbalance. The magnitude and plane of this couple indicates the correction to be applied to the body under test to produce a perfect dynamic balance.

A rigid horizontal beam, such as a lathe bed, is hinged at one end of the machine and supported by a spring at the other. The body to be tested, already in perfect static balance, is rotatively supported on the beam. If dynamically unbalanced, the body will, on rotation, cause the beam to vibrate in a vertical plane. The object of the spring is to amplify the vibrations. A so-called squirrel cage is located on the underside of the beam and, in operation, is rotated in unison with the body being tested. This squirrel cage consists of two circular discs carrying an even number of rods arranged slidably in the two discs and parallel to the axis of rotation of the cages. When the ends of the rods are in one plane, the cage is in both static and dynamic balance, but if two opposite rods are displaced the dynamic balance is destroyed and the couple produced will itself cause vibration of the beam. One pair of rods in the squirrel cage would suffice if the relative position of the rods could be altered through the transmission device, but for convenience, three or four pairs are employed, and even then it is sometimes necessary to change the angular position of the cage so that the balancing can be done by one pair of rods and not two.



DYNAMIC BALANCING MACHINE READY FOR BALANCING A MOTOR ARMATURE

NEWS OF THE INDUSTRY

A Review of Activities in the Electrical Manufacturing, Selling and Central-Station Fields

Public Service Commission News

Iowa Commission

In a case brought against the Sumner Light & Power Company by the Hawkeye Co-operative Telephone Company charging interference from paralleling the telephone line the Railroad Commission held that while there is such an interference it does not justify the abandonment of the transmission line.

The power company received its franchise to use certain highways only after it had agreed with the telephone company to build the lines the same as those between Cresco and Decorah.

On the hearing of the matter, the telephone company which operates a grounded system, contended that the power company "failed in its agreement in that it did not build a three-phase line, did not transpose it, and did not put on a static wire; did not so construct its line as to overcome 'loss of electricity and induction;' did not use the most modern appliances for overcoming induction, and did not use any of the methods now in use for preventing induction, and failed to construct its line in the same manner in which the Cresco-Decorah line was built."

The testimony introduced showed that the transmission line was built on the opposite side of the highway from the telephone, on 25-ft. poles, fifty poles to the mile; 30-ft. poles over all crossings; two No. 6 wires, transposed once every mile; insulators sufficient for a 25,000-volt circuit, but the line only carrying 13,200-volt circuit; the line properly guyed, insulated, and well built. There was no showing that there are any modern appliances or methods in use to prevent induction which were not used in the construction of this transmission line. The showing was that the transmission line was built a single-phase line, not a three-phase line, and that no static, lightning, or overhead wire was used.

In regard to the line being three-phase or single-phase the commission said:

"So far, then, as induction is concerned, it makes no practical difference whether the transmission line is a single-phase or three-phase system. If the transmission line had been built as a three-phase system, it would have had the same effect upon the telephone plant as the single-phase line that was built. This statement is based upon the assumption that each of such lines was equally well built.

"Manifestly, the only interest the telephone company could have in the transmission line being built like the line between Cresco and Decorah, would be for the protection of its telephone line; to avoid interference. If, then, the failure to put on a static wire, and the building of a single-phase system instead of a three-phase line, did not affect the telephone line more than a three-phase line with a static wire would have affected it, it is very clear that the telephone company cannot be heard to complain if such failure in no manner injures it, and the performance of which would in no manner be beneficial to the telephone company. One cannot have redress who has sustained no injury, and where no injury is threatened, unless the performance of the act would have been beneficial.

"Since the hearing of this case, we have had the lines of both the companies involved in this matter examined by an electrical engineer in our employ. From his report, we learn that where the wires of the telephone company enter the houses they are fastened to the wood, and no insulating bushing is used, and that in some places, where examined by him, the wires of its line were resting on wood between the brackets and poles, and were not insulated. The physical condition of the line of the telephone company will probably account, in some considerable measure, for the 'noises.'

"The only testimony on the subject shows that the transmission line was built, in all respects, like the line from Cresco to Decorah, except it is a one-phase line; the same system; no wire was put above, and 'wishbone construction' was not used. Neither of which things have anything to do with induction.

"In nearly all cases, the troubles to a grounded telephone line consequent upon such line being parallel to a transmission line along a highway, may be overcome by making the telephone line a full metallic circuit, and properly transposing the line. The only evidence as to the cost of making the telephone line a full metallic circuit, is, 'it would not cost more than $15 a mile at the most,' and that it would cost the transmission line at least $3,000 to rebuild it as a three-phase line and put on a static wire. From our investigation, and the evidence in this case, such expenditure on the part of the transmission line would be valueless to it and afford no relief to the telephone company. (Since this testimony was taken prices of material have advanced, so that the figures given above should not be accepted.)

"The relief asked by the telephone company partakes very largely of the nature of an application for an injunction. We think a court would not be justified in granting an injunction upon a petition containing such allegations, and supported only by the proofs offered in this case, and in that respect the powers of this commission are no greater than the powers of a court. It being possible, at small cost, to so modify or change the system of the telephone line that both it and the transmission line could use the same highway, without substantial interference with or destruction of the property of either, the transmission line should not be denied the right to the use of the highway. If the telephone company is entitled to recover damages for any interference caused by the transmission line, and for the cost of so changing its plant as to avoid interference caused by the transmission line, such relief cannot be granted by this body, but must be found in the courts.

"We have reached the conclusion that the insulation of the transmission line would be improved if it would use insulators of a higher voltage rating, and we, therefore, order that the Sumner Light & Power Company insulate its line with insulators of a higher voltage rating than is now being used by it.

"We recommend to the Hawkeye Co-operative Telephone Company that it improve its line by placing glass insulators where its wires are now resting on wood between the brackets and poles, and we would suggest that insulating bushing be used where the wires pass through the walls of the houses, and that the trees along its line should be properly trimmed, so as not to interfere with the line."

Barstow Weekly News Letter.—On Jan. 4, W. S. Barstow & Company, Inc., made its initial issue of a weekly news letter designed to disseminate information regarding the company's activities.

Missoula Rates Reduced.—The Missoula (Mont.) Light & Water Company announced on Jan. 1 a reduction in electric rates based on the amount of energy used. Both large and small consumers will be affected.

Improvements to Alaska Radio System.—According to recent reports, the Navy Department will improve the radio system in Alaska in 1917 at an estimated expenditure of $187,277. Among the items included for improving the Alaskan wireless stations are $22,000 for St. Paul, $5,000 for St. George, $8,250 for Kodiak, $7,203 for Sitka, $4,700 for a new station at Seward and $27,500 for a new station at Cordova.

Uniform Rates for Empire Gas & Electric.—The Empire State Gas & Electric Company has adopted a uniform schedule of rates for all of the different communities it serves. In some cases it will increase and in others lower the existing rates. In the aggregate the new rates will increase the gross revenue from the entire territory about 2 per cent. The proposed electric rates follow: Rate No. 1.—A customer charge ranging from $1 to $4 per month, depending on the size of the consumer's connected load, plus 7 cents per kilowatt-hour for all energy consumed. Rate No. 2.—A customer charge of $2.50 per month plus a demand charge of $3 per month per kilowatt connected for six months beginning April 1 each year, and $3.60 per month per kilowatt connected for six months beginning Oct. 1, each year, plus 2½ cents per kilowatt-hour for all energy consumed.

Municipal Utilities Must Be Operated Separately.—According to an opinion handed down recently by R. E. Campbell, Assistant Attorney General of the State of Washington, each municipally owned and operated public utility, including municipal power and light plants, water plants and street railway systems, must be conducted separately and as an entirely distinct business, and special arrangements between various departments of the city as to rates and services cannot be made. Transferring of public funds from one department to another is condemned by Mr. Campbell. In summing up his conclusion, he says: "A city has no power to require one public utility to loan money to another department, unless the current rate of interest is charged. A city has no power or right to require a public utility to furnish free service or service below the usual cost to another utility or municipal department. A city council has no power to appropriate, directly or indirectly, any part of the income or surplus of one utility for the benefit of another utility. The city council has no authority to make a gift of money from the general fund to provide working capital or cover a deficit."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Municipal Plant Falls Into River.—Supposedly due to quicksand upon which the concrete foundation is believed to have been built, the Lowell, Mich., municipal light plant, valued at $60,000, toppled into the river shortly after midnight two weeks ago. Citizens heard a crash and many rushed to the scene and discovered the plant had fallen into the water and was practically wrecked. It is a question whether the generator or other equipment can be saved. The plant will be rebuilt, it is understood.

Urges Employees to Keep Expenses Down.—In view of the rapidly increasing cost of materials that go into the manufacture of gas and electricity, J. T. Hutchings, general manager of the Rochester Railway and Light Company, has issued a letter to employees explaining that under the circumstances the utmost diligence must be exercised to avoid all waste and cut the cost of production to the irreducible minimum. The letter makes the further point that however much the cost of materials and manufacture may increase under the stimulus of abnormal conditions, the company cannot recoup itself by a corresponding advance in the price of its products. This increase must be absorbed by the company through stoppage of leaks and the highest effectiveness generally on the part of employees. The letter recites a long list of materials showing the price-level before the sharp advance began and the present cost to the company.

A New Insulating Material.—According to the U. S. Commercial Report No. 238 a new insulating material has been developed in Germany which possesses some interesting features. This material is known as "galalith," and is a bone-like substance similar in many respects to celluloid. It is manufactured from casein and formaldehyde. A solution of casein is obtained by treating skimmed milk with caustic alkali, after which the solution is clarified and the casein then precipitated by means of acids and filtered. The water is then extracted under pressure and the product slowly dried over a period extending several weeks. The product obtained is casein plate, which is treated by thorough saturation with formaldehyde and dried again. Galalith is said to be an excellent insulating material somewhat transparent, although never completely so, and of a yellowish-white horn-like color. It is workable either in the hot or cold state, the cold galalith being softened by treatment in hot water. It is odorless, and very much less inflammable than celluloid. It cannot be made into very thin sheets.

Electric Vacuum Cleaner Used to Remove Carbon in Automobile Engine Cylinders.—According to a writer in a recent issue of *Scientific American* the household electric vacuum cleaner has been found an effective means of removing carbon from automobile engine cylinders. The procedure with this method is to treat the engine cylinders with alcohol, kerosene or other agent to loosen the carbon. This is most effectively done by scraping with a suitable tool. The vacuum cleaner is then connected to the cylinder through a tube nozzle and the carbon quickly removed.

Cleveland Illuminating Company Gets Railway Power Contract.—A board of arbitrators has rejected the bid of the Cleveland municipal plant for furnishing energy to the Cleveland Railway Company to take the place of that generated at the Cedar Avenue power station, which is to be abandoned, and approved the bid of the Cleveland Electric Illuminating Company, which was a little less than 6 mills per kilowatt-hour. The arbitrators said the figure presented by the municipal plant might be a little lower in itself, as pertaining only to the energy furnished t replace that of the power house to be abandoned, but that of the Illuminating company not only covered this, but the energy furnished to four substations under a former contract, amounting to about 40 per cent of the total amount used, on which the new figure makes a material reduction. Furthermore, all the additional energy needed during the term of the contract will be furnished at the same figure. The amount of energy needed at present to replace that lost is 30 per cent of the total.

The Illuminating company will be in position to furnish the required energy by July 1, 1917, while the municipal plant could not have installed the necessary equipment for the purpose before July 1, 1918. As estimates show there will be a saving of about $200,000 a year through purchasing energy. This presents another important reason for the award made. The Illuminating company's contract covers a period of eighteen years, while the municipal plant wished to contract for ten years only. The contract with the Illuminating company provides that at the end of five years the railway company may receive bids and, if any competitor proposes to furnish energy at a figure 10 per cent lower than the present rate or so low that the company does not care to meet it, then this contract may be abrogated. The board found that the bid of the municipal plant had not been approved by the board of control, as required by law, and that under it the contract would be tentative, the real basis and details being left for arrangement later on. A. F. Ingersoll, chairman of the board, and Warren Bicknell, the arbitrator selected by the railway company, signed this report, while Thomas L. Sidlo, selected by the city, made an adverse report. The contract was consummated shortly after the report was made to the company and the city.

Adirondack Power Reduces Rates.—On Jan. 1 the Adirondack Electric Power Corporation, Saratoga Springs, N. Y., announced in a circular letter to its customers a reduction in rates for electric energy.

Power Company Employees' Insurance to Be Increased.—The Southern Sierras Power Company and its associated and allied companies have notified their employees that the $1,000 life insurance policy which was given them at the company's expense Christmas, 1915, will be increased to $1,500. This additional insurance will be carried without expense to the employees. The families of about 350 employees are benefited.

Electric Vehicles in Chicago.—The Commonwealth Edison Company has in daily service 145 electrics, of which eight are passenger cars. Another large user is Marshall Field with some 246 electric trucks of various capacities. Altogether there are 780 electric trucks in use in Chicago and some 6500 commercial gasoline vehicles.

Coal Shipments Tightening Up.—Indications are that coal shipments are again tightening up, according to W. S. Barston & Company, due in part to shortage of cars and in part to weather conditions which make the movement of freight slow and uncertain. There is also the possibility of embargoes to which the railroads have resorted frequently during the past year.

Fire Loss Due to Electricity.—After collating and analyzing the details of a very large percentage of all fires in New York, the National Board of Fire Underwriters has ascertained the causes of these fires, for 1915, with the relative losses, to have been as follows: Strictly preventable causes, 21.7 per cent; partly preventable cause, 31.9 per cent, and unknown causes, 46.5 per cent. Electricity is listed under the partly preventable causes and to it was due in 1915 a fire loss of $935,413 in New York, or 4.7 per cent of the total loss in the state that year from fire. For the same year electricity was the cause of 3.9 per cent of the fire loss of New Jersey and 6.0 per cent of that of Pennsylvania.

Convention in February.—The New Mexico Electrical Association will hold its annual convention in Albuquerque, with headquarters at the Alvarado Hotel, Feb. 12, 13 and 14.

New Hampshire Contractors Organizing.—Steps towards the organization of a New Hampshire Electrical Contractors' Association were taken on Jan. 5 at Concord.

Jobbers' Association Meetings.—The next semi-annual meeting of the Electric Supply Jobbers Association will be held at the Homestead Hotel, Hot Springs, Va., May 22, 23 and 24. The quarterly meeting of the Pacific division was held at Del Monte, Cal., on Jan. 11, 12 and 13.

New Chicago Club Officers. — The new officers of the Electric Club-Jovian League of Chicago, are: President, H. A. Mott; first vice-president, B. E. Blanchard; second vice-president, George H. Jones; secretary-treasurer, W. H. Hodge, and trustee, H. A. Porter.

Mid-Winter Meeting of Illinois Electrical Contractors.—The Electrical Contractors' Association of the State of Illinois will hold its mid-winter meeting at the Hotel Sherman, Chicago, Jan. 25 and 26. Louis B. Van Nuys of the Central Electric Company of Peoria, Ill., is secretary-treasurer of the association.

The Electrical Development and Jovian League of San Francisco.—The regular luncheon of the Electrical Development and Jovian League held on Jan. 3 was arranged as a farewell to F. H. Leggett, Pacific Coast manager of the Western Electric Company, who has been transferred to the New York office of the company.

Philadelphia Iron and Steel Engineers to Discuss Polyphase Motors.—At the February meeting of the Philadelphia section of the Association of Iron and Steel Electrical Engineers James Burke, president of the Burke Electric Company, Erie, Pa., will present a paper entitled "Polyphase Motors." Will J. Davis, Jr., president of the American Lighting Company, Chicago, Ill., addressed the section on Jan. 6 on the subject, "Industrial Flood Lighting, Its Origin and Application."

Associations and Societies

A complete Directory of Electrical Associations is regularly printed in the first issue of each month on the next-to-last text page.

Cleveland League Hears About Mexican Power Development.—At the Jan. 11 meeting of the Electrical League of Cleveland, H. M. Morrison, electrical consulting engineer, spoke on the following subject: "The Development of Water Power in Mexico for Generating Electricity; also a Short Description of the Tehuantepec National Railroad Company as a Competitor of the Panama Canal."

Indiana Engineering Society to Meet at Purdue University.—The features of electrical interest on the program for the 1917 meeting of the Indiana Engineering Society, which will be held at the electrical building, Purdue University, LaFayette, Ind., Jan. 18, 19 and 20, are as follows: Address of welcome, Prof. W. E. Stone, president Purdue University; address of president, Prof. L. W. Wallace; address by Gen. Anson Mills, Washington, D. C.; "Financial and Ethical Status of the Engineer," by Prof. F. C. Newell, Urbana, Ill.; "Electrical Lighting," by Prof. A. M. Topping, LaFayette, Ind.; "Street Lighting in Small Towns," by Samuel B. Mott, Noblesville; report of committee on electrical engineering and electrical railways; "Human Engineering," by E. B. Smith, Marion, Ind.; "Cases Before the Public Service Commission During the Past Year," by H. O. Garman, Indianapolis; "Cost to the Utilities of Rate Investigation," by Charles E. Hurd, Indianapolis; "Public Utility Lines," by Peter Junkersfeld, Chicago; "Cost Accounting," by Harrington Emerson; report of committee on power plants, and election of officers. Charles Brossmann, 1616 Merchants Bank Building, Indianapolis, Ind., secretary of the association, has also announced that the annual banquet will be held at 7.30 p. m., Jan. 19.

Western Association of Electrical Inspectors to Meet at Toledo.—William S. Boyd, secretary of the Western Association of Electrical Inspectors, has announced the following program for the twelfth annual meeting of that association, which will be held at the Hotel Secor, Toledo, Ohio, Jan. 23, 24 and 25: Address of Welcome, Hon. Charles M. Milroy, Mayor of Toledo; Reply to Address of Welcome, Emil Anderson, Minneapolis; Address of President F. H. Moore; reports of other officers and committees; "Industry Conference Standards," by A. R. Small, Chicago; "Lamp Socket Rating," by Dana Pierce, New York; "The Fire Hazard in Organ Wiring," by Washington Devereux, Philadelphia; "The Squirrel-Cage Type Induction Motor and Its Wiring," by G. S. Lawler, Boston, Mass.; "The Electrical Manufacturer's Point of View," by F. A. Barron, Schenectady, N. Y.; "The Electrical Contractor's Point of View," by H. R. Fowler, Toledo, Ohio; "The Electrical Engineer's Point of View," by W. E. Richards, Toledo; "The Central Station's Point of View," by W. E. Richards, Toledo; "The Electrical Inspector's Point of View," by Ralph E. Knox, Louisville, Ky.; "Advantages and Disadvantages of the Insulated Inlet Bushing for Sockets and Outlet Box Covers," by F. D. Varnam, St. Paul, Minn., and Dana Pierce, New York; three points of view on "The Relation of Feeder Sizes to Connected Load," by Oscar M. Frykman, Minneapolis, Minn., G. Southern, Toledo, Ohio, J. J. Duck, Toledo, Ohio, and H. B. Gear, Chicago; "The Field Trial of the National Electrical Safety Code," by Dr. E. B. Rosa, Washington, D. C.; "Insulated Service Conduit and Cabled Service Wires," by George E. Bruen, New York; four points of view on "Shall the Insulating Joint Be Abandoned in Connection with Electric Light Fixtures," by Joseph C. Forsyth, New York; a representative of the Macallen Company; Howard R. Sargent, Schenectady, and W. J. Canada, Washington, D. C.; "Electrical Development," by Henry L. Doherty; open discussion of inspectors' problems, and election of officers. The convention will be closed Thursday, Jan. 25, by a banquet. Inspection tours about the city have been arranged for Jan. 26.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

ELECTRIC RANGE BUYING IN 1917

Twenty-Three Central Stations Report the Probable Sale of 14,325 Ranges

Unless something unforeseen happens the coming twelve months should result in a much wider sale of electric ranges than in any previous year. In reply to letters sent out by the ELECTRICAL WORLD to some of the central stations that are playing an important part in the distribution of ranges asking for figures on the number of ranges they proposed to sell in 1917 the following data were received: New England States, ten companies, 2255 ranges; Atlantic States, two companies, 200 ranges; Central States, seven companies, 5790 ranges; Pacific and Mountain States, nine companies, 6280 ranges, a total of 14,325 ranges to be sold by a total of twenty-three companies. Inasmuch as the average sale price of electric ranges is around $100 the sales of just the above ranges would be, roughly, $1,500,000.

Replies were received from other companies, saying that the sale of ranges would be actively taken up in 1917, but no figures as to the probable sales were given. The replies also disclosed that orders had been placed already for at least 25 per cent of the 14,000 ranges.

There seem to be a number of factors which will militate against electric range sales this year. The old feeling of the central stations that the price was too high was intensified by the fall increase in prices. Since the replies were written another increase in price of ranges has been announced.

While there seems to be little doubt that the central stations are, and must so remain during the initial years, the logical distributers of electric ranges the central station discount is less than that of the jobber. This some central stations feel, and particularly those in the far West, where the greatest development of electric cooking is taking place, is not right.

KENNY PATENT UPHELD

Circuit Court of Appeals Renders Decision on Basic Vacuum Cleaner Patent

The United States Circuit Court of Appeals has affirmed the decree of the District Court for the Southern District of New York, adjudging valid the fourth claim of letters patent No. 847,947, the Kenny patent, and granting a permanent injunction against infringement and an accounting of profits and damages subsequent to October, 1915. The patent is the basic vacuum cleaner patent. The suit was brought by the owners of the patent, the Vacuum Cleaner Company against the Innovation Electric Company, Inc.

Claims 1, 3 and 4 were previously declared valid by Judge Mayer in the case brought against the American Rotary Valve Company. Article 4 which was under contention in the case just settled has to deal particularly with two features, namely, that the cleaner shall have a suction chamber and that the cleaning tool shall have a narrow slot.

In its decision the court says in conclusion:

"Kenny, with little or no capital, invented a cleaner which has met with great success by reason of the novelty and intrinsic merits of the device. The hand implement under consideration is one of the forms of the Kenny invention. We think Kenny's contribution to the art of vacuum cleaning has been sufficiently fundamental to entitle his patent to a broad interpretation and when given such interpretation there can be no doubt that the defendant's devices infringe."

Under the licensing arrangements only a certain number of licenses are permitted and in order to acquire a license the purchaser must at the same time buy the entire vacuum cleaner business of the seller. Licensees, however, may make machines under any trade name for different distribution and such machines may bear the Kenny patent trademark. Some of the machines marketed by the Innovation company are manufactured under a license and arrangements have been made to so manufacture the other types.

There are a number of electric vacuum cleaner manufacturers whose cleaners are not licensed. Whether they will accept the result of this decision is not known. It has been rumored, however, that further litigation may be expected on the electric portable cleaners.

FAN SEASON OPENING UP

Few New Models Developed—Number of 1917 Models Have Steel Instead of Brass Guards

Within a few weeks the 1917 electric fan campaign to the trade will be fully launched. A number of the manufacturers are now ready and some have already begun. There are some, however, that still have loose ends to tie together. Literature has been prepared, stock laid in and the desired changes made in design. The only real factor that remains undetermined in a number of cases is that of price. It is certain that prices will be higher in 1917, but how much has as yet not been determined. Some fans have advanced but a few per cent in price, while others have gone up as much as 30 per cent over 1916 prices.

Of one thing the manufacturers are certain and that is a market thoroughly depleted of fan stocks. Last summer developed real fan weather, especially in the Middle West. Practically every jobber is sold out. This is an entire reversal of the conditions found at the beginning of 1916, when, owing to the unseasonableness of the 1915 summer, a very large stock of fans was carried over. It is, therefore, expected, from the manufacturers' standpoint, that 1917 will be an excellent fan year.

Few new fans will be placed on the market this year. There are some changes in design which for the most part are of a minor character. One of the changes that is rather general is the replacement of the brass guard with one of steel. An authority estimated that fully 90 per cent of the 1917 fan production will have this change included in it. Some well-known lines will still appear entirely in brass.

In the fan blades there is no tendency toward a general change for 1917. It is true that a few companies are planning to put out some steel and even some wooden-bladed products, but the number of these fans offered this year will be small when compared to the year's total production.

There are several causes for the change in guards:

First, the 1916 fan season produced an exceptional volume of sales, practically clearing all of the stocks in the hands of jobbers and dealers, and exhausting manufacturers' stocks and unassembled parts. The year 1917 is, therefore, an appropriate time to effect a change in outward appearance of the products.

Second, the change will improve the appearance of the fans. As one manufacturer aptly phrased it, "There are probably other determining factors as important as the state of the brass market and the state of the fan trade. The tendency to take note of the location in which fans are used and to make them harmonize more readily with surroundings is an important factor in the elimination of glittering brass generally. It is probable that the predominance of fans finished in color instead of in any metal finish will be noticeable during the coming season."

Furthermore, it has been pointed out that the black guards will not show fly specks much and will be very easy to keep clean.

Although the price of brass has advanced it is not the ruling factor, because, between the price of fabricated steel guards and blades and fabricated brass guards and blades, there is not a wide margin of difference. This is due to the present high price of steel and the greater cost of working steel. Nevertheless, it is rather generally felt that the change from brass to steel will be permanent and that in the future when raw material prices are readjusted, the wisdom of the present change will be more apparent.

It is not expected that this change, which has been largely forced on the fan manufacturers, will cause any loss to the trade or to the public. The opinion is firmly held by those making the change that the steel guards which have been developed are more attractive in appearance, are stronger and more durable and will be in better condition as regards finish after a year's service than brass guards would be.

COPPER QUOTATIONS LOWER

With Spot Prices Now Down to Purchase Price No Further Drop of Importance Is Expected

Copper is dropping in price from the high levels registered a month ago. It is still, however, more than double peace values. Spot copper was quoted on Tuesday at 28 cents with February metal 0.5 cent lower. First quarter copper was quoted at 27.5 cents, second quarter at 26.5 cents, third quarter at 25.5 cents and last quarter at 24.5 cents. These are all nominal prices.

Producers are sold out for the first half of the year and any copper they might offer is on account of a customer who has copper for resale. There is a feeling that until the second half of the year copper will stay at practically the present quotation. The market is now at about the same level it was when the copper for first half delivery was purchased. There being, therefore, little or no opportunity to make a profit in resale, it becomes apparent that less copper will find its way to the market. Any further offering would only tend to depress the market still more.

Quotations on copper wire base on Tuesday were 34.25 cents spot and 34 cents, February delivery.

PLACE OF UNITED STATES IN JAPANESE FOREIGN TRADE

Official Statistics for 1914 and 1915 Show but Small Amounts of American Products Purchased by Japan

Official statistics of the foreign commerce of Japan in electrical and allied goods during 1914 and 1915 have recently been issued showing the electrical goods imported from different countries. Of a total of $6,132,500 of electrical and allied goods imported to Japan in 1914 but $1,805,500 were of American origin. In 1915 the total imports were $4,495,500, of which $1,908,500 were made in the United States.

Germany led before the war in electrical goods sent to Japan. In 1914 the German total was $2,156,500 and England was second with $1,589,000. The United States was third. In the following year but $119,000 were German made, while the imports from Great Britain were $1,157,500. Imports of American made goods, therefore, exceeded those from any other country in 1915.

However, most of this trade was in goods allied to the electrical trade, such as galvanized iron wire, turbines, cranes, poles, internal combustion engines, boilers, crude insulation, etc. Of straight electrical products the total imports in 1914 were but $2,031,500 and in 1915 they were $503,500. Of the 1914 imports $682,000 were manufactured in the United States and in the next year $257,000.

Prior to the war Germany ranked first in the Japanese market in galvanized iron wire, transmission line materials and poles, insulated electric wire, steam turbines, pumps, internal combustion engines, water turbines and wheels, incandescent lamps and wattmeters. England ranked first in copper tubes and pipes, cranes, steam engines, steam boilers and storage batteries. The United States stood first in dynamo electric machinery, and ammeters and voltmeters.

NEW YEAR BRINGS ADVANCE IN APPLIANCE PRICES

Raw Materials Purchased at Top of the Market Have Greatly Increased the Cost of Manufacture

As was predicted some weeks ago in these pages, the New Year has brought higher prices for electric appliances. With but few exceptions the price is now higher or will be higher in a few weeks on fans, toasters, flatirons, ranges, vacuum cleaners and washing machines. The advance on the heating appliances is scheduled for Feb. 1 and will be a minimum increase over the Oct. 15 schedule of 50 cents on flatirons and toasters and $5 on ranges.

Fan prices have advanced from a few per cent in some cases to 30 per cent in others, depending largely on the design of the apparatus. Washing machines have advanced on the average of 10 per cent over last year's prices. The advances in vacuum cleaner prices generally have been 10 per cent or more.

These prices have been caused almost entirely by the high prices for raw materials that obtained last year when stocks were ordered. In a number of cases the cost of manufacture of goods for 1917 sale has been greater than the 1916 prices.

There is, however, hesitation, particularly on the part of fan manufacturers, to name a 1917 selling price. In 1916 the price, it is pretty generally admitted, was too low. There is no intention of making this mistake again. On the other hand, the manufacturers are equally anxious not to increase the price unnecessarily.

In some quarters it is freely admitted that at these prices the gross volume of sales will be less, but it is felt that it is the better policy to do a smaller business at a safer margin of profit than to accept larger orders at a margin of profit too small to be safe. Where the decrease will probably come will be in selling a cheaper article where formerly a more expensive one was sold. This undoubtedly will be largely the fault of the merchandising agent. The central station buyer, or the contractor, or the dealer, and even the jobber, knowing the former prices appreciate the extent of the advance. It is, however, rather generally forgotten that the general public knows little or nothing about prices and that the higher prices do not mean nearly as much to the public as to the man who is constantly dealing with them. In other words, the public buys what the merchandising agents' buyer decides the public is going to buy. An instance of the mistake that is thus made is recalled. A large central station company with many branch offices formerly sold large numbers of a well-known make of toaster that production costs have forced to the price of around $7. The same manufacturer brought out last fall a cheaper toaster to sell at the same price that the $7 used to sell at—some $3 less. This central station stocked up on the $4 toasters and would not lay in a single $7 toaster. During the holiday trade this company had a large number of inquiries for the higher priced toaster and the customers seemed disappointed when told that the best that could be offered was the $4 article. Furthermore, there is little doubt but that a large percentage of those who purchased $4 toasters would have just as willingly ordered a $7 article had it been shown. There are many just such cases where the merchandising agent has allowed his own fears to dictate what shall be sold rather than the demand of his customers.

In the case of ranges there was a real opposition by the central station to the former prices, but with the fall advance and the advance to come shortly this opposition will probably become stronger.

By properly selling the merchandising agent, however, the manufacturer should be able to prevent such occurrences as above related. There is a real demand for electrical appliances and what the customer wants is something that will do what is claimed for it. Electric appliances are not such commodities that the public know the prices, and even if the old prices were rather generally known, the public appreciates that everything has gone up in price. For these reasons it is argued in the wholesale trade that the one to be sold is the merchandising agent—after that the retail trade will take care of itself.

Manufacturing and Industrial

Moulton Engineering Corporation announces the opening of a New York office at 233 Broadway, under the direction of Horace W. Flashman.

Babcock & Wilcox Company, manufacturers of watertube boilers, will build an addition to its plant at Lexington Avenue and Third Street, Bayonne, N. J., to cost about $100,000.

Driver-Harris Wire Company announces the appointment of George A. Lennox as western district sales manager, succeeding Stanley M. Tracy, who will in the future operate from the main office as assistant general sales manager.

Century Electric Company, St. Louis, Mo., announces the establishment at 10 High Street, Boston, Mass., of a branch office under the direct control of the home office for the handling of all sales matters in the New England States.

The Westinghouse Lamp Company has purchased a tract of 5 acres of land on Pennington Avenue and the Philadelphia & Reading Railroad, Trenton, N. J., for the erection of a new manufacturing plant. The initial capacity will employ about 500 persons.

F. R. Blair & Company, Inc., 50 Church Street, New York City, announces that on Jan. 1 H. H. Gildner, who has been for the last three years chief engineer of the S. K. F. Ball Bearing Company, Hartford, Conn., joined the Blair organization as manager of the "Flexite" department. Mr. Gildner will make his headquarters in New York.

H. W. Johns-Manville Company has opened a new office at 911 Walnut Street, Des Moines, Iowa, Jan. 1, bringing the total number of branches up to fifty-five. Practically every important city in North America now has a Johns-Manville branch. Wm. B. Roberts, who has been with this organization for a number of years, caring for the Iowa sales, has been appointed manager of the new office.

Samuel G. Hibben, formerly head of the engineering department of the Macbeth-Evans Glass Company of Pittsburgh, Pa., and associated with the Westinghouse Electric & Manufacturing Company, has recently become identified with the Westinghouse Lamp Company. Mr. Hibben is well known as chairman of the Pittsburgh section of the Illuminating Engineering Society. With the lamp company he will continue in the engineering work, furnishing expert lighting advice to the various users of Westinghouse Mazda lamps. Mr. Hibben will have his headquarters at the Pittsburgh office.

Western Electric Buffalo Staff Celebrate.—Members of the Buffalo, N. Y., staff of the Western Electric Company celebrated the increased business handled throughout western New York during the past year at a banquet and sales conference held at the Iroquois Hotel. New specialties for 1917 were announced by J. W. Tabb, manager of the Buffalo branch, and plans for the sales work were considered. Many suggestions were made by various members of the staff and the spirit of co-operation was reflected in all the discussions. In the evening a banquet was held at the hotel for members of the sales staff and employees of all departments.

New Exide Service Station in New York—The increase in the use of "Exide" batteries for automobile service in and around New York City has made it again necessary for the Exide Battery Depots, Inc., to increase its service facilities with a new service station and electric vehicle garage at Sixty-fourth Street and West End Avenue. This new location will be the official "Exide" headquarters in New York City. The company will retain its West Side commercial electric vehicle garage at 527-541 West Twenty-third Street, as well as its East Side garage at 141-155 East Twenty-fifth Street, giving the company three separate and well-situated locations in New York.

The Thomson Spot Welder Company, 84 State Street, Boston, Mass., which was recently incorporated, has a plant at Cincinnati, Ohio, and will manufacture electric spot welders, having acquired the Harmatta patent of spot welding, it is said, and other spot welding patents of the Thomson Electric Welding Company and the Universal Electric Welding Company. The Thomson Spot Welder Company is owned by the Thomson Electric Welding Company of Lynn, Mass. The officers are J. W. Farley, president, and George A. Cutter, treasurer. Mr. Farley is also president of the Thomson Electric Welding Company, and Mr. Cutter is general manager of the Thomson Electric Welding Company.

The Frantz-Premier Company, Cleveland, Ohio, manufacturer of electric vacuum cleaners, has just increased its capital stock to $1,500,000, made necessary by the need for larger manufacturing facilities to handle the large growth of business during the year just closed, when the Frantz-Premier Company's business was about twice that of 1915. The company employs 500 men and turns out 500 electrical units per day. Practically all parts, including castings and motors, are made in the company's own factory. Within a short time, according to an announcement by an official of the company, other electrical labor-saving household devices will be added to the Frantz-Premier lines.

Better Conditions Expected in the Reflector Trade.—The National X-Ray Reflector Company of Chicago, and other companies which use cyanide in some of their plating processes, have suffered as the result of the power shortage at Niagara Falls. All of the cyanide made in this country is manufactured by one company, which has plants at Niagara Falls, and Perth Amboy, N. J., and the output of this concern was greatly reduced when the Canadian government requisitioned electrical energy it had been exporting to the United States. The records of the X-Ray company also show that labor in the trade during 1916 was transient. Of the number of factory men hired during 1916 only 18.7 per cent remained in the employ of the company. In spite of these difficulties the company's production department was able during 1916 to fill orders, so that the volume of 1916 business exceeded that of 1915 by 33 1/3 per cent. Better conditions on delivery and another 33 1/3 per cent increase are expected during the current year.

Co-operation in Promotion of Argentine Trade.—At a recent meeting in New York the organization of the Argentine Mercantile Corporation with a capital of $5,000,000, for marketing American goods in Argentina, was perfected by a number of the leading manufacturers of the country. The feature of the organization is that no competing lines of goods will be carried and that each manufacturer will bear a share of the expense of marketing his product in Argentina in proportion to the extent of his business. The corporation combines in one solid organization the distributing, selling and financing of the merchandise of the manufacturers. It has taken for its salesrooms in the city of Buenos Aires an entire building in the center of the retail district. Purchasing and forwarding offices are to be maintained in New York City. The building in Buenos Aires which is now being fitted up for the corporation, and will probably be occupied by next March, is being outfitted for the display of the samples of the allied manufacturers. Each classification of trade will be exhibited in a separate department, and each department will be in charge of an experienced manager, with a competent corps of salesmen and travelers experienced in the merchandise trade and customs of the Argentine.

NEW YORK METAL MARKET PRICES

	Jan. 3 Selling Prices Bid	Jan. 3 Selling Prices Asked	Jan. 9 Selling Prices Bid	Jan. 9 Selling Prices Asked
Copper	£ s d		£ s d	
London, standard spot	133 10 0		133 0 0	
Prime Lake	29.00	to 29.50†	28.25	to 28.75†
Electrolytic	28.00	to 29.00†	27.75	to 28.25†
Casting	27.00	to 28.00†	27.00	to 27.50†
Copper wire base	36.00†		34.25†	
Lead	7.50		7.50	
Nickel	50.00		50.00	
Sheet zinc, f.o.b. smelter	21.00		21.00	
Spelter, spot	9.67½	to 9.92½	9.42½	to 9.67½
Tin, straits	42.75†		42.60†	
Aluminum, 98 to 99 per cent	55.00	to 58.00†	54.00	to 57.00†

OLD METALS

Heavy copper and wire	24.00 to 25.00†	23.00 to 23.50†
Brass, heavy	14.12 to 15.50†	14.50 to 15.50†
Brass, light	10.50 to 11.00†	11.00 to 11.50†
Lead, heavy	6.50 to 6.62½†	6.50 to 6.62½†
Zinc, scrap	6.00 to 6.25†	6.00 to 6.50†

COPPER EXPORTS

Total tons to Jan. 9 6162

†Nominal.

BOSTON EDISON COMPANY BORROWS MONEY CHEAPLY

President Edgar Discusses Its Financial Affairs Before the Massachusetts Commission and Says the Company Has the Best Credit in the City Because It Has No Permanent Debt

At a hearing Dec. 29 before the Massachusetts Gas and Electric Light Commission upon a petition for stock increase, President C. L. Edgar, of the Edison Electric Illuminating Company of Boston, discussed the financial policies of his organization at considerable length. Mr. Edgar pointed out that the more money the company can borrow temporarily the cheaper its financial administration becomes. The company has paid as low as 3 per cent. and as high as 6 per cent. for money in the past three or four years. At the moment it looks as though money would be considerably higher in 1917 than in 1916. Money is to-day 4.5 per cent. "The Boston company," Mr. Edgar stated, "has prided itself on having the best credit in town. I think we can borrow money as cheaply as anybody on the street, entirely due to the fact, as bankers tell us, that there is no permanent debt. We have $22,000,000 par value of capital and $15,000,000 of premium, but we would have to consider the par value of the capital in striking a proportion to put out in a bond issue rather than capital and premium. Our conditions are rather different from those in other states and in different kinds of corporations. I think it is perfectly true that we can afford to have $5,000,000, possibly $10,000,000 of bonds out. I don't think it would save us much money, however.

"For instance, we could put out nothing less than a 5 per cent. bond. Some bankers have told me within a month that they didn't think we could put out a 5 per cent. bond at par. We are paying 12 per cent., but we are paying it on a price of $215 and not $180. The very theory of the Massachusetts law is that the people who bought their stock in the earlier days have had it automatically watered by the state, and when we put out our stock under your order at $215 we have to pay a dividend and a proper dividend on the $215. (The commission here disclaimed responsibility for dividends.) Of course, the men who got the stock at $100, $125 and $175 are getting a larger return than the people who got it at $215. As you know, we have tried seriously to have that law changed and have not succeeded and we thoroughly believe that the law is bad."

Mr. Edgar pointed out that the relation between the market price and the dividend is very uncertain. The company's stock sold up to $300 when it was paying 10 per cent., but that did not mean that it was worth it. It is in the management's interest to have the stock put out at the highest price that it believes it will bring. The setting of the price is purely a matter of judgment between the directors and one or two bankers who are consulted. The value of what the stock represents cannot be taken into consideration. If the stock is issued at too high a figure to be taken, it becomes a reflection on the judgment of the management. Market conditions have been very erratic during the last six months and may be worse.

"If we had any material amount of bonds," said Mr. Edgar, "I feel very sure that our financial condition would not be as good as it is to-day. I am perfectly willing to admit, on the other hand, that the time may come, and come soon, when we may have to issue bonds." The witness said that the time is coming when Boston will not absorb all the stock the company will need. The company has no sale for its stock at present outside Massachusetts. "We could no more sell stock in London, as some of the big companies have done, than we could fly," said Mr. Edgar, "because we haven't given the kind of security that the rest of the world has given."

Mr. Edgar said that there is no question about the ability of the company to sell bonds. The first bond step is a difficult one because it starts a policy which inherently leads to a company's being a bond rather than a stock company. Commissioner Schaff stated that the long-established policy of the British Empire, including Canada, requires that from 25 to 33 1/3 per cent. of all additional capital shall go out as bonds, low interest bearing liabilities. "That has been tried for nearly fifty years," said the commissioner, "and there has not been a wreck in all the history of England, Scotland and Ireland of all their company plants." Mr. Edgar maintained that it does not follow that the customers profited by the English and Canadian policy. Although it may be a good point that a reasonable amount of bonds does not weaken the credit of those companies, it does not at all follow that the Canadian companies could not sell energy at a lower price if they financed themselves in some other way. Not over 200 to 300 shares of Boston Edison stock are sold on the average each week.

Corporate and Financial

Commonwealth Edison Company, Chicago, Ill.—A 10 per cent increase in the capital stock of the company has been voted by the stockholders and the directors of the company and has been authorized by the State Public Utilities Commission of Illinois. The amount of the increase is $4,583,900. This will bring the company's total authorized issue of capital stock to $50,000,000. The stock is now being offered to stockholders of record Jan. 10, 1917, and is to be paid for in four installments, Feb. 1, May 1, Aug. 1 and Nov. 1. The money is to be used for general extension of the company's business.

Georgia Railway & Power Company, Atlanta, Ga.—The accrued and unpaid dividend of 24 per cent on the $2,000,000 first preferred cumulative 6 per cent stock has been declared payable Jan. 15 to holders of record Jan. 5 as follows: 3 per cent in cash and the remaining 21 per cent in non-interest bearing script maturing at the rate of $30,000 each six months, beginning July 1 next and ending Jan. 1, 1924. This is subject to the approval of the Georgia Railroad Commission. The commission has also been asked to authorize the issuance of $459,000 of 5 per cent first and refunding mortgage bonds of 1914 on account of improvements and additions and lands acquired, and also $283,000 of Georgia Railway & Electric Company refunding and improvement mortgage 5 per cent bonds of 1907 on account of capital outlays. It is understood that the company has acquired the properties of the Franklin Light & Power Company, Broad River Power Company and the J. B. McCrary Company at Hartwell, Ga.

Northern Idaho and Montana Power Company.—After an examination of the property a plan of reorganization has been formulated for the purpose (1) of preserving the property of the company, (2) of reducing the fixed charges to an amount safely within the net earning capacity of the reorganized property, and (3) of providing adequate capital for present and future requirements. Consideration has been given to the holders of the floating debt and of the preferred and common stock; $2,426,550 par value of common stock will be given to the holders of the floating debt with the arrangement, however, that they shall offer this stock to the preferred and common stockholders at $15 per share. Particular attention is called to the fact that $1,742,500 par value of bonds of the company, owned by the Standard Gas and Electric Company, H. M. Byllesby & Company and William P. Bonbright & Company, Inc., will be subordinated to the other bonds of the company, and under the plan, if carried out, will receive for these bonds only $87,125 in new bonds and the remainder in new preferred and common stock. Should the plan not be carried out, the bonds owned by these companies will, of course, share the same as other bonds of the company. Should any other holder of bonds desire to do so, he may, by electing at time of deposit, exchange his bonds on the basis of the exchange of the Standard Gas & Electric Company, H. M. Byllesby & Company and William P. Bonbright & Company, Inc., up to the amount of the securities available for that purpose, the election of bondholders to be accepted in the order received until the amount of securities is exhausted. The holders of bonds, preferred and common stock desiring to participate in the reorganization must deposit their securities on or before April 1. The provisions of the plan will result in these new securities: bonds, $3,000,000; preferred stock, $1,794,150; common stock, $5,000,000.

New Utility and Industrial Companies

The Canyon Light & Power Company of Wallace, Idaho, has been incorporated with a capital stock of $100,000.

The Pomeroy (Pa.) Utility Company has been incorporated with a capital stock of $1,000 by H. P. Collins and others.

The Philip (S. D.) Light & Power Company has been chartered with a capital stock of $10,000 by O. K. Whitney and others.

The Wood River Power Company of Hailey, Idaho, has been chartered with a capital stock of $27,500 by I. E. Rockwell, L. R. W. Rockwell and E. W. Rising.

The Farmers Light & Power Company of Kalona, Iowa, has been chartered with a capital stock of $10,000. Joseph C. Brenneman is president and C. C. Yoder is secretary.

The South Bay Power Company of Toronto, Ontario, Canada, has been incorporated with a capital stock of $1,000,000 by Alexander Fasken, James Aitchison, 36 Toronto Street, Toronto, and others.

The Del-Home Light Company of St. Louis, Mo., has been incorporated with a capital stock of $15,000 to manufacture electric light fixtures, etc. The incorporators are: W. O. Waldsmith, F. W. A. Vesper and others.

The Sherrard (Ill.) Power Company has been incorporated with a capital stock of $30,000 to supply electricity for lamps and motors in Sherrard. The incorporators are: D. W. Bowen, B. Bowen and Joseph Klucker.

The Allis-Chalmers Manufacturing Company will spend about $50,000 in enlarging its Bullock works, in Norwood, near Cincinnati. Five separate buildings will be constructed, giving some needed working space.

The Michigan Power & Paper Company of Toronto, Ont., Can., has been incorporated with a capital stock of $6,500,000 by William A. J. Case, 801 Dominion Bank Building, Toronto; James B. Taylor, William B. Smith and others.

The Electrical Supply Company of Joplin, Mo., has been chartered with a capital stock of $10,000 by C. H. Belden, E. M. Confer and Rex Chamberlain. The company proposes to deal in electrical supplies, equipment and appliances.

The Super Lighting Company of New York, N. Y., has been incorporated by A. M. Sullivan, F. E. Hebberd and S. S. Meyers, 318 West 100th Street New York, N. Y. The company proposes to manufacture optical system for headlights, signals, beacons, etc.

The American Sleeve Valve Motor Company of Wilmington, Del., has been incorporated, with a capital stock of $3,000,000, to carry on a general mechanical and electrical engineering business. The incorporators are: S. C. Seymour, F. R. Hansell and H. B. Martin.

The Amsden-Ferguson Company of Buffalo, N. Y., has been incorporated with a capital stock of $50,000 to manufacture and deal in lanterns, lamps, igniting devices, etc. The incorporators are: R. F. and H. F. Ferguson, T. G. Amsden, 238 DeWitt Street, Buffalo, N. Y.

The Fleischmann Illuminating Company of New York, N. Y., has been chartered with a capital stock of $20,000 by W. Rosenfeld, S. and N. Louden, 26 West 111th Street, New York City. The company proposes to deal in Fleischmann's light, heat, power and electric appliances.

Horace Keane, Inc., has filed articles of incorporation with a capital stock of $17,000 for the purpose of manufacturing and dealing in lighting appliances, effects, etc. The incorporators are: F. E. Hebberd, A. M. Sullivan and H. M. Keane, 165 Audubon Avenue, New York, N. Y.

The Lustrolite Electric Company of New York, N. Y., has been incorporated by J. Zwicki, A. McVicker and J. H. Conor, 222 West Forty-second Street, New York City. The company is capitalized at $25,000 and proposes to do a general contracting, electrical and mechanical engineering business.

The Lapp Insulator Company of Leroy, N. Y., has been incorporated by S. Levy, H. W. Rippey and J. B. Abbott of Geneseo, N. Y. The company is capitalized at $150,000 and proposes to manufacture and deal in electrical and mechanical apparatus, hardware, insulators, rubber, pottery, porcelain, etc.

The Central Utilities Company of Milwaukee, Wis., has filed articles of incorporation under the laws of the State of Delaware, with a capital stock of $200,000. The company proposes to take over small utility plants and operate them under one management. The directors are: W. N. Albertson, E. M. McVicker and others.

The Dyneto Electric Corporation of Albany, N. Y., has been incorporated to take over the business of the Dyneto Electric Company, which manufactures motors, dynamos, mechanical and electrical engineering supplies. The incorporators are: G. D. Mackay, H. Taffer and H. A. Rosenburg, 19 Cedar Street, New York, N. Y.

The International Electric Signal Company has filed articles of incorporation under the laws of the State of Delaware. The company is capitalized at $1,500,000 and proposes to install electric and pneumatic systems of signalling. The incorporators are: Samuel B. Howard, Joseph F. Curtin and Arthur Britton, all of New York, N. Y.

The Keystone Utilities Company has filed articles of incorporation under the laws of the State of Delaware. The company is capitalized at $5,000,000 and proposes to act as a holding corporation to a number of light and power properties located in Pennsylvania, which include the Hanover (Pa.) Light & Power Company, Hanover & McSherrystown Street Railway Company, Gettysburg (Pa.) Electric Company, Dubois (Pa.) Electric & Traction Company and the Susquehanna (Pa.) County Light & Power Company. Among the directors are: Frederick J. Platt, president of the Scranton (Pa.) Electric Construction Company; Everett J. Lynett, James A. Linen, Jr., all of Scranton, and others.

Trade Publications

Oil Engines.—The International Steam Pump Company, Buffalo, N. Y., has issued an illustrated and descriptive folder of its oil engines.

Arc Welding.—Electrical arc welding equipments, leaflet 3668-B, describing the equipment furnished for arc welding and explaining and illustrating the various places in which this form of weld may be successfully applied has been recently issued by the Westinghouse Electric & Manufacturing Company.

Industrial Equipment.—Bulletin No. 114, which is descriptive of a modern lumber mill, its electrical and mechanical equipment, has recently been prepared by the Wagner Electric Manufacturing Company of St. Louis. The bulletin is well prepared and shows many views of actual installation in mills.

Mine Substations.—Substations for mines are thoroughly described and illustrated in leaflet 3697 just issued by the Westinghouse Electric & Manufacturing Company in which a discussion is given of the use of motor generators and rotary converters for mining work. Installation views of mine substations are shown.

Textile Industry.—"The Silk-Throwing Industry in Northeastern Pennsylvania," by G. F. Smith and Elmer L. Kyle, a reprint of an article which appeared in the *Electric Journal*, September, 1915, has just been issued in pamphlet form by the Westinghouse Electric & Manufacturing Company. This paper describes the textile industry in northeastern Pennsylvania, and describes the operations performed by the machines used.

Motors, Generators and Regulators.—Among the publications recently issued by the Westinghouse Electric & Manufacturing Company are the following: Self-contained vertical shaft alternating-current generators, leaflet 3555-A, describing by means of diagrams and photographs the construction of this type of generator, particular attention being given to the Kingsbury thrust bearing used therein. Alternating-current motors for driving grinders, leaflet 3903. The particular features of the motor adapting it for this type of work are emphasized and illustrated. Leaflet 3927, on the automatic operation of induction feeder-voltage regulators. This is a comprehensive treatise on this subject, representing the latest developments in this type of apparatus, the demand for which has been very great during the past several months.

New England

ANTRIM, N. H.—The Public Service Commission has approved the sale of the electric properties owned by the Goodell Company of Antrim to the Antrim-Bennington Electric Light & Power Company, recently incorporated. The latter company has also been authorized to do business in the towns of Antrim, Bennington, Hancock and Greenfield.

BOSTON, MASS.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Jan. 16 for furnishing and installing exhaust steam system and furnishing ammeters, voltmeters annunciators, electrical supplies, etc., and turbo-generating sets at the navy yard, Boston Mass.

NORWOOD, MASS.—The general contract for addition to the municipal electric-light plant has been awarded to Walter Smith.

WORCESTER, MASS.—A contract has been awarded by the Wright Wire Company for the erection of a factory building, 64 ft. by 230 ft., at its local plant, to be equipped with a 2-ton electric traveling crane. The company will also build a boiler house at the plant.

BRIDGEPORT, CONN.—The City Council is considering extensions to the street-lighting system, including the installation of 69 ornamental units, 50 arc lamps and 60 tungsten lamps.

HARTFORD, CONN.—Further extensions are contemplated to the power plant of the Hartford Electric Light Company at Dutch Point, including the installation of a 10,000-kw turbo-generator and two boilers of the Bigelow-Hornsby type, for which orders have been placed. The company has filed a petition with the Secretary of State asking permission to extend its system to Manchester to supply electricity for commercial purposes. Samuel Ferguson is vice-president.

Middle Atlantic

ANTWERP, N. Y.—Plans are being considered by F. X. Beaumert & Company for the construction of a hydroelectric-light plant. Anderson & Jones of Carthage are architects.

ATTICA, N. Y.—At an election held recently the proposal to purchase the electric plant and water-works system of the Attica Water, Gas & Electric Company, to be owned and operated by the municipality, was carried.

BUFFALO, N. Y.—Drawings for the proposed substation of the New York Central Railroad Company at Bond and Clinton Streets as part of the $6,000,000 passenger and freight terminal development proposed south of Exchange and east of Washington Streets have been submitted to the Terminal Commission by the architects for the New York Central lines.

DUNKIRK, N. Y.—The Dunkirk Electric Manufacturing Company has notified its patrons that it will close down its electric plant the 15th of January.

HENDERSON, N. Y.—Application has been made to the Public Service Commission for approval of the transfer of the lighting system, owned by George N. Wilson to C. W. Valentine and M. B. Steele. The new owners contemplate the installation of a new lighting system in Henderson and Henderson Harbor and to establish a 24-hour service. Energy will be secured from the Northern New York Utilities Company, through the Adams power station. The company will be known as the Lake Shore Electric Company.

ITHACA, N. Y.—The Cayuga Power Company is contemplating extending its service to Dryden and also to Groton to supply energy to the Corona Typewriter Company. The company also contemplates erecting a transmission line from Ithaca to Groton via Freeville, with branch lines to villages in that vicinity.

NEW YORK, N. Y.—The By-Products Company, 10 Broadway, New York City, is contemplating the erection of addition to the boiler house at its plant on Shooter's Island, near Staten Island, to cost about $125,000. A new tankage plant will also be erected at a cost of about $150,000.

NEW YORK, N. Y.—Steps have been taken by the Public Service Commission looking to the installation in the near future of additional entrance and elevator facilities at the station of the first subway at Broadway and 168th Street. It is proposed to install shafts for four new elevators and to install two elevators at once and also to construct a mezzanine entrance and a new bridge across the tracks. The cost is estimated at $200,000.

ROCHESTER, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until Jan. 30 for construction, heating and electric work of additions to Livingston Building (additional accommodation for disturbed patients), Rochester State Hospital, Rochester, Drawings and specifications may be consulted at the Rochester State Hospital; at the New York office of the Department of Architecture, 1224 Woolworth Building, and at the Department of Architecture, Capitol, Albany. Drawings and blank forms of proposal may be obtained at the Department of Architecture, Capitol, Albany. Lewis F. Pilcher is state architect.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

SALAMANCA, N. Y.—Plans are being considered for extensions to the municipal electric-light and water plant, to cost from $12,000 to $15,000. H. E. Heller is superintendent.

SYRACUSE, N. Y.—The plans prepared by Henry C. Allen, city engineer, for the elimination of grade crossing on the New York Central, West Shore and Lackawanna Railroads, to cost about $8,000,000, including electric track installation, the cost to be divided between the city, state and railroads, it is reported, have been approved by Bion Arnold, engineer, of Chicago, Ill.

TROY, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Jan. 31 for changes in plumbing, conduit and wiring and lighting fixtures in the United States post office, court house, etc., in Troy, N. Y. For details see proposal columns.

UNADILLA, N. Y.—The Standard Light, Heat & Power Company of Unadilla, which recently purchased and consolidated a number of electric plants in Delaware and Otsego Counties, has applied to the Public Service Commission for approval of the erection of transmission lines connecting the various isolated plants.

CHARLEROI, PA.—The Town Council has entered into a contract with the West Penn Power Lighting Company for street-lighting, under the terms of which the company is to install new street lamps, consisting of twelve 600-watt, six 400-watt, fifty-five 250-watt, thirty-five 100-watt, and sixty-three 80-watt lamps. The contract is for a period of ten years.

CHESTER, PA.—The Consumer's Ice Company is planning to double the capacity of its local ice manufacturing plant. The installation will include two water tube boilers, engine and a 75-ton ice machine. The cost of the work is estimated at $125,00.

DENVER, PA.—The Denver Street Railway Company, recently incorporated with a capital stock of $130,000, is planning to build an electric railway from Denver to Ephrata, a distance of 5 miles. H. S. Distler is president of the company.

HAZLETON, PA. — The Pond Creek Mines, it is reported, will be equipped for electrical operation. The Harwood Electric Company will supply energy to operate the mines.

LANSDOWNE, PA.—The Counties Gas & Electric Company, of Norristown, has been granted permission by the Public Service Commission to acquire the capital stock and control of the Lansdowne Construction Company, operating electric properties at Lansdowne and vicinity.

NEW CASTLE, PA.—The Council has awarded the contract for installation of an ornamental-lighting system. (three-lamp clusters) on Long Avenue and South Mill Street to the Price Electric Company, at $8,856.

NEW CASTLE, PA.—Charters for sixteen companies all of them affiliated with the Mahoning & Shenango Railway & Light Company of Youngstown, Ohio, to operate in Mercer, Lawrence and Butler Counties of Pennsylvania have been granted by Governor Brumbaugh as follows: Jackson Township of Butler; Big Beaver Township of Lawrence; Shenango Township of Lawrence; Wayne Township of Lawrence; Big Beaver Township of Lawrence; Big Beaver Township of Beaver; Franklin Township of Beaver; North Sewickley Township of Beaver; Borough of Farrell of Mercer; Borough of West Middlesex of Mercer; Borough of Wheatland of Mercer; Hickory Township of Mercer; Pymatuning Township of Mercer; Shenango Township, Mercer and Williamton township, Mercer Light & Power Companies. By the granting of these charters the plans of the Mahoning & Shenango Railway & Light Company are completed for the extension of transmission lines throughout the Sharon and New Castle industrial districts. Each company will be capitalized at $10,000 and will have offices in New Castle and are to operate in districts of the names taken and in counties names in the corporate title. The incorporators are: J. C. Chestnut, L. B. Round, H. N. Wood and M. Pendleton, all connected with the Mahoning and Shenango Company and C. H. Akens, attorney for the company at New Castle.

PHILADELPHIA, PA.—A new electric power plant will be built in connection with extensions at the hospital for the insane at Blockley. Contract for the structure has been awarded by the city.

PHILADELPHIA, PA.—Plans are being prepared by the General Scientific Equipment Company, 2719 West Lehigh Avenue, Philadelphia, for the erection of a factory, 110 ft. by 124 ft., three stories high, to provide adequate manufacturing facilities. The company proposes to manufacture scientific instruments, hydrometers, thermometers, etc., Maurice Kline is manager.

POTTSVILLE, PA.—The City Council will readvertise for bids for street-lighting. The Schuylkill Gas & Electric Company of Mahanoy City has submitted a proposition to supply the service at a lower rate than the Eastern Pennsylvania Light, Heat & Power Company, which now furnishes the service here.

WHITE HALL, PA.—The Lehigh Navigation Electric Company of Hauto is planning to erect new transmission lines in the township of White Hall, where it has been granted a franchise.

BURLINGTON, N. J.—Mayor E. E. Mount in his annual address to the City Council recommends the establishment of a municipal electric-light plant, with appointment of a committee to acquire the necessary data.

ELIZABETH, N. J.—In his annual message to the City Council Mayor Mravlag recommends the establishment of a municipal electric light plant in Elizabeth.

JERSEY CITY, N. J.—The Board of Freeholders is considering plans for increasing the output of the electric-light plant in Court House to furnish service for all county buildings and roads.

PERTH AMBOY, N. J.—The report of Thomas Grieve, superintendent of the water-works, submitted to the water commissioners, electrically operated pumping station and additional filtering basins. The cost of the improvements, exclusive of filtering basins, is estimated at $50,000.

SALEM, N. J.—The local plant of the Electric Company of New Jersey will be closed down soon, when energy for the system in Salem will be supplied from Bridgeton and Wilmington.

CUMBERLAND, MD.—Plans are being prepared for the erection of a manufacturing plant for the Kelly Springfield Tire Company in Cumberland, consisting of four or five factory buildings, storage building, emergency hospital, power plant, pump house and office building, to cost about $200,000. Edward Necarsulmer, 507 Fifth Avenue, New York, N. Y., is architect; S. Dieschler & Sons, Farmers Bank Building, Pittsburgh, Pa., are engineers. F. A. Seaman, Broadway & Fifty-seventh Street, New York, N. Y., is secretary.

ST. HELENA, MD.—Plans and specifications are being prepared by the Roland Park Company for an industrial city residential development for the employees of the Bethlehem Steel Corporation of Sparrows Point plants, involving an ultimate expenditure of from $4,500,000 to $5,000,000. The entire project will utilize about 700 acres; 300 acres will be used for the first unit; the improvements for this year will include the erection of several hundred houses (ultimately several thousand houses), roads, paved streets, water supply electric-lighting, sewers, playgrounds, athletic fields, etc. E. H. Bouton, 400 Roland Avenue, Roland Park, is president.

CHARLESTON, W. VA.—Bids will be received by the Board of Education, Charleston, W. Va., until Jan. 23 for construction of Junior High School, separate bids to be submitted on electrical work and plumbing. Revised plans and specifications are on file at the office of Frank L. Packard, architect, Columbus, Ohio, and at school building. W. O. Daum is secretary.

LOGAN, W. VA.—Preparations are being made by the Logan County Light & Power Company for the erection of an addition to power plant, to cost about $200,000. Bids, it is understood, will soon be asked. F. R. Weller, Hibbs Building, Washington, D. C., is engineer.

MORGANTOWN, W. VA.—Bids will be received by the State Board of Control, Charleston, W. Va., until Feb. 14 for furnishing material and construction of the

following buildings for the University of Virginia as follows: one agricultural building, 85 ft. 9 in. by 188 ft., three stories and basement, including heating, electrical work and plumbing; one girls' dormitory building 42 ft., 9 in. by 220 ft., 40 m., three stories and basement, including heating, electrical work and plumbing. Plans and specifications may be obtained at the office of the State Board of Control, Charleston, upon deposit of $10. Paul A. Davis, 3rd, 1713 Sansome Street, Philadelphia, Pa., is architect.

WINCHESTER, W. VA.—The Northern Virginia Power Company of Winchester, which for some months has been endeavoring to institute condemnation proceedings to acquire certain rights on the Shenandoah River near its plant, has won a decision before Judge Woods in the circuit court in Charleston, W. Va. The company proposes to make extensive improvements, raise the dam and increase the output of its plant.

NORFOLK, VA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Jan. 15 for furnishing two 300-kw. motor-generator sets and switchboard at the navy yard, Norfolk.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Brooklyn, N. Y., Schedule 611—25,000 ft. telephone cable; Schedule 610—miscellaneous copper tubing; Schedule 611—120,000 ft. twin conductor wire, 200 fire control telephones. Mare Island, Cal., Schedule 617—miscellaneous fittings, bushings and switches, 18 electric flatirons and 18 portable ventilating sets. Applications for proposal blanks should designate the schedule desired by number.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Boston, Mass., Schedule 591—2500 lb. copper bar. Newport, R. I., Schedule 602—250,000 lb. unannealed brass tubes, 25,000 lb. brass tubing; Schedule 604—25,000 ft. iridium platinum wire. Philadelphia, Pa., Schedule 593—one pile driver engine and boiler. Mare Island, Cal., Schedule 586—one 30-kw. generator. Applications for proposal blanks should designate the schedule desired by number.

North Central

DETROIT, MICH.—The contract for construction of an ice manufacturing factory and power plant, one and two story, 141 ft. by 128 ft. for Pittman & Dean, coal and ice dealers, 10 West Adams Avenue, has been awarded to Pine & Munnecke Company, 115 State Street.

LOWELL, MICH.—The municipal electric-light plant on Dec. 31 toppled over into the river and was practically destroyed. The accident is supposed to be due to quicksand upon which the concrete foundation is believed to have been built. The plant is valued at $60,000 and it is a question whether the generator and other equipment can be saved. Power will be furnished by the Edison company until the plant is rebuilt.

AKRON, OHIO.—The local power plant of the Northern Ohio Traction & Light Company was recently damaged by fire, causing a loss of about $12,000.

BLOOMVILLE, OHIO.—E. C. Snyder, receiver of the Bloomville Light & Heating Company, has petitioned the Seneca County Common Pleas Court to authorize the operation of the plant to be discontinued, which is now being operated at a loss. The Ohio Light & Power Company of Tiffin is erecting a transmission line from Tiffin to Bloomville.

CANTON, OHIO.—Extensive improvements and extensions are contemplated by the Central Union Telephone Company in Canton, involving an expenditure of about $150,000. The local system will be practically reconstructed. A new exchange building will be erected or a large addition will be made to the present structure.

CLEVELAND, OHIO.—The National Acme Company, 212 East 131st Street, Cleveland, contemplates the construction of a power plant, to cost about $16,000.

CLEVELAND, OHIO—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, until Jan. 17 for a gas engine-driven generating unit for the division of the city farm at Warrensville, Department of Public Welfare. Specifications may be obtained upon application to the secretary to the director of public welfare, Room 327, City Hall.

CLEVELAND, OHIO.—The general contract for the construction of five mercantile buildings, consisting of an ice rink, two stories, 154 ft. by 261 ft.; store and hotel, four stories, 74 ft. by 51 ft.; store and hotel, five stories, 101 ft. by 120 ft.; market house, one story, 150 ft. by 150 ft., and power and refrigerating plant for the Euclid Loan Company, is reported to have been awarded to the Crowell, Landoff, Ltd. the Company, 1951 East Fifty-seventh Street. The total cost of the work is estimated at $600,000. The Allen, Osborne Company, Rose Building, has charge of the engineering work. A. J. Harvey, the Arcade, is president of the Euclid Loan Company.

LEIPSIC, OHIO.—The local plant of the Northwestern Ohio Light Company was badly damaged by fire recently.

LORAIN, OHIO.—The Public Utilities Commission has granted the Lorain County Electric Company permission to close a lease for the property of the Citizens Gas & Electric Company for a period of 25 years, at a total consideration of $250,000. Extensive improvements and extensions are contemplated.

MARIETTA, OHIO.—Plans are being considered by E. B. Young, president of the Hocking & Sunday Creek Traction Company for equipping the M. C. & C. railroad property for electrical operation. Energy will be supplied by the Hocking Power Company's electric power plant. The Hocking Power Company proposes to supply electricity for lamps and motors to towns along the railroad.

MANCHESTER, KY.—The installation of an electric-light plant in Manchester is under consideration. It is reported that $25,000 has been subscribed toward the project. A small bond issue will also be voted.

MURRAY, KY.—Contract for the construction of a municipal electric plant, it is reported, will be awarded Feb. 1. Bonds to the amount of $20,000 have been voted for the system.

NEWPORT, KY.—Plans are being considered by the City Commissioners to require all the public service companies to place their electric wires underground in the business section of the city.

STAMPING GROUND, KY.—Steps have been taken toward establishing an electric-light and power plant in Stamping Ground. W. W. Caficy is interested.

CONNERSVILLE, IND.—The Public Service Commission has granted the Connersville Hydro-Electric Light & Power Company, recently incorporated, permission to consolidate the Connersville Light & Power Company and the Hydro-Electric Light & Power Company with the new company. Authority to issue $240,000 in capital stock was also asked by the company.

DELPHI, IND.—The Council of Carroll County is considering the installation of a power plant in the new court house in Delphi to supply electricity for lighting and operating electric elevator in the new building. E. E. Dunlap of Indianapolis is architect.

FORT WAYNE, IND.—The Fort Wayne & Northern Indiana Traction Company is contemplating altering its boiler room, either by the addition of a 1000-hp. unit, equipped with underfeed stokers and erection of new smokestack, or by re-equipping the present boilers with underfeed stokers. The company will furnish energy to the new factories of the General Electric Company, which will require from 2000 to 3000 kw., which will be connected up about March 1. Two new 4-wire circuits (copper wire, 4000 volts), eadh 1½ miles long, will be erected to supply the service.

KOKOMO, IND.—The Indiana Railways & Light Company contemplates extensive improvements to its power plant in Kokomo, including the installation of four new boilers of 500 hp., to cost approximately $48,000; a 5000-kw. turbine with necessary auxiliaries, to cost about $90,000, and additional pumps, heaters and other devices, at a cost of $10,000. The installation of 250 new street lamps, to cost from $10,000 to $12,000, is also under construction.

MONGO, IND.—The Farmers & Merchants Light & Power Company, recently incorporated with a capital stock of $500,000, proposes to supply electricity for lamps and motors in this section. Hiram Himebaugh is interested in the company.

ROCHESTER, IND.—Beginning with January 1, 1917, the business of the Rochester Electric Light, Heat & Power Company will be operated under the name of the United Public Service Company, which has operated some of the Rochester company's extensions for about two years. No change has been made in the officers and management. Charles A. Davis is treasurer.

SALEM, IND.—Options, it is reported, have been taken by the Inter-State Service Company of Indiana for the construction of a new plant in Salem. Temporary repairs have been made to the local plant following the recent fire.

SULLIVAN, IND.—The Vandalia Coal Company, which is now sinking two large mines east of this city, it is reported, will erect a large power plant to supply electricity to its mines in this district and to the proposed new traction line, which it is stated, will be built next summer from Sullivan to Linton, through Dugger, thence through Bruceville and Bicknell to Vincennes.

CHICAGO, ILL.—The general contract for construction of boiler house addition to central power station of Swift & Company, Chicago, has been awarded to the C. A. Moses Construction Company, 133 Washington Street. The cost is estimated at $50,000. Oscar Shanks is engineer.

JACKSONVILLE, ILL.—Bids will be received by the Board of Commissioners of the Valley Drainage & Levee District, at the office of the Jacksonville Engineering Company, City Hall Building, Jacksonville, until Jan. 22 for furnishing and directing a 125-hp. oil engine, additional building, etc.

TAYLOR SPRINGS, ILL.—The City Council has granted the Southern Illinois Light & Power Company of Hillsboro a franchise to construct a line to the smelter of the American Zinc Company.

AMERY, WIS.—Plans have been completed, it is reported, by the Apple River Milling Company of Amery for the construction of a power plant. J. C. Jacobson, Security Building, Minneapolis, Minn., is architect.

GREEN BAY, WIS.—The Wisconsin Public Service Company contemplates the construction of a 500-kw. auxiliary steam station in Manitowoc; also the reconstruction of the 7-mile transmission line of the Manitowoc & Northern Traction Company between Manitowoc and Two Rivers to supply energy for lamps in Two Rivers and for operating the railway.

IRON RIVER, WIS.—A company is being organized by T. N. Okerstrom of Port Wing, backed by Minneapolis men, to construct a power plant on the Iron River at the falls at a point 2 miles from the mouth of the river.

NEWBURG, WIS.—Plans are being considered by Dr. H. F. Weber of Newburg for the construction of an electric-light plant to supply electrical service in the villages of Newburg, Boltonville, Saukville and other smaller villages.

RACINE, WIS.—Plans are being prepared for the erection of an addition to the power plant of the Milwaukee Electric Railway & Light Company in Racine, to cost about $18,000.

HIBBING, MINN.—The village of Hibbing, it is reported, has postponed indefinitely the construction of the proposed new municipal electric-light plant. C. L. Pillsbury, Metropolitan Life Building, Minneapolis, is consulting engineer.

ST. PAUL, MINN.—The installation of an ornamental lighting system on Robert Street, between Eighth Street and Central Avenue, to cost about $8,357, has been approved by the Council. Plans are also being considered for the installation of ornamental lamps on Rice Street, between University Avenue and Maryland Street, on Cedar Street from Third Street to Central Avenue, and on Third Street, from Jackson to Robert Street.

VICTORIA, MINN. — The Waconia (Minn.) Light & Power Company has been granted a franchise to erect a transmission line into the village of Victoria.

IOWA CITY, IOWA.—The Capitol City Electric Company of Des Moines submitted the lowest bid ($11,781) for electric wiring for three school buildings in the First Ward.

LANESBORO, IOWA.—The local electric-light plant, owned by J. R. Davis, was recently destroyed by fire.

SPENCER, IOWA.—Contract for equipment for the municipal electric-light, consisting of two 300-hp. water tube boilers, with type "E" stokers; one 375-kva. direct connected unit, tandem compound Corliss engine, and one switchboard complete, at a total of $38,705, has been awarded to the Northwestern Electric Equipment Company of St. Paul, Minn. W. E. Skinner, 715 Plymouth Building, Minneapolis, Minn., is consulting engineer.

KANSAS CITY, MO.—Plans have been prepared by Wight & Wight, Kansas City, for the construction of an interurban terminal station in this city for the Kansas City Interurban Terminal Company, to cost about $1 400.000. Franchise is now pending in the City Council.

COURTNEY, N. D.—An election will

soon be held to submit the proposal to issue bonds for the installation of a municipal electric-light plant to the voters.

KENSAL, N. D.—Plans are being considered for the installation of an electric-light plant in Kensal. Anton Feckler is reported interested.

GARRETSON, S. D.—Bonds to the amount of $18,000 have been voted for additional equipment for the municipal electric-light plant.

MALMO, NEB.—At a special election to be held Jan. 16 the proposal to issue $3,500 in bonds for the installation of an electric-lighting system will be submitted to the voters.

OMAHA, NEB.—Plans are nearly completed for the construction of a steam and electric bakery, to cost about $100,000, in Omaha, for the Union Pacific Baking Company. The C. D. Cooley Company of Pittsburgh, Pa., and Kansas City, Mo., are architects.

ANTHONY, KAN.—Bids will be received by W. R. Canaan, city clerk, until Jan. 24, for furnishing and erecting one steam engine and generator, directly connected, at the municipal electric plant. Bids are requested on two units as follows: one 150-kw. direct-connected unit, consisting of one 150-kw. generator and steam engine, and switchboard, and on one 75-kw. generator and steam engine, directly connected, and switchboard. Only one of the above units will be purchased. Specifications are on file at the office of the city clerk, Anthony, and at the office of Black & Veatch, Inter-State Building, Kansas City, Mo.

LA CROSSE, KAN.—At an election held recently the proposal to issue $12,500 in bonds for the installation of a municipal electric-light plant and $40,000 for water-works system was carried. Stevens & Stiles, 221 Commerce Building, Kansas City, Mo., are engineers.

LENORA, KAN.—Bids will be received at the office of C. W. Thuma, city clerk, Lenora, until Jan 30 for construction of a municipal electric-light plant as follows: (1) For internal combustion engines installed complete on foundations built under separate contract. Bids to be submitted on the following combinations: two 25-hp., one 25-hp., one 35-hp., and two 35-hp. (2) Two 20-kw. alternators, two 25-kw. alternators, one 20-kw. and one 25-kw. alternator; one constant-current transformer, switchboard and all station equipment. (3) Furnishing all material for transmission lines. (4) Furnishing material not named in "List of Materials" and labor for erecting station and all station equipment. Plans and specifications are on file in the office of the city clerk and at the office of George P. Taylor, engineer, Stockton, Kan.

MUNDEN, KAN.—At an election held recently the proposal to issue $20,000 in bonds for the installation of an electric-light plant and water-works system was carried. Stevens & Stiles, Commerce Building, Kansas City, Mo., are engineers.

WICHITA, KAN.—The Arkansas Valley Interurban Railway Company, it is reported, contemplates the construction of three extensions, work to begin next spring; from Hutchinson to Kinsley and Great Bend, and from Newton to Salina.

Southern States

ATLANTA, GA.—The Georgia Railway & Light Company has decided to replace the 313 flaming arc lamps now in use throughout the city with nitrogen-filled lamps.

PENSACOLA, FLA.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Jan. 16 for furnishing transformers at the navy aeronautic station at Pensacola. Further information may be obtained at the above bureau or to the supply officer at Pensacola.

BEARDON, TENN.—Bids will be received by the Colonial Lumber Company, Beardon, until Jan. 31 for furnishing and erecting about 3 miles of wiring and from 300 to 500 lamps; poles and electricity to be supplied by the company, who will also consider the purchase of complete equipment for a 50-hp. plant for sawmill and electric lighting; gas engine to be used. J. D. Wyrick is manager of the company.

MONTGOMERY, ALA.—The Montgomery Light & Traction Company contemplates extending its street railway from Pickett Springs to Wetumpka, a distance of 9 miles, during 1917.

WOODVILLE, MISS.—Preparations are being made by the city of Woodville to install additional machinery in the municipal electric-light and water plant, including one 75-hp. fuel oil engine, semi-Diesel type; belt-driven air compressor and one two-stage centrifugal pump having a capacity of 250 gal. per minute. Bids have been received for the above equipment.

CHARLESTON, ARK.—The City Council has granted the People's Service Company, which has purchased the electric plant at Paris, a 25-year franchise to supply electricity in Charleston.

MINERAL SPRINGS, ARK.—The Nashville Ice, Coal & Light Company of Nashville is contemplating extending its electric transmission lines to Mineral Springs. The lighting service is already within a few miles of this place.

SPRINGDALE, ARK.—The Springdale Light & Power Company contemplates rebuilding its system, including construction of new power house and lines. M. C. and C. C. Martin have recently taken over the property.

NEW ORLEANS, LA.—Plans are being considered for extensive improvement to the street-lighting system, provision for which has been made in the new contract with the New Orleans Railway & Light Company. Preliminary plans provide for the installation of about 1800 standards, which will be mounted with 250-cp. units.

VIDALIA, LA.—Plans are being considered for the installation of an oil engine in the municipal electric-light plant, which is now operated by steam power. The Council is also considering a proposal submitted by the Southern Railway & Light Company of Natchez, Miss., which provides for laying a cable by the company across the Mississippi River and supplying energy to the Vidalia switchboard.

COWETA, OKLA.—The town of Coweta is in the market for the purchase of one 100-hp. gas engine and one 75-kw. three-phase, 60-cycle, 2300-volt generator, directly connected. No belt-driven units will be considered. G. W. Obenchain is superintendent of the water and light department.

KAW CITY, OKLA.—At a recent election bonds to the amount of $25,000 were voted for the installation of an electric-lighting plant and water works system in Kaw City.

STROUD, OKLA.—Contract for improvements to the municipal electric-light plant and water-works system has been awarded to the Chicago, (Ill.) & Iron Company, at $30,000.

EL PASO, TEX.—Extensions and improvements to its power plant and system is under consideration by the El Paso Electric Railway Company.

LUBBOCK, TEX.—Estimates have been received by the City Council of the cost of the installation of a municipal electric-light plant. The cost is estimated at about $40,000.

WILLS POINT, TEX.—The capital stock of the Wills Point Electric Light Company has been increased from $10,000 to $20,000. The company contemplates improvements to its plants.

Pacific States

INDEX, WASH.—The Town Council has engaged G. N. Miller of Seattle to take charge of the engineering work in connection with the construction of a municipal electric-light plant. Notice of appropriation of water on Deer Creek to furnish power to operate the proposed plant has been filed with the county auditor. The Council is also considering plans to establish a municipal water-works system to be operated in conjunction with the electric plant.

KENNEWICK, WASH.—The City Council is considering a proposal submitted by the Pacific Light & Power Company for installing a new street-lighting system in the business section. The plans provide for replacing the carbon lamps now in use with nitrogen-filled lamps, and to substitute the prismatic Holophane shades for the metal shades now in use. The Council is considering entering into a 10-year contract for street-lighting with the company.

LYNDEN, WASH.—The City Council is considering the proposal of the Puget Sound Traction, Light & Power Company to extend the street-lighting system in Lynden.

PALOUSE, WASH.—The City Council has appointed a committee to investigate the proposition of granting a franchise to the Washington Water Power Company of Spokane to erect transmission lines and a distributing system in Palouse. The Council has also decided to ask the Washington-Idaho Light & Power Company of Lewiston, Idaho, to submit a proposal for lighting the streets and residences of the city.

SEATTLE, WASH.—Bids will be received by the Board of Public Works, Seattle, until Feb. 16 for construction and equipment of an addition to the Lake Union municipal steam auxiliary plant, for which $390,000 in bonds have been authorized by the City Council. The new addition will increase the output of the plant from 7500 to 15,000 kw. J. D. Ross is superintendent of lighting.

ASTORIA, ORE.—A. G. Spexarth of Astoria is planning the installation of an electric-light plant in the Spexarth Building in this city.

HALSEY, ORE.—The City Council has passed an ordinance providing for the installation of street lamps. A contract has been signed for street lighting for a period of five years with the Oregon Power Company of Eugene.

ARBUCKLE, CAL.—The Northern California Power Company of San Francisco contemplates building a substation in Arbuckle.

LOS ANGELES, CAL.—The Board of Works has contracted with the Southern California Edison Company of Los Angeles for the erection of a temporary electric transmission line for use in connection with the contruction of the Bellevue Avenue outfall sewer at Hyperion and for the maintenance of 37 lamp posts on Sixth Street.

PACOIMA, CAL.—Application has been made to the State Railroad Commission by the Tejunga Water & Power Company, Wright & Callender Building, Los Angeles, for permission to issue $150,000 in bonds for improvements in Big Tejunga Canyon, including additional pipe lines.

SACRAMENTO, CAL.—In the biennial report of George Radcliff, state superintendent of Capitol buildings and grounds, submitted to Governor Hiram W. Johnson, recommends that in drawings plans for the two new buildings of the Capitol extension, to cost about $3,000,000, that the architects be requested to prepare the basement plan of the new office building to provide space for an electric generating plant, making it possible for the state to supply electricity for all the departments.

SAN FRANCISCO, CAL.—City Engineer O'Shaughnessy has recommended to the Supervisors the award of the contract for installing the electric cables and lighting fixtures in the Twin Peaks tunnel to R. C. Storrie & Company, at $11,650.

SAN FRANCISCO, CAL.—Preliminary plans have been prepared by James J. Walsh of San Francisco, at the request of the local steamship operators, for an elevated electric railway along the water front from the channel to Fort Mason, about 2.8 miles, to cost approximately $1,120,000.

SANTA ROSA, CAL.—Application has been filed with the State Railroad Commission by the California Telephone & Light Company for permission to purchase the water systems of the Calistoga (Cal.) Electric Company and the Calistoga (Cal.) Water Company.

SOUTH PASADENA, CAL.—The Pacific Light & Power Company is contemplating removing its substation in the city to a new location just outside the city limits.

TORRANCE, CAL.—Work has begun on the construction of the new car shops for the Pacific Electric Company of Los Angeles at Torrance. Fourteen buildings will be erected at this time, these forming the first and principal unit of a group that will ultimately include thirty or more structures. The new buildings, including equipment, will cost about $500,000.

EDEN, IDAHO.—The Idaho Power & Light Company of Boise has been granted a franchise to erect a power plant in Eden.

PRESCOTT, ARIZ.—Contract has been awarded by the Arizona Power Company of Prescott for the construction of an electric power plant on the Verde River, 3 miles north of Clarkesdale, to cost about $1,000,000, to Charles C. Moore & Company of San Francisco, Cal. The plans provide for a development of from 15,000 to 20,000 hp.

Canada

CHATHAM, ONT.—The City Council has adopted a resolution requesting the Ontario Hydro-Electric Power Commission to consider taking over the electrical department of the Chatham Gas Company, to be operated in conjunction with the Chatham hydroelectric system.

SUDBURY, ONT.—The Town Council is considering securing power from French River through the hydro organization for Sudbury in order to supply electricity to the British-American Company, which operate the Murray Mine. The cost of the proposed development is estimated at $2,000,000.

TORONTO, ONT.—The Chippewa hydro-electric power development project of the Ontario-Hydro Electric Power Commission has been approved by all the municipalities interested, with the exception of Goderich.

1,210,737. Electrical Fuse. Albert F. Daum, Pittsburgh, Pa. App. filed Oct. 30, 1911. In which the fuse wire, strip or ribbon may be positively and reliably clamped to the terminal caps.

1,210,389. Manual and Semi-Automatic Telephone System. William Aitken, London, England. App. filed Aug. 24, 1915. Operations are wholly or partly manual.

1,210,735. Successive Non-Intelligence Signal Box. Chester E. Beach, Binghamton, N. Y. App. filed Aug. 11, 1913. Improvement.

1,210,444. Telephone Desk Set. Edward E. Craft, Hackensack, N. J. App. filed March 2, 1915. Condenser and induction coil are mounted within the standard.

1,210,441. Brake System. Nathan Fallek, Denver, Col. App. filed May 11, 1914. Improvements.

1,210,411. Mining Machine Cable-Connector. Thomas G. Fear, Bayview, Ala. App. filed Nov. 3, 1915. Mining machine may be connected to the trolley wire.

1,210,063. Telephone Recorder. Rupert H. Greenlaw, Lawrence, Mass. App. filed April 5, 1915. Number of calls sent and received.

1,210,470. Insulator-Clamp. Edwin G. Hatch, Hoboken, N. J. App. filed Jan. 19, 1914. Conductor is supported on top of the insulator.

1,210,481. Monitor System for Carrier-Despatch Apparatus. Chester S. Jennings, Boston, Mass. App. filed April 8, 1914. Pneumatic tube apparatus.

1,210,492. Outlet-Box. Julian Gordon Knight, New York, N. Y. App. filed Aug. 24, 1912. Interior is accessible from the top or upper side after the box has been placed.

1,210,499. Telephone System, John H. Levis, Jr., Rochester, N. Y. App. filed Feb. 7, 1916. Provide an intercommunicating telephone system with improved means for obtaining a central-exchange connection.

1,210,503. Railway-Signal; Daniel G. Lyzen, Grand Rapids, Mich. App. filed Nov. 2, 1914. Motormen on one car may be apprised of the approach of a car on an intersecting or cross-line of track.

1,210,505. Point-Finder System; Albert E. Lundell, New York, N. Y. App. filed Nov. 28, 1914. Keyboard controllers.

1,210,528. Connector for Reactance-Coils; John F. Peters, Edgewood Park, Pa. App. filed Oct. 3, 1914. Current-limiting reactance coils.

1,210,540. Cathode-Ray Tube; Hans Ewald Reinhold Rukop and Wilhelm Kuno Max Schloemilch, Berlin, Germany. App. filed Oct. 28, 1915. Pure electron tubes under a high vacuum.

1,210,554. Street-Indicating Mechanism; Thomas W. Small, Cleveland, Ohio. App. filed Nov. 24, 1909. Improvement.

1,210,566. Method of and Apparatus for Testing Conductors for Faults; James A. Vahey, Boston, Mass. App. filed April 28, 1915. Alternating voltage which will result in a current flow whether the conductor be a faulty or a healthy conductor.

1,210,568. Protective Apparatus for Electric Circuits; Eugene M. Vogel, Oak Park, Ill. App. filed May 1, 1914. Conveniently employed in a signal box or in similar situations.

1,210,581. Circuit-Controller; Johan M. Andersen, Boston, Mass. App. filed June 18, 1913. Distant controlled switch or circuit breaker.

1,210,586. Boiler; Harvey W. Bell, Pittsburgh, Pa. App. filed June 26, 1915. Adapted to be heated by flame from a gas or oil burner.

1,210,591. Electric Heating Apparatus; Albert R. Braden, Beverley, Mass. App. filed July 16, 1915. Heating metal strips.

1,210,602. Telephone-Exchange System; Henry P. Clausen, Mount Vernon, N. Y. App. filed Sept. 8, 1915. Central Energy type.

1,210,603. Calling Device; Henry P. Clausen, Mount Vernon, N. Y. App. filed Aug. 30, 1916. Automatic and semi-automatic telephone systems.

1,210,604. Telephone-Exchange System; Edward E. Clement, Washington, D. C. App. filed July 12, 1912. Applicable to automatic and semi-automatic connective systems therefor.

1,210,609. Wattmeter; Charles W. Davis, Edgeworth, Pa. App. filed Oct. 19, 1914. Arrangement of the connections.

1,210,616. Machine-Switching Telephone-Exchange System; Bert G. Dunham, Hawthorne, N. J. App. filed Sept. 14, 1915. Provides an improved connector circuit.

Record of Electrical Patents

Notes on United States Patents issued on Jan. 2, 1916

1,210,617. Relay. Bert G. Dunham, Hawthorne, N. J. App. filed Oct. 12, 1915. Slow-acting relays.

1,210,620. Exhausting Machine. John T. Fagan and Cleveland H. Quackenbush, Cleveland, Ohio. App. filed Dec. 2, 1914. Incandescent lamp bulbs and other articles in which a vacuum is required.

1,210,628. Loading Coil. William Fondiller, New York, N. Y. App. filed June 21, 1916. For loading phantom telephone lines.

1,210,635. Dynamo-Electric Machine. Johann Geisslinger, Geneva, Switzerland. App. filed May 23, 1912. Improvements.

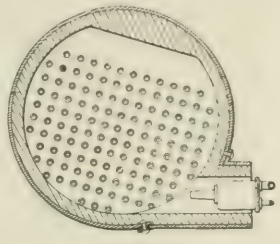
1,210,639. Dynamo-Electric Machine; Johann Geisslinger, Geneva, Switzerland. App. filed June 17, 1913. Magneto electric generator well adapted for lighting electric lamps.

1,210,640. Brake-Lock for Automobiles; Leon Goldmerstein, New York, N. Y. App. filed March 25, 1916. Improvements.

1,210,642. Selective Signalling System; John Brayton Harlow, New York, N. Y. App. filed May 6, 1915. Single track railway system.

1,210,652. Telephone-Exchange System; Lewis B. Johnson, Bloomfield, N. Y. App. filed March 10, 1915. Systems of the divided multiple type.

1,210,653. Telephone-Exchange System; Lewis H. Johnson, Bloomfield, N. J. App. filed May 26, 1916. Central energy type.



1,210,586 Boiler

1,210,658. Electric Switch; Charles J. Klein, Milwaukee, Wis. App. filed Aug. 26, 1912. To control a plurality of circuits or branches of a single circuit.

1,210,659. Electric Switch; Charles J. Klein, Milwaukee, Wis. App. filed Jan. 13, 1913. Double pole panel-board switch.

1,210,663. Electroplating and Lacquering Apparatus; John J. Mace and John Roy Murr, York, Pa. App. filed Oct. 9, 1915. For electro-plating or galvanizing wire cloth and lacquering the same.

1,210,678. Thermionic Amplifier; Alexander McLean Nicolson, N. Y. App. filed May 19, 1915. Improved organization of electrodes.

1,210,685. Insulator-Support; Charles L. Peirce, Jr., Pittsburgh, Pa. App. filed Feb. 5, 1916. Comprising a bracket part of sheet metal to give supporting strength, and a wooden thimble for providing a resilient seat for insulators.

1,210,686. Insulator-Support; Charles L. Peirce, Jr., Pittsburgh, Pa. App. filed April 6, 1916. New and useful improvements.

1,210,687. Insulator-Suspension Bracket; Charles L. Peirce, Jr., Pittsburgh, Pa. App. filed May 17, 1916. To be suspended from a messenger cable.

1,210,691. Liquid-Heater; Fred Poole, Jewell City, Kan. App. filed Feb. 9, 1915. Instantaneous.

1,210,703. Commutator; Charles F. Schneider, Springfield, Ohio. App. filed July 21, 1914. Simplify the construction of the armature of electric machines.

1,210,705. Apparatus for Power Distribution; Rudolph F. Schuchardt, Chicago, Ill. App. filed Jan. 12, 1912. Protect the apparatus and circuits of an electrical system against faults which may occur in a part only of the system.

1,210,709. Speed Controlled Electric Switch. Thomas W. Scott, Baltimore, Md. App. filed April 17, 1914. To control an electric circuit in a speed control mechanism for railway vehicles.

1,210,710. Contactless Controlling Mechanism for Vehicles. Thomas W. Scott, Baltimore, Md. App. filed March 23, 1915. Provide for the continuous control of a train or vehicle throughout its travel along the trackway.

1,210,738. Indicator for Faucets. Joseph E. Ward, Hanover, N. J. App. filed June 15, 1914. Indicator is operated in unison with the faucet.

1,210,750. Dynamo-Electric Machine. Thomas S. Allen, Milwaukee, Wis. App. filed July 14, 1909. Rotating members.

1,210,764. Binding-Post. Frederick W. Cole, Newton Highlands, Mass. App. filed Nov. 24, 1915. Terminal portion of the wire may be arranged on a seat co-extensive with the diameter of the post, and impinged by the binding-screw for a considerable length.

1,210,765. Signal-Box; Frederick W. Cole, Newton Highlands, Mass. App. filed Nov. 24, 1915. Switch-element is made as a unit.

1,210,786. Secondary or Storage Battery; Bruce Ford, Philadelphia, Pa. App. filed April 22, 1915. Means for preventing or opposing the entry of sea water through the vent of storage battery jars.

1,210,787. Secondary or Storage Battery, Bruce Ford, Philadelphia, Pa. App. filed April 22, 1915. Proper ventilation.

1,210,794. Furnace-Draft Operator; Walter Hann, Hasbrouck Heights, N. J. App. filed April 18, 1916. Device for electrically operating a draft opening mechanism.

1,210,816. Railway Signaling System; Reed M. Lewis, Aliquippa, Pa. App. filed Nov. 4, 1914. Forming blocks or sections.

1,210,821. Battery-Lamp; Henry Ed. McClure, Marion, Ind. App. filed Feb. 5, 1915. Lamp attachment adapted to be connected to the terminals of one or more cells.

1,210,851. Electrical Connector; Otto Schaefer, New York, N. Y. App. filed Nov. 20, 1914. For portable electrical apparatus.

1,210,872. Process of Making Electrotype-Plates or Metallic Shells; Frank T. Thompson, Chicago, Ill. App. filed Aug. 4, 1916. Improved process.

1,210,884. Phantom-Circuit Loading; John Franklin Baldwin, Jr., East Orange, N. J. App. filed June 27, 1916. For simultaneously loading two physical circuits and their derived or phantom circuit.

1,210,889. Regulating Apparatus; Joseph Bijur, New York, N. Y. App. filed Nov. 18, 1911. New and useful improvements.

1,210,912. Selecting Mechanism and System; Amos F. Dixon, Newark, N. J. App. filed March 27, 1915. Electromechanical type.

1,210,917. Calling Device; Alfred H. Dyson, Chicago, Ill. App. filed Feb. 14, 1912. Setting member is actuated to adjust impulse mechanism.

1,210,966. Signal Apparatus for Motor-Vehicles; Max A. Miller, Maywood, Ill. App. filed March 31, 1916. Rear signal.

1,211,000. Apparatus for Rendering a Protective Device Responsive to Phase Relations; Severn D. Sprong and Walter E. McCoy, New York, N. Y. App. filed March 2, 1916. Consists in establishing phase relations substantially 180 deg. apart.

1,211,006. Electric-Current Collector; Alfred G. Taylor, Greenville, S. C. App. filed May 24, 1916. Frame is pivotally secured to a trolley pole.

1,211,010. Conductor-Support; John T. Tighe, Scranton, Pa. App. filed July 8, 1914. For overhead trolley wires.

1,211,016. Arc-Lamp; John Vintila, Cleveland, Ohio. App. filed Jan. 19, 1916. Used in motion picture work.

1,211,017. Means for the Regulation or Control of Railway and Like Traffic; Hans Von Kramer, Edgbaston, Birmingham, England. App. filed June 1, 1916. Improvement.

1,211,031. Telephone System and Apparatus; Allison Akin, East Orange, N. J. App. filed June 21, 1915. Combined electromagnetic signal controlling relay and impedance coil for a bridged impedance type of link circuit.

1,211,044. Signaling System; Henry M. Bascom, Brooklyn, N. Y. App. filed Sept. 7, 1915. Telephone.

Electrical World

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Henry G. Stott

AN excellent engineer and operator has passed away in Henry G. Stott. Always human, seldom complacent and never superficial, he won for himself a standing in the profession second to none; and engendered in the hearts of those privileged to know him a feeling akin to love. His administration of the affairs of the American Institute of Electrical Engineers was one of the best that body knew and his contributions, while perhaps not brilliant, were lasting in their effects and exceedingly helpful. Mr. Stott never spoke without saying something, and what he had to say was informative, constructive and satisfying. His knowledge of theory and of fundamentals was buttressed by a wide and intimate experience especially in underground construction and thermodynamics which caused him to be regarded as an authority in steam station practice and one of the most skillful and successful operators in the world. Original in all things, Mr. Stott was a leader and not a follower in his profession. Moreover he inspired confidence and his counsel was always sought on important engineering matters. Modest he was and sincere in all that he said and did. His home and professional life was one to pattern after, and his loss to the company he served and to the engineering fraternity in which he was wrapped up will be keenly felt.

The Central Station Load

CENTRAL STATIONS found that under the conditions prevailing last year they acquired large power loads formerly carried by isolated plants. A continuation of the same tendency of industrial power users to seek central station energy is generally anticipated this year. It is due partly to other considerations than those which are normally concerned in the question of the relative merit of the two classes of service for an individual installation. Scarcity and the largely increased costs of coal have emphasized to the isolated plant operator the advantage of a service involving little more than financial responsibility on his part. The extraordinary coal situation will enhance the business of the central station permanently if the problems which it causes can be solved without saddling additional excessive cost upon operating expense. Evidently central stations will have to figure rates on such business with eyes clearly open to the prospect that higher costs in some materials show no present sign of reaction. However, they have also to take into account the consideration that lessening demand in some industrial lines will mean smaller consumption of power in those directions, and will therefore leave a surplus for the better service of other customers whom they will try to hold fast.

Government Control of Radio Undesirable

THE article by J. L. Hogan, Jr., on page 120, draws attention to the rapid strides which radio signalling has already made in its brief history, as well as to the great need for inventive and engineering effort, in overcoming numerous existing difficulties in the way of further development. American progress in radio-communication has been particularly rapid; because the art has not been a government monopoly here, but has been open to free competition from all parts of the country. In Europe also, the progress has come from those individuals and organizations unhampered by governmental restrictions, and in those places where intellectual liberty and initiative have had sway.

The London International Radio Convention, having been subscribed to by the United States, has already hampered industrial radio-development here. It has laid severe and unnecessary restrictions on the use of a large range of wave-lengths. The air we breathe is no longer free, in the sense that all electric waves in it may be utilized for the transmission of intelligence by those who undertake to serve the public by sending their radio messages. Only a relatively small range is permitted to civilian use, the greater share being reserved to military service, where it is but little needed in time of peace. Moreover, the military authorities of the United States are given arbitrary powers in time of peace for the suppression of all use by civilian telegraphists of the pre-empted range.

As though this unnecessary invasion of the rights of public service radio-telegraphers in the use of the circumambient ether were not enough, a bill is now proposed for enaction by Congress, which will not only give to the military authorities of the United States a free entrance into commercial radio-communication but also increase their powers of regulation and restriction. In view of the freedom which governments affect toward patented inventions, and the length of an arm of interference which extends over the entire country, it is manifest that such legislation is likely to mean the speedy regulation of all commercial competitors out of existence, leaving the military in complete economic control.

Because all good citizens should loyally aid and support the military forces in time of war, is no reason for sacrificing the interests of radio-communication in times of peace. The military profession is so exacting

in its duties and requirements, that military men cannot properly attend to the invention and designing necessary for keeping American radio-communication in the front rank of preparedness. One might just as well hand over the control of radio-communication to the profession of law or the profession of medicine. It is no disparagement of either of these professions to say that they are necessarily unfitted to carry on and promote the development of radio-communication. If war does come, it is just as likely to come very suddenly, and much will then depend upon the state of development of the art of radio-communication in this country. The right way to be prepared is to leave the development of the art to radio engineers and inventors, and then to commandeer their services for military use. The wrong way and the one which legislation is designed to bring about is to leave it exclusively to the military departments of the government.

Designing a Station for the Future

IN this issue there appears a detailed description of the electrical design of the new Essex station of the Public Service Electric Company of New Jersey. Although only a quarter of its capacity has yet been installed the plant promises to be a large one, and when completed, with a probable rating of 200,000 kva., it will rank as one of the greatest generating systems in existence. Connected as it is to other plants operated by this company it has not been necessary to organize it as an independent unit, so that while it is designed ultimately for six large turbo-generators the two units now installed are rated at 25,000 kva. each. One of these is held in partial reserve. It is a plant of large generator units and large boiler units, a group of four boilers being allotted to each turbine. While the present generating sets are of 25,000 kva., subsequent ones will be of 35,000 kva. and possibly more.

If one were to pick out a single salient feature as characterizing the design of the equipment it would be an exceptionally high degree of automatism. Every effort has been made to depend as little as possible upon human attention, and the connections and apparatus are so arranged that whatever emergency may arise it will be cared for fully without waiting for the intervention of an operator. With the great service that the plant will have on hand it is imperative that continuity of supply be insured by every practicable means, and little has been left undone to this end. Not only the electrical equipment but the boiler plant is rich in special provisions for operating at high efficiency and with small opportunity for accident. Beginning even back of the boiler room at the coal tower, the fundamental idea of mechanical operation throughout appears. In the coal tower there is complete equipment for unloading the fuel from cars or barges, for crushing it to uniformity and conveying it to the coal bunkers, for unloading fuel, for storage in the coal-yard and for taking it thence for crushing prior to its transportation to the bunkers. From these it is mechanically transported to the conveying system that ends at the boilers. These are set high so that there is ample space in the basement for ash-handling devices, blowers, feed and other pumps and all the necessary accessories. The whole structure thus conveys the idea of being roomy and well arranged.

In the turbine room likewise extra space has been provided for the installation of larger units and for their assembly and repair by the aid of a 100-ton electrically driven crane. Directly under the turbine room is a high basement with condensers and other auxiliaries. A special feature of the layout is the switch house, six stories high and containing on one side the whole high-tension switch equipment, the other being devoted to the control room offices and miscellaneous operating requirements. One-half of the switchboard equipment has already been installed. The source of energy is found in the six turbo-generators which will make up the complete plant, and its distribution includes no less than sixty-six feeders, each of which requires full protection by switching devices, both to secure continuity of operation and to permit swift isolation at any point that fails. The penalty for thus concentrating generating devices must obviously be repaid by extraordinary care in the cable connections between the generator house and the main switch equipment.

The general arrangement of the switchboard is the grouping of one generator with its own bus and with a group bus for each generator providing the full interchangeability which would be found, for instance, on an arc switchboard. As the generators are designed for 13,200 volts, and the feeders of large capacity, oil switches have been installed throughout plus selector switches, so that each feeder may be connected with either of the two bus groups. In all there are twenty-five high-tension switches per generator, but this large number is chiefly due to the elaborate feeder requirements. Thus arranged, feeders can be quickly segregated and buses readily cleared for repairs. An important feature of the installation of generators of so large capacity is their protection from short-circuits in such manner that abnormally large capacity in switches will not be required. To this end reactors will be provided in the complete installation between each generator and its tie bus, and also in each high-tension feeder. By this means the maximum short-circuit current which can be thrown upon any switch will be kept below its full capacity for rupturing the circuit. The generator oil switches are protected by reverse power relays, and special relays also guard the tie-bus switches and feeders so as still further to lessen the danger from short-circuits. To the same end all the automatic oil switches are equipped with relays, which prevent their being held closed in case of closure on a short-circuit. Another group of safety precautions is that the control cable for each oil switch is carried in a separate conduit throughout. This and the other automatic devices similarly served implied a very large amount of conduit, nearly 50 miles being installed in the part of the system already completed. Most of the conduits to the switchboard system emerge in a con-

duit room, whence they are distributed to their destinations in the control room. Some particularly interesting devices are installed to protect the generators from difficulty with excitation. The regular exciters are direct connected, and at any signs of trouble the generator is thrown over upon an emergency storage battery until a motor-driven exciter can be started up from the control room and thrown upon the generator circuit, at which moment the battery automatically goes off. This abstract of the system can give hardly more than an idea of the extent to which human operators are dispensed with, but the engineer will find material for careful study in the investigation of the details outlined in the article.

Individual responsibility outside of the control further seems to have been eliminated as far as possible in the present state of the art. How far such automatic control can be carried to advantage has always been a mooted question among engineers. We certainly know of no instance which affords a more crucial test of the merits of the system or which shows greater ingenuity in providing for possible emergencies.

Electricity in the Automobile Show

ELECTRIC VEHICLES made a creditable and admired part of the display at the highly successful automobile show in New York last week. Electric vehicle makers had their exhibits attractively massed in one section of the Grand Central Palace and the distinctive beauty of their cars made them conspicuous features. Although the electric vehicle was the principal outward sign of electrical activity in an exhibit which was mostly of gasoline cars, electricity does not receive full credit for its incidental application in car operation. Certainly the automobile industry, although not commonly regarded as a part of the electrical industry, has points of intimate relation to it which suggest future possibilities of increasing importance. The electrical industry has many ramifications, and it is not dependent for its markets upon the development of automobiles. On the other hand, the automobile industry is dependent upon electricity, the incidental use of which has done much to foster the growth of pleasure riding. Electrical manufacturers will inevitably enlarge their activities in automobile parts and accessories. Rapid though the rise in the automobile industry has been, it still has ungaged opportunities for expansion. Sharp fluctuations in business will cause sharp fluctuations in the buying of pleasure cars, but expansion is bound to continue, and this will undoubtedly benefit the electrical industry in large degree.

Mechanical Principles of Transformer Design

THE ancient world boasted traditionally of seven wonders, which were all, save two, architectural. The modern world has many wonders, and one of them is the alternating-current transformer. In large sizes, it looks like a big black water tank, with conducting cables attached to it. Yet such a seemingly quiescent monster may be receiving, transforming and delivering many megawatts of electric power. If the same power existed in mechanical form, we should witness large stresses moving with high speeds; but in the electric form all is invisible. In the article by Messrs. McConahey and Peters elsewhere in this issue, some of the history of this wonderful development of the transformer is briefly reviewed. The development has been nearly all in America, and the world owes to American engineers the greatest share of the initiative, courage and skill in design which have made the modern transformer the wonder that it is to-day.

In the early days of transformer design, the electric properties of the apparatus occupied almost exclusive attention. It was required to give a certain rated output with satisfactory pressure regulation, adequate insulation, and low internal heating. As the size and power of the apparatus increased, however, mechanical deformations presented themselves after accidental overloads or short-circuits. The designers were brought by experience to realize that a transformer, being an electromagnetic device, developed electromagnetic forces in its windings that might become very large under occasional conditions of accidental excessive load. This necessitated the introduction of ample mechanical support along with the ordinary electrical requirements, and the elimination of certain types of structure in which the electromechanical stresses became difficult to resist. The nature and directions of these stresses are presented clearly in the article. The subject is of importance to operating men, as well as to designers; so that it should be studied by all who come into industrial touch with transformers.

The Coming Issues

NEXT week's ELECTRICAL WORLD will be the fourth or commercial number for January, and a feature of that number will be an article on customer growth and rate reductions, recounting the experience of two Middle West central station companies in revising downward their rates for electric service, in conformance with a pre-announced schedule, as the number of their customers increases from time to time. The account of the electrical features of the new Essex plant of the Public Service Electric Company of New Jersey, begun in the issue now before the reader, will be completed in the Jan. 27 number. Other broad commercial topics of interest to the lighting company executive and manager will be treated in the commercial issue, which will also contain the regular departments for the engineer and operating man. The first issue of February will deal largely with matters of public policy in the management of central station properties, and the second number of that month will contain engineering articles of particular interest to the station and operating man. The January number of ELECTRICAL MERCHANDISING, the new monthly magazine of the electrical trade, appeared on the fifteenth of the month, and to it are referred readers who are interested in detail merchandising and business methods.

Chronicle of Events of the Industry and of Important Movements in the Field

NEWS OF THE WEEK

Reports of Conventions and Meetings of Electrical Associations and Societies

OHIO NEW BUSINESS MEN PLAN MONTHLY CAMPAIGNS

Methods of Handling Customer Complaints and Considerations Necessary in Campaigning for Industrial Heating Business Discussed at Toledo Meeting

Plans for handling 1917 campaigns dealing with customers' complaints and getting industrial heating business were the outstanding features of the Ohio new-business men's meeting at Toledo on Jan. 18. Favorable opinion was expressed on the idea of having a special drive on some appliance each month, all fitting into a general plan for the year. The arrangement of the Toledo plan which seemed to be acceptable to all is as follows: Washing machines in February and June, cleaners in March, house wiring in April, and irons in May. These appliances are to be rotated for the summer, fall and winter months except December and January. The thought that each campaign should be planned at least thirty days in advance was emphasized.

A paper by Frank Wert of Youngstown, entitled "Is the Customer Always Right?" opened an enthusiastic discussion of methods for handling customers' complaints and brought out the fact that all companies should assume the customer right unless he is proved to be in error. The keynote of the talk on "Industrial Heating," by H. J. Kuntz of Toledo, was that the installation of each prospective customer should be analyzed on the basis of the reduction in over-all production cost possible through the application of electric heating processes. On some jobs, said he, the actual fuel cost for electricity may be eleven times what it would be with oil or gas, yet the over-all saving with electricity may decide the case in its favor.

PHILADELPHIA ELECTRIC MAY NOW MERGE SUBSIDIARIES

Pennsylvania Commission Approves the Application Upon an Agreement That the Cost Be Borne by the Stockholders and Not by the Consumers

Upon agreement by the Philadelphia Electric Company that the cost attending the merger of the fourteen subsidiary companies located in Philadelphia should be borne entirely by the stockholders and in no way affect the customers of the company, the Pennsylvania Public Service Commission on Monday last approved the merger of all of the underlying companies under the corporate title of the parent company.

The company's refinancing plans, announced last summer and reported in the ELECTRICAL WORLD for July 29, 1916, will undoubtedly have by this move a clear road. The plans as thus announced provided for increasing the authorized capital stock to $50,000,000 and an authorized bonded indebtedness of $60,000,000, to be secured by a first mortgage maturing in fifty years and bearing interest at the rate of 5 per cent.

In announcing the plan, President McCall said:

"To provide the necessary capital in order to meet the increasing requirements of the public and to continue that high character of service which we feel it our duty as a public service company to furnish the community, it is necessary to refinance the property on a broad, substantial basis which will provide for the demands of the consumers."

The commission has had the matter of permitting the merger under consideration for months. It refused to act last week on the ground that it desired more information regarding the terms of the transaction.

The point at issue involved the premiums at which the underlying bonds were to be taken in. Commissioner Michael J. Ryan is said to have opposed the company's suggestion to take this sum out of gross earnings on the basis that it might open a way to saddle the cost on the consumer by offering an opportunity to increase rates. Mr. Ryan's contention, it is understood, was to deduct this cost from net earnings. In that way, whatever expenses were attendant would fall on the stockholders entirely. This method was adopted by agreement.

CONTRACTORS CONSIDER WAYS TO REDUCE COSTS

Wisconsin Association at Annual Meeting Discusses Plans for Co-operative Buying and Estimating Now Being Used Successfully in Milwaukee

At the fourteenth annual meeting of the Electrical Contractors' Association of Wisconsin, held during the first three days of the week at Milwaukee, co-operative buying and quantity estimating were the subjects which claimed closest attention. A. M. Kailing of the A. M. Kailing Company, Milwaukee, outlined a co-operative buying scheme which six Milwaukee electrical contractors have been using successfully. C. E. Flamboe, manager of the estimating on jobs in Milwaukee County for twelve building concerns, told how this bureau was operated and what were its advantages. It is the duty of this bureau to work out from plans and specifications a detailed list of all material needed for any job on which the twelve member concerns wish to bid. This data is then handed to all members and they themselves put their own prices on the job.

In this way the bidding is done on a competitive basis but the actual labor of estimating is performed in one operation for all twelve companies. The plan eliminates the trouble which arose with architects who were unwilling to provide twelve separate plans and specifications in order to give all of the bureau men a chance to bid. It also substitutes the work of one estimator for the work of twelve separate estimators and it provides each bidder with a more accurate set of figures upon which to base his bid than he could himself work out in the limited time he usually has for such jobs.

In discussing the advantage of this plan William H. Schmidt, Jr., one of the members of the bureau, said it now costs him $40 a month on the average for the estimating which is done for him by the bureau. The saving which has been effected through this plan in his particular instance may be appreciated from the fact that it formerly cost him from $125 to $150 per month for estimating. The cost of the bureau to its other

members ranges between $25 and $90 per month, depending upon the gross amount of business they handle.

Following this presentation of their plan by the Milwaukee mill men, the contractors discussed it with relation to their business, and while no definite decision was taken before the final closed session it was understood that the contractors were considering a trial of the plan in Milwaukee County. Beside the three closed sessions at this meeting one session was open to other than member contractors. At this meeting the speakers were P. T. Bowler on "Selling Electrical Applications;" J. R. Morrisey on "Enforcing the Underwriters' Rules;" W. D. Kellogg on "Farm Lighting Plants," and S. A. Hobson on "Jovianism." In the future it will be the plan of the Wisconsin contractors to hold four meetings annually in order better to foster the spirit of co-operation.

DEATH OF HENRY G. STOTT

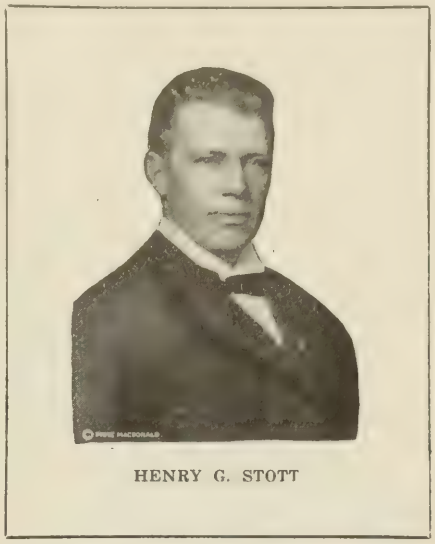
Noted Engineer and Operator Passes Away After Lingering Illness—Synopsis of His Career

Henry Gordon Stott, past-president of the American Institute of Electrical Engineers and superintendent of motive power of the Interborough Rapid Transit Company and New York Railways Company, died at his home in New Rochelle on Jan. 15, after an illness of many months.

He was a native of the Orkney Islands, Scotland, where he was born in 1866, the son of the Rev. David and Elizabeth Jane (Dibblee) Stott. After a thorough grounding in the fundamentals at the hands of his father and elementary school instructors he was enrolled as a student at the Watson Collegiate School, Edinburgh. On leaving this institution he entered the College of Arts and Sciences at Glasgow, and began a course in mechanical engineering and electricity, graduating in 1885. In the year previous he had entered the employ of the electric illuminating company of Glasgow. Shortly after graduating he was made assistant electrician on board the steamship Minia, belonging to the Anglo-American Telegraph Company. The next four and one-half years saw him engaged with those duties, during the course of which he saw much service in connection with repairs to the cable lines of that company. In this period he undertook a number of experiments that resulted in the introduction of improved methods of handling cable repairs. He was also identified with the "duplexing" of the United States Cable Company's main cable (2750 knots), the longest duplex cable in the world.

In 1889 Mr. Stott was made assistant engineer of the Brush Electric Engineering Company's plant at Bournemouth, England. The following year he was offered a post by Hammond & Company as assistant engineer in the construction of an underground cable and power plant at Madrid, Spain. He remained there until 1891, coming to the United States in that year to install an underground cable and conduit system for the Buffalo Light & Power Company (now the Buffalo General Electric Company). This work was completed with a degree of success that reflected very greatly to the credit of Mr. Stott. As a result he was named engineer of the company, and during the next ten years was one of the most active figures in the industrial progress of Buffalo. During this period he designed and executed some notable construction work, including a power plant on Wilkeson Street, Buffalo.

His efforts attracted wide attention, and in 1901 he was appointed superintendent of motive power of the Interborough Rapid Transit Company, New York City, a position which he has filled with signal success. At the time he took up these duties the Interborough had not yet been organized, the company having the title of the Manhattan Railway Company. The post which Mr. Stott was called to had just been created, and it devolved upon him to organize the operating force, in connection with which he completed the Seventy-fourth



HENRY G. STOTT

Street power plant of the company, various substations and transmission lines.

When the Manhattan system was amalgamated with the Interborough in 1904 Mr. Stott was invited to retain his office with the new corporation. He accepted and immediately took over supervision of the construction of the power plant on Fifty-ninth Street. Since that time he has been constantly in charge of design, construction and operation of the power generating stations and the distributing system of the Interborough, which comprehends both the subway, elevated and surface lines of New York City.

The plans for the electric power system of the new subway lines have been developed under his supervision, and the work has progressed so far and bears so strongly the stamp of his work that, when completed, it will be a monument to him.

Mr. Stott was a firm believer in co-operation among engineers, through the agency of engineering societies. He was president of the American Institute of Electrical Engineers for the term 1907-1908, vice-president of the American Society of Mechanical Engineers for the term 1912-1914, director of the American Society of Civil Engineers in 1911, and was vice-president and trustee of the United Engineering Society at the time of his death. Up to the last Mr. Stott was a recognized power in the American Institute of Electrical Engineers, and was a member of the standards committee, public policy committee, the committee on development of water power, the United States national committee of the International Electrotechnical Commission, the power stations committee, the committee on economics of electric service, Edison medal committee, and was one of the institute's representatives on the joint committee on the metric system, of which he was an ardent advocate.

As a result of his unusually wide experience and extended research, Mr. Stott has been called upon often to contribute papers to the various engineering societies. He was especially well known for his minute analysis of engineering problems. Among the large number of papers which he has written on this subject are: "The Conversion and Distribution of Received Currents," "Power Plant Economics," "Notes on the Cost of Power," "Steam Pipe Covering and Its Relation to

Station Economy," "Tests of a 15,000-kw. Steam Engine Turbine Unit," "Power Plant Design and Operation" (a series), etc. He acted as consulting engineer for the Buffalo General Electric Company and had much to do with the design and equipment of that company's new steam station now building near Tonawanda, N. Y., the completion of which he looked forward to with much pleasure and satisfaction. He confidently expected that it would be the most efficient steam-generating station so far built, and that it would easily compete with Niagara Falls water power in cheapness of energy production.

Mr. Stott was a remarkable figure in the engineering world, because he was in the front rank of both electrical and mechanical engineers, because in both branches of the art he was a master of theory and practice, and because with these technical qualifications he combined a rare executive ability, power of inspiring the confidence of his employees and of bringing out the best that was in the men who worked for him.

Mr. Stott's activities were not confined to engineering matters. He early became a citizen of the United States, and served for five years in the Seventy-fourth Regiment of the National Guard of New York State.

He was married on July 22, 1894, to Miss Anna Mitchell of Belfast, Ireland, who with their two children, a son and a daughter, survive him.

WATER-POWER BILL UP FOR DISCUSSION IN SENATE

A Number of Senators Make Efforts During the Debate to Amend the Bill—Doubtful if Bill Will Receive President's Signature During This Session

The Senate has voted to make the water-power bill, to provide for the development of water power and the use of public lands in relation thereto, as the unfinished business of the Senate, and it is now before that body and will be so until voted upon. This is House Bill No. 408, which has passed the House. The bill is now being debated, and comes up automatically every afternoon, under the unfinished-business rule.

This action was taken by the Senate on Dec. 9, as the result of a Democratic caucus the previous night. The bill is in charge of Senator Walsh, and favorable action on it was obtained only after a filibuster against it by Senator Townsend, who desired to press an army bill he has been supporting for six years. Senator Townsend, Senator Jones and others will amend the water-power bill or attempt to do so during the debate. Senator Jones declared that the caucus has coerced "those who are in favor of this measure, and will compel them to vote against their sentiments with reference to it."

The Senate has continued during the past week the consideration of and debate on the bill, and the week in Washington has also been marked, as to water-power matters, by a conference at the White House between President Wilson and Representative Adamson, chairman of the House committee on interstate commerce, concerning the general dam bill. Mr. Adamson is endeavoring to obtain from President Wilson support as to the passage of the dam bill, which is in conference between the two houses of Congress, the conferees being unable to agree on items in the bill providing for charges for dam rights.

Most of the argument in the Senate on House Bill No. 408 has been of a legal character. Questions of leasehold values, taxation, etc., were gone into. Concerning the value of a leasehold, for taxation purposes, Senator Shafroth of Colorado, said:

"When you consider that all this is hedged about by the fact that there shall be a utility commission that will not permit a company to earn more than a reasonable rate, the leasehold would be of absolutely no value. Consequently, even if there was a liability there would not be a liability for the payment of taxes, because the leasehold is made by the very act itself, so that it cannot become valuable. If you limit the amount of money that can be charged by these companies, so that they cannot for instance make more than 6 per cent per annum, what value is there in a leasehold estate?"

Senator Walsh, who is in charge of the bill, said in support of it that "when the proposed commission comes to fix a rate, it must first allow all expenses, taxes and everything else, and then it must allow a fair return on the money invested besides."

Senator Shafroth replied: "That may be, but the difficulty about that is that what they have got as an initial investment, being curbed and limited by the proposed utilities commission itself, would make it impossible for the investment ever to be worth anything over and above the cost of the enterprise in the first instance."

One of the most important statements made so far during the debate was that if the bill becomes a law $300,000,000 would be invested in water powers.

A number of amendments have been tacked on to the bill or offered for possible consideration. Senator Norris desires to amend the bill by providing that in granting leases under the act the Secretary of the Interior shall give preference to applications for leases for development of electrical power by states, counties, municipalities and government irrigation districts. In all such leases no rent or fee of any kind would be charged. In lieu of such leases to any state, county or municipality, or at any time after the making of the same, Senator Norris, in his proposed amendment, would provide that the Secretary of the Interior on demand from the proper authority shall execute to any state, county or municipality a patent for the property so leased or authorized to be leased by the provisions of the act. Penalties of reversion of rights to the United States are provided in case rights granted are not taken advantage of. Senator Works has offered an important amendment to the bill which is in effect the substitution of another bill for the one under consideration. The pending bill provides principally for the leasing of water-power sites on public lands. Senator Works' proposed amendment provides for the sale and granting of those rights for a price either to be determined upon between the Secretary of the Interior and the purchaser, or, if they are unable to agree, then by procedings in court. Senator Works would provide that the sale may be made to any person who has acquired the right to divert and distribute and use the waters under the laws of the state in which the water power is situated. His proposal distinguishes from the pending measure particularly because it provides for the sale rather than for the leasing of water-power rights.

The bill continues to be the unfinished business of the Senate, a tactical position which might seem to give it some assurance of being voted upon soon, but there are many bills on the calendar of the Senate in which Senators of all political parties have special, private interests, and the water-power bill will be displaced by common consent from time to time for the passage of those bills, making for a delay in the final action upon it. The bill will certainly be so amended when it leaves the Senate that it is doubtful if the House will pass it, and there is even doubt as to whether conferees could agree upon it in the few days remaining of the present session of Congress.

CONGRESS PROPOSES TO TAX BUSINESS $214,000,000

Part of Sum Needed to Wipe Off Portion of National Deficit and to Provide Money for Next Year—Proposed Tax on Raw Materials Abandoned

The ways and means committee of the House of Representatives—the revenue-producing body of the House—with, it is formally announced, the approval of President Wilson and Secretary of the Treasury McAdoo, has decided to wipe off some of the enormous deficit in the Treasury and to provide the money needs of the country for next year by imposing a tax of 8 per cent on corporations and co-partnerships on net incomes over $5,000 after 8 per cent normal profits (dividends) has been deducted. Other revenues will be produced by an additional inheritance tax. Other requirements will be met by bond issues, some of which have already been authorized in special laws.

The sum of $525,000,000 is needed for the government. Of this, the proposed tax on business, from corporations, is expected to furnish $175,000,000. The proposed tax on business co-partnerships is expected to furnish $39,000,000. The inheritance tax (additional) is expected to yield about $22,000,000.

For the present, the ways and means committee has abandoned the proposal considered last week to tax automobile engines, and output taxes on petroleum, copper, aluminum, pig iron and rubber. Chairman Kitchin of the committee has been authorized to draft a bill along the lines outlined above. The 8 per cent tax on business now proposed is 3 per cent more than was proposed last week.

The proposed taxes of $236,000,000 on business and inheritances outlined above are in addition to the bond issues which will be necessary to finance the government.

TARIFF AND FEDERAL TRADE COMMISSION VACANCIES

Speculation Continues Keen in Washington Concerning the Personnel of These Commissions, Especially the Tariff Commission

Edward N. Hurley, chairman of the Federal Trade Commission, having resigned from that body, to take effect Feb. 1, there are now practically two vacancies on the commission which the President must soon fill. Commissioner Rublee has never been confirmed by the Senate because Senator Gallinger has said Mr. Rublee is "personally obnoxious" to him, Senatorial courtesy allowing the Senator from New Hampshire to prevent the confirmation.

In this connection it is reported in Washington that President Wilson is considering the names of a number of men who would make suitable appointees on both the Federal Trade Commission and the new Tariff Commission, and that he may be expected to announce the names of the latter commissioners shortly. Almost the same type of man is wanted for both commissions. It is believed extremely unlikely that President Wilson will again send the name of Mr. Rublee to the Senate, especially as Mr. Rublee has been named as a member of the board headed by General Goethals, to observe the working of the so-called Adamson "eight-hour" railroad act.

There is much speculation in Washington concerning the prospective commissioners on these two bodies, and in regard to tariff matters. Secretary McAdoo and the ways and means committee of the House are searching for many additional articles to tax, in the form of tariffs or otherwise, owing to the big deficit in the public funds. The tariff commission when appointed will have much to say on these matters before any definite decision is made.

REGENERATIVE BRAKING DISCUSSED BY A. I. E. E.

Entire Technical Session Held in Connection with the Pittsburgh Meeting Devoted to Consideration of the Subject

The 328th meeting of the American Institute of Electrical Engineers was held at Pittsburgh, Pa., on Jan. 12, under the auspices of the Pittsburgh section of the traction and transportation committee. The session was called to order by President H. W. Buck who introduced R. E. Hellmund of the Westinghouse Electric & Manufacturing Company who spoke on the subject of regenerative braking.

Mr. Hellmund described twenty-one different possible systems for regeneration, explaining in detail the advantageous features and limitations of many possible methods of obtaining regeneration with different types of motor. He attributed the meager use made of regenerative control to the hitherto increased complication and decreased reliability, but said that this condition has changed and that ordinary requirements for reliability and safety can now be met with a high degree of success.

Regeneration with three-phase motors does not introduce any complication, and to obtain satisfactory results it is only necessary to provide electrical equipment of sufficient capacity to take care of the regenerative current. With the three-phase system, however, the possibilities for reducing the speed below the synchronous speed of the motors are either very limited in scope or necessitate the installation of cumbersome equipment and their application in practice does not seem to be very likely in the near future. The difficulties prevailing with a phase-converter system employing a single-phase line and a phase-converter locomotive are practically the same with regard to regenerative braking as with the three-phase system.

The present-day direct-current railway motor lends itself less readily to regeneration than the polyphase induction motor. Separate excitation offers the most promising possibility for successful regeneration and the author described six of the more important requisites that have to be considered in all cases. He then discussed the principal characteristics of the source used for separate excitation and the consequent characteristics of the main generator.

The result of regeneration upon direct-current lines may at times be rather disadvantageous with regard to fluctuations in line voltage. The difficulty of connecting alternating-current generators to the line, however, is materially reduced as compared with direct-current motors because the inductive effect of an alternating-current system materially reduces the tendency toward current peaks.

The paper was discussed by Robert Lundell of New York City; E. W. Alexanderson, of the General Electric Company, Schenectady, N. Y.; Mr. Hall of the Westinghouse Electric & Manufacturing Company; R. E. Ferris and W. V. Turner, chief engineer of the Westinghouse Air Brake Company; H. M. Hobart of the General Electric Company; F. R. Phillips of the Pittsburgh Railways; Prof. C. A. Adams of Harvard University, C. L. Fortescue, of the Electric & Westinghouse Manufacturing Company and W. B. Potter of the General Electric Company.

Electric Transmission of Intelligence in 1916-1917

Developments in Telegraphy, Telephony and Radio Engineering, Including Progress in Transoceanic Communication and Control of Radio Stations

By John L. Hogan, Jr.

Chief Research Engineer, National Electric Signaling Company



JOHN L. HOGAN, JR.

LINE wire telegraphy and telephony in the United States have been so completely standardized and give such excellent service under normal conditions that there is little indication of any radical change to be expected to the practice of either. Vacuum tube amplifiers of the "audion" type are finding greater and greater use in the electrical transmission of speech, and it is presumed that they will be further extended. Minor improvements which increase service effectiveness are of course made almost daily, and will doubtless continue to appear. In wire telegraphy, the extension of printing systems is to be noted. Keyboard transmitters (operated by girls having no knowledge of Morse), connected in synchronous quadruplex relation to page-printing receivers, obviously increase line capacity and decrease message transmission costs where the volume of traffic is large. In addition to the synchronous multiplex printers, one or two forms of non-synchronized printing telegraphs have demonstrated their practicability and will in all probability find further commercial applications during the coming year.

Submarine cable telegraphy is also an art in which basic changes must come slowly. Like the wire line systems, the existing plant meets all normal needs. Alterations which, because of their radical nature, involve the necessity of abandoning reasonably satisfactory apparatus and which consequently are extremely expensive, can only be made after experience has shown them actually to be essential. Various proposals of interlinking wire telegraph and cable systems by direct relays, to avoid manual repetition of messages, as well as plans for distortionless alternating-current working, were brought out during the year just closed. Which schemes possess genuine practical merit can scarcely be determined without extended tests on a commercial scale; it seems unlikely that any large application of either of these general plans will be made in 1917. The use of magnifiers, usually of the galvanometer-controlled heated-wire type, is said to be proving important in increasing cable speed and signalling reliability. In all probability, therefore, installation of these instruments will be continued.

New Devices and Methods Appearing

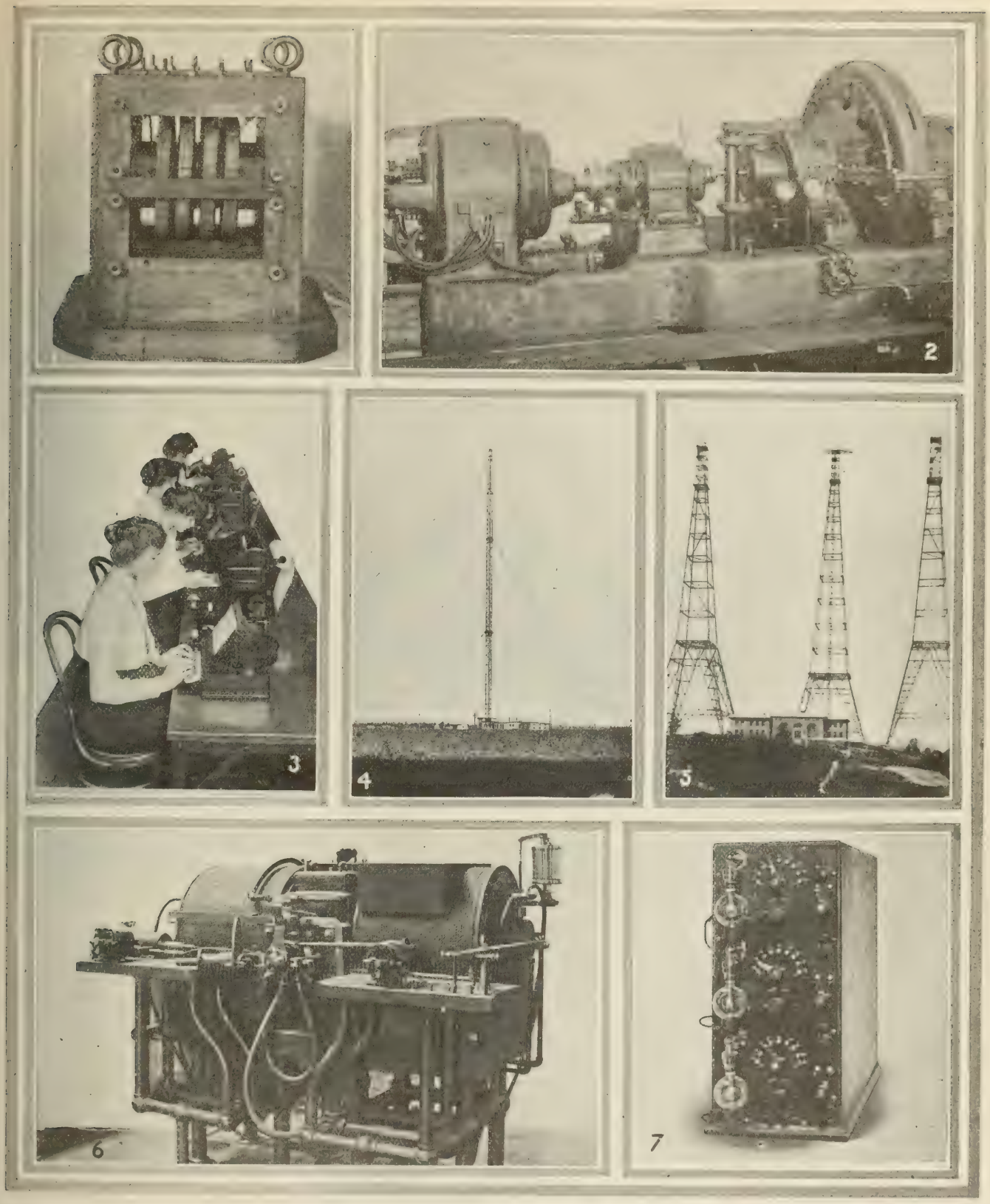
When the young arts of radio signaling are considered, however, very different conditions are found. Both in radio telephony and radio telegraphy new devices and modes of operation are constantly appearing. The commercial practice is fairly well defined, and entirely satisfactory within proper limits, but new inventions (or new applications of old ideas) continually tend to extend the limits and to make radio available for new uses. It is true that the presentation of novel schemes in general merely changes the relative emphasis placed upon various elements of the radio systems as a whole, and ordinarily does not enforce any basic readjustments; nevertheless, the presence of inventive effort keeps the arts in a state of flux and results in an almost phenomenal growth toward the highest points of commercial utility.

In radio telephony, for example, nothing fundamentally new has appeared since the earliest work involving vocal modulation of a continuously radiated stream of sustained electromagnetic waves. Yet the practical work of the first experimenters has been completely eclipsed, in so far as magnitude is concerned, within the past year or so. The transmission of speech across the Atlantic to Paris, and over the continent and the Pacific to Honolulu was accomplished in 1915 by the effective modulation of some 10 or 15 kw. of radio frequency power. During 1916 has come the announcement that speech vibrations have been used for the vocal control of powers some five times as great. Though the distance effect of such a powerful radio telephone transmitter has not been demonstrated, it is obvious that transoceanic distances should be covered with much greater ease and uniformity than in the 1915 tests. Sound-wave control of still higher powers seems just within view, and it has been stated in an entirely confident manner that the coming year would see speech transmitted by radio over the 4000 miles which separate the United States from Germany.

It is particularly interesting to compare these great distances covered by radio telephony with the limits of length of telephone cable over which speech is effective. Now that wireless telephonic accomplishments are rivaling those of the line telephone in the matter of distance, the possible technical and economic advantages inherent to the radio method are becoming more widely appreciated. Concentrated plant maintenance, distortionless transmission, and depreciation-free trunk "lines" are points of superiority which will be given further consideration.

Atmospheric Interference

An important difficulty which confined radio telephony to short-distance working was that of modulating the high frequency power in accordance with voice waves. This problem seems to have been solved in a large measure by the development of magnetic and vacuum amplifiers. The generation of powerful streams of sustained waves, for either telegraphy or telephony by radio, has been practicable for many years. There remains in both branches of the wireless art, however, what is perhaps the most difficult problem of all. This is the elimination, or reduction, of the harmful effects of atmospheric interference. Until the "stray" or atmospheric problem is solved, wastefully large power is essential at the transmitting station, for the signal at the receiver must be so strong as to dominate the sounds of "static." Long distance signaling dependent upon the use of delicate amplifiers at the receiving station, as in the 1915 radio telephonic tests across the oceans, can be practiced only when atmospheric interference is substantially absent. The reason for this condition is, of course, that the receiving amplifiers commonly magnify the interfering effect of "strays" as much or more than the desired signals. Once the atmospherics are eliminated or re-



1—Magnetic amplifier used for controlling powerful radio-frequency currents. The output of a microphonic transmitter, once amplified through a vacuum tube, has modulated telephonically some 75-kw. of radio-frequency power.

2—75-kw., 50,000-cycle, high-frequency alternator for radio telegraphy and telephony. When connected directly to a tuned aerial wire system, this machine generates a continuous stream of 6000-meter ether waves.

3—Page printing telegraph with girl operators sending from one end of a quadruple duplex installation. A single wire with ground return is thus used, on the synchronous distribution plan, to transmit simultaneously eight messages. Each is automatically typewritten by the receiving machine at from forty to sixty words per minute.

4—The main tower of the new Sayville, Long Island, wireless station, which is in daily communication with Nauen, Germany. Two other 500-ft. towers have been erected, and, together with the central tower shown, support a "roof" antenna having a ridge length of about 2000 ft. 200-kw. is used in signaling across the 4000 miles to the station near Berlin.

5—The United States government station at Arlington near Washington. The central tower is 600 ft. high, and the others 450 ft. Trans-Atlantic telephony was first accomplished from this plant.

6—Poulsen 100-kw. arc transmitter used during San Francisco-Honolulu tests. A typical form of this type of undamped wave generator. The arc discharge in a strong magnetic field is such that it produces sustained electrical oscillations of radio frequency.

7—DeForest audion amplifier. The characteristic structure of hot filament, cold plate and intermediate grid electrode is embodied in each of the three evacuated tubes shown. Such devices are capable of magnifying telephonic currents without introducing great distortion.

duced before the amplifier is reached, however, feeble incoming or received power may be built up materially by local telephone relay action, and a corresponding saving in transmitter power will result.

During 1916 a number of new proposals for stray reduction have been brought forward. It seems likely that during the coming year at least two of these methods will have sufficiently extended practical trials to determine their true commercial value. In the past fifteen years or so a vast group of static-preventing schemes have been tried and found worthless for their intended purpose. Nevertheless, by the elimination of many false ideas on atmospherics (rather than by the elimination of the interference itself) these early plans have been of material assistance in the growth of the art. When a well-informed radio engineer of to-day brings forward a stray reducing invention, the probability that it will prove useful is far greater than was the case under equivalent circumstances some five years ago.

The "static" problem is not the only one engaging the attention of workers in the art, though it is probably of the greatest basic importance. The combination of sustained wave generation by arc or machine having radio frequency output, with "heterodyne" or electrical beat receivers, has already provided a practical freedom from atmospheric disturbance which makes long distance radio telegraphy entirely practical. The main advantage to be secured from further stray reduction is the great economy of sending power (and the consequent simplification of transmitter design and construction) which will result. Since this is a matter controlling the size of profits to be gained, rather than determining commercial operability, many engineers have directed their energies along other lines. The transmission of messages over great distances at high Morse speeds in the neighborhood of 100 words per minute, and the automatic recording of received signals in such systems, are approaching conditions of practical performance. In fact, such "rapid" systems are already in use at some of the most important trans-oceanic stations.

Commercial or Governmental Ownership

Although much attention is being given to the difficulties emphasized by the conditions of long distance radio signaling, steady improvement in local and ship-to-shore service is to be noted. The probability that generators of undamped waves suitable for ship working, and producing the extremely high frequencies corresponding to the 300 and 600 meter wave lengths specified by law, will be brought out during the coming year, shows the drift of all branches of the art toward the continuous-wave method. Ship-and-shore communication has had a hard struggle against restrictive legislation of a most unintelligent sort, but has grown and improved despite the handicaps imposed by the Berlin and London International Radio Conventions. The military interests of the federal government, acting in the name of "preparedness," are now urging further and stricter laws to govern the commercial operation of radio telegraphy. It is admitted that the proposed legislation is intended to make possible, if not inevitable, the naval ownership of coast radio stations involved in ship-to-shore signaling. Commercial, scientific and non-military interests are opposing the Navy Department's campaign. The outcome is not yet in sight, but the conflict promises to be memorable. Its result will determine whether radio signaling in the United States will continue to hold its present position of pre-eminence, or whether the art will be subject to the initiative-killing suppressive policies of military ownership and domination.

SOME NEEDS OF THE ILLUMINATING ENGINEER

Illumination Considerations That Involve Design, Selection and Installation of Fixtures for Gas-Filled Tungsten Lamps

BY DR. LOUIS BELL

This brief article is written in the hope that it may stir to activity the designer of illuminating accessories, bring the maker to an appreciation of some missed opportunities, and perhaps bring into the spotlight some excellent devices already at hand but not yet as widely known as they deserve. The coming of the Mazda C lamp into wide use has materially changed the requirements for lighting accessories like shades, globes and reflectors. The Mazda C lamp does not interchange readily in the devices convenient for the older type. This difficulty was appreciated from the very first and has been in part remedied, so that special lines of fixtures have been brought out at least fairly well adapted for the new illuminant. Yet the range of fixtures for type C lamps is still limited, and in particular there is need for socket and shade holding adapters so that many excellent installations of glass ware can be conveniently utilized. This work is under way, but it is far from complete. Somewhat more serious are the difficulties brought by the concentrated filament of the type C lamp, valuable for some purposes yet presenting a source of such enormous brilliancy that it requires special treatment. Globes which were entirely unobjectionable with the type B lamps glare very seriously when equipped with type C and in many instances the new filament shows a conspicuously bright spot.

The concentrated source of light, too, complicates considerably the design of many excellent types of semi-indirect fixtures; the shadows at the edge of the bowl become hard and unpleasant, and the chain shadows, too, form black markings on the ceiling much more obtrusive than those due to the more extended filament of the earlier lamps. To overcome the former difficulty particular care has to be used in planning the edge of the bowl and in positioning the filament with the utmost accuracy. Here again a suitable set of adapters would be a great convenience in getting the filament at exactly the right point. Likewise the chains should be lightened and so positioned as to diminish the shadows as far as feasible. As regards the material of the bowls the filament does not as a rule show through conspicuously, but often produces a bright diffused spot which greatly detracts from the appearance of the fixture when lighted. Here again careful positioning of the lamp is necessary, and as the type C lamps are now fitted for horizontal burning multiple fixtures can and should be used very much more than they were at first. Extra care has to be exercised in order to obtain a suitable diffusion of the light between the transmitted light and the reflected rays, and in general terms the bowl design can well be modified in the direction of more oblique incidence of the reflected rays, producing better diffusion on the ceiling and at the same time lessening the effective transmission.

In general, too, the size of bowls, and for that matter globes, or other inclosing shades, must be somewhat larger than with the earlier lamps to avoid too great intrinsic brilliancy. If one stops to consider the apparent area of the diffusing screen used, for instance, to house a 500-watt lamp and measures the light transmitted, it will often be found that the intrinsic brilliancy of the fixture runs very much higher than is desirable for good illuminating practice. This difficulty is in part due to lack of thought in changing illuminants, and in part to the constant and very natural

tendency of manufacturers to keep down cost of fixtures by diminishing their size. There are a good many fixtures adapted for type C lamps on the market, which, from the standpoint of intrinsic brilliancy, are absolutely intolerable with the size of lamp for which they are listed. This same difficulty was conspicuous in the days when open shades were the general rule. There was a constant tendency to make them just a little too small, and the writer for some years habitually used with a given lamp the next larger size of shade to get the skirt deep enough to protect the eye. This difficulty, both with open shades and with inclosed ones, is greatly aggravated by the type C lamp and a little more liberality in the matter of sizes would improve the situation very much. It is true that the commercial pressure of costs is against this change, but on the other hand good engineering demands it. It is one of the inevitable penalties paid for having available an illuminant of peculiarly high efficiency. Part of the advantage gained in watt consumption has to be sacrificed in many cases to requirements of proper installation.

Finally, there is an increasing call for shades of color somewhat toned in order to avoid the extreme whiteness of the type C lamps. This is extremely useful for some purposes as witnessed by the rapidly increasing use of these units, and even those in which still higher efficiency and a blue bulb gives the daylight effects sometimes greatly desired; but there is a large call especially in domestic work for toning in the other direction, toward the red and yellow. It is a comparatively easy matter to get, at a price, built-up shades to meet this requirement, but there is certainly an admirable chance for a line of well-designed decorative shades of moderate price to meet the special requirements of the very white and very bright modern lamp. The manufacturer who will specialize a little in this direction at the present time is likely to reap a very satisfactory reward. Suitable shades can be obtained by discriminating search but they ought to be so common an article of manufacture and carried so regularly in stock that the purchaser would find them ready to his hand. Plain bulbs dipped, and bulbs made of colored glass, are already coming into use and for certain purposes are quite sufficient, yet they hardly give the same result in softening of light as artistically designed fixtures.

Eminent Domain and Transmission Lines

When the laws relating to the manufacture, distribution and sale of gas and electricity were codified and extended in Massachusetts (Chap. 742, Acts of 1914), a new section (128) was introduced giving a limited power of eminent domain for the construction of transmission lines. As a condition precedent to the exercise of this power it had first to appear, after a public hearing, that the company had acquired rights in the public ways or over private lands for more than three-fourths of its length in the city or town through which it was to pass, and that the line was necessary and would serve the public convenience and be consistent with the public interest.

Experience in the administration of the law has developed a serious embarrassment in that a company has no occasion or even right to invoke the gas and electric light commission's authority until it has purchased or optioned not less than 75 per cent of the route and is held up by a few landowners with whom it cannot trade at all or upon reasonable terms. At this stage the commission is called upon to pass for the first time upon the questions which are fundamental to the exercise of eminent domain. In place of the present procedure the commission recommends to the 1917 Legislature that there should be first a preliminary hearing and decision upon the broad question of the public convenience and necessity to be served by the line. If this is decided affirmatively and the company is unable subsequently to acquire rights for the entire length of its line, further hearings and decisions as at present provided may then be had looking directly to the exercise of eminent domain.

MUNICIPAL PLANTS SHOULD SHARE COST OF REGULATION

Massachusetts Commission Also Recommends That All Managers of Municipal Plants Be Chosen from Civil Service List

Massachusetts municipalities operating lighting plants have from the outset been required to make annual returns to the Gas and Electric Light Commission and are subject to its specific authority with respect to certain features of their business. They are not required at present to share in the board's expenses, which have been entirely assessed upon the private companies under its supervision. Since municipal lighting plants were first acquired, states the commission in its recommendation for legislation just filed with the General Court, the board has been frequently called upon for interpretation of the municipal lighting law, and for advice as to accounts and the conduct of the business and still devotes an increasing amount of time to them. In view of their number and importance the Commission believes that the time has come when its expenses should be assessed upon municipal plants as well as upon the privately owned companies, and recommends legislation to this effect at the present session.

The commission has for many years regarded the existence of the power of a municipality to acquire a gas or electric plant, even though not exercised, an important aid to the effective public regulation of the privately owned companies under its supervision. In its recommendations the board points out that the value of this power is dependent upon the successful operation of such plants as have already been acquired by cities or towns. "One weakness which experience has developed is the insecure tenure of office of the managers of such plants, and the pressure which is frequently brought to bear upon them to permit or adopt practices with respect to the conduct of the business which will in time undermine the efficiency of such plants and the integrity of the public investment therein," states the report. The manager of the largest and most successful municipal plant in the commonwealth (Holyoke) was in 1915, by special act, put under the civil service laws to its distinct advantage. The board believes that the managers of all municipal lighting plants should be brought under the civil service.

The report further points out that any abandonment of public ownership once undertaken may seriously impair the value of the existence of the power in cities and towns to engage in the business of supplying gas and electricity as an aid in the proper regulation of gas and electric companies. Considerable headway has recently been made in two important instances (Concord and Westfield) in projects for the sale to privately owned companies of existing municipal plants. In two minor instances such sales have occurred. The commission recommends legislation prescribing the same careful and deliberate action in abandoning as in undertaking public ownership. Municipal plants have hitherto been restricted from supplying power to electric railways for car service, and the board recommends that this prohibition be nullified.

Features of New Jersey Company's Latest Station

By P. H. Chase

Member of the Engineering Department of the Public Service Electric Company of New Jersey

Switching and Reactor Arrangements, Use of Special Apparatus and Provisions for Insuring Continuous Service and Facilitating Plant Operation



THE new Essex station of the Public Service Electric Company of New Jersey embodies the most modern of construction features. Among these are the use of 25,000 kva. 1800 r.p.m. turbo-generators with direct-connected exciters, provisions for reclaiming heat lost in the electrical apparatus, switching methods to permit independent or parallel operation of generators, employment of synchronizing and feeder reactors, isolation of switch and control house from remainder of plant, arrangements for transferring control, extensive use of motor drive for auxiliaries, provisions for an uninterrupted supply of exciting energy and aluminum arresters on the generator fields. Other novel features which may be found at this plant are the elaborate indicating and recording boiler-room instruments, motor-operated steam and water valves, multi-recorders for indicating sequence of switch operations, faulty-cable localizers, high-tension testing apparatus, signalling system for auxiliary attendants, automatically indicating load-dispatcher board, and radial-type control system.

General Layout of Station

Essex station is located on the Passaic River about 2.5 miles east of Newark, N. J. This station had to be built to provide for present and future increases of both commercial and railway loads and to insure continuity of service with economy of operation. Of the available sites, the one selected was chosen because of its nearness to load, abundance of circulating water, convenient facilities for receiving coal by rail and water, and because of ample coal-storage space. Construction was started in 1914 and on Oct. 1, 1915, the first power was delivered from its generators.

The layout of the station will permit an ultimate installation of six generators. The first installation included two 25,000 kva. generators and four boilers, one generator being considered spare. In 1916, four additional boilers were installed, and orders were placed for a third generator of 35,000-kva. capacity and another set of four boilers to be installed in 1917. The coal-handling equipment is designed for an ultimate station capacity of 200,000 kva.

Of the ultimate station, one-third of the boiler house, one-half of the turbine room and one-half of the switch house are now constructed. This year the switch house will be extended to accommodate more out-going feeders, and the second section of the boiler house will be erected. The present boiler house is 166 ft. deep, 116 ft. wide and 106 ft. high; the turbine room is 90 ft. wide, 113 ft. high and 167 ft. long; and the switch house is 70 ft. wide, 95 ft. high and 117 ft. long, with six floors. Future extensions to the station will be made toward the south.

Since this article centers on the electrical features of the station, mention will be made of other equipment only when necessary for completeness or clearness. At the east river end of the boiler house is a coal tower which includes all equipment necessary for (1) unloading coal from railroad cars or river barges, crushing it to uniform size and conveying it to the coal bunkers located back of and adjoining the boiler house; for (2) unloading coal from railroad cars or river barges for storage in the coal yard; or for (3) reclaiming coal from the storage yard, crushing and conveying it to the coal bunkers. Chutes are provided in the outside coal bunkers, opposite the end of each firing aisle, so that coal may be brought into the building and distributed to the motor-driven stokers by means of 15-ton motor-driven weighing larries, one for each firing aisle.

The boilers are located on the main floor of the boiler house and are arranged four per row, with firing aisles at right angles to the center line of the turbine room. Below them in the basement are located ash-handling equipment, forced-draft blowers, boiler feed and miscellaneous pumps, piping and the power-distribution switchboard for the present section of the boiler house. Above the boilers are the economizers, one being provided for each boiler. Provision is made, as usual, for by-passing the flue gases. When the economizers are being used, the gases are drawn through them by motor-operated induced draft fans.

A wider turbine room than is usually employed in central stations was provided to allow the installation of generating units of 35,000 kva., without cramping the space required for assembling and repairs. A 100-ton electrically operated crane was also provided. Space was allowed at the north end of the turbine room for three 150-kw. motor-driven exciters, one of which is now installed. Under the turbine room is a basement, approximately 30 ft. high, containing the condensers, auxiliary apparatus and air-washing equipment for the generators.

Isolated from the rest of the station and standing to the west of the turbine room is the switch house, which contains six floors. A covered bridge connects the buildings. The southern part of the building contains the high-tension equipment, while the remainder is devoted to offices, station-power equipment, storage batteries and the control room.

Main Electrical Connections and Switching Arrangements

For the main electrical connections an adaptation of the old arc-board scheme has been adopted, since it affords very flexible operation. With this arrangement, which consists of one generator bus and one feeder group bus for each generator installed, any generator may be connected directly to any group of feeders. Eleven feeders will eventually be connected to each group bus. Oil switches are used between each generator, its respective bus and the tie bus, and also between each generator bus and group bus. In addition selector switches are provided so that each feeder may be connected to either of two group buses. Including the feeder oil switches, but not the ground suppressor oil switch which will be connected to the tie bus, there will thus be 180 high-tension oil switches required in the ultimate plant of six generators and sixty-six feeders, making 30 switches per generator. The relatively large number of oil switches is justified, however, by the ease with which loads may be shifted from one generator to another, individual feeders segregated for special operating conditions or test, and buses quickly cleared for repairs.

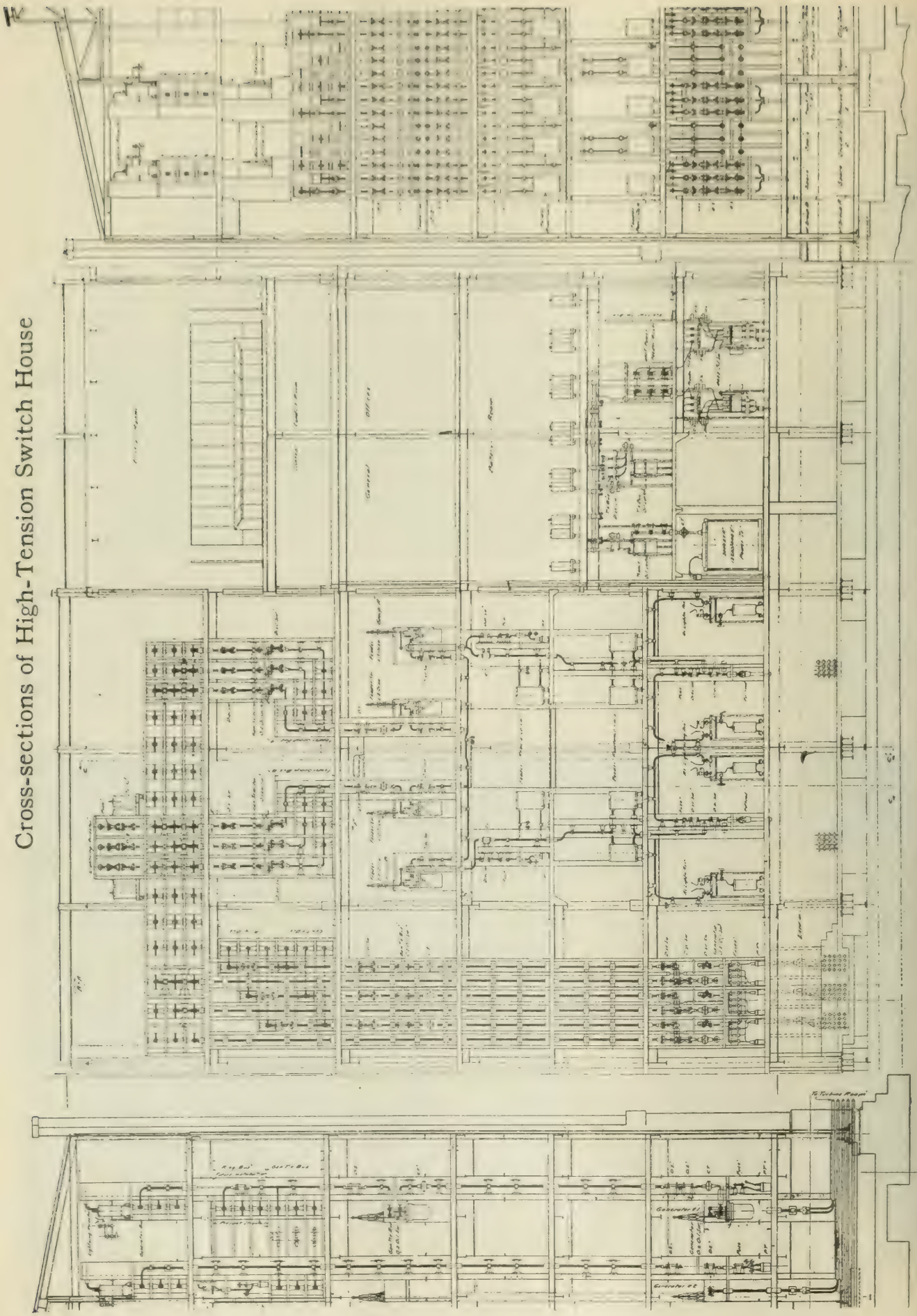
Reactors will be installed later between each generator and the tie bus for the following reasons: (1) To protect the generator windings, buses, connections and oil switches; (2) to help maintain service when a fault develops on one feeder; (3) to maintain service on all feeders when trouble occurs in any one of the generators, and (4) to secure protection while obtaining the several operating advantages of parallel operation. The particular connection selected for these reactors was chosen because it will permit using the minimum size reactors under given conditions of generator capacity, reactance and short-circuit protection. The general scheme of connections and the effect of the tie-bus reactors on short-circuit with grounds are shown in the diagram on page 128.

Reactors will also be used in each high-tension feeder, those connected with substations having 5 per cent reactance and those for tie feeders to other stations having 2.5 per cent. Since reactance is also inserted in the other ends of the tie feeders the total is the same as for feeders to substations. The effect of the tie-bus reactors is indicated by accompanying curves. These are based on six 25,000-kva. generators like those installed at present, carrying separate loads, and a short-circuit occurring on a generator bus or lead. With the particular value of reactance selected, therefore, the maximum short-circuit current will be within the rupturing capacity of the oil switches employed. The reactors will not be installed until the 35,000-kva. generator ordered for 1917 delivery is in place, since one of the two 25,000-kva. generators was intended originally as a reserve unit. As shown by the diagram of main electrical connections, disconnecting switches are inserted in the tie bus between each generator so any section may be repaired while the generators are tied together



TWO 25,000-KVA. TURBO-GENERATORS COMPRISING PRESENT STATION EQUIPMENT. A 35,000-KVA. UNIT IS BEING INSTALLED AND PROVISIONS ARE MADE FOR EXTENDING THE STATION TO ACCOMMODATE SIX GENERATORS HAVING A TOTAL RATING OF OVER 200,000 KVA.

Cross-sections of High-Tension Switch House



through the loop. Reverse-power relays protect the generator oil switches, overload relays with high time setting the tie-bus switches, time-element relays the feeder selector switches and radial feeders, and special relays the tie feeders. The generator selector switches are non-automatic.

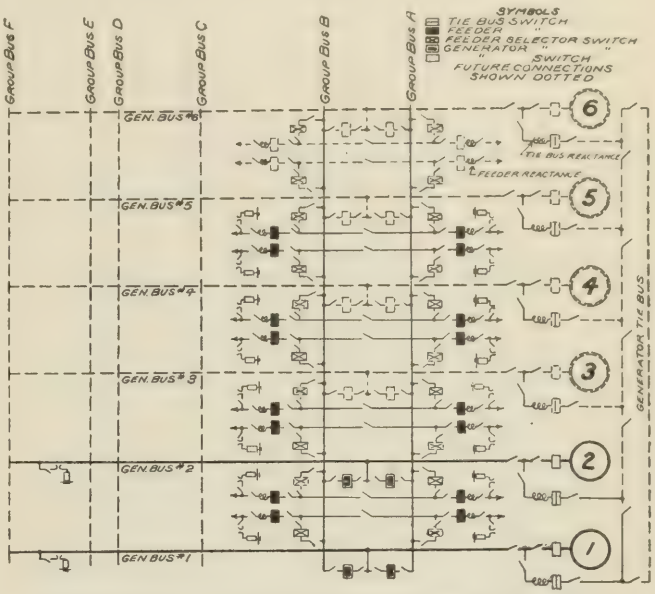
Since it was not considered necessary to have the switchboard operators see the turbines, the switch house was detached from the turbine room. This arrangement permits better lighting and ventilation, and minimizes the chance of serious trouble in the boiler or turbine room interfering with switchboard operation or load dispatching. The arrangement of apparatus in the switch house is shown in accompanying cross-sections and the wiring diagram in conjunction with these sectional views shows the course of circuits.

Switch Structures, Cable and Wiring

The various compartments, switch cells and bus structures in the station are constructed of special concrete brick, and are painted a battleship gray. For mounting the supports of the main leads and disconnecting switches, cast-iron inserts were built in these structures and also cast in the floors. For the generator leads and feeder selector leads cambric-insulated and braided copper tubing is used. The feeder connections are 350,000 circ. mil. cambric-insulated braided cable and the 13,200-volt buses are bare flat copper. Double supports are used for the buses and the generator leads to further safeguard these important parts of the main connections. Connections in the copper tubing are made by "shrink-fit" copper connectors to insure an absolutely reliable electrical and mechanical connection. The cables for the 440-volt power service and the main lighting feeders are cambric insulated and lead sheathed.

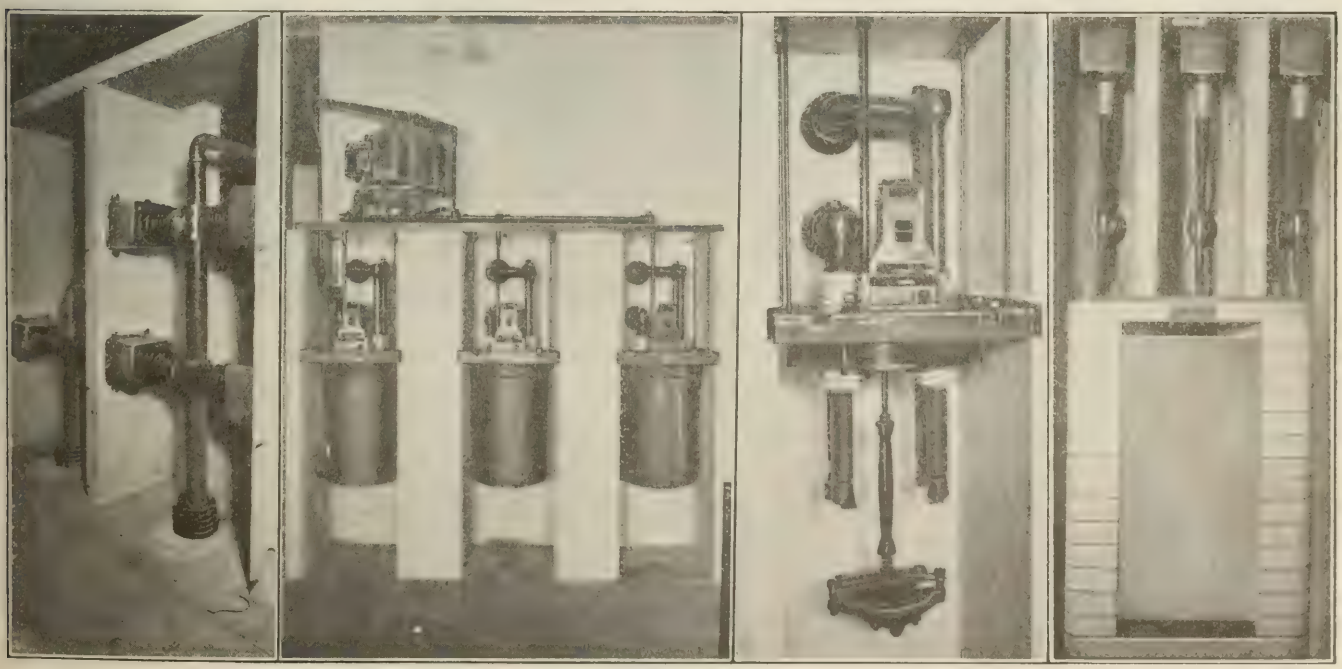
All of the automatic solenoid-operated oil switches are equipped with special "trip-free" relays which will not allow the oil switch to be held closed in case it has been closed on a short-circuit. This permits proper operation of overload and other protective relays with close time settings. The control cable for each oil switch is carried in a separate conduit from start to finish and the old type of common pull box has been abandoned. The 13,200-volt oil switches are mounted in concrete brick cells, with the operating solenoids above, while the 440-volt oil switches are mounted on pipe framework with the operating solenoids at the front of the switch. Every 13,200-volt and 440-volt disconnecting switch is equipped with a lock which prevents the switch being opened except by a switch hook.

In the present part of Essex station there is in the



CONNECTIONS OF GENERATORS WITH GROUP BUSES AND OUTGOING FEEDERS

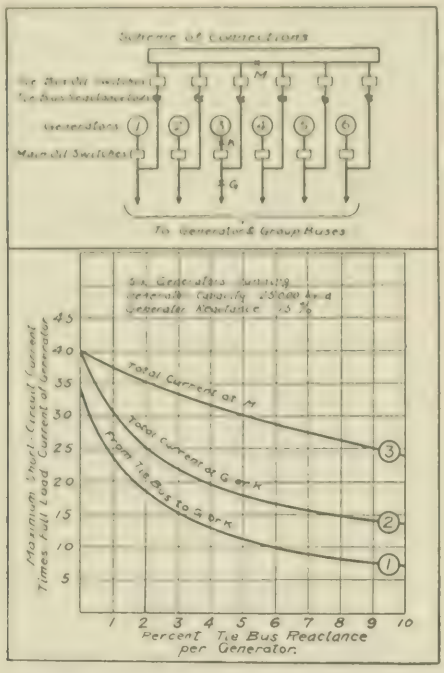
neighborhood of 250,000 ft. of conduit of all sizes. Most of it is of iron, although some brass was used for runs near or across single-conductor leads passing through floors and walls. Fiber conduit was used for the generator cables between the turbine room and switch-house basements. A large part of the lighting and control conduits in the boiler house are run exposed, but elsewhere conduits are carried largely in the floors and behind curtain walls. Many individual junction and pull boxes are installed to facilitate pulling cable and for protection between cables. On account of the large number of conduits and the necessity of properly identifying them while making up the conduit drawings,



BRACED GENERATOR LEAD, FEEDER OIL SWITCH AND FEEDER REACTOR

during construction, and for future additions, a numbering scheme was adopted.

Taking up the entire space on the fifth floor under the control room is a conduit room, where most of the conduits coming up the walls and in the floors are distributed to their proper destinations in the control room. It is believed this control conduit room is a



EFFECT OF TIE-BUS REACTORS ON SHORT-CIRCUIT CURRENTS WITH GROUNDS AS INDICATED

somewhat novel solution of the problem of properly distributing the conduits while providing for any changes that may be required in the future by expansion or changes in arrangement.

Type of Control System Used

Particular attention was given to laying out the control system so it would be as reliable as possible and so any trouble could be localized, easily located and service restored immediately through the proper emergency connections.

To use a radial scheme of control distribution satisfactorily it has been necessary to resort to special relays and connections to avoid any inter-connections between the branch feeds of the system under all operating conditions. The chance that trouble on one branch feed may affect the rest of the system is therefore very remote. A 35-kw. charging set will be floated on the control battery continuously, but in case of trouble the control system may be connected to the 250-125-volt exciter battery leads.

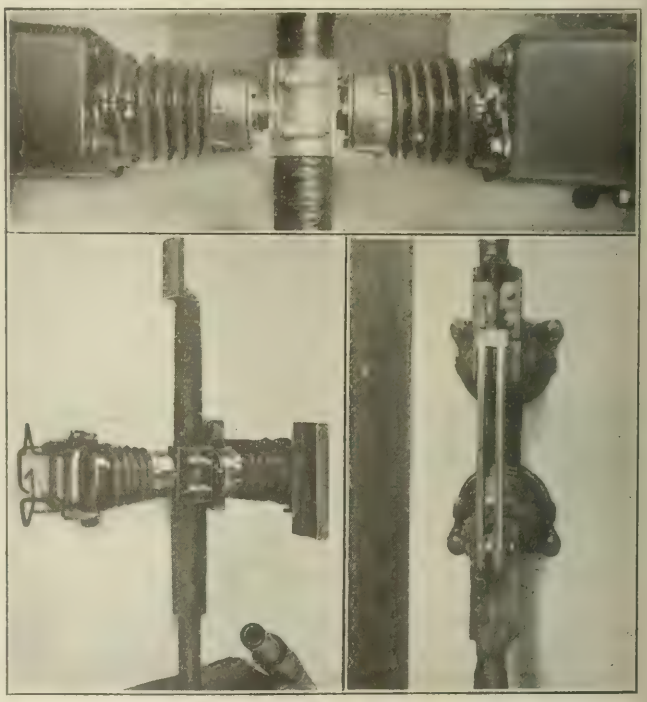
The control switchboards, which consist of two groups of three boards each, are arranged in curved rows on opposite sides of the operators' desk. One group of boards is for the generators and exciters and the other set for feeders. The boards nearest the operator's desk are of the bench type, and carry the control switches and indicating lamps. The second row of panels is vertical, and carries the indicating instruments. The third row of feeder panels carries protective relays, while the third row of generator panels carries curve-drawing and recording meters. This arrangement and segregation of panels simplifies the wiring on the boards and also permits all control and indicating equipment being seen from the operator's desk. While only part of the ultimate generating and feeder equipment is installed at present it was considered advisable to provide the complete switchboard equipment on account of wiring conditions and appearance of the boards. Vertical panels are installed at the sides of the control room for controlling the station power and lighting equipment and the multi-recorder and control batteries. Space is also provided for future generator-voltage-regulator panels.

On one of the vertical boards is a panel carrying a clock and two special synchronism indicators which are equipped with recording paper and an attachment for automatically moving the paper when a record is made. All the high-tension oil-switch control connections are so arranged that one of these synchronism indicators must be connected therein before the oil switch can be closed. Thus a record is obtained when each oil switch closes, showing whether it was closed at the correct instant. The synchronizing equipment throughout is in duplicate.

High-Tension Testing Equipment

A high-tension set is provided for testing the outgoing high-tension cables. With it is used a 2500 kva. reactance with 75, 50 and 25 per cent taps, which will closely balance the capacity of high-tension cables of any size up to 350,000 c.m. and 15 miles in length at 30,000 volts, the 350-kva. testing transformer supplying the additional capacity. From the testing equipment a high-voltage lead is carried along the feeder compartments on the first floor and test connections are made to the cable at the pothead.

In another section of this article to appear in a



METHODS OF BRACING HIGH-TENSION LEADS AND TYPE OF DISCONNECTING SWITCH USED

The construction shown in the top panel is used where the insulators can be attached to cell walls. Where this arrangement is impracticable one insulator is fastened to the back wall and the other placed on the open side of the cell wall and attached to brackets bolted to the barriers.

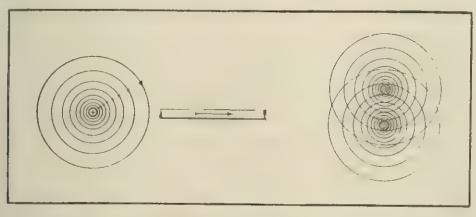
following issue other features of this station will be described. It is of interest to note that the electrical layout of Essex station and all the electrical construction work, except the erection of the generators and storage batteries was made entirely by the engineering department of the Public Service Electric Company of New Jersey, no outside consulting engineers being employed in its design or construction.

Fundamental Principles of Present-Day Transformer Design

How Different Arrangements of Coils Affect the Displacement Stresses in Transformers, Methods of Bracing Windings and Considerations in Favor of Moderate Reactance

By W. M. McConahey and J. F. Peters

ALTHOUGH the induction coil which is the same in principle as the transformer was developed by Joseph Henry about 1830 nothing was done toward the development of the transformer until about fifty years later, when the question was taken up in England by Gaulard and Gibbs. Patents on core-type transformers were secured by these men in 1882. The following year the late William Stanley began an investigation of the subject for George Westinghouse and in 1885 designed shell-type transformers that had substantially the same form as many of those built to-day. In 1886 the Westinghouse Electric Company purchased the American rights of Gaulard and Gibbs and secured from them samples of transformers that they had built in England. During the same year the Westinghouse

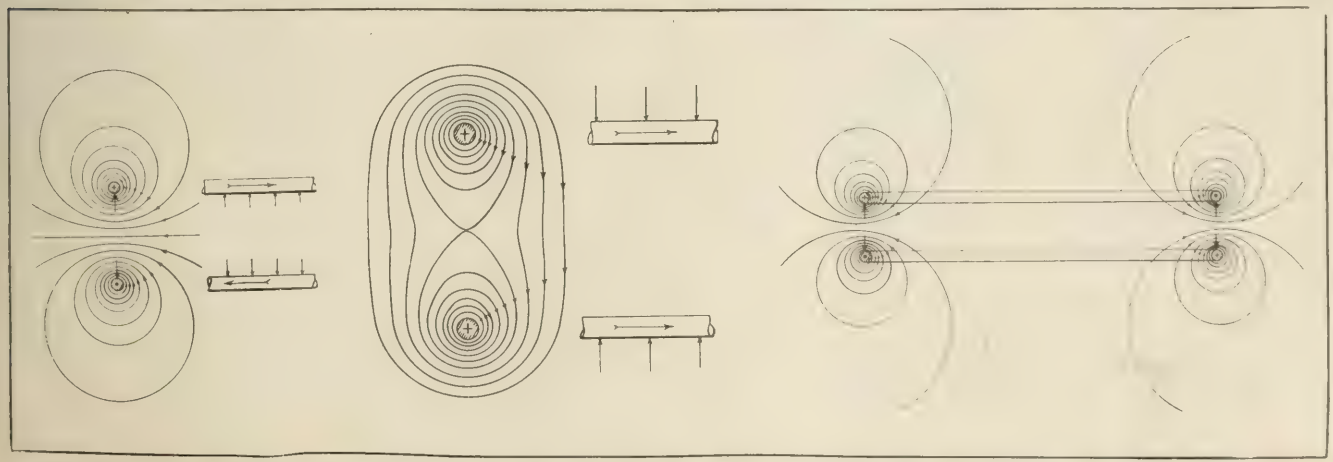


FIGS. 1 AND 2—MAGNETIC FIELDS AROUND SINGLE AND PARALLEL CONDUCTORS ASSUMING NO DISTORTION

company began the production of transformers for commercial use and from that time on there has been steady progress in the art. Ratings have increased from 2 or 3 kva. to 15,000 or 20,000 kva. and voltages from a few hundred to 150,000, but all this advance has been made in the short space of thirty years. Naturally, during this period many different forms of construction have been tried out, but, except for distributing transformers, the original simple forms of shell and core types, with modifications and improvements, have survived. Each of these types has its particular advantages under different conditions and careful designing engineers will consider the conditions involved before recommending a type for any specific service.

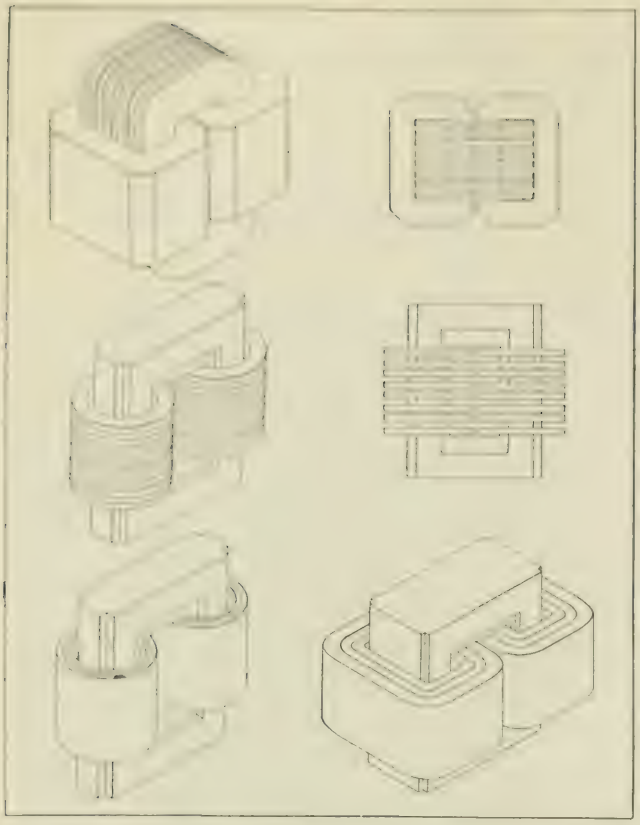
Some of the fundamental principles of design that apply to all types of transformers will be taken up in this article, particular attention being paid to the mechanical stresses that occur in the windings during short-circuit in the secondary system. To permit logically following the theory that applies to transformer operation it may be pointed out that a conductor, carrying either direct or alternating current, will produce a magnetic field like that shown in Fig. 1 if located in air or in any other non-magnetic medium and at a considerable distance from other current-carrying conductors or magnetic material. The field is in the form of concentric circles, its density at any point being directly proportional to the current flowing in the conductor and inverse proportional to the distance from the point to the conductor. If two conductors carrying current are brought close together, each will be subjected to the magnetic field surrounding the other, and if the two fields were not influenced by each other they would assume the paths in Fig. 2. Actually, however, the fields combine to form a resultant field, the shape of which depends upon the relative directions of the flow of current in the two conductors. With currents flowing in opposite directions the relation is as shown in Fig. 3. This field is in the form of eccentric circles and tends to produce mechanical repulsion between the conductors. When the currents are in the same directions (Fig. 4) the field tends to produce mechanical attraction between the conductors. The conditions illustrated are typical of those that exist in coils without iron, such as current-limiting reactors. Whether the force exists as repulsion or attraction its value is the same for any given current and separation of conductors.

Applying these relations to coils it can be seen that the conductors in one side of a coil attract each other, while those in opposite sides repel each other. However, when coils are assembled in groups in a transformer, the secondary ampere turns are equal and opposite to the primary ampere turns, so one side of a primary group will attract the opposite side of an adjacent secondary group, the net result being that the repelling and attracting forces between opposite sides



FIGS. 3, 4 AND 5—FLUX PATHS AROUND PARALLEL CONDUCTORS WHEN CURRENTS ARE IN OPPOSITE AND SAME DIRECTION

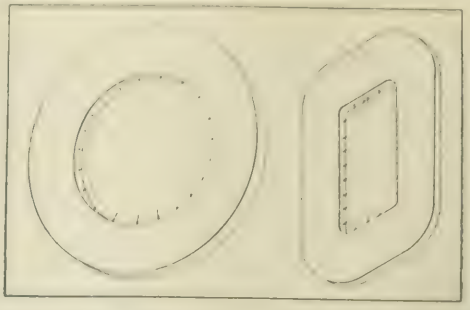
With currents through parallel conductors in opposite directions as shown in Fig. 3 the conductors repel each other while with currents in the same direction as in Fig. 4 attraction exists. Fig. 7 represents the flux paths around two adjacent primary and secondary coils showing repulsion.



FIGS. 6, 6A, 7, 7A, 8 AND 9—FORMS OF WINDINGS ORDINARILY USED WITH CORE AND SHELL-TYPE TRANSFORMERS

practically balance each other. In other words, the repelling forces between opposite sides of a coil in a transformer under short circuit are negligible compared with the forces tending to force apart adjacent primary and secondary coils. By examining Fig. 5, showing the field around two adjacent primary and secondary coils of one turn each, it may be noted that the magnetic condition is similar to that shown in Fig. 3, and that it produces repulsion between the coils.

The forces of repulsion between primary and secondary coils under the short-circuit conditions depend upon several factors, chief among which are frequency, size, voltage and the amount of reactance in the circuit. These factors can be controlled to a large extent by carefully proportioning the design. The worst conditions are met in designing a large transformer for low frequency and low or moderate voltage to operate on a circuit of low impedance fed from a power house of very large rating compared with the size of the transformer. No matter what type of design is used, there are always adjacent groups of primary and secondary coils to repel each other, in case of short-circuit, so that the problem of bracing against these stresses is ever present. Short-circuit stresses can be calculated with a reasonable degree of accuracy, so that the suitability of any design, as regards mechanical strength,

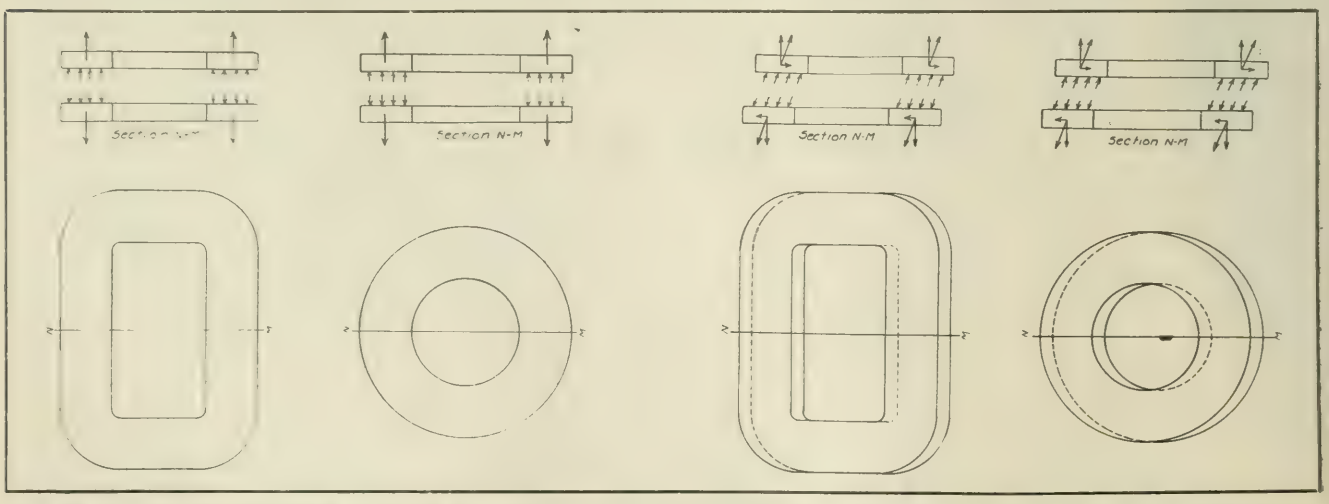


FIGS. 10 AND 11—FORCES ACTING ON ROUND AND RECTANGULAR COILS

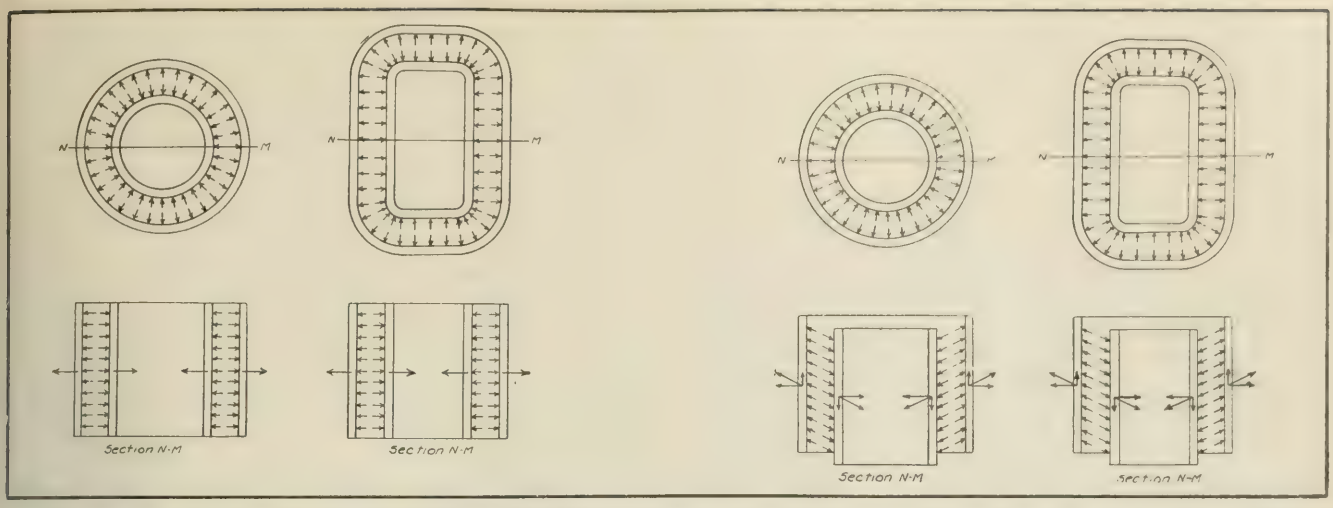
can be determined easily if the necessary service data are at hand. The amount and direction of the forces in different parts of the winding must be analyzed carefully, however, and all parts designed with such strength that mechanical distortion or damage cannot take place. In addition, careful attention must be paid to the relative positions of the groups of primary and secondary windings, as regards their electrical centers, since this relation has considerable influence on the distorting effect of the repulsive forces. By referring to Figs. 6, 7, 8 and 9, showing forms of windings ordinarily used with shell and core-type transformers, it should be evident that the problem of taking care of the short-circuit stresses does not differ materially with the two types.

When groups of flat primary and secondary coils having the same overall dimensions and identical electrical centers are used the magnetic forces act in the directions shown in Fig. 12. In this case the repelling forces are all at right angles to the planes of the coils. When the electrical centers are separated, however, there is a component of force parallel to the planes of the coils as well as at right angles to them, as shown in Fig. 13. The perpendicular component may be quite large, and in some cases sufficient to drive the coils apart with enough force to damage them.

With concentrically arranged primary and secondary



FIGS. 12 AND 13—FORCES EXERTED BETWEEN FLAT PRIMARY AND SECONDARY COILS WHEN THE ELECTRICAL CENTERS ARE IDENTICAL AND SEPARATED

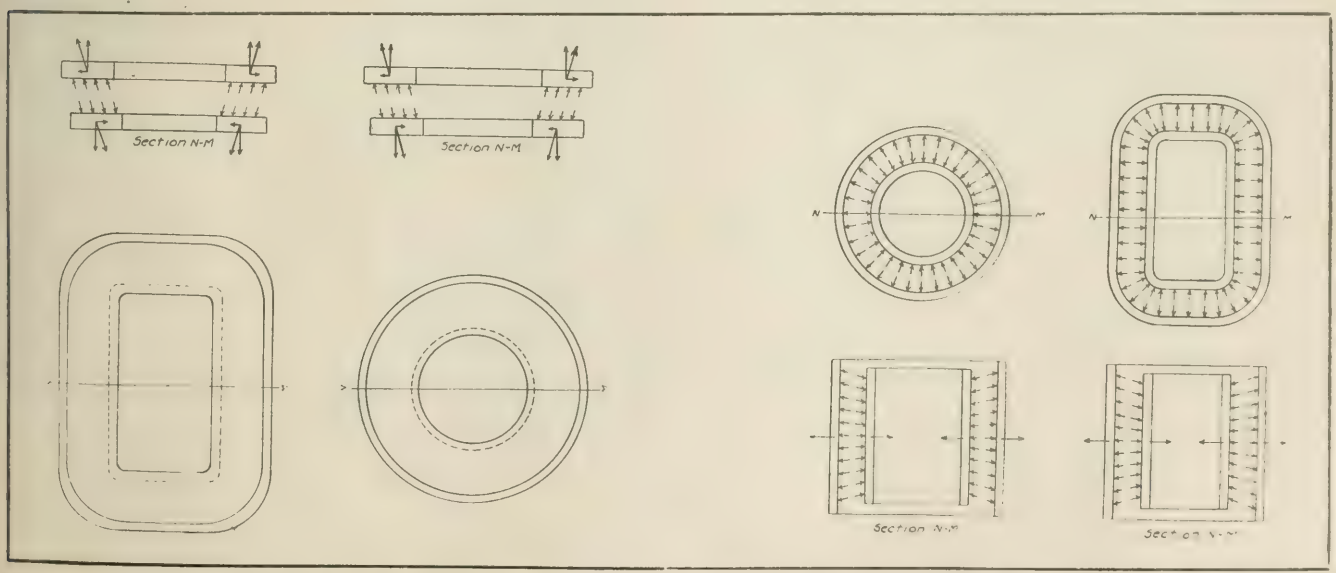


FIGS. 14 AND 15—FORCES EXERTED BETWEEN CONCENTRICALLY ARRANGED CYLINDRICAL PRIMARY AND SECONDARY COILS WHEN THE ELECTRICAL CENTERS ARE AND ARE NOT IDENTICAL

core-type windings whose electrical centers are in the same plane, the forces are at right angles to the axis or center line of the windings, as shown in Fig. 14, so they will not injure cylindrical or round coils. In large transformers wound with rectangular coils, however, the repulsive forces may be great enough to cause the coils to bulge out and tend to take a round or cylindrical form. For this reason rectangular coils are used only with comparatively small transformers of this class in which the forces of repulsion are small. When the electrical centers of concentrically arranged coils are not in the same plane, a magnetic component is produced parallel to the axis or center line of the coils. Even with a small displacement, this force may be very large, due to the fact that the primary and secondary windings are each arranged in one group per leg instead of being split into several smaller groups which are interleafed. The force is directly proportional to the product of the square of the ampere turns per group and the average length of the turns, and inversely proportional to the length of the magnetic leakage path between groups.

Since it is generally impracticable to employ a plurality of interlaced windings of the types shown in Figs. 14 and 15, in high-voltage transformers, due to the complications introduced in winding, insulating and bringing out leads, only one group of primary and one of secondary coils is employed on each leg in nearly all cases. With this arrangement the length of the leakage path between primary and secondary groups is comparatively long, but the square of the number of turns in a group is relatively very large, the net result being that, with a small relative displacement of windings, the short-circuit stresses may be very large. Furthermore, with the cylindrical or tubular form of coil, the surface afforded on the ends for bracing is very small, so that the short-circuit stresses per unit area may be very great and may be sufficient to cause the end turns to telescope and damage the coil. In practice it is difficult to assemble the primary and secondary windings so that their electrical centers are in exactly the same plane, this difficulty being increased when taps are brought out from the windings, as is generally the case. Slight variations in the thickness of ventilating spacers between flat or disk-shaped coils may also be sufficient to throw the electrical center off from the mechanical center enough to cause considerable stresses, even though the primary and secondary windings may be properly centered mechanically.

Fig. 16 shows the directions in which the magnetic forces act between groups of flat primary and secondary coils in which the groups are concentric with reference to one another, but one group has smaller dimensions than the other. In addition to the repelling forces at right angles to the planes of the coils, there are com-



FIGS. 16 AND 17—FORCES EXERTED BETWEEN FLAT AND CYLINDRICAL PRIMARY AND SECONDARY WINDINGS WHEN THE COILS HAVE DIFFERENT DIMENSIONS

ponents parallel to the planes which tend to force the sides of the smaller coils inward and the sides of the larger coils outward. With a large transformer these forces may be sufficient to damage the windings seriously. For this reason coils should be made to conform with a reasonable degree of closeness to the arrangement shown in Fig. 12.

During a short-circuit the repelling forces at right angles to the surfaces of the groups of primary and secondary coils in shell and interleafed core-type transformers may be a few pounds or several thousand pounds, depending upon conditions already stated. With shell-type transformers the parts of the coils within the iron core are held rigidly in place by the latter, so that movement cannot take place, while the ends outside the core are braced by heavy iron plates that are pressed tightly against the coils by means of tie bolts or pressure screws in the end frames. In interleaved core-type transformers the coils are braced by circular plates or rings, which are also held in place by tie bolts or pressure screws. So that forces in all directions, other than normal to the surfaces of the coils, will be negligible, care should be taken in winding and assembling the coils of either type to see that they are arranged in a manner similar to that shown in Fig. 12.

When one winding of a transformer with concentrically arranged primary and secondary coils has a greater axial length than the other, and the electrical centers are in the same plane, the magnetic forces act in the directions shown in Fig. 17. In this case there is a component of force parallel to the axis of the coils, which tends to drive the end turns of the longer winding outward and to compress or force together the turns of the shorter winding. Considering each winding separately, there is an attractive force between the turns due to the current in all of the turns flowing in the same direction. This force is sufficient to overcome the repelling force exerted by the shorter winding on the outer turns of the longer winding, except in case of extreme difference in length. When rectangular windings are used there is a tendency for the outer high-voltage coils to assume a cylindrical shape and for the inner low-voltage coils to press in toward the core.

The short-circuit stresses may be higher in the core-type transformers with concentric windings than in any other type. The high-voltage coils are braced in the same manner as the windings of an interleafed core-type transformer, while the cylindrical low-voltage coils are ordinarily braced by means of blocks pressing against their ends. These blocks must be arranged so as to provide adequate bracing and at the same time not interfere with ventilation. In all cases the characteristics of the design and the relative size and arrangement of the primary and secondary coils should be such as to keep all stresses within limits that can be controlled successfully.

Mechanical bracing as well as ventilation must be taken into consideration when deciding on the arrangement of ventilating spacers between transformer windings. Under certain conditions of short-circuit there may be a tendency in large transformers for the conductors of some of the coils to be forced out of place and into the ventilating ducts. Displacement is prevented in large shell-type transformers by using wave-shape spacers which insure good ventilation and practically uniform temperature. With disk-shaped core-type coils, spacers are arranged radially. This arrangement affords good mechanical support for the conductors, but it is not ideal for oil-cooled transformers so far as ventilation is concerned, because the planes of the coils are horizontal and therefore do not induce circulation of the oil. As a result the temperature of the coils increases from the inner and outer edges toward the mid-circumference. Full benefit is obtained from the temperature head in shell-type transformers since the spacers are placed vertical. Under ordinary conditions the rate of oil circulation does not exceed about 6 ft. per minute, so that the resistance to the flow due to the wave-shaped ventilating spacers is so small as to have an unappreciable effect upon the temperature. Generally, the difference in oil temperature at the top and bottom of the windings is about 6 deg. C. to 10 deg. C., whichever type of transformer is used.

Not many years ago transformer users were demanding units having low reactance because of the good regulation secured thereby. In many cases the reactance specified was so low that the designing engineer had trouble in securing it. With the increase in the number of large generating stations, however, transformer troubles increased due to the fact that the units were not strong enough mechanically to withstand short-circuit. Because of the low reactance the amount of current that flowed on short-circuit was so high as to make the mechanical stresses excessive. When this was finally realized there gradually developed a tendency to go to the other extreme and use transformers with quite high reactance. While reactance as high as 10 per cent may be desirable in a few cases, it is neither desirable nor necessary in a large majority of cases. Furthermore, it is by no means always true to say that the amount of reactance in a transformer is a measure of its ability to withstand short-circuit, since the reactance of transformer increases with increase in size, frequency and voltage, while the short-circuit stresses increase with size but decrease with increase in frequency and voltage. In most cases the short-circuit stresses can easily be kept within reasonable limits with a moderate amount of reactance. A large 60-cycle transformer of high voltage will naturally have comparatively high reactance and the short-circuit stresses will not be very great. On the other hand, a large 25-cycle transformer of medium or low voltage will naturally have comparatively low reactance and the short-circuit stresses will be high. Between these limits there is a wide field where transformers can be designed with a moderate amount of reactance and still have an ample margin of safety in mechanical strength under short-circuit.

A Potential Transformer for Direct Current

What purports to be a potential transformer for transforming low-tension direct current into corresponding high-tension direct current is the invention of P. M. J. Boucherot of Paris, France, patent No. 1,206,662. The process employed to accomplish this result may be summarized in three operations: (1.) First to transform the direct current into two or more alternating currents by means of a rotary commutator. (2.) Then to transform these alternating currents into other alternating currents of different emf. by means of ordinary static transformers. (3.) Finally to transform these new alternating currents into a direct current by means of a commutator rotating synchronously with the first. In reality, however, things are not as simple as might appear, for even when no current is taken from the terminals, the emf. between these terminals is far from uniform and heavy sparks are apt to be set up at the commutators. It is necessary, therefore, to add to the system some device which will furnish suitable excitation to the transformers, and therefore a small two-phase alternating exciter is mounted on the same shaft as the commutators, of which each phase is shunt connected to the primary or secondary of one of the transformers employed.

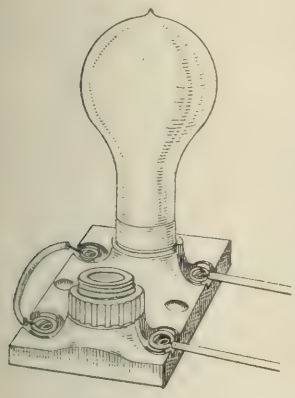
STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Temporary Arrangements for Serving High-Wattage Lamps

BY C. B. DEAN

Since the National Electrical Code does not permit connecting more than 660-watt loads with each cut-out on inside low-voltage systems, the writer has employed the arrangement illustrated herewith when high-wattage lamps must be installed temporarily. As shown two-receptacle cut-outs like Trumbull No. 2965 are used, the corresponding terminals of each socket being connected by a wire and the remaining terminals connected with the supply circuit. A fuse is placed in one receptacle and the high-wattage lamp in the other, thus protecting each individual lamp and permitting the connection of as many lamps as desired to the supply circuit. This arrangement can also be employed for serving heating appliances to avoid running separate circuits to them. In such a case, however, it would be advisable to place the fuse in the cutout next to the grounded circuit so the main fuse will be protected.



COMBINED CUT-OUT AND LAMP RECEPTACLE

Specifications of Kansas Company for Light Rural Transmission Lines

In Kansas a number of small towns of about 500 population are securing electric service by building transmission lines for themselves to larger neighboring cities in which central stations are operating. In such cases the smaller towns generally look to the engineers of the central station company for advice regarding line construction. C. A. Leland, Jr., electrical superintendent of the Atchison Railway & Light Company, has made up the following specifications for such cases.

LINE CONSTRUCTION FOR RURAL CIRCUITS OPERATED AT 6600 OR 13,200 VOLTS

Poles—White Cedar, minimum length 25 ft. with 6 in. top, spaced 140 ft. For road crossings 30 ft. poles should be used and at telephone and railroad crossings poles high enough to give 8 ft. clearance above other wires.

Cross-Arms—Standard electric light, two-pin arms with galvanized steel pins and standard hardware.

Insulators—Porcelain rated at 15,000 volts.

Pole Guying—Poles should be guyed wherever line changes direction more than 10 deg. At corners poles should be guyed both ways and have double arms.

Lightning Arresters—Westinghouse type S arresters or equal protection installed every 3 miles. Arresters should be grounded by means of 2-in. galvanized rods driven into ground.

Line Switches—Simple air-gap, fused switches should be used at line junctions.

Conductors—For voltages of 6600 or 13,200, No. 6 hard drawn, copper wire should be used. Transformers should have taps for raising the voltage when necessary.

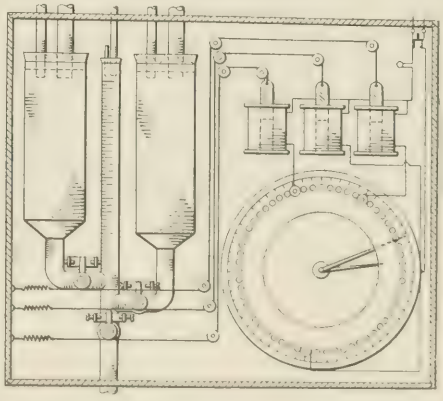
Single-phase, 6600-volt, or 13,200-volt, lines are considered more satisfactory than three-phase lines on account of the lower first cost.

In recommending these specifications under present conditions, Mr. Leland generally tells the prospective line builders that with the increased cost of copper the use of iron wire has come into vogue, although for the same conductivity this wire would cost as much at 6 cents per pound as copper wire would at 38 cents per pound, the conductivity of B.B. iron wire being 16 per cent that of hard-drawn copper. Since it takes several years to build up the load on a line it is often economical to install iron wire on lines built at present, expecting to replace the iron with copper when the load and price of copper justify it.

The cost of these rural lines was from $433 to $500 per mile in 1915, including all labor, material, lightning arresters and transformers at either end. This cost includes No. 6 bare copper wire at approximately 15 cents per pound. By using No. 6 B.B. iron wire instead of copper, the same type of transmission line could be built at approximately the same cost at present conductor prices.

Method for Continuously Testing Feed Water

Walter C. Raddant of Elia, Cuba, has recently developed and patented a device which is adapted to continuously and automatically testing liquids. It is being employed to good advantage for testing feed waters for boilers and the like, and for indicating the presence of sugar in boiler feed waters. This testing device has an improved form of time-controlled mechanism, so that it will test successively and automatically at predetermined intervals without attention other than to set the time-controlling mechanism at the desired time intervals. The glass liquid receiving tube with graduated marks shown in the accompanying illustration forms a mixing chamber. The larger pipe at the top of the tube is an inlet pipe, the smaller, a vent pipe. The tube is extended downwardly to form an outlet conduit controllable by a turning plug valve arranged therein. The two containers on either side of the tube are formed of glass or other transparent material, these containers having outlet pipes connecting with the outlet pipe of the tube. The containers are intended to hold the re-



VERTICAL SECTIONAL VIEW THROUGH HOUSING SHOWING ARRANGEMENT OF PARTS OF LIQUID TESTING DEVICE

agents, the one on the left receiving a chemical indicator and the one on the right receiving the acid which is to be combined with the chemical indicator and the liquid to be tested. A pair of turning plug valves is interposed in the outlet pipes of the containers.

The time-controlled mechanism of this tester includes a plurality of electromagnets as shown in the illustration, these magnets being of the solenoid type and having movable cores. The cables are connected with the cores and trained over a plurality of sets of guide pulleys, the cables being convoluted about the valve stems of their respective valves, the grooves in the valve stems serving to accommodate the cables. The free ends of the cables are connected to coiled retractile springs for returning the valves to closed position after an actuation. The time-control mechanism includes an ordinary clock having the usual minute and hour hands, being specially modified to close the respective circuits of the electromagnets to energize the latter. The circuit-closing mechanism referred to includes an insulating ring member provided with a plurality of circumferentially arranged threaded openings spaced at intervals conforming to minutes or any desired intervals of time. The illustration clearly shows the electrical connection of the device.

In operation the liquid to be tested is supplied to the mixing tube. At a predetermined moment the minute hand will make contact with the first screw. This energizes the right-hand electromagnet, exerting a pull on the cable and the opening valve of the container on the left. This permits some of the chemical indicator to flow from the container to the mixing chamber. After a predetermined interval of time has elapsed the hand reaches the next contact screw, where the foregoing operation is repeated and the container on the right opens. When the hand reaches the third contact screw the operation is again repeated, the bottom valve opening. It is pointed out that the valves only remain open while the minute hand is in contact with the screws, the valves immediately closing by virtue of their respective retractile springs. However, the bottom valve remains open a sufficient time to permit all of the contents of the tube to flow through the outlet and permitting some of the incoming liquid to wash the tube before the valve closes.

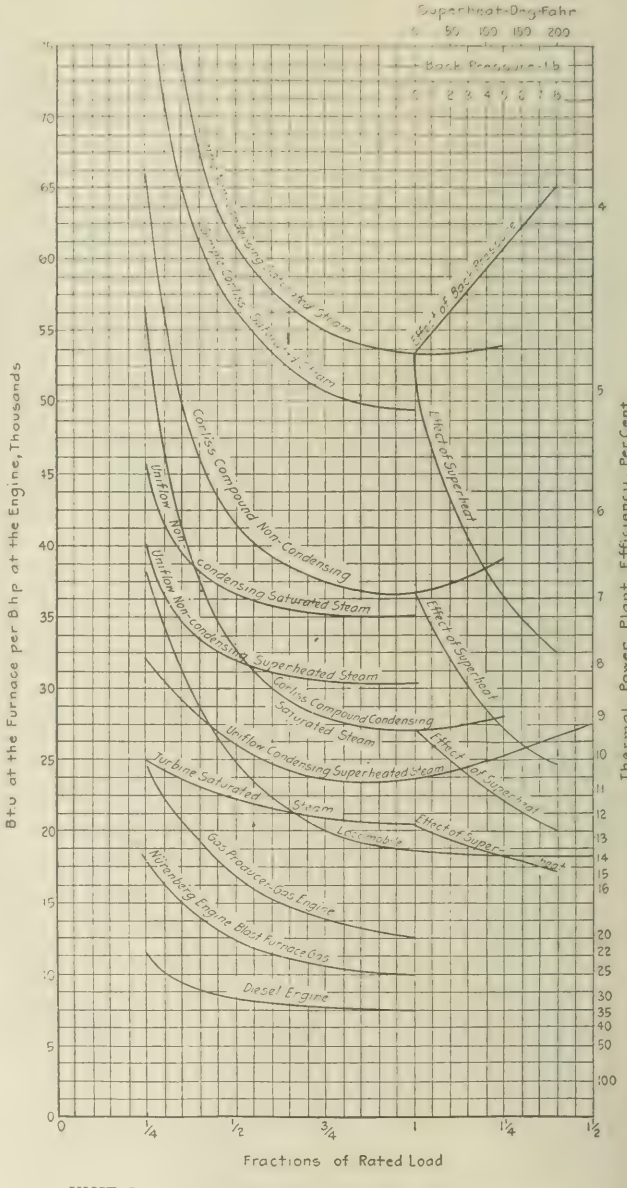
A Multiple Door Arrangement at Entrances to Air Ducts

To permit an entrance into the air ducts through which air passes to air-cooled transformers, reactances, and the like, it is usually the custom to build two doors, so that a person may enter without interfering with or interrupting the supply of air. If two doors were not used, with the area of the doors usually employed and at typical air pressures, it would usually be impossible and in any case difficult either to open the door or, if opened, to close it again. In many stations the doors leading into the air ducts are made of sufficient area to permit apparatus being taken in or out, which means that the doors are 25 or more feet in area. Even when two doors are installed with an intervening space between them for equalizing the air pressure, the opening of the doors, especially the interior one, becomes tiring and annoying where there is much traffic passing in and out of the duct.

A simple little arrangement has been installed in several instances which overcomes the need for exertion in opening the interior door. It consists of merely building into the interior door another smaller door with a handle which opens inward; that is to say, toward the interior of the duct and against the air pressure. If this small door has an area of 96 sq. in., or 12 by 8 in., or 0.75 sq. ft., and the air pressure is 0.75 lb. per square inch, this door can be opened with ease, whereas considerable effort would be required to open the main inner door, of perhaps 36 sq. ft. Opening the small interior door allows the air pressure to equalize in the space intervening outside and between the inner and outer doors. The small door acts as a small valve. It is best to install a small spring upon this small or pilot door so that it will close as soon as the hand is removed.

Relative Heat Consumptions of Various Prime Movers

The relative thermal efficiencies and unit heat consumptions of various types of prime movers are given in the accompanying chart presented recently before the A. S. M. E. by Victor J. Azbe. The ratings vary



UNIT HEAT CONSUMPTION OF PRIME MOVERS AT DIFFERENT LOADS

from 300 to 400 brake-horsepower, except for the simple non-condensing engine and locomobile, which were 150-hp. units, the turbine, which was rated at 4000 kw., and the gas engine, which was a 1200-hp. machine. In each case boiler efficiency was assumed to be 70 per cent, an

allowance of 3 per cent being made for the boiler feed pump and 2 per cent for leakage and condensation. For the condensing engines the auxiliary steam consumption was assumed to be 5 per cent of the total steam consumption. The temperature of the feed water entering the boiler was assumed to be 200 deg. Fahr., as heated by either exhaust or an economizer. For the uniflow engine, when operating non-condensing with superheated steam, the superheat was 120 deg. Fahr., and when operating condensing was 100 deg. Fahr., with 25.5 in. vacuum. The turbine tests represent performance with 28-in. vacuum, 175-lb. steam pressure and saturated steam. The locomobile curve represents tests with a varying high-pressure superheat of 80 deg. at one-fourth load to 235 deg. at one and one-fourth load and ordinary intermediate superheat.

Why a Motor Reversed Its Direction of Rotation on High Speed

BY R. L. HERVEY

A 2-hp. 220-volt direct-connected compound motor driving a band saw had been in service for approximately eighteen months without giving the slightest bit of trouble until the operator wanted to work the saw at its highest speed, which was obtained by using a field rheostat. When all of the resistance was cut in the field circuit the motor slowly came to a stop and started in the opposite direction. This was tried several times, and resulted in blowing the fuses most of the times. There could be but one condition that would cause this reversal of direction of rotation, namely, the compound winding being in opposition to the shunt field and overcoming it when the shunt field was weakened. By reversing the compound field leads the trouble was removed. This motor had been in operation for a year and a half without any indication of anything being wrong. The brushes and commutator were in excellent condition, which speaks well for the design of the machine.

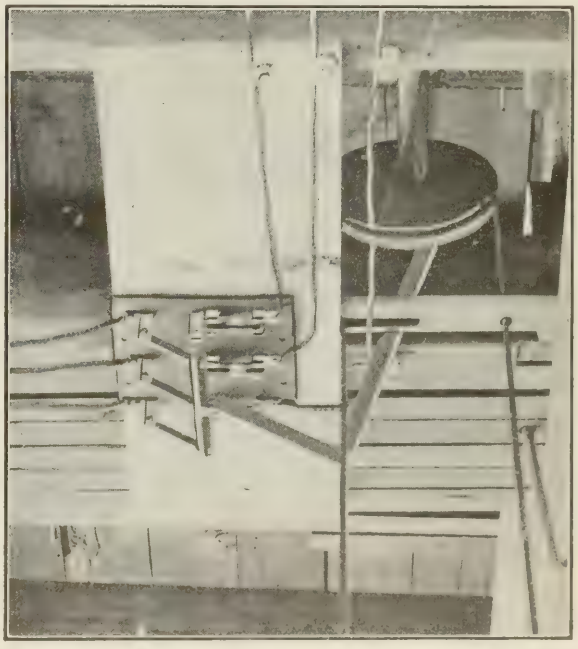
Results of Short-Circuit Tests on Oil Circuit Breakers

Recent tests of circuit breakers installed in a plant of large capacity, while not subjecting the breakers to the guaranteed limit of rupturing capacity, furnish an interesting demonstration of the ability of breakers to withstand successively severe operation without damage to the contacts. Sixteen short-circuit tests were made through the same breaker without the breaker being opened for change of arcing tips or examination of the state of the contacts. At the end of the test the breaker was opened for inspection, and there was no evidence on the arcing tips of excessive burning such as might be expected. The test was conducted by short-circuiting a 25,000-kva., 23,000-volt turbo-generator, five of them being made without external reactance in the test circuit. Five were made with 5 per cent 500 amp. reactance coils between the breaker and the short-circuit. The remaining tests were made by short-circuiting the circuits at a substation 7 or 8 miles distant, their circuit including about 3 miles of cable. In these latter tests the power stored in the combination of underground cable and overhead line probably represented a considerable increase in the kilovolt-ampere broken at the breaker contacts.

A series of tests were also conducted on another type of breaker rated at 25,000 volts, 600 amp., in which short-circuits having a root-mean-square value of 475,000 kva. at 24,500 volts, were repeatedly successfully interrupted, representing the largest amount of power which has ever been used under such a test. The generating apparatus was rated at 142,620 kva. The generator voltage was stepped up through a total transformer capacity of 90,500 kva., and oscillograph records were made of each test. The record of the most severe test showed that the short-circuit continued for six cycles on a 60-cycle circuit before the breaker contacts parted and continued for three cycles through the arc. This short-circuit, as well as the others, was opened by the breaker without difficulty, the same arcing contacts and oil being used in all the tests. There was no damage to the circuit breaker other than slight burning of the contacts and tank lining, which did not affect its continued successive operation. In the first series of tests Westinghouse type E-6 circuit breakers were used and in the second series Westinghouse type O-1 oil breakers.

Arrangement for Operating Ceiling Switch from the Floor

The arrangement shown herewith was devised so that the main line switch of a small alternating-current motor could be installed on the ceiling near the motor and still be operated from the floor. The switch-operating mechanism consists of a horizontal-shaft grooved pulley, near the rim of which is a pin carrying a link attached to the extended switch handle. Around the groove of the pulley and hanging down within reach



CEILING-MOUNTED MOTOR SWITCH THAT IS OPERATED FROM THE FLOOR BY ROPE

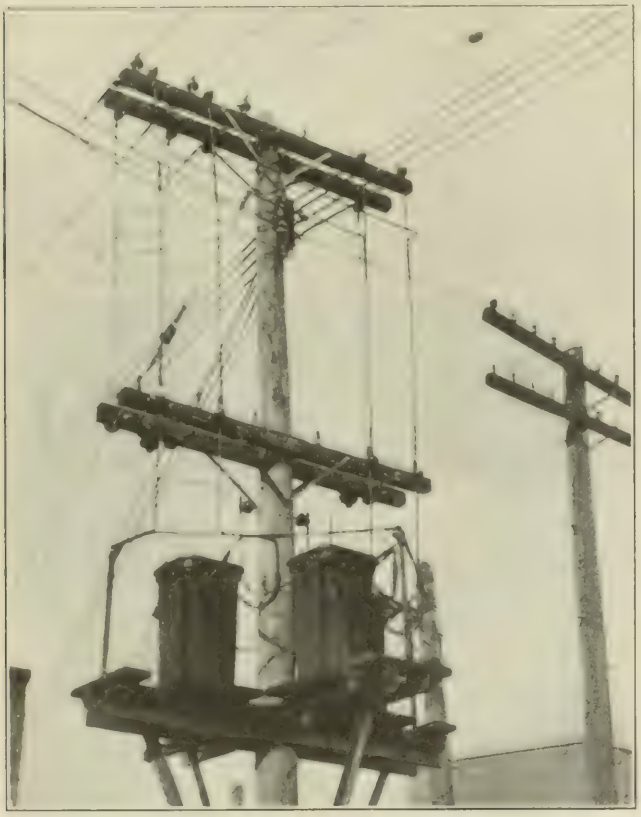
of the floor is a rope by means of which the pulley is revolved and the switch consequently opened or closed. Handles are provided on each end of the operating rope that hangs from the ceiling.

The operator who developed this idea points out that the switch can be made operable from several positions by extending the pulley shaft and placing grooved pulleys with operating ropes at intervals along the shaft. Aside from permitting simplified wiring the arrangement has the advantage that it does not hinder the movement of material around the shop in which it is installed as would rigid operating rods hanging from the ceiling.

Conveniently Arranged One-Pole, 75-Kva. Transformer Installation

Transformer installations such as shown in the accompanying illustration are employed by the Ohio Light & Power Company, Newark, Ohio, in alleys of congested districts, or in places where property owners object to a number of poles being set on their lots. Such an installation is capable of supporting three, or, if conditions should require it, four transformers of any size up to and including 25 kva. each. It possesses the further advantages of presenting a pleasing appearance and of being quite reasonable in price. The transformers may be placed at any height above the ground, and by increasing the size of the steel supporting members units even larger than 25 kva. may be so mounted.

The framework of the platform of these installations consists of channels and angle irons. Four 4-in. by 6.5-ft. channels are bolted into gains cut in the pole in the same fashion that gains are made for double buck arms. Besides the through bolts that hold the channels in



PLATFORM THAT CAN BE MOUNTED ON ONE POLE AND PROVIDES FOR FOUR TRANSFORMERS

place, four sets of space bolts are also used in each pair of channels to insure rigid construction and to hold the members parallel. The space bolts near the outer ends of the channels also hold the upper ends of the 2-in. by 2-in. by 0.25-in. angle-iron braces in place. The lower ends of these braces are secured by lag screws driven into the pole. On top of the pair of channels which occupies the lower gain, two sets of short 4-in. channels are fastened to bring the foundation of the platform into one horizontal plane. Pieces of 2-in. by 4-in. timber are bolted into the U's of the upper channels so that the platform planks can be nailed to them.

As a rule only three transformers are installed on such platforms. This leaves the fourth place for a man to stand while working on connections or fuses. It has also been found advisable to install double arms above the station to support primary and secondary leads. This practice allows neater construction and provides a convenient and safe mounting for fuses near the vacant side of the platform. An additional safety feature has been added by running the neutral wire around the edge of the platform on angle-iron standards to act as a platform railing. This installation was described by R. R. Krammes at a recent meeting of the transmission committee of the Ohio Electric Light Association.

Conclusions on Lightning Protection Arrangements

During the years 1915 and 1916 the Topeka (Kan.) Edison Company has followed the practice of installing lightning arresters on transformer poles, until now about 20 per cent of its transformers are so protected. From records covering the years 1912, 1913 and 1914 the average number of transformers burned out equaled 2 per cent of the total number in use. In 1915 and 1916, since changing the method of protection, the number of burnouts has been reduced to 0.44 per cent, or about one-fifth the previous amount. During the year 1916 the company has not experienced any cases of trouble at transformer installations protected by arresters on the same pole. This was probably due in part to few lightning storms during the year.

Direct-current meters appear to be especially susceptible to damage from lightning, and it is difficult to protect them, as they are natural discharge points owing to the direct path to ground afforded by the potential circuit. The number of direct-current wattmeters connected on the company's circuits has remained practically constant for the past five years, and during that time the cost per meter for repair parts has equaled 15.5 cents per year. The alternating-current meters show much better results. For the years 1912, 1913 and 1914 the cost for repair parts per meter averaged 1.3 cents per year. For 1915 the average cost was 1.26 cents. During 1916 this cost has been reduced to 0.83 cent per meter. These figures all show a noticeable improvement in conditions which the company feels is a result of the rearrangement of the protective devices on its system. Moreover, all outgoing 2300-volt, three-phase feeders and all 600-volt power and railway feeders are protected with aluminum-cell arresters and the interruptions of service caused by circuit breakers opening has been greatly reduced since they were installed.

From tests made over various portions of the distribution system and from general observation and experience J. E. Gossett, engineer of distribution for the Topeka Edison Company, reported before the recent meeting of the Kansas Public Utilities Association that his company has formed the following conclusions: First: Lightning arresters should be placed as near as possible to the device they are to protect. Second: Ground wires should be installed with the most direct path to ground, avoiding sharp bends or loops. A wire not smaller than No. 6 should be installed and if the secondary here exceeds this size a ground wire should be installed of the same size as the main. The ground wire should extend considerably below the surface of the ground unless the cross-section is increased. Third: Water-pipe grounds should be secured if possible; otherwise rods should be driven to a depth of from 6 to 8 ft. The greater depth will justify the additional expense. Smaller diameter and greater length produce better results at the same expenditure than rods of greater diameter with a corresponding decrease in length. Fourth: Rods should be placed about every 500 ft. or about every fifth span. Secondaries should be grounded as near transformer terminals as possible.

COMMERCIAL AND BUSINESS POLICY

A Department of Plans and Methods for Widening the Application of Electricity and for Extending Electric Service

THE SMALL-COMPANY EXECUTIVE AND NEW BUSINESS

A Plea That the Manager Interest Himself More Closely in the Work of His Commercial Aides, and Intensively Cultivate All Available Business

By the Manager of a Small Central Station

It is a regrettable fact that the selling methods employed by many small central stations are far less efficient and effective than are the selling methods used by merchants operating in the same territory.

The sole reason for this fact may be expressed in three words—"lack of competition." More often than one would imagine the manager or superintendent, who should be the leading spirit in the selling efforts of his company, busies himself in other matters of the company operation to the almost complete exclusion of new business. True, this official generally engages the services of one or more new-business solicitors, but proceeds quite promptly to permit them to drift pretty much for themselves. Generally, if more than two solicitors are engaged, one of them is given certain supervision authority over the others.

In this manner does the executive deliberately place a reducing valve between himself and the main artery of his company. The almost immediate resulting effect on the official himself is that his lack of contact with new business results in his failure to intelligently appreciate the new-business conditions of his company.

He quickly loses the ability to properly consider new-business problems. Those of his organization who handle the commercial work of his company are quick to appreciate his discomfiture upon taking up with him matters of their department. In consequence, it is only natural that the number of new-business problems presented to him are soon reduced to a minimum. Under these conditions, the matters of appliance purchasing and testing, advertising, special campaigns, etc., are not given the attention their importance should warrant.

Another result is a tendency towards a frequent change in salesmen. The ambitious ones are quick to see the advantages of associating themselves with other companies where there is a greater opportunity for learning. The unambitious ones accomplish little and soon drop out as a natural result.

Each salesman who leaves the company carries with him an investment which is in proportion to the length of time during which he has been an employee of the company.

The foregoing statement of conditions is not exaggerated, and is true to-day in some degree in a great number of small central stations. Larger central stations avoid this condition since they generally have a commercial manager of a caliber equal to the manager or superintendent of the smaller company. Since this commercial manager is employed solely for new-business work, the affairs of this department are, in consequence, placed in able hands.

Wherever in the business world the spur of competition is removed, the result is often that the business or the service suffers. Central-station managers should be keenly awake to this fact, and it should be their constant duty to see that the evils of this lack of competition do not in any degree overtake their companies.

How many small central-station managers can look into their consciences and answer that they personally know that the new business activities of their companies are as good as they could be? Let each ask himself if it would not be possible to turn over to some assistant purely routine work, and as a result gain sufficient time to permit his personal domination of the new-business work of his company.

There is scarcely a city or town in the United States in which there is not an attractive amount of new business to be had right under the nose of the central station simply for the proper going after it. This new business will never be found unless each central station manager believes it exists and makes plans to secure it.

With the present high cost of construction material, new business on existing lines has never been so valuable as at the present time.

Let us start the new year with the thought that we are proud of the fact that we are selling one of the few commodities which may be obtained at the old price and let us go out and get the necessary new business to make it possible to continue at the old price.

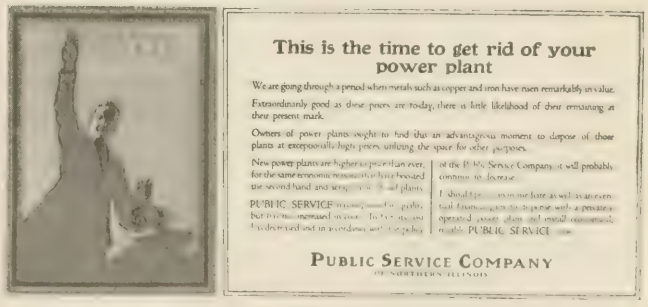
Electric Trucks in Government Printing Office Service

The United States government printing office at Washington, D. C., operates ten electric vehicles. Two of these are passenger cars, and the rest are of the commercial type. Of the latter class, two are of 1000-lb. capacity, two of 2000-lb., three of 5000-lb. and one of 8000-lb. The printing office also takes care of two "electrics" for the Post-Office Department and one for the Department of the Interior.

The following cost data refer to the printing office cars:

Weight of Car	Approximate Annual Miles	Yearly Cost of Operation
1,000 lb.	5,000	$550
2,000 lb.	6,000	$550
5,000 lb.	4,000 to 4,500	$600 to $700
8,000 lb.	3,500	$780

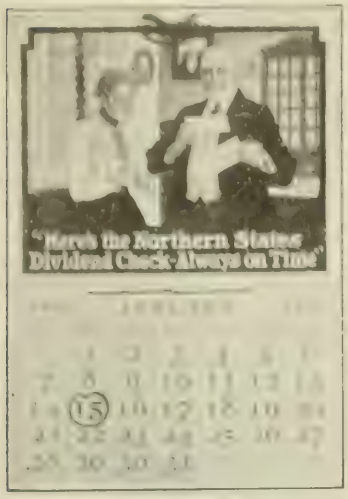
Taking Advantage of the High Price of Scrap Metal



In order to bring before the owners of privately operated power plants the excellent opportunity offered for the profitable disposal of their plants as a result of the present prices of scrap metal, the Public Service Company of Northern Illinois has issued this attractive three-color folder.

Advertising Prompt Dividend Payments to Sell Stock to Consumers

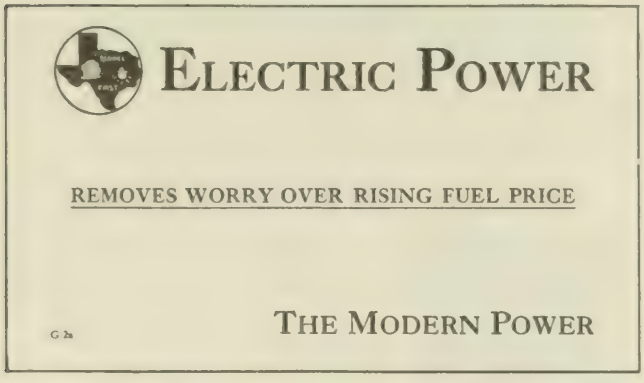
Another novel method of advertising its plan of selling Northern States Power Company's stock to consumers has been evolved by the publicity department of H. M. Byllesby & Company. Calendars like the one reproduced herewith will be distributed to customer-shareholders and to new purchasers of stock in home territory during the early part of 1917. The illustration on the calendar is one which appeared in one of the company's newspaper advertisements in the fall. The noticeable lack of advertising matter is intentional; since the calendars will be placed in the hands of only those owning stock, no elaborate explanation to them is necessary. Moreover, it is expected that the lack of a full explanation will cause non-owners who see the calendars to ask questions which will lead to a discussion of the stock and perhaps the sale of more shares. The red circles around Jan. 15, April 16, etc., indicate that these are "red-letter days" when the quarterly 1.75 per cent dividend will "always be on time."



CALENDAR DISTRIBUTED AMONG CUSTOMER HOLDERS OF STOCK IN THE NORTHERN STATES POWER COMPANY

The success of Byllesby company's effort to sell stock to consumers is considered remarkable. At the present time there are over 2000 customer-shareholders who own in excess of $1,100,000 worth of Northern States Power Company's preferred stock. Inauguration of the movement in other communities is being considered.

Fuel Prices Prove Potent Argument in Power Sales Campaign

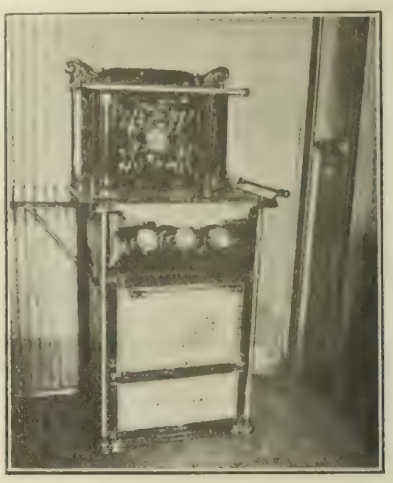


Pictured herewith is one of a set of postcards sent by the Texas Power & Light Company of Dallas, Tex., to cotton-gin prospects prior to the beginning of the present cotton season. There were six cards in this set, and they were included in a series of circular letters on the advantages of using electric power. A direct-by-mail campaign lasting sixteen weeks, during which time the prospects received at least one piece of mail matter each week, was productive of very good results.

Gasoline Stove Electrified at a Cost of Twenty Dollars

In order to get its customers started to "cooking by wire," the Otter Tail Power Company, with general offices at Fergus Falls, Minn., does some unusual things. For example, one customer who had been considered a prospective electric-range purchaser for a long time would not place his order on account of the price of the electric range. Being a mechanic he suggested having his old gasoline stove equipped electrically. At first the idea seemed impractical, but wishing to satisfy the customer if possible, C. B. Kidder, the company's general manager, sent a man to look over the old gasoline stove. He found that with a little work it could be made into an electric range at low cost.

From the stove—a Quick Meal, two-burner-and-oven type—the tank, all tubing, valves and burners were removed. This left nothing but a mere shell. The two



GASOLINE STOVE ELECTRIFIED BY ADDITION OF 3500 WATTS IN HOT PLATES

top burners were replaced with General Electric 8.5-in., 1000-watt, three-heat, sheath-wire hot plates; the oven was insulated with asbestos 1 in. thick, and was partially relined, leaving a small vent in the back; and one 1500-watt, three-heat, sheath-wire oven unit was placed in the bottom of the oven. All units were then fused separately and circuits leading to a porcelain connection block were connected through snap switches on the front of the stove. The stove was then enameled black. In this manner, with a few hours' work an old, nearly worn-out gasoline stove was transformed into a modern, cleaner and safer outfit.

The range was installed in the customer's home and has been giving satisfactory service. The customer was charged only for the actual cost of material, which amounted to $20. The result is that the customer was satisfied by getting an electric range at small outlay, and the Otter Tail Power Company has made this customer a greater source of revenue for central-station service.

Drying Fresh Ink Electrically

A Western central station company is furnishing energy for 250 heating units which are used to dry ink on freshly printed matter. The units are rated at 600 watts and are arranged on traveling conveyors, so that the intensity of heat upon the paper to be dried may be varied by raising or lowering the heating unit. Educating the printer in the value of such a drier leads to a profitable day load.

Revenue per Customer Increased by Appliance Load

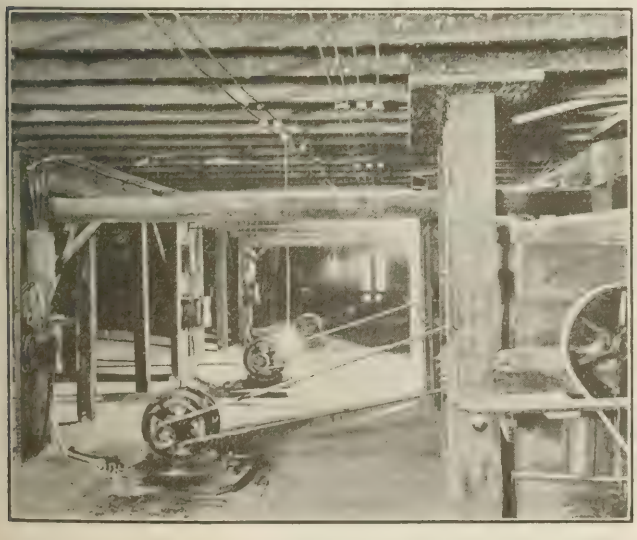
Prior to 1910, the central-station company at Youngstown was not actively engaged in selling current-consuming devices to its lighting customers, but lately it has taken store space in the most prominent location in the city. Evidence of the wisdom of this policy, according to C. E. Yacoll, the company's new business manager, is to be found in the fact that the company's revenue from residential customers has increased from $15 per customer in 1910, to $21 per customer in 1915. Moreover, while making this record the appliance sales department has been able to pay $500 a month rent in addition to all its other expenses and still "break even." It is the company's policy to sell appliances at list prices.

Loading Electric Trucks Inside the Building

A large New York City department store has been able to operate its electric trucks very efficiently by loading them inside its building. While gasoline cars, on account of insurance regulations, are compelled to load from the exterior of the building, this firm's electric delivery wagons actually go into the building proper, and through the agency of large elevators, are transported to various floors. There the wagons are loaded, thus saving expensive handling of packages. This method of handling the electric vehicle and its contents, which is permissible owing to the absence of fire hazard, is found to speed up deliveries considerably.

Motors Ten Years in Service Under Salt Works Conditions

A great deal has been said and written on the reliability of motor drive. Much of this discussion has, however, passed over the heads of non-technical readers and in spite of widespread educational work many power users still believe that the electric motor is not suitable for certain kinds under trying conditions of dust, moisture, and the like. A practical illustration of



MOTORS TEN YEARS IN CONTINUOUS SERVICE IN CLEVELAND SALT WORKS. WINDINGS AND PARTS ARE CAKED WITH THE SALINE DEPOSIT

the ability of motors to operate under severe conditions is the plant of the Cleveland (Ohio) Salt Works. The motors in this plant were furnished by the Lincoln Electric Company and have operated in rooms where moist salt is always present. This salt has caked into the windings, until they are hardly visible, as will be observed in the accompanying illustration. In spite of this there has not been a single shutdown from motor trouble in the ten years since the motors were installed.

This unique demonstration not only proves that the electric motor is a most reliable piece of apparatus, but shows that expensive protection is not always necessary against even severe moisture and dust conditions.

Mixing Lamp Tints

To make the lighting in its store conform to a general color scheme that was being worked out, the Merchants Heat & Light Company at Indianapolis, Ind., recently wished to give lamps which were to be mounted



DISPLAY ROOM AT INDIANAPOLIS DECORATED WITH ORNAMENTAL POST STANDARDS BEARING RUBY LAMPS

in some street lighting standards an "old-rose" tint. A red dip was the nearest color obtainable. An endeavor was made to thin the red with alcohol, then with lacquer, then with water. In each instance the result was a red jelly, not an old-rose liquid. Then mixing two different colored lamp dips of the same make was tried. They also jellied. Finally by mixing a quart of lamp frosting and 0.5 pt. of ruby lamp dip, a beautiful old-rose coloring was obtained. Later it was learned that the red coloring could have been thinned with ether. The result of mixing the frosting and the ruby coloring, however, left nothing to be desired and the lamps when inserted inside the diffusing globes, produced an old-rose shade that cleverly matched the old-rose cloth coverings on the ceiling units.

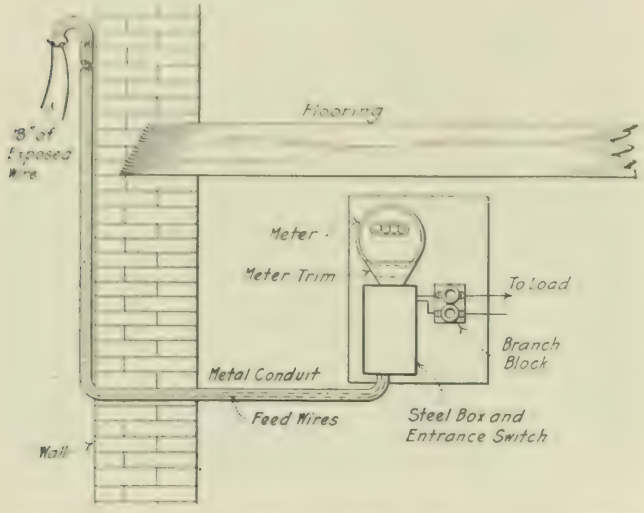
Two-Thirds of Irons Found in Regular Use Six Months After Purchase

Some managers have questioned whether the sale of a large number of devices, especially irons, really indicates that more than a very small percentage of them are actually kept in use.

"There was one Southern city," said Frank Hammond, the general agent of the Birmingham (Ala.) Railway & Light Company, before the Southeastern Section, N. E. L. A., "which put on a special sale of irons and disposed of 350, and the addresses of 290 buyers were placed on file. Six months later a canvass of these 290 consumers was made, and it was found that 63 per cent of these irons were in use on an average of two hours per week. The other 37 per cent had either moved or the iron was stored away."

Specifications for Meter Installation Adopted by Illinois Company

The Canton (Ill.) Gas & Electric Company has been experiencing considerable difficulty through thefts of energy on the part of persons by-passing meters. On this account the company has just issued a new set of specifications covering the installation of meters and the connection of service wires. These specifications provide for the installation of the meters in inside cellar ways or basements. If these places are unfit for placing the meter, provision is made for its installation in the kitchen. Each meter is to be hung on an asbestos-covered board in a position which will be accessible to the meter reader with the least annoyance to the customer. In no instance is the meter to be placed more than 7 ft. above the floor. The fact that the State Pub-



SKETCH SHOWING APPROVED METER INSTALLATION PROOF AGAINST TAMPERING

lic Utilities Commission requires frequent testing of watt-hour meters has caused the company to specify also that a meter must be installed with sufficient space around it to enable the meter tester to do his work in a satisfactory manner. The specification also states that a service cut-out and main line fuse shall be installed on the line side of the meter inclosed in a locked iron box and that a meter trim shall be placed between the meter and the box so that there will be no exposed wires between the meter and the service cut-out. All wiring from the service cut-out to the outside of the building must be placed in conduit. No wire smaller than No. 12 is to be used for feed wires between the outside of the building and the service cut-out. The illustration herewith shows a typical installation under these specifications.

Putting on a Successful Electrical Show in a Town of 8000

An electrical show that was run for one week at a total cost of 17 cents per visitor was put on during America's Electrical Week by the Rumford Falls (Me.) Light & Water Company.

After renting a vacant hall the company set up a framework to represent a living room, dining room, kitchen and bath room. The rooms were supplied with furniture, rugs and portieres by a furniture dealer, and the kitchen and bath room were fitted up by a local plumbing firm. Tea and coffee were supplied by an importing company of Rumford, and the light company installed complete electrical equipment throughout.

An experienced woman demonstrator was employed. She made it a point to show the visitors how the various appliances performed during actual working conditions.

Data on Small-Town Electric Service

C. A. Leland, Jr., superintendent of the electrical department of the Atchison (Kan.) Railway & Light Company, speaking before the Kansas Public Service Association, presented statistics which, he said, had proved valuable to him in securing transmission line business from small towns. These data were collected during an investigation of about fifteen small towns.

The maximum demand per capita averaged 37 watts. There was one residence to each 3.5 of population. The gross earnings per capita during the first year a town is served averaged $2.50. This increased about 10 per cent per year and sometimes reached as much as $7 per capita. The line and transformer loss varied from 20 to 33 per cent. The distribution loss usually amounted to about 10 per cent where no transformers were used, and 25 per cent where distribution transformers were used. Gross earnings per meter averaged from $20 to $28 per year.

The earnings on all classes of this service increased more rapidly than the earnings in the near-by larger city of Atchison, although practically no effort was made to increase the small-town business, and there was a continual appliance and house-wiring campaign in the city.

How a Michigan Central Station Lives Up to Its Service Slogan

The Consumers Power Company of Owosso, Mich., features its slogan as widely as possible. The phrase which it has taken as its text is worded:

"Always—AT YOUR SERVICE—All Ways"

"Service" is a broad-gage word, but the company uses no limiting adjectives. Recently the principal of a local school asked the firm for complete data on the number of employees and their earnings in a given industry between 1909 and 1914. The information was furnished promptly, much to the satisfaction of the school director.

A short time later a debate was scheduled in the Owosso high school on the subject: "Resolved, That the City of Owosso Should Own and Operate Its Electric Light Plant." The principal for whom the company had secured the above-mentioned data, suggested that the students having the negative side call at the power company's office for material.

Naturally the company's slogan was again justified and the debaters were given arguments galore. The negative side scored a decisive victory, and as it happened that the leader of that team was the daughter of the Mayor, and succeeded in convincing her father of the value of independent plant operation, the company felt well paid for its trouble.

Recently the company received a request for data on the value of products manufactured from 1909 to 1914 and the capital required to handle the industries of the United States during that period. The request was promptly complied with, as was one from the business men's association for storage room for some banners that are in use for a short time each year. The policy of diversified service is claimed by the company to be steadily building good will for it.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

TUNGSTEN FOR BATTERIES

Electrolytic Behavior of Tungsten, and Its Possible Use in Standard Cells and in Storage Batteries

TUNGSTEN has become a very important metal in recent years. The bulk of tungsten produced now goes into the steel industry for the manufacture of special tool steels, with the percentage of tungsten as yet used in the electrical industries almost insignificant when compared with the total production. The industrial importance of the electrical uses of tungsten is nevertheless very great. First of importance is the tungsten lamp, with various minor electrical uses like tungsten wire and ribbon for resistors in electric furnaces or heating apparatus. The possible minor electrical applications of tungsten are numerous. One particular field that has been little investigated, the electrolytic behavior of tungsten, is treated fully in a paper by Walter E. Koerner, presented at the last New York meeting of the American Electrochemical Society and published in *Metallurgical & Chemical Engineering* of Jan. 1, 1917. It gives the results of an extensive investigation carried out by the author under the direction of Dr. C. G. Fink in the research laboratory of the Edison Lamp Works, Harrison, N. J.

The researches covered three distinct fields. First the author determined the single potentials of tungsten and tungsten oxide in various electrolytes, with a view of obtaining some light on the relative solubility of tungsten in those electrolytes.

Second, the anodic behavior of tungsten and its passivity were studied. The conditions under which tungsten as an anode becomes passive were investigated and it was found that the passivity of tungsten is due to adherent films of hydrated tungsten oxides. These hydrated films appearing on the anode vary in color from brown through blue to yellow. The degree of passivity varies with the color of the film. The films may be readily dissolved and the passivity of the metal thereby destroyed.

The third field investigated, and possibly the one of most direct present interest from a practical viewpoint, is the use of tungsten in cells.

For the construction of a voltaic cell with tungsten as negative electrode it is desirable to use an electrolyte in which both the tungsten and the anodic reaction products are most soluble. With a sodium hydroxide solution as electrolyte mercury or silver may be used as positive electrode against tungsten as negative electrode. The emf. of such a combination using mercury is 0.49 volt, with silver 0.69 volt. Preliminary experiments with tungsten both as fused slugs and as metal powder were promising, especially those with the metal powder. Another series of experiments was made and is still being continued on the use of tungsten in standard cells.

Finally some rather interesting tests were made on the possible use of tungsten in storage batteries, using combinations of tungsten and tungsten oxides. Three types of cells *A*, *B*, *C* (Table I) were studied.

Cell *A* had tungsten and tungstic acid as the positive electrode and tungsten metal as the negative before charging. Cell *B* had tungsten and tungstic acid as both electrodes, while cell *C* had tungsten-tungstic acid as negative electrode and tungsten as positive, being the reverse of *A*, before charging. The cells were connected in series and charged. The emf. of *each* cell was measured immediately after charging and found to be 3 volts for cell *A*, 3.20 volts for cell *B*, and 6.20 volts for cell *C*. Twenty-four hours after charging the cells, the emf. had dropped to 0.2 volt, 0.55 volt and 0.85 volt respectively. The cell *C* having $W|WO_2$ as positive electrode and $W|W_2O_5$ as negative electrode has so far been the most satisfactory.

TABLE I—BEFORE CHARGING

Type	Positive Electrode	Negative Electrode	Emf.
A	$W\|WO_3.\ xH_2O$	W	+0.08
B	$W\|WO_3.\ xH_2O$	$WO_3.\ xH_2O\|W$	0
C	W	$WO_3.\ xH_2O\|W$	−0.08

TABLE II—AFTER CHARGING

Type	Positive Electrode	Negative Electrode	After Charging, Emf.	Twenty-four Hours After Charging, Emf.
A	$W/WO_3.\ xH_2O$	W	Volts +3.00	Volts +0.2
B	$W/WO_3.\ xH_2O$	Blue $W/W_2O_5.\ zH_2O$	+3.20	+0.55
C	Brown $W/WO_2.\ yH_2O$	Blue $W/W_2O_5.\ zH_2O$	+6.20	+0.85

The results obtained with the tungsten storage batteries look rather promising.

Generators, Motors and Transformers

Burning Out of One Transformer of Two in Parallel.—A concise discussion of a case in which two identical

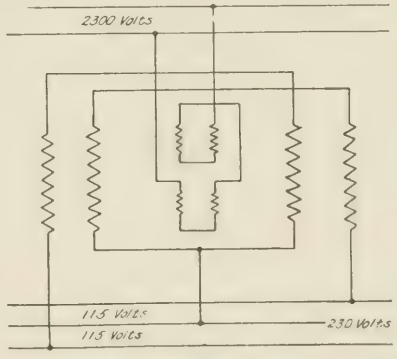


FIG. 1—THREE-WIRE TRANSFORMERS CONNECTED IN PARALLEL

three-wire transformers were mounted on a pole and connected in parallel, according to Fig. 1. One of them burned out. That the two combined were not overloaded was later demonstrated by the remaining transformer carrying the entire load satisfactorily. What was the probable cause of the burnout? It is pointed out that with identical transformers having properly

balanced windings successful parallel operation should be obtained with the connections shown in Fig. 1, unless there was some defect in one or both machines. If the machine was not defective a possible cause of the burnout may have been an imperfectly balanced design, resulting in an unbalanced heating or three-wire load. The wiring diagram of a transformer having

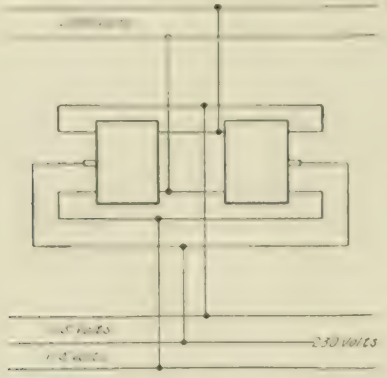


FIG. 2.—THREE-WIRE TRANSFORMERS WITH BALANCED WINDINGS

balanced windings is shown in Fig. 2. This transformer will maintain a uniform heating on either balanced or unbalanced three-wire load. In it both halves of the secondary winding are distributed equally on each side of the primary coil; in other words, the entire length of each half of the secondary winding is directly adjacent to the whole primary winding. The diagram shows that the inside secondary coil is in series with the outside secondary coil. Such an interconnection insures that the resistances of the two secondary halves are equal and also that the reactances are equal; thus perfect regulation of the two halves is obtained and the voltage drop in either secondary circuit will not exceed the listed regulation drop under ordinary unbalanced load conditions.—*Gen. Elec. Rev.*, January, 1917.

Ultra-Violet Rays and the Eyes.—An article giving a summary of recent investigations on the effect of ultra-violet light on the eye and an editorial on the same subject. The higher the temperature of the source of light the greater the proportion of ultra-violet rays, but ordinary glass absorbs ultra-violet rays to a marked extent and the percentage of ultra-violet radiation from incandescent lamps is minute and smaller than that present in strong sunlight. There is no good reason to use special glass in the construction of electric incandescent lamps to provide against this supposed evil. "What is far more likely to produce harmful effect on eyesight is the use of sources of illumination of high intrinsic brilliancy, such as the ordinary tungsten lamp or half-watt lamp, unshaded, so that the eye receives light direct from the filament. It is regrettable to see the way in which clear glass lamps are still constantly used without proper shades. If those who should know better persist in this crude method of illumination more harm will be done to the eyesight than can possibly result through the presence of ultra-violet rays in the spectrum." On the other hand, in special work with arcs, with the quartz-tube mercury lamps, and in the case of auto-welding where the operator is necessarily at close quarters with the source, the use of special screens designed to protect against excess both of visible and of ultra-violet light is a natural and necessary precaution.—London *Electrician*, Dec. 1, 1916.

Variation of the Wave-Length Sensibility of Photoelectric Cells with Time.—HERBERT E. IVES.—A brief account of an investigation carried out in the physical laboratory of the United Gas Improvement Company of Philadelphia. In order to use the photoelectric cell in photometry it is essential that the cell have two qualities. First, the relationship between illumination and current should be rectilinear; second, the wave-length sensibility curve must be of permanent character, and for reasons of practicability it should be the same from one cell to another, in order that any means for screening to copy the wave-length sensibility curve of the eye would not have to be worked out separately for each cell.

An investigation of the first point by the author established the fact that photoelectric cells as previously made for photometric purposes could not be relied on to give the rectilinear relationship. Further study developed the explanation for this, and led to the design of a type of cell in which the current is strictly proportional to illumination. A simultaneous study of the wave-length sensibility characteristics of a number of cells showed these to be widely variant. The present work is part of an investigation being carried on to develop, if possible, cells of uniform and permanent characteristics, the question of permanency being first under study. The particular cell studied has potassium for the active metal, which is deposited on the inner walls of a 3-in. diameter bulb, leaving only a small spot clear for the entrance of the light. The potassium was colored by a hydrogen glow discharge, and the bulb afterward filled with helium gas at a pressure to give the maximum photoelectric current under working conditions. Measurements of the wave-length sensibility curve have been made at intervals over a period of eight months, during part of which time the cell has stood unused, part of the time it has been used for routine spectrophotometric measurements, and twice it has been exposed for an extended period to a considerable illumination with voltage applied so that a photoelectric current passed continuously. The result of this test is to show a gradual change in the shape of the wave-length sensibility curve, corresponding to either an increase of red or a decrease of blue sensitiveness, probably the latter. The relative blue and red sensitiveness has changed in the period mentioned by roughly 40 per cent. Time, rather than the amount of exposure of the cell, appears to be the determining factor. A slow diffusion of the sensitizing hydride layer into the pure alkali metal layer beneath is a possible explanation. The experiments will be continued.—*Journ. Franklin Inst.*, December, 1916.

Incandescent Lamps.—A note on a recent British patent (11,332, 1915) of C. A. Bastian for a method of avoiding the necessity for prolonged exhaustion of metallic filament lamp bulbs or filling them with a specially prepared inert gas consisting in absorbing the residual oxygen in a roughly exhausted bulb chemically by deoxidizing agents within an extension of the sealed bulb, which is heated externally.—London *Elec. Eng'ing*, Dec. 14, 1916.

Lubrication.—G. B. VICKERS.—A long abstract of a paper read before the Diesel Engine Users' Association on piston and end lubrication of Diesel engines.—London *Electrician*, Dec. 15, 1916.

Installations, Systems and Appliances

Electric Steel Furnaces in Sheffield Supplied from Central Stations.—A note stating that there are at present twenty electric furnaces connected to the electricity supply network of Sheffield, England, and sixteen are waiting to be connected, the total capacity being equivalent to an output of 100,000 tons of steel per year. "This particular application is now becoming so developed that the Sheffield Corporation has decided to promote a bill for powers to erect a new generating sta-

ion just outside the borough boundary at a cost of £7,500,000, with a view to giving a suitable supply. It is also interesting to note that the corporation has formed a development committee, charged particularly with the duty of keeping in touch with consumers and seeing in what way developments in electricity supply are desirable."—London *Electrician*, Dec. 22, 1916.

Field-Connection for Self-Starting Converters.—When a rotary converter is started from the alternating-current side, a strong alternating flux is set up, part of which links with the field coils and, since these have a large number of turns, induces a high voltage in them, which is liable to cause an insulation failure. One way of protecting the insulation is to mount a "field break-up" switch on the converter frame. When starting the converter this switch is opened, thus disconnecting the field coils from each other and preventing the voltages generated in the separate coils from adding in series. The connections for this scheme are shown in Fig. 3. Another scheme of connections for starting is shown in Fig. 4. The field switch is a plain

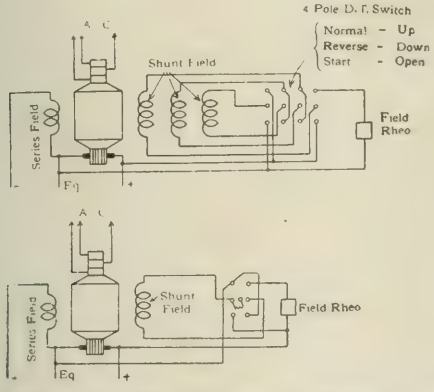


FIG. 3—FIELD CONNECTIONS THAT PREVENT DANGEROUS VOLTAGE INCREASES DURING STARTING

double-pole, reversing field, discharge switch. The switch is closed in the normal position for starting. There are two voltages acting on the field coils—one due to the transformer action of the armature flux, as in the previous case; the other, the armature emf. which is applied to the field coil terminals through the direct-current brushes. The latter voltage varies from line frequency at stand-still to zero frequency at synchronous speed, and its maximum value is the converter ratio times the alternating voltage applied. Since the resistance of the armature is small compared to its reactance, the reactance voltage will be of nearly the same magnitude as the applied voltage. The reactance voltage is generated by the same flux that induces voltage in the field coils, so that ratio of the induced field voltage to the armature voltage (which is nearly the same as the reactance voltage) will be approximately the ratio of shunt field turns to armature turns Consequently the induced field voltage is much greater than the armature voltage, so that no matter what phase relation these two voltages have, even if they are opposed, the field voltage will send current through the circuit composed of shunt field, field rheostat, direct-current brushes and armature. This current will neutralize part of the flux through the field coils and reduce the voltage induced in them. The action is similar to that of a series transformer—the armature corresponds to the primary, the shunt field to the secondary. Since the armature current is practically independent of the shunt-field current, the mutual flux will decrease as the field current increases, thus decreasing the voltage generated in the field. This scheme eliminates the complicated break-up switch and extra field wiring on the converter and affords satisfactory protection from high field voltage.—*Electric Journal*, January, 1917.

Wires, Wiring and Conduits

Copper Resistance at Temperatures Below Zero.—E. C. PARHAM.—Given the resistance R_o of a copper winding at a temperature of zero deg. C., the resistance R_t of that winding at a temperature of t deg. C. can be derived from the formula $R_t = R_o\ (1 + 0.0042\ X\ t)$. This holds good for all values of t met with in ordinary electrical practice (that is, the formula fails for very wide and unlimited temperature ranges); therefore the resistance R_s corresponding to a temperature s would be $R_s = R_o\ (1 + 0.0042\ X\ s)$. Usually the measured resistance R_t at a certain temperature, t, is known, and the resistance R_s at another temperature, s, is desired. From a combination of the above two formulas it follows that $R_s\ (1 + 0.0042\ t) = R_t\ (1 + 0.0042\ s)$. This formula does not involve R_o; consequently, the resistance R_s at any temperature, s, can be derived from the measured resistance R_t corresponding to any other temperature, t. It is assumed in the formula that the resistance is 100 per cent at zero deg. C., therefore, the resistances corresponding to negative temperatures will be less than 100 per cent. It follows, then, that where negative temperatures are involved, due reversal of algebraic sign must be observed in using the formula, otherwise misleading results will be obtained. To illustrate: In a locality where the temperature frequently dropped to —40 deg. C. a field coil was measured at —20 deg. C. and it was desired to know what would be the resistance at +20 deg. C. because that was the average room temperature in the season during which the machine was operating. The resistance R_t as measured at —20 deg. C. was 91.6 ohms. The quantities to be incorporated in the formula were $t = -20$, $R_t = 91.6$, and $s = +20$. In applying the formula we get $R_s\ (1 - 0.0042\ X\ 20) = 91.6\ (1 + 0.0042\ X\ 20)$ or $R_s = 108.4$ ohms.—*Gen. Elec. Rev.*, January, 1917.

Electrochemistry and Batteries

Current Efficiency in Copper Refining.—LAWRENCE ADDICKS.—The different items which lower current efficiency in the multiple system of electrolytic copper refining are discussed as follows: current leakage (to the ground, through the electrolyte, between electrodes); secondary reactions (deposition of impurities, gassing, valence); cathode shrinkage (sulphatizing, ferric salts, nodules, etc.). In practice it is possible with care and dismissal of questions of labor costs to obtain a working efficiency on a large scale of 99 per cent. Commercially it is found, however, that 92 per cent is about as high a figure as it is advisable to insist upon, and at some plants 90 per cent or even 88 per cent is considered satisfactory. Current density has a direct bearing on the problem in that a high density greatly increases the difficulty in preventing short-circuits between the electrodes.—*Met. & Chem. Eng'ing*, Jan. 1, 1917.

Units, Measurements and Instruments

Iron-Cored High-Frequency Current Transformers.—N. W. MCLACHLAN.—Campbell and Dye have demonstrated the use of current transformers with cores of stalloy stampings (silicon iron) for measuring very high-frequency alternating currents. During the progress of the work undertaken by the author on the magnetization of iron at very high frequencies, it became necessary to consider the theory of this method of measurement for such frequencies as occur in wireless telegraphy and the results of this investigation are given in the present paper which is of a highly theoretical nature.—London *Electrician*, Dec. 22, 1916.



SAMUEL KAHN

Samuel Kahn, who has just been elected vice-president of the new Pacific Coast Section of the National Electric Light Association, is the vice-president and general manager of the Western States Gas & Electric Company of Stockton, Cal. He is a native of San Antonio, Tex., and, after preliminary work at the University of Texas, was graduated from the School of Electrical Engineering of Purdue University in 1903. During the next six years Mr. Kahn served as engineer to the San Antonio Gas & Electric Company and the San Antonio Traction Company, and in 1909 he was appointed general manager of the Union Light & Power Company of Fargo, N. D. In May, 1911, he became general manager of the Appalachian Power Company, then a Byllesby property, with headquarters at Bluefield, W. Va., and ten months later he became assistant to the vice-president of H. M. Byllesby & Company, with headquarters at Chicago and Tacoma, Wash. Mr. Kahn has been vice-president and general manager of the Western States Gas & Electric Company since May, 1913.

William Sangster has been appointed superintendent of the Uncas Power Company's hydroelectric plant at Scotland Station, Conn.

A. W. K. Billings has returned from Barcelona, Spain, where he has been for the past five years as manager of construction, managing director and vice-president of the Ebro Irrigation & Power Company, Ltd., and allied interests, in responsible charge of extensive hydroelectric construction and other work. Over 110,000 hp. has already been developed, one interesting feature being the construction of the largest dam in Europe under very unusual conditions. Prior to his work in Spain and elsewhere for the Pearson interests Mr. Billings spent two years in Pittsburgh and ten years in Cuba, principally on electric railway and power plant construction, and two years in New York as engineering manager of J. G. White & Company, Inc. He has opened an office as consulting engineer at 115 Broadway and will devote considerable attention to engineering work in Europe and in Latin America.

Men of the Industry

Changes in Personnel and Position — Biographical Notes

C. A. Felker, who for fifteen years has been a traveling representative for the Central Electric Company of Chicago, has been made manager of country sales for that company.

C. O. Randall, for the past seventeen years superintendent of the Colonial Power Company of Cavendish, Vt., has been appointed electrical superintendent of the Rutland (Vt.) Railway, Light & Power Company. Charles D. Spencer will succeed Mr. Randall as division superintendent and system operator of the Colonial company.

Pearl F. Hodgkins has been appointed local manager of the Blackstone Valley Gas & Electric Company, Pawtucket, R. I., succeeding A. F. Townsend, who has been transferred by the Stone & Webster Management Association to Beaumont, Tex. Joseph Pratt has been appointed superintendent of the distribution department and William Cheney has been placed at the head of the meter department of the Blackstone Valley Co.

H. H. Magdsick, who with R. F. Carbutt has just been awarded a medal by Mayor Mitchel's Committee of Two Hundred for his work in designing the flood-lighting of the Statue of Liberty in New York Harbor, is a member of the illuminating engineering department of the National Lamp Works of the General Electric Company, Cleveland, Ohio. Mr. Magdsick is a graduate of the University of Wisconsin, and has been with the lamp works for a number of years. Among his other important pieces of flood-lighting work was the illumination of the Woolworth Building, New York. With Mr. Carbutt, Mr. Magdsick was joint author of the article on the engineering features of the Liberty installation, published in the ELECTRICAL WORLD of Dec. 23.



H. H. MAGDSICK



I. E. MOULTROP

Irving E. Moultrop, assistant superintendent of the construction bureau, Edison Electric Illuminating Company of Boston, Mass., completed twenty-five years of service with the company on Jan. 1, and in recognition of the occasion was presented with a handsome traveling bag by his associates. Mr. Moultrop was born in Marlboro, Mass., in 1865. After serving a number of years with the Whittier Machine Company at Roxbury, Mass., he joined the staff of the Boston Edison Company in 1892 and has since contributed largely to the layout of steam apparatus for the company's generating plants. Mr. Moultrop's work on the prime movers committee of the National Electric Light Association is well known among central-station engineers. He has also served as manager of the American Society of Mechanical Engineers (from 1908 to 1911) and as vice-president of that organization (from 1912 to 1914). Mr. Moultrop is a member of the A. I. E. E., the Engineers Club of Boston, and the Boston Society of Civil Engineers.

T. D. Witherspoon has resigned his position as chief draftsman of the Union Electric Light & Power Company of St. Louis, Mo., to become engineer in charge of construction for The Milwaukee (Wis.) Electric Railway & Light Company. Mr. Witherspoon graduated from Rose Polytechnic Institute in 1900 with a B.S. degree, and at that time entered the employ of the National Malleable Castings Company of Chicago. He has had wide engineering experience with the Pennsylvania Railroad, Youngstown (Ohio) Engineering Company, and the Toledo Furnace Company.

Obituary

Alfred B. Jenkins, president of the valve manufacturing firm of Jenkins Brothers of New York City, died at his home in West Orange, N. J., Dec. 29.

Horace D. Bean, manager of the Roller-Smith Company's factory of Bethlehem, Pa., died suddenly while on a visit to his old home at Penacook, N. H. Mr. Bean was forty-five years old.

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Improved Mercury Vapor Lamps

The Cooper-Hewitt Lamp Company of Hoboken, N. J., has made several improvements and added new types to its line of lamps. A complete Cooper-Hewitt lamp outfit consists of the tube, the auxiliary and the reflector-holder. The tube is of clear glass with electrodes at each end and contains a small quantity of metallic mercury. The current passing between the electrodes, vaporizes a portion of the mercury, and causes the tube to glow with a soft, bright radiance. The auxiliary consists of the operating mechanism, together with the supporting framework; the



AUTOMATIC TILTING MERCURY VAPOR LAMP

auxiliary being inclosed in an enamel sheet metal cover. The shifter, which is mounted in the auxiliary, is a small glass vessel with two electrodes and contains a small quantity of mercury. The shifter serves for lighting the tube, and operates automatically. The reflector-holder supports the tube in two clamps and is attached to the auxiliary.

The type P automatic lighting-tilting type lamp with FA auxiliary has an average current rating of 3.5 amp., 385 watts, a mean hemispherical candle power with reflector of 800, a commercial efficiency-watts per M. H. candle of 0.48, with length of light-giving tube 50 in., and diameter of tube 1 in. The improvements in the auxiliary are larger coils and a different arrangement of the shifter. The outfit takes less headroom and allows the tube to be hung closer to the ceiling. It is equipped with two insulated hangers, but when only one suspension point is available in the ceiling, as in the case of an outlet box, a horizontal suspension bar with a hook on each end and a cross in the middle may be secured.

The new type L lamp has an average current rating of 2 amp., total watts 220, mean hemispherical candle power of each lamp, with reflector, 400; commercial efficiency in watts per M. H. candle, 0.55; length of light-giving tube, 35 in., and diameter, 0.75 in.

This lamp has been developed to meet the demand for a unit smaller than the type P (385 watts), where it is essential to have a multiple lamp with high efficiency. The type L lamp is automatic in starting and does not have to be tilted for lighting. It requires little head-room and can be hung very close to the ceiling. The lamp outfit has two insulated hangers, but when only one suspension point is available at the ceiling, it can be suspended in the same way as described in the type P unit.

Vacuum Cleaner with Automatically Controlled Suction Space

Several features are claimed for the vacuum cleaner shown here that has been developed by the Apex Electrical Manufacturing Company, 1111 Power Avenue, Cleveland, Ohio. This cleaner is mounted on a three-wheel carriage, leaving the body free to operate its self-and-automatic adjustment, which permits the cleaner to be operated on the bare floor and on the thickest rug or carpet, and conveys the maximum cleaning power through automatic control of the required suction space along the nozzle front, regardless of the surface it may be cleaning.

As shown in the circle inset of the illustration, the upper wall of the nozzle is made with rounded, diagonal-set, protruding ribs that distribute the suction evenly across the entire nozzle—and that riffle the surface of floor covering to enable the suction to easily draw up all deeply embedded particles of heavier dirt. The nozzle, too, is designed to confine the air into the nap of the carpet and not on the surface.



VACUUM CLEANER MOUNTED ON A THREE-WHEEL CARRIAGE

An improved, revolving brush, traction operated, is mounted in a sunken housing or shroud, so that the brush itself does not interfere with, or in any way impede the suction, the latter merely passing over the extreme ends of the brush so as to gather off the lint, hair, thread, etc., that has been loosened and picked up.

Extension or Remote Tank Gage

The Universal Tank Gage Company of Tacoma, Wash., has developed an extension or remote tank gage that shows on a vertical scale the amount of liquid

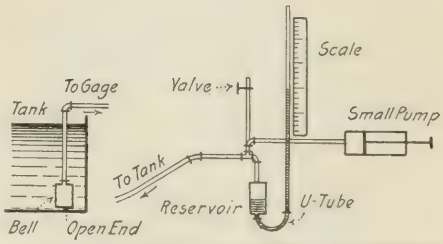


DIAGRAM SHOWING FEATURES OF REMOTE TANK GAGE

in a tank. The gage consists of a U tube containing a colored liquid, arranged as shown in the accompanying illustration. The long arm of the tube is open to the air; the other is cut quite short and connected to a small reservoir of a size sufficient to hold the contents of the other arm. The top of the reservoir is connected by means of ⅛-in. copper tubing to the tank, this tubing terminating in a small bell which is placed open and downward. At the gage end of the connecting tube is a small hand air pump and valve, as shown in the illustration.

After the instrument is set up and connected to the tank, air is pumped into the tubing until it bubbles freely from the bell in tank. The air then in the tubing is under atmospheric pressure plus the head due to the height of the liquid in the tank, which is exactly counterbalanced by the column in U tube. As the contents of the tank is drawn off the air escapes from the bell and the column in the gage glass falls. When the tank is filled the process is reversed, but if air is compressed too much and the liquid is forced into the copper tubing a few strokes of the hand pump will correct it. The change in temperature is automatically cared for, a rising temperature merely forcing a

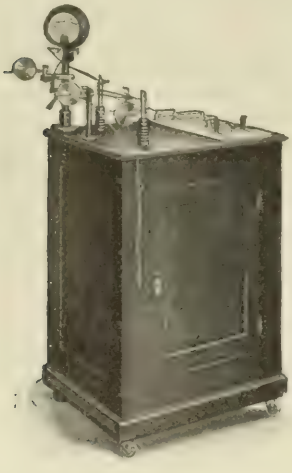
little air out of the bell in the tank. A falling temperature will cause the column of liquid to read slightly lower than it should and this can be corrected by using the pump. There is no capillary action to be adjusted for, it is claimed, since there is no liquid in the small tube.

This gage is guaranteed to read within 1/16-in., and its operation is independent of the location of the tank. It is made in various forms for use on fuel oil, water, gasoline or any tank containing liquid and is used in garages, on automobiles, on gas tanks, in ships to indicate level of bilge water, and in power stations.

Dental Roentgen Ray Machine

The Wappler Electric Company of New York has developed an interrupterless dental roentgen machine which is constructed upon the same principles as its largest roentgen machines. The accompanying illustration shows the complete unit, in which the alternating current is rectified with a Wappler rectifying disk and delivered as a unidirectional current for the tube, insuring a long life for the tube and perfect, clear pictures with good contrast. Five stages of voltage are provided. With the highest the tube will back up 6 in. and give a good picture of the lateral and frontal sinus in four to five seconds. The power in the tube would be about 40 milliamperes. The pictures, it is said, will always show good contrasts, and the results obtained can be compared in every way with the quality of work obtained from the more powerful and expensive machines.

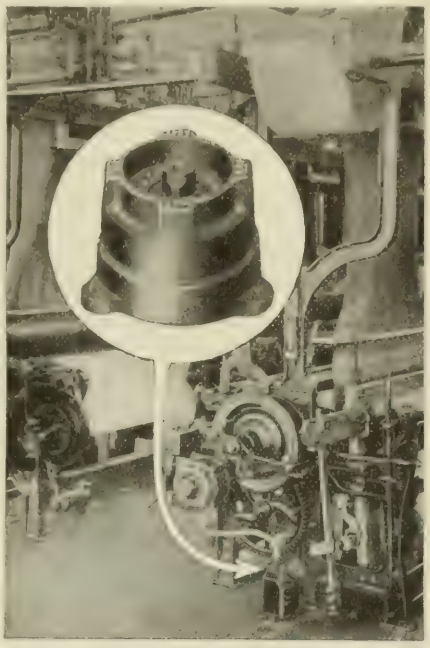
A milliampere meter is mounted on the machine, also a sparkgap to measure the back-up and penetrating power of the tube. Automatic tube reels connect the tube to the high-tension terminals. The safety switchboard permits only the operating levers to protrude, eliminating the possibility of shock. All types of tubes may be used with the dental interrupterless machine.



ROENTGEN RAY MACHINE FOR DENTAL WORK

Indicating Switch for Small A.C. Motors

The triple pole indicating switch shown in the accompanying illustration has been designed for use where machines are individually driven by alternating current motors of 2 hp. and smaller. The "shell" or cover is a one piece iron casting and is dust tight, which makes it suitable for mill installations. The switch mechanism is mounted on a porcelain block, which is entirely inclosed within the cover. As will be noted from the illustration, the indicating switch handle is countersunk below the top rim of cover, upon which are cast the words "off" and "on." By this construction the handle is perfectly accessible, the position of switch may be readily seen, and at the same time it is protected from damage and accidental operation. Three supporting ears are provided at the bottom of the cover and so spaced as to permit of ready installation on PG and ZG condulets. This switch carries an approved rating of 20 amp., 250 volts, and may be used for controlling three-phase alternating-current motors up to and including 2 hp.



TRIPLE POLE INDICATING SWITCH FOR MILL INSTALLATIONS

Accessible Photometer Sight Box

A photometer sight box which has been developed by the Leeds & Northrup Company, Stenton Avenue, Philadelphia, Pa., is shown in the accompanying illustrations. When the top of the instrument is taken off by removing a thumbscrew all working parts are exposed to view. The cube, in its mounting, may be easily removed, the mounting sliding in grooves provided for this purpose. Totally reflecting prisms are used on the sides of the box in place of mirrors. An advantage of prisms, it is claimed, is found in the fact that silvered mirrors are selective and thus introduce errors in the results obtained when sources of different color values are being compared. The Lummer Brodhun cube is the most important part of the instrument, and great care, it is pointed out, is taken in its construction. The two hypotenuse faces of the prisms upon which the designs are etched must be plane, since it is absolutely necessary that when mounted they should be in optical contact. Each instrument is provided with absorption glasses for use with the contrast cube. When the absorption glasses are not in use they are turned out of the way by means of knurled heads on the outside of the instrument. Arrows on the knurled heads pointing toward the arrows on the box indicate when the absorption glasses are in place. It is never necessary to remove these glasses from the instrument, thus eliminating a very common cause of breakage. The box weighs, without mounting bracket, only 1.5 lb. The overall dimensions are 3.5 in. by 5.75 in. by 2.5 in., excluding telescope.

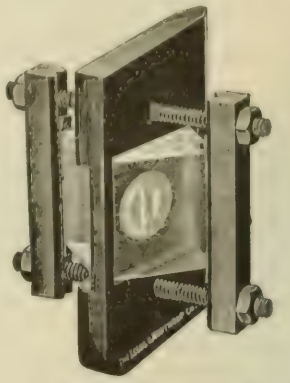


FIG. 1—SIGHT BOX CUBE IN ITS MOUNTING

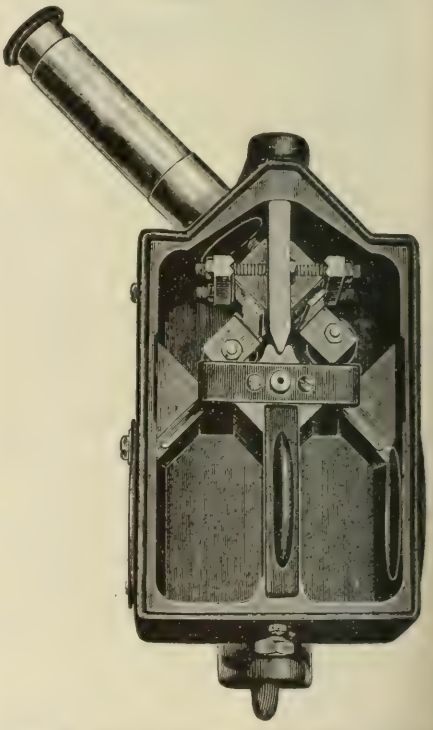
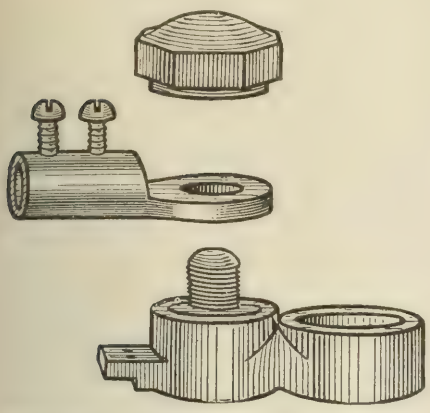


FIG. 2—PHOTOMETER SIGHT BOX WITH TOP REMOVED

Adaptable Terminal Connector

An adaptable terminal connector which consists of a lead alloy connector with a threaded stud anchored in the body, a wire terminal, and a nut on the



TERMINAL CONNECTOR THAT PREVENTS BREAKING OF BATTERY PLATE

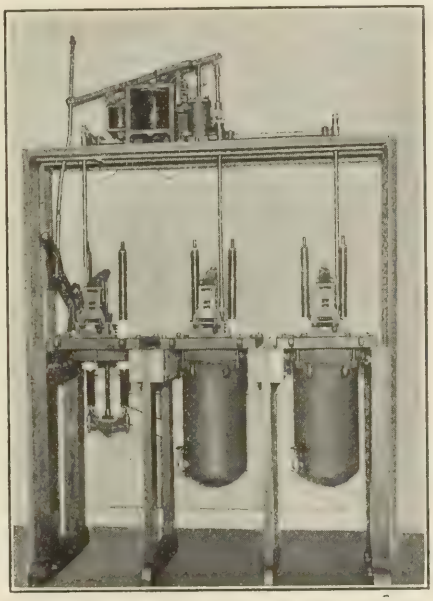
threaded stud to clamp the terminal to the connector has been developed by Paul M. Marko, 1191 Bedford Avenue, Brooklyn, N. Y. The wire terminal into which the bare cable is inserted can be fastened by set screws or by solder. The anchored stud is spaced at a distance from the battery terminal post, which, it is claimed, prevents corrosion should creeping by acid take place along the terminal post. The terminal can be clamped on the seat of the connector at any angle. The maker calls attention to the fact that the feature of this connector is that it prevents the breaking of the battery plate when the nut is tightened.

Oil Circuit Breakers for Cell Mounting

The two forms of oil circuit breakers, one of which is shown in the accompanying illustration, designated as types O-1 and O-2, have recently been placed on the market by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa. These breakers are for voltages up to 25,000 and are furnished in current capacities of 600 to 4000 amp. They are supplied in two frames, the type O-1 with current capacities up to and including 1600 amp., for plants up to 80,000 kva., three-phase rupturing capacity (a root mean square value of 500,000 kva. ruptured at contacts) and the type O-2, a larger frame, with current capacities of 2000, 3000 and 4000 amp. for plants up to 100,000 kva., three-phase rupturing capacity (a root mean square value of 625,000 kva. ruptured at contacts). The high capacity ratings of these breakers, it is claimed, are due to the form of tank, the use of steel supporting flanges, and large volume and head of oil. The tanks are round in form and seamless. They are die pressed from heavy sheet steel, representing the strongest tank construction possible, it is claimed.

Both types of breakers are furnished in single-pole unit form for cell mounting only, each pole unit to be mounted in a separate brick or concrete compartment in the standard arrangement. The operating mechanism, which is mounted on top of the cell structure on a channel and plate base supported from the cell structure, is solenoid operated and consists of a common operating shaft with levers and rods operating the several poles as a unit. Each pole unit is complete with a heavy steel frame supporting the contacts and tanks, and is provided with an independently adjusted toggle lever arrangement for operating the moving contacts. Adjustments for contact pressure and travel can be made in each pole unit independently. An accelerating spring and dashpot is operated as part of the common control mechanism to assist in forcing the circuit breaker to the open position and in taking up the shock of the moving parts.

The live metal parts of each pole are immersed in a separate single piece



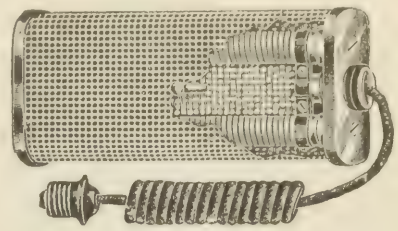
OIL CIRCUIT BREAKER MADE IN CURRENT CAPACITIES OF FROM 600 TO 1600 AMP.

round steel tank which can be removed readily without interfering with the other parts of the breaker. Drain and filler fittings and oil gages are furnished so that the tanks can be emptied before lowering, or filled when in position. As a protection from arcing to ground, a removable Micarta insulating lining is used in each tank. The tanks are deep to allow ample head of oil and space above the oil for a compression chamber to reduce internal gas pressure.

All types O-1 and O-2 breakers are furnished as either automatic or nonautomatic. Automatic operation of nonautomatic breakers may be obtained by the application of suitable relays for actuating the shunt tripping coils. Such auxiliaries as under-voltage trip devices of the self-resetting type, shunt or under-voltage trips, and mechanical interlocks can also be obtained when necessary.

Electric Heater for Automobile Engines

An electric heater for automobile engines and radiators which, it is claimed, will keep water in radiators warm in the coldest weather is being offered the trade by the Metal Specialties Manufacturing Company of Chicago, Ill. The thin oval shape of the heater permits



THIN OVAL SHAPED ELECTRIC HEATER FOR AUTOMOBILE ENGINES

it being placed wherever heat is desired. The heater is 7 in. long, 3.5 in. wide and 1.5 in. thick, and consumes 220 watts. This electric heater is furnished with 10 ft. of cord and attachment plug.

Three Draft Gages Combined in One

The 3 in 1 air gage shown in the accompanying illustration has been designed to meet the demand for concentrated control of the draft conditions of any forced-draft furnace, but particularly for boiler service. The ranges



THREE DRAFT GAGES IN ONE FOR BOILER SERVICE

are 0 to 2 for the damper or last pass draft, — 1 to 0 to + 1 for the combustion chamber, and 0 to 6 or 0 to 8 for the ash pit. The case is of cast-iron, all black enameled. This gage is of the dead-beat type.

NEWS OF THE INDUSTRY

A Review of Activities in the Electrical Manufacturing, Selling and Central-Station Fields

UNION ELECTRIC VALUATION

Commission Experts Estimate the Cost of Reproduction New at $22,757,409

Additional information regarding the valuations of the Union Electric Light and Power Company of St. Louis, Mo., has been received.

The appraisal of the Missouri Public Service Commission placed an estimate of the cost of reproduction new of the physical property of the company at $22,757,409. This did not include an allowance for preliminary expense, promotion, cash working capital or going value, because the engineering department of the commission reported on physical values only. The company placed a value of $25,384,888 on its physical property and a total value of $31,206,950.

A comparison of the company's valuation with that of the commission follows:

	Commission Appraisal	Union Electric Company Appraisal
Land	$1,522,743	$2,958,560
Buildings	3,134,124	3,200,771
Equipment	6,303,551	6,514,363
Transmission and distribution	7,759,564	7,908,981
Teams, autos, tools and office equipment, electric signs	285,772	368,825
Rights—licenses	225,977	248,751
Stores and supplies	401,550	421,697
Overhead charges	3,124,128	3,762,940
Total	$22,757,409	$25,384,888
Cash		788,960
Promotion, brokerage, etc.		533,102
Going value		4,500,000
		$31,206,950

PACIFIC GAS & ELECTRIC GETS ORO PROPERTIES

California Commission Authorizes Sale Urging Company to Be Liberal in Making Extension Into Territory Not Developed by Oro Concern

The California Railroad Commission has issued an order authorizing the Oro Electric Corporation and the Oro Water, Light & Power Company to sell to the Pacific Gas & Electric Company their entire public utility properties, with certain exceptions, and the Pacific Gas & Electric Company to issue at not less than 90 per cent of face value its general and refunding bonds to realize the sum of $1,491,151.35 to reimburse the treasury of the Pacific company for money expended in the purchase of the bonds of the Oro Electric Corporation.

The Oro Electric Corporation has an authorized issue of $10,000,000 capital stock, and $10,000,000 of 6 per cent first mortgage bonds. Of the stock, $1,950,000 is owned by the Oroville Water, Light & Power Company and $8,050,000 is in the hands of the public. Of the bonds, $1,830,000 were reported in the application of the Pacific company as in the hands of the public and $180,000 in the treasury of the Oro Electric Corporation. The other Oro companies also have issues of stocks and bonds which are mentioned in detail in the commission's decision. The books of the Oro Electric Corporation and subsidiary corporations show that the cost of their public utilities properties was $3,488,249.

Public Service Commission News

Michigan Commission

Vol. 5, No. 2, of the orders and opinions of the Railroad Commission covering the period from July 1 to Sept. 30, 1916, has been issued.

California Commission

Volume I of the report of the Railroad Commission of California from July 1, 1915, to June 30, 1916, has just been printed. The present volume is a narrative of the work done by the commission during the fiscal year ended June 30 last. Volume II, which is not yet ready for distribution, is a digest of the finances of California public utilities.

Wisconsin Commission

In fixing the rates of the Tomah Electric & Telephone Company, which does not own a generating station but purchases all the energy distributed, the Railroad Commission prescribed rates that would yield over 9 per cent on a rate-making value of $30,000. This return, the commission says, "may seem a little high at the first glance, but, bearing in mind the size of the property and that this property is operated very economically, and further that the general officers of the company receive only a nominal sum, $150 a year, for their services to the electric utility, it seems to us that the total return is not unreasonable."

Massachusetts Commission

At a recent hearing before the Massachusetts Gas & Electric Light Commission upon a petition of the Edison Electric Illuminating Company of Boston for a stock increase, General Morris Schaff, senior member of the board, discussed public utility management with special reference to surplus. When the board originated, surpluses were encouraged for the security of the property and the natural obligations of the consumer with respect to surplus accumulation were laid down. "In doing this," the commission stated in part, "we created, unfortunately, one of the greatest evils, not unknowingly, that I think has befallen our public service corporations. These surpluses we created immediately became the target, became the prey of the people who created our public utility holding companies. They bought those stocks and then turned in and capitalized all those surpluses. And we are to-day suffering from the evil of our own creation, and we have up to this time been hardly able to hold our own against it. But I think the tide is turning and public opinion is going to compel these people to loosen their grasp on these public service corporations.

"Now, so much for that reference to surplus. There is a limit where a surplus would be wrong. That is for the management and the directors to fully decide. The earning power of that surplus, however, must be divided between the people who created it and the people who have the honest title to it. I do want to impress upon every man connected with these public service corporations that our first desire is to see that the money that has gone in there shall be absolutely protected, and shall be as sure as it can be made of a dividend."

Will Recommend Addition of Public Necessity and Convenience Clause to Oregon Law.—Public Service Commissioner Corey, Salem, Ore., has announced that he will recommend to the Legislature that the public utilities law be amended to contain the usual public necessity and convenience clause. Such an amendment was introduced at the 1915 session of the Legislature, but was defeated after a close contest, in the house.

A New Overhead Line Trouble.—Evidence that there is no limit to the variety of overhead line troubles is submitted by S. W. Borden, general manager of the coast division of the Lakewood and Coast Electric Company of Summit, N. J., who writes that a few days ago the company's emergency men were called out to disentangle an aeroplane from their overhead wires and to rescue the driver by means of an extension ladder.

Large Public Utility Development Ahead for California.—California public utility development aggregating $25,000,000 has been presented to the Railroad Commission for investigation and approval during the last few months. Of this amount, $16,700,000 is involved in application for issuance of public utility securities for extensions, additions, betterments and mergers in northern California and at least $8,500,000 for southern California. Some of these applications have been granted by the commission, while the remainder are under consideration and affirming orders are expected at any time. Of the utilities included in the list, hydroelectric corporations are contemplating the largest development expenditures, water companies come next and last intrastate railroads. The applications disclose that all the utilities are enlarging their plants, extending into new territory and improving the systems already in operation.

May Install Telautograph System in Senate.—Experiments are being made in Washington to ascertain if it would be possible to install in the Senate a telautograph system, or something similar to it, electrically operated, to inform Senators while in their offices what is going on in the Senate chamber. Under the present system of informing Senators what is going on in the Senate chamber, a series of call bells, ringing from one to five, announces to them that a roll-call is then being demanded, or that no quorum is present, or other similar information. Under the proposed system, a clerk at the reading desk of the Senate, or beneath the chair of the presiding officer, would record upon an electrical device similar to the so-called telautograph what is actually happening on the floor of the Senate, such as "Senator So-and-so" is wanted on the floor, "The army appropriation bill is now up for debate," etc. The old-fashioned call-bell system, which means the loud ringing of a gong, with only five indications of what is transpiring in the Senate chamber, is felt by some of the younger Senators to be out of date and not sufficiently indicative.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

New Jersey Capital Considering Municipal Ownership.—Mayor Donnelly of Trenton, N. J., has engaged F. W. Ballard to make investigations of local water-power properties and of the feasibility of utilization for the installation of hydroelectric plants for municipal operation.

Big Increase in Zinc Production.—The new year estimate of the production of zinc in 1917, just issued by the United States Geological Survey, shows the recoverable zinc content of ore mined in the United States in 1916 as 708,000 tons, a gain of more than 120,000 tons, or 20 per cent, as compared with 1915. The Joplin region made the largest gain.

May Hear Inaugural Address by 'Phone.—Gatherings in all parts of the country may be able to listen to President Wilson's inaugural address on the morning of March 5 by long-distance telephone. The Washington inauguration committee has taken up with telephone companies the feasibility of such an arrangement, and it was pronounced quite possible.

Increase in Number of Commonwealth Edison Company's Employees.—In September, 1916, the total number of employees of the company was 5336, or a 25 per cent increase for the year. Over the same period of time the amount of the company's payroll increased 31.3 per cent. Of all the company's employees, 65 per cent have been with the company less than five years, 8⅓ per cent, ten years but less than fifteen; 3 per cent, fifteen but less than twenty years; 2 per cent, twenty but less than twenty-five years; 0.8 per cent, twenty-five but less than thirty years, and only 0.08 per cent, or four persons, had a record of thirty years' continuous service or longer.

Bill to Prohibit Spreading of Light and Power Utility Control in Texas.—Among the several bills that are directed against corporations which have been introduced in the Legislature of Texas at the present session is one by Senator I. F. Clarke of Schulenberg, which provides that no light and power company, firms or business interests that already own an electric light and power plant shall be permitted to purchase, lease or acquire the business of another electric light and power concern. Another bill affecting electrical interests is that introduced by J. W. Parks, which provides for creating the office of chief electrical inspector to be appointed by the Governor and requiring the licensing of firms and individuals in the electrical contracting business.

Franchises Submitted to Dallas Taxpayers for Vote.—The Dallas Commission has submitted to vote of the taxpayers the proposition of granting franchises for organizing a proposed new electric light and street railways company in Dallas. The election will be held on April 3. The franchises have already been granted by the City Commission, and the vote upon them will be in the nature of a referendum. Immediately upon granting the franchises the attorneys for J. F. Strickland, who will head the new light company, and C. W. Hobson, head of the new street railway company, filed bonds in the amount of $1,000,000 to guarantee to the city the carrying out of specified agreements to comply with the ordinances. In the recent postcard ballot the voters showed themselves to be overwhelmingly in favor of granting the proposed franchises.

Negotiating a Street Lighting Increase.—A proposal to increase street lighting rates is fundamentally an unwelcome task, but a recent letter of J. G. Meunt, general manager of the Colonial Power & Light Company, to the Village and Fire District of Manchester, Vt., handles such a problem in a frank and interesting way. The author pointed out that doubtless in their knowledge of conditions existing in other towns, the municipal authorities must have realized that the price the Colonial company is now charging for street lights is somewhat below the ordinary figure. In view of the former difficulties with the service the management of the company had refrained from raising this question prior to the completion of arrangements for a service of as good quality as any city or town could desire. The point was then made that in comparing the price for the Manchester street lighting with the prices charged for similar service in other towns one or two things must be true: that the prices charged in other town are exorbitant or else that the price charged in Manchester must be below the actual cost of the service.

"Owing to the fact that the Public Service Commission of Vermont has a careful supervision over such prices and because of the fact that there have been several cases dismissed before this board and settled by it," says the letter, "we believe that you will agree with us when we say that we feel that the true conclusion is not that prices charged in other towns are too high, but that the price charged in Manchester is too low; and we do not think that you will feel it fair that the company should continue to supply service at a very considerable loss." In quoting the following rates, which the company desires to have established in a new contract, the management stated that pending consideration and discussion of the matter, the present street lighting service in Manchester would be supplied after Jan. 1, 1917, at $1.60 per month per lamp. The proposed rates, now under consideration, are $18 per year per 32-cp. lamp burned all night and $20 per all-night 60-cp. lamp; $15 per 32-cp. and $18 per 60-cp. lamp burned until midnight.

Automobile Headlights.—W. F. Little, of the Electrical Testing Laboratories, presented before the New York section of the Illuminating Engineering Society on Jan. 10 a survey of the automobile headlight situation.

Safety Meeting for Pittsburgh Iron and Steel Electrical Engineers.—The February meeting of the Pittsburgh section of the Association of Iron & Steel Eectrical Engineers will be held on Feb. 17 at the Fort Pitt Hotel, under the auspices of the safety committee, H. A. Schultz, chairman.

Dallas Electric Club Officers.—The Dallas Electric Club and Jovian League at its weekly luncheon elected the following officers for the year 1917: Ben K. Howard, president; E. E. Roessler, secretary; E. G. Warner, assistant secretary, and R. W. Wakefield, E. M. Powell and L. A. Ott, vice-presidents.

Brooklyn Section N. E. L. A.—The annual meeting of the Brooklyn Company section was held on Jan. 16. T. I. Jones, general sales agent, Brooklyn Edison company, spoke on the growth of the company during the year. W. F. Wells, vice-president and general manager of the company, delivered an address.

New York Electric Production Meeting.—The electric production committee of the Empire State Gas and Electric Association held a meeting in the Onondaga Hotel, Syracuse, on Jan. 12. The general subject for discussion was "Fuel, Coal-Handling, Stokers and Furnaces—and Smoke Prevention." There was a question box at the morning session and the questions asked were discussed at the afternoon session.

Florida Engineers Organize.—The Florida Engineering Society was organized recently in Jacksonville with a charter membership list of eighty-four. The officers are: President, L. D. Smoot, Jacksonville; vice-presidents, W. P. Darwin, Jacksonville, and R. E. Chandler, Gainesville; secretary, J. R. Benton, Gainesville, and treasurer, H. D. Mendenhall, Lakeland. The first annual meeting of the society will be held at Tampa, Fla., on Feb. 2 and 3.

New York Electrical Society Hears Choralcelo.—The New York Electrical Society held its 352nd meeting at the Choralcelo Galleries, New York City, on January 15. E. R. Knowles lectured on "Dust, Its Universality, Its Conservation and Its Elimination." After Mr. Knowles' address Guy P. Norton spoke on the operative principles of the Choralcelo, the music of which is produced electrically. His talk was accompanied by many striking illustrations.

Meeting of Worcester Polytechnic Institute Branch.—The fourth regular meeting of the Worcester Polytechnic Institute branch of the American Institute of Electrical Engineers was held Jan. 5. This meeting was a joint meeting with the local Civil Engineering Society and the student branch of the American Society of Mechanical Engineers. H. T. Miller of Boston, New England agent, National Tube Company, presented a lecture entitled "From Ore to Finished National Pipe."

Associations and Societies

A complete Directory of Electrical Associations is regularly printed in the first issue of each month on the next to last text page.

Iowa Contractors to Meet.—The semi-annual meeting of the Electrical Contractors' Association of Iowa will be held at Cedar Rapids on Jan. 30 and 31.

Store Lighting Discussed at Chicago.—A. L. Powell, illuminating engineer, Edison Lamp Works, addressed the Chicago Section of the Illuminating Engineering Society on Jan. 9, his subject being "Store Lighting."

Wisconsin Association Meeting.—The annual meeting of the Wisconsin Electrical Association will be held at the Hotel Phister, Milwaukee, on March 15 and 16. W. E. Haseltine of Ripon, Wis., is president of the association.

Portland (Ore.) Sections, A. I. E. E. and N. E. L. A.—The sections were addressed at a recent luncheon in the Oregon Hotel by A. H. Babcock, consulting electrical engineer for the Southern Pacific Company, San Francisco, who talked on "The National Reserve Corps of Engineers." Paul Lebenbaum, electrical engineer, Southern Pacific Company, Portland division, acted as chairman.

Electrical Club of Toledo.—A dinner is being arranged by the club for the members of the Western Association of Electrical Inspectors, which will hold its convention at Toledo on Jan. 23, 24 and 25. Chairmen of the ten committees appointed to look after the matter are: H. R. Fowler, J. W. Strub, Albert A. Merickel, S. M. Strub, J. N. Riddell, H. C. Scannell, E. Berger, G. Sothern and F. L. Lucas.

Annual Meeting of Wisconsin Engineers.—The Engineering Society of Wisconsin, which will hold its annual meeting at Madison on Feb. 15 and 16, will include in its program the following papers which may be of interest to electrical men: "Valuation Methods," by F. J. Bachelder; "Public Service Regulation," by L. F. Boon; "Street Lighting," by F. A. Vaughn, and "Wisconsin Conservation Law," by H. V. Tennant, to be followed with discussion by W. D. Mead.

Commission Valuation Rough Guess, Says Former Commission Engineer.—James E. Allison, president of the James E. Allison Company, in an address before the St. Louis Jovian League luncheon meeting on Jan. 9, cited facts showing how it was impossible for a commission to place a fair valuation on public utility property that has been operated. Mr. Allison, who formerly served as engineer of the Missouri Public Utilities Commission, stated that owing to the impossibility of estimating the future earning power of a utility property, to attempt to estimate depreciation of mechanical values or the appreciation of organization values, was nothing more than a rough guess.

Louisville Jovians Reorganize with Local and National Members.—According to a proposal approved unanimously by the members of the Louisville Jovian League, that organization will continue its existence, though as an independent association of men in the electrical industry. It will receive a charter from the Jovian Order and its membership will include those who are members of both the local and the general organizations, as well as those who are members only of the local, to which the charter will be granted on account of the local members who have qualified, by remitting the increased dues, as members of the Order. However, according to action taken at the same meeting at which the amended constitution and by-laws were adopted, the men who are members of the Jovian Order will not pay, in addition, dues to the local organization, which are $2 annually. It is proposed that an arrangement will be worked out by which the league shall each year choose from its membership perhaps fifteen who will be named to represent it as ranking Jovians. Such a disposition of the matter will stand for a year. The annual meeting and election of officers of the Louisville Jovian League will be held at one of the local hotels on the evening of Jan. 30. It will be a banquet meeting, with enrollment of new members, after which the election of officers will be held.

New York Companies Section Hear New York Edison Figures.—Arthur Williams of the New York Edison Company on June 16 spoke before the New York Companies Section of the National Electric Light Association on "Reminiscences and Forecasts." Mr. Williams told of the growth of electric service in New York City since its beginning, illustrating his remarks with pictures. He also gave some figures to show the extent of electric service supplied by his company at the beginning of 1917. More than 200,000 separate customers, served through a considerably greater number of meters, have an aggregate connected load of, roughly, 15,000,000 in 50-watt equivalents, or 750,000 kw. Nearly 500,000 hp. in elevator and industrial motor load is recorded on the company's books, and there are many such motors of which the company has no record. Based on a 3 to 4 cent per kilowatt-hour rate, the annual income from electric vehicles in New York City for battery charging is $18,000,000. The company has 1000 telephones. The daily number of telephone messages to and from customers is 8000 calls. The daily incoming mail contains 7000 letters. More than 1,500,000 separate parcels are sent out yearly either by mail or by local delivery. Although the number of customers is increasing, the number of complaints is decreasing. But 8700 complaints were received last year. Following Mr. Williams, Mr. Robert A. Carter, vice-president of the Consolidated Gas Company, made a few remarks.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

SALES BILLED BY LARGE MANUFACTURERS IN 1916

General Electric, Western Electric and Westinghouse Sales Total More Than $305,000,000—Unfilled Orders Are in Excess of $105,000,000

In many respects the year that has just passed was remarkable, especially so as regards the sales billed for electrical goods. In 1916 the sales billed by the three largest distributers of electrical goods, the General Electric Company, the Western Electric Company and the Westinghouse Electric & Manufacturing Company, amounted to more than $305,000,000, while the value of unfilled orders on Dec. 31 was in excess of $105,000,000.

In comparison with 1915 this was a gain of $117,000,000, or 62.3 per cent in sales billed, and $62,000,000, or 144 per cent in unfilled orders. Previous to 1916 the largest year was 1913, when the sales billed amounted to $228,000,000. The sales billed last year, therefore, were $77,000,000, or 34 per cent greater than in the industry's largest previous year.

Compared with 1915 and with 1913 the sales billed by these companies for last year were as follows: General Electric Company—1916, $120,000,000; 1915, $85,500,000; 1913, $107,000,000. Western Electric Company—1916, $105,000,000; 1915, $63,800,000; 1913, $77,500,000. Westinghouse Electric & Manufacturing Company—1916, $80,000,000; 1915, $38,000,000; 1913, $43,700,000. These figures are for the regular line of products and do not include orders for war munitions. The 1915 and 1913 Westinghouse figures are for the fiscal year which ended March 31 of the following year in each case, while the 1916 figures are for the calendar year. Therefore, compared with the 1915 fiscal year that included the first quarter of 1916 the Westinghouse figures for the calendar year 1916 do not show as large an increase by many millions of dollars as if they had been compared with the figures for the calendar year 1915.

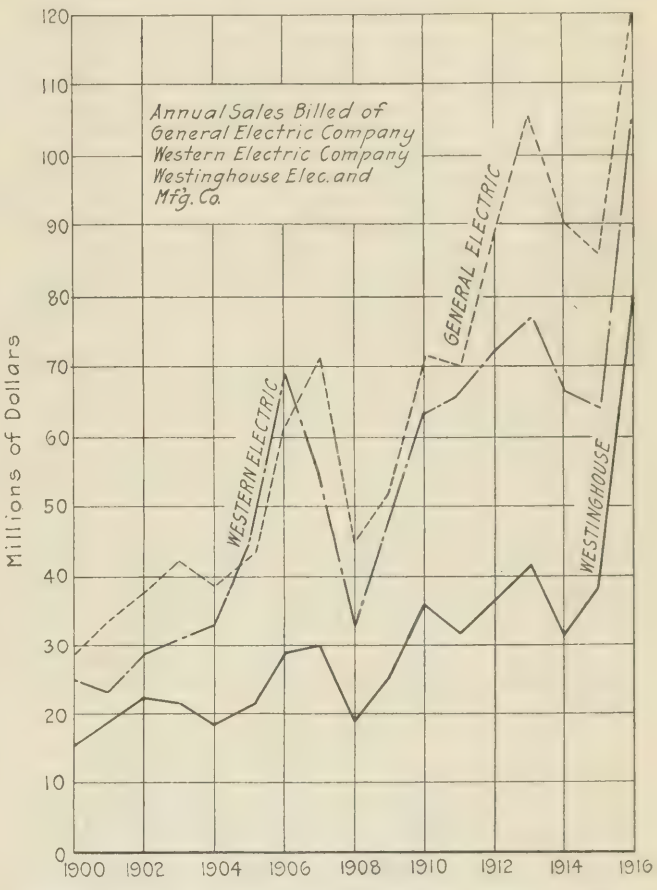
The unfilled orders for the three companies on Jan. 1, 1917, were: General Electric Company, $45,000,000; Western Electric Company, $30,000,000; Westinghouse Electric & Manufacturing Company, $30,000,000.

In comparing the 1916 figures with those of previous years it must be remembered that values and not volume of goods are here given. Prices advanced on the whole during 1916 about 35 per cent, but most of the orders delivered in 1916 were placed prior to July, thereby escaping the fall price increases. Furthermore, goods which were ordered in 1915 at the old prices were delivered in appreciable volume during 1916. For these reasons it is probable that the average increase over previous years in prices of goods delivered in 1916 was not more than 15 per cent. Therefore by subtracting 15 per cent roughly from the sales billed in 1916 figures will be obtained from which rather accurate comparisons could be drawn.

On this basis then the actual volume of business done in 1916 by the three companies was 38 per cent greater than that done in 1915 and 14 per cent greater than that done in the record year of 1913.

All electrical manufacturing plants were taxed to their utmost in 1916 and could, therefore, handle no more business than they did. However, had manufacturing space been available, had it been possible to secure sufficient stocks of raw materials and had labor been more plentiful it is difficult to say how much greater the 1916 business would have been. Certain it is that there was a demand for electrical goods equal to at least twice what it was possible to turn out.

All but about 7 per cent of the 1916 business was for domestic consumption. The foreign trade, amounting to about 7 per cent of the total, was by no means indicative of the foreign demand. Had it been possible to satisfy foreign as well as domestic demand for electrical goods it



SIXTEEN YEARS OF SALES BILLED BY THREE LARGEST DISTRIBUTORS OF ELECTRICAL GOODS

is quite probable that the 1916 sales for the entire industry would have overreached the $1,250,000,000 mark.

With the above volume of orders on the books to start off 1917, the outlook for the current year is excellent. Present indications are that the 1917 business will not fall far short, if at all, of the 1916 record.

Even should the market fall off later in the year there will be sufficient business on hand to keep the industry busy during 1917.

COPPER MARKET FIRMER

Little Inquiry and No Evidence of Desire on Part of Those Holding the Metal to Sell

Again the copper market shows an upward swing. This advance, however, is not occasioned by any volume of buying or inquiries, for there has been but little of either. It is but a technical condition that was expected after the drop from 36 cents. Holders of the red metal show no evidence of a desire to part with any quantity of their holdings. It is doubtful, however, if the price will reach much above 30 cents in this upward movement.

January copper was quoted on Tuesday at 29.5 cents

and February at 29 cents. First quarter was quoted at 29 cents, second quarter at 28.25 cents, third quarter at 26.5 and last quarter at 25.5.

WARNING SOUNDED BY WIRE MANUFACTURING COMPANY

While Prospects for the 1917 Wire Market Are Bright Buyers of Insulated Wire and Cable Are Warned to Purchase for Actual Needs Only

Speculation is running wild over the prospects for the new year. One thing, however, is certain. The first sign that the nations of Europe are ready to consider peace proposals will be accompanied by a break in the raw-materials market and a slump in the value of jobbers' supplies. This statement is well borne out by the reaction in the copper market on the news of Teutonic peace proposals. Prices of raw materials are undoubtedly inflated and will therefore tumble, not far, perhaps, for some time, when peace becomes somewhat certain.

To the electrical jobber this is causing no end of concern, and the manufacturer is likewise worried, for he must not only face the loss in his raw materials but he may have to face a period of very slow collections from the jobbers to whom he has sold large stocks on credit and from whom he has orders for large quantities of electrical merchandise now in the course of production and which will be billed at the high prices that obtained at the time of ordering.

In view of this condition the following paragraphs from the current number of *The Wire Message*, published by Habirshaw Electric Cable Company, Inc., and The Electric Cable Company, are significant.

"In the insulated wire and cable industry we find evidence of sound prosperity. Reasonable profits have made possible increased facilities and higher efficiency. Most factories are working overtime and orders are booked that cannot be delivered until well into 1917. Reports from all sections of the country indicate no curtailment of demand in the near future. Some decrease in purchasing activity that would bring demand near to maximum production, should be welcomed rather than feared. The industry as a whole has never faced a New Year with brighter prospects. It has but one thing to fear.

Warning

"When great business activity exists and supplies of all kinds are difficult to obtain, there is strong temptation to over-buy. Speculation of this kind, especially at top prices, may lead to disastrous results, though basic conditions of business may be sound. Our warning is to buy for actual needs only, and we cannot make this warning too strong. We reiterate our belief that the wire and cable industry, and business in general, faces a year of great prosperity, but it would be fatuous to believe that abnormal conditions will continue to prevail. Sooner or later there must be an adjustment to the normal. When this comes those who have bought in excess of their needs will be under strong temptation to pass along their losses by endeavoring to cancel unfilled orders and outstanding contracts. This attitude is wrong, and a much harsher term might rightly be applied to it. We are not speculating in raw materials, but are buying only to take care of orders and contracts in hand. We assume these were given us in good faith and to supply legitimate needs, and we shall insist upon the acceptance of all goods covered by such contracts and orders, under the exact terms and conditions on which they were accepted. To avoid misunderstanding we stamp all quotations and invoices as follows:

"'Owing to the extraordinary conditions which now exist, and the cost of labor and materials, all quotations are made and orders accepted with the absolute understanding that material will be taken in full quantities and without change of specifications.'"

The following local conditions are reported by the companies' branch offices:

San Francisco.—Slight falling off in business, account of price. Light and power companies hold up extension work, looking for lower prices. Conditions good but any further advance will cause decrease in demand. Jobbers pretty well covered for several months. Large jobber recently contracted for carload of insulated had to buy from eight different houses to collect carload for prompt shipment. Large building operation contemplated for next spring. Stocks of rubber insulated wire and weatherproof very low on entire coast.

Omaha.—Bright outlook. Building conditions good. No material change since last month.

Minneapolis.—Large business in sight but delay in placing same on account of high prices. Lower prices anticipated.

St. Louis.—Building operations brisk. Steady demand for wire. Principal trouble is with deliveries.

Salt Lake.—Conditions same as last month. Good demand. Can sell all the wire we can get.

Richmond.—Wire business increasing. Unable to make shipments on account of difficulty in procuring stock.

Philadelphia.—Every prospect for a very good year.

Chicago.—Little change since last month. Some low prices quoted on large orders, but prices well maintained as a rule. There is still great difficulty in securing stock promptly and in sufficient quantities.

INCREASE IN RANGE PRICES DUE TO RAW-MATERIAL COSTS

Careful Estimates Place Last Year's Sales at $2,300,000 List, While 1917 Sales at List Prices Are Expected to Total $4,750,000

The advance in list price of electric ranges to go into effect on Feb. 1, as pointed out in the ELECTRICAL WORLD for Dec. 30, was owing entirely to the advanced costs of manufacturing material and labor. The licensing arrangement with the owners of the Marsh patent provides for the payment of a royalty of such small proportions that it can in no way be held accountable for the present high prices of ranges. Manufacturing costs advanced from 20 per cent on some items to almost 200 per cent on others during 1916, and manufacturers therefore were faced with a very large output, but at a very much smaller percentage of profit.

That the advance has occurred in practically everything used, and not merely in a few parts, is evident from the following table of percentage increase which was worked out from prices quoted Jan. 1, 1916, and Jan. 1, 1917. The increases have been:

Material	Per Cent Increase
Sheet steel	196
Resistance wire	35
Asbestos covered wire and cord	81
Cut outs, fuse plugs and bushings	81
Castings	35
Screws, nuts and bolts	135
Mica	100
Asbestos products	100
Labor	20

Competent authorities seem to believe that on the whole deliveries on ranges will be better in the year 1917 than they were in 1916. This optimistic view is not occasioned by any marked improvement in the raw-material market, but is due to the fact that range manufacturers understand better the conditions they must meet. When the shortage in materials was first realized the situation was a new one to the majority. Manufacturers did not know what to promise and what not to promise. But now everyone has become accustomed to the new order of things and knows how best to meet the new conditions efficiently and effectively.

The electric range business for 1916, in spite of the fact that range salesmen were in several instances called in off the road, amounted, according to an accurate estimate, to $1,500,000 at manufacturers' net selling prices, or about $2,300,000 list prices.

It is estimated, basing the figures on raw materials which range manufacturers have already actually contracted for, that the total value of electric ranges sold in 1917 at manufacturers' net selling price will be $3,000,000, or $4,750,000 list.

Manufacturing and Industrial

Holabird-Reynolds Electric Company, Los Angeles, Cal., has changed the firm name to Graham-Reynolds Electric Company.

Electric Furnace Company of America will move to Cleveland, Ohio, following the sale of $100,000 preferred and $50,000 common stock. The company manufactures the Bailey electric furnaces which are used in heat-treating steel and in melting, heating and annealing non-ferrous metals.

Lincoln Electric Company, Cleveland, Ohio, held on Jan. 5 and 6 its annual sales convention, at which fifty of its district representatives and sales agents were present. Policies for next year were discussed and plans worked out for close co-operation with users of electric motors. The convention closed with a banquet at the Hotel Statler.

Hoover Sweeper Licensed.—Following the decision of the Circuit Court of Appeals in the Innovation case in favor of the Vacuum Cleaner Company, owner of the Kenny patent for a vacuum cleaner, the Hoover Suction Sweeper Company has made arrangements whereby the Hoover cleaner will hereafter be manufactured under a license.

Bonus for Cutler-Hammer Employees.—The shop employees of the Cutler-Hammer Manufacturing Company of Milwaukee received a Christmas present in cash on Dec. 23, and before New Year's Day a notice was posted which advised everyone of a bonus of 10 per cent of the yearly wages or salary. This bonus goes to all of the 2400 employees of this company.

Exide Battery Depots Convention.—An all-day convention of the New York distributers of Exide starting and lighting batteries was held at the Hotel Martinique, New York City, on Jan. 11, under the direction of the New York office of the Exide Battery Depots, Inc., of which F. F. Sampson is manager. The convention, which was followed by a banquet, was presided over by J. A. Gould, S. L. I. sales.

Farley Gannett, consulting engineer, Harrisburg, Pa., has changed the firm name to Gannett, Seelye and Fleming. Mr. Seelye has been a member of the firm since its organization, Aug. 1, 1915, and Mr. Fleming since February, 1916. On account of expanding business, the firm has found it necessary to change the location of its offices and after Jan. 15 will occupy offices at 204 Locust Street, Harrisburg, Pa.

Hurley Salesmen Help Estimate Factory Size.—For ten days during the early part of January all salesmen of the Hurley Machine Company were at the firm's Chicago office for a sales conference. Meetings were held in the factory as well as in the office to acquaint the men with the company's manufacturing methods. This year's meeting was more than a sales conference, for in addition to discussing sales problems of 1917 the salesmen assisted in estimating the desirable capacity for the new factory which the company will soon begin building. These salesmen's estimates were based on the business each expects to do in his territory in the future.

L. L. Fleig & Company, 212 West Austin Avenue, Chicago, Ill., for the past four years operating as a partnership, have recently formed a corporation and will continue in the same lines as heretofore, but on a more extensive scale. The company has incorporated for $30,000 fully paid, the former owners, L. L. Fleig and E. P. Fleig holding all the stock in the new concern. On May 1 the company will move to more extensive quarters at the present address, at which time an additional building will be completed. The company has confined its efforts solely to electrical insulations in the past, but intends to broaden its line to cover a general jobbing trade. The company covers the seven states of Ohio, Indiana, Illinois, Michigan, Wisconsin, Iowa and Minnesota and has branch offices at Cleveland, Ohio; Indianapolis, Ind., and Milwaukee, Wis. Announcement is also made that the company has taken on the lines of the Fibre Specialty Manufacturing Company.

Allis-Chalmers Employees to Receive Bonuses in 1917.—Each employee on the payroll of the Allis-Chalmers Manufacturing Company on Jan. 1, 1917, who continues in the employment of the company during the year will receive an extra payment of 10 per cent of his total individual earnings for the year, according to a plan outlined by President Otto H. Falk. Approximately $750,000 will be distributed during 1917 in this way. Nearly 8000 employees will be affected. The plan has been established in view of the increased cost of living, and it takes into consideration the fact that continuous service tends to make employees more valuable to the company, according to a leaflet describing the arrangements which has been sent to the entire shop organization, the office and selling forces of all works of the company.

NEW YORK METAL MARKET PRICES

	Jan. 9 Selling Prices Bid	Jan. 9 Selling Prices Asked	Jan. 16 Selling Prices Bid	Jan. 16 Selling Prices Asked
	£ s d		£ s d	
London, standard spot copper	133 0 0		130 0 0	
Prime Lake	28.25	to 28.75†	28.50	to 29.50†
Electrolytic	27.75	to 28.25†	29.25	to 29.75†
Casting	27.00	to 27.50†	27.50	to 28.00†
Copper wire base	34.25†		38.00†	
Lead	7.50		7.50	
Nickel	50.00		50.00	
Sheet zinc, f.o.b. smelter	21.00		21.00	
Spelter, spot	9.42½	to 9.67½	9.92½	to 10.00†
Tin, straits	42.60†		44.50†	
Aluminum, 98 to 99 per cent	54.00	to 57.00	51.00	to 55.00†
OLD METALS				
Heavy copper and wire	23.00	to 23.50†	22.50	to 23.00†
Brass, heavy	14.50	to 15.50†	13.50	to 14.25†
Brass, light	11.00	to 11.50†	10.50	to 11.00†
Lead, heavy	6.50	to 6.62½†	6.37½	to 6.50†
Zinc, scrap	6.00	to 6.50†	6.50	to 6.75†

COPPER EXPORTS

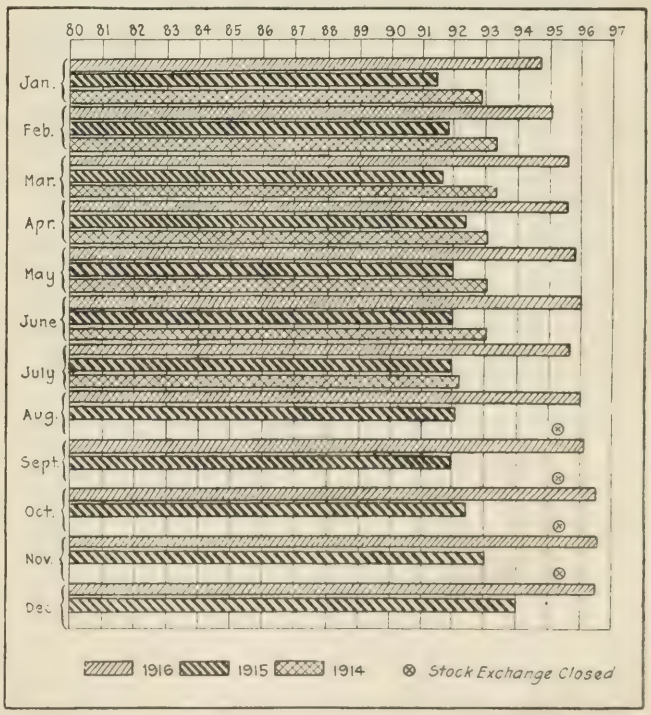
Total tons to Jan. 16 11,591

†Nominal.

ELECTRIC LIGHT AND POWER BOND PRICES IN 1916

Average Quotation on Ninety-Six Issues Showed Advance of Two and a Half Points During the Twelve Months

There was no let-up in 1916 of the pace set during the last quarter of 1915 in investment circles for electric light and power bonds. Investment bonds were never in such demand as during the past twelve months. Banking institutions and individuals had on hand large sums of idle



TREND OF BOND PRICES IN LAST THREE YEARS

money. There was by far more money waiting for investment than there were investment securities available. Several features attended this financial market. One of them, namely, that of a general tendency to permanent financing, was analyzed in the ELECTRICAL WORLD for Jan. 6. Another feature was that of very high prices.

No higher average price for electric light and power utility bonds ever existed than those quoted in 1916. On the average such bonds increased in price during the past year 2.5 points, according to the regular compilation made by the ELECTRICAL WORLD of monthly quotations on ninety-six representative issues, or over one-third of the aggregate par value of all American light and power bond issues. The result of this compilation is shown graphically for the three years 1914, 1915 and 1916. During August-December, 1914, inclusive, quotations were not obtainable owing to the closing of the stock exchanges.

The closing price of 1915 was 94 and for 1916 it was 96.5, an increase of 2.5 points. The highest price in 1916 was 96.6, registered in November. The lowest price was 94.1, registered in January.

During the seven months of 1914 prior to the war the highest average price attained by these bonds was 93.3. The lowest price after the war started was in the month following the opening of the exchange—January, 1915. It was 91.5.

Between this low price and the high of 96.6 the difference is but 5.1 points, or less than 6 per cent. It is doubtful if the bonds of any other industry can show a greater or, indeed, equal stability.

Because this is not a picked list but contains issues which are very inactive and for which there is but little demand, it is doubtful if the price will go much higher.

Corporate and Financial

Alabama Power Company, Birmingham, Ala.—A block of $2,000,000 of first mortgage 5 per cent. gold bonds due March 1, 1946, is being offered to investors.

Atlantic City (N. J.) Electric Company.—The company has been granted permission by the New Jersey Board of Public Utility Commissioners to issue bonds to the amount of $137,000 for station and system improvements.

Commonwealth Power Company of Nebraska.—A block of $750,000 of first mortgage 6 per cent. gold bonds, due March 1, 1944, is being offered at part and interest.

Iowa Southern Utilities Company, Centerville, Iowa.—An issue of $550,000 of first mortgage sinking fund 6 per cent gold bonds dated Oct. 2, 1916, and due Oct. 1, 1933, is being offered at 101 and interest.

National Carbon Company, Cleveland, Ohio.—According to an announcement made on Jan. 13, a recapitalization plan has been formulated for the National Carbon Company through which there will be greater representation in the hands of the holders of common stock. The plan provides for the incorporation of the National Carbon Company, Inc., in the State of New York, with an authorized capital of 56,000 shares, par $100, of preferred stock and 1,000,000 shares of common stock without par. The preferred stock will draw cumulative dividends at the rate of 8 per cent, payable February, May, August and November, and will be redeemable at $140 a share. Every holder of 7 per cent cumulative preferred stock in the present New Jersey corporation will be given an opportunity to exchange his securities share for share for the preferred stock of the new corporation, and every holder of common stock in the old company may exchange on the basis of one share of stock of the old company for four shares of the common stock of the New York company. The organization will be completed and the certificates ready for exchange on Feb. 1.

Texas Gas & Electric Company.—The Texas Southern Electric Company, which operates electric light and power plants at Cuero, Victoria, Beeville, Corpus Christi, Yorktown and other towns of southern Texas, has changed its name to the Texas Gas & Electric Company. It is stated that the company has adopted plans for greatly enlarging its scope of operations during the coming year.

Nova Scotia Tramways & Power Company, Halifax, N. S.—An issue of $2,500,000 of first mortgage 5 per cent gold bonds dated Dec. 1, 1916, and due Dec. 1, 1946, is being offered at 95.5 to net 5.3 per cent. There is now outstanding in addition to the issue $1,500,000 of 6 per cent cumulative preferred stock and $2,500,000 of common stock. The proceeds from the outstanding securities will provide for the acquisition of the properties of the Halifax Electric Tramway Company and the water-power rights, lands, etc., on the Gaseraux River and also for adequate working capital.

Pacific Gas & Electric Company, San Francisco, Cal.—The California Railroad Commission has issued a first supplemental opinion in the application of the Pacific Gas & Electric Company for authority to use the proceeds from the sale of its first preferred stock and its general and refunding mortgage gold bonds for additions and betterments to its plant, permitting the Pacific company to reimburse its treasury $1,068,803.86 for expenditures to Aug. 31, 1916, and to apply a balance from the sale of its stock and bonds to construction expenses after that date. Included in past expenditures within the last few months are $210,000 for raising Lake Spaulding Dam from 225 ft. to 266 ft., $235,000 for canals and conduits to return water used through the Halsey and Wise power houses to the irrigation system near Newcastle, $68,181 for a new substation at South San Francisco, $34,000 for land and rights-of-way for spilling water from the Bear River Canal, $72,425 for an office building site in Oakland, $26,000 for an office site and buildings in Berkeley, etc. The commission has also issued an order authorizing the company to issue $2,500,000 face value of its general and refunding 5 per cent bonds due Jan. 1, 1942, at not less than 90. The proceeds are to be expended under the commission's orders for the construction, completion, extension and improvement of its system. The company's program on Aug. 31, 1916, called for the expenditure upon its system of $6,431,488.18. The company had installed fixed capital prior to 1913 of $106,047,475, and since that date has brought this total of fixed capital up to $127,762,-415. The decision of the commission notes that while the company was able to sell its bonds of this same issue in 1912, when the commission had assumed jurisdiction over the company's finances, at 85 per cent of par, it is able to sell them now at 90. This is an advance of five points, which in this particular proceeding amounts to $125,000. The vice-president of the Pacific company informed the commission that the company will be able to sell these bonds at more than 90.

Wagner Electric Company, St. Louis, Mo.—The stockholders voted on Jan. 8 to increase the capital stock of the company from $2,000,000 to $5,000,000. The shares of the company will be increased from 20,000 to 50,000 of a par value of $100 per share. The increase will be met by three new rulings of the board of directors, as follows: A portion of the new shares is to be paid up from the surplus account and distributed to the stockholders pro rata for their holdings. A portion not to exceed 3000 is to be sold from time to time to employees of the company at a price of not less than $100 per share, and the proceeds, at the discretion of the directors, are to be distributed to the shareholders of record in the form of extra cash dividends. The remainder of the new shares are to be sold from time to time to shareholders pro rata at par or distributed in the form of stock dividends in the manner outlined.

New Utility and Industrial Companies

The Chatham Electric Motor Corporation has been incorporated with a capital stock of $10,000 to manufacture and deal in electric motors and other vehicles. The incorporators are: A. Kislik, S. and H. Lippman, 212 North Vernon Avenue, Arverne, N. Y.

The Boehm Surgical Instrument Corporation of Rochester, N. Y., has been incorporated by A. Butler, G. J. Boehm and F. P. Hoffman, 129 Aberdeen Street, Rochester, N. Y. The company is capitalized at $5,000 and proposes to manufacture electrically lighted surgical instruments, appliances, etc.

The Efficiency Turbine Company has filed articles of incorporation under the laws of the State of Delaware, with a capital stock of $300,000, for the purpose of manufacturing engines, dynamos, etc. The incorporators are: G. Carl Scheck, Frederick Camer of New York, N. Y., and Kellogg Sherwood of Brooklyn, N. Y.

The Buckeye Hydro-Electric Company of Cincinnati, Ohio, has been chartered with a capital stock of $25,000 by E. O. Dana, Robert P. Gillham, Frank L. Garrison, Fremont Hill and Willis G. Durrell.

The Ohio Hydro-Electric Company of Ashtabula, Ohio, has been incorporated by F. R. Garver, Mary R. Garver, B. C. Blakeslee, E. C. Brakak and Arthur Rinto. The company is capitalized at $10,000.

The Acme Power Company of Toledo, Ohio, has been incorporated with a capital stock of $25,000. The incorporators are: F. J. Derge, C. E. Murray, M. C. Seeley, A. C. Van Driesen and W. H. Torrey.

The Magnet Manufacturing Company of St. Louis, Mo., has been chartered with a capital stock of $10,000 to manufacture and deal in electrical appliances. The incorporators are: I. Korach, L. F. Korach and M. D. Frumberg.

The Binghamton (N. Y.) Motor Car Company has been incorporated by P. R., R. W. and W. G. Faatz of Binghamton, N. Y. The company is capitalized at $50,000 and proposes to manufacture autos, electrical apparatus, garages, etc.

The Electrograph Company of Kansas City, Mo., has been incorporated with a capital stock of $1,000,000 by J. F. Rudd, A. L. Landsberg and M. T. Miller. The company proposes to deal in electric advertising and electrical supplies.

The Crombie Process Corporation has been incorporated with a capital stock of $100,000 by W. E. Richards, B. B. Crombie and E. Kemble of Rye. The company proposes to do a general electrical and metallurgical engineering business.

The Michigan Porcelain Insulator Company of Hastings, Mich., has been incorporated with a capital stock of $25,000. The officers are: E. Tyden, president; R. B. Messer, vice-president; W. W. Peck, treasurer, and Albert L. Grainger, secretary.

The Simplex Ray Corporation of New York, N. Y., has been incorporated by Arthur W. Britton, Samuel B. Howard and L. H. Gunther, all of New York, N. Y. The company is capitalized at $5,000 and proposes to manufacture electrical machinery, especially X-ray apparatus.

The Ford Instrument Company of New York, N. Y., has been incorporated by J. R. Bredhuad, J. B. Goldsborough and H. C. Ford, 290 Broadway, New York City. The company is capitalized at $250,000 and proposes to manufacture mechanical and electrical machines and devices.

The Stoneware Electric Stove Company of Dover, N. J., has been chartered with a capital stock of $50,000 to manufacture electric stoves and electrical devices. The incorporators are: Arthur O. Christensen, John L. Sullivan of Dover, and William Taylor of Plainfield, N. J.

The Ritter Illuminating & Manufacturing Company of St. Catherines, Ontario, Can., has been incorporated with a capital stock of $75,000 to manufacture electrical apparatus, appliances, lamps, etc. H. Karlritter, 825 Linwood Avenue, Niagara Falls, N. Y., is representative.

The Hawkes-Ives Corporation of Brooklyn, N. Y., has been incorporated with a capital stock of $10,000 by R. C. Ream, A. E. Ives, Jr., and W. M. Hawkins, 231 Hancock Street, Brooklyn, N. Y. The company proposes to manufacture electrical appliances and do a general contracting business.

The Old Dominion Power Company of Norton, Va., has been incorporated to do a light and power business. The maximum capital stock is placed at $500,000, and the minimum $100,000. The officers are: D. Terpsrts of Dorchester, Va., president, and W. W. Kemp of Norton secretary and treasurer.

The Commercial Utilities & Manufacturing Company of Worcester, Mass., has been incorporated with a capital stock of $50,000 to manufacture and deal in electrical devices and supplies. The officers are: Linwood M. Erskine, president and treasurer; Alfred J. Holm, vice-president, and C. H. Shedd, clerk.

The Lake Shore Electric Company of Henderson, N. Y., has been organized to take over the lighting system in Henderson and Henderson Harbor, owned by George N. Nilson. C. W. Valentine of Watertown, N. Y., and M. B. Steele, president and manager of the Adams (N. Y.) Electric Light Company, are interested in the new company.

The United States Truck Corporation has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $5,000,000 and proposes to manufacture all kinds of motor-driven vehicles. The incorporators are: Robert W. Crawford of Streator, Ill.; Charles H. McDermott and Warner A. Ross of Chicago, Ill.

The Klett Manufacturing Company of New York, N. Y., has been incorporated with a capital stock of $25,000 to manufacture scientific, surgical and electrical appliances. The incorporators are: G. L. J. Sorenson, 539 East Eighty-third Street; M. Sorenson, 177 East Eighty-seventh Street, and J. Werner, 301 East Twenty-ninth Street, New York, N. Y.

The H. L. Wheelden Company of Bangor, Me., has been organized with a capital stock of $10,000 to do a general contracting business in connection with the installation of appliances, fittings, etc., used in the transmission of electricity, gas, gasoline, steam and water. The officers are: Harry L. Wheelden, president; Cora I. Morrison, clerk and treasurer, both of Bangor.

Trade Publications

Motor Trucks.—Sterling motor trucks are illustrated and described in a folder issued by Lewter F. Hobbs, Norfolk, Va.

Fire Detection.—"Fire Detection" is the title of a booklet issued by the Fire Detecting Wire Company of 101 Park Avenue, New York City.

Feed Water Regulators.—The Ray Manufacturing Company of Louisville, Ky., has issued a bulletin descriptive of its continuous feed-water regulators.

Railway Motors.—The General Electric Company of Schenectady, N. Y., has prepared bulletin No. 44,417 descriptive of its GE-258 ventilated commutating-pole railway motors.

Electric Heaters.—The Majestic Electric Development Company, 428 O'Farrell Street, San Francisco, Cal., has prepared a leaflet descriptive of its "Majestic" No. 7 electric heaters.

Chains.—"A Chain of Evidence" is the title of publication No. 15 issued by the Morse Chain Company of Ithaca, N. Y. This bulletin deals with power drives of less than 100 hp. each.

The Vanadium-Alloys Steel Company, Pittsburgh, Pa., has for distribution a folder descriptive of Vasco-Marvel, a semi-high-speed steel. This folder contains much information of interest, together with the High-Speed Steel Standard Classification of Extras adopted July 22, 1915.

The Youngstown Sheet & Tube Company, manufacturers of iron, steel, and other products, Youngstown, Ohio, have issued a very attractive calendar for 1917. This calendar contains twelve large two-color photographic views showing the processes used in their works in the manufacture of pipe and other products.

Batteries.—The "Iron-Clad Exide" battery for storage-battery industrial trucks and tractors is well described and illustrated in bulletin No. 160 recently issued by the Electric Storage Battery Company of Philadelphia. Numerous illustrations showing actual performances of these storage-battery tractors are shown.

Die Casting.—"Creating an Industry" is the title of a carefully prepared and well illustrated book that is now being distributed by the Doehler Die Casting Company of Brooklyn, N. Y. This book goes into the history of casting metals starting with the early Egyptian methods up to the present ones used by the Doehler Company.

Instruments.—The Precision Instrument Company of Detroit, Mich., has issued a loose-leaf catalog entitled, "Precision." This catalog contains bulletins on CO_2 Combustion Recorders, "Pico" Gages, Indicating and Recording Precision Gages, Precision Micrometer Gages, U Type Gages, Precision Efficiency Kit, Gas Collectors, and Water Meters.

New England

MONTPELIER, VT.—The Montpelier & Barre Light & Power Company is contemplating the erection of a 2400-volt, three-phase transmission line from North Montpelier to East Calais, 4½ miles, to furnish electricity for street and residential lighting. The company is now building a high tension line to connect its No. 3 and No. 5 stations.

HAVERHILL, MASS.—Preparations are being made by the Haverhill Electric Company for the installation of a 625-kva. turbo-generator.

WORCESTER, MASS.—The Worcester Electric Light Company has accepted the orders adopted by the Board of Aldermen authorizing the company to erect transmission lines on Vernon, Paine, Kenilworth, Greenwood Streets and Malvern Road.

NEW HAVEN, CONN.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Jan. 31 for the installation of three electric elevators in the United States post office at New Haven. For details see proposal columns.

Middle Atlantic

BINGHAMTON, N. Y.—The Binghamton Light, Heat & Power Company contemplates the erection of a substation on Noyes Island for the distribution of electricity in the downtown district.

INDUSTRY, N. Y.—Bids will be received by Mrs. Warham Whitney, president of board of managers, New York State Agricultural and Industrial School, Industry, until Feb. 13 for construction, plumbing and drainage, and electric work for new cottage for boys at above named school. Drawings and specifications may be consulted at the school; at the New York office of the Department of Architecture, Room 1224, Woolworth Building, and at the Department of Architecture, Capitol, Albany. Copies of plans may be obtained at the Department of Architecture, Albany. Lewis F. Pilcher is state superintendent.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, Park Avenue and Fifty-ninth Street, New York City, until Jan. 29 for tool equipments and electric wiring for same, for shops (duplicate school plan) in Public School 43, Brown Place, 135th and 136th Streets, borough of the Bronx. Blank forms, plans, etc., may be obtained or seen at the above office.

NEW YORK, N. Y.—The Public Service Commission has awarded contract for the installation of third-rail, track bonding and miscellaneous electrical equipment on the Culver line of the New York Municipal Railway Corporation to Lupfer & Remick of Buffalo, at $101,000.

RENSSELAER, N. Y.—The Albany Southern Railroad Company of Hudson has submitted a proposal to the Rensselaer Water Company offering to supply electricity to operate the water works plant. James E. Hewes of Hudson is general manager of the railroad company.

UTICA, N. Y.—The City Council has awarded the Utica Gas & Electric Company a contract for lighting the streets of the city for a period of five years. The new contract provides for the installation of ornamental magnetite arc lamps in the center of the city and nitrogen Mazda tungsten lamps in various locations in other parts of the city. The specifications under the new contract call for the installation of much new apparatus.

ALLENTOWN, PA.—Bids will be received at the office of A. L. Reichenbach, Mayor, 39 North Seventh Street, Allentown, Pa., until Jan. 30 for furnishing and installing two 400-hp. boilers in the pumping station in the city of Allentown. Specifications may be obtained upon application to the superintendent of parks and public property, division of water.

NORRISTOWN, PA.—The Counties Gas & Electric Company has purchased the property at Swede and DeKalb Streets, in connection with the proposed additions to its electric and gas plants.

PHILADELPHIA, PA.—The Bureau of Water is considering the installation of new electrical equipment to operate the Roxborough pumping station, to replace the present steam equipment.

PHILADELPHIA, PA.—A large power plant will be erected in connection with the proposed improvements and extensions at the League Island Navy Yard. The cost of the entire work is estimated at about $6,000,000.

PHILADELPHIA, PA.—The construction of a high-speed electric railway between Frankford and Somerton sections of the city for which $1,200,000 has been appropriated, is under consideration by the Mayor and the City Council.

PHILADELPHIA, PA.—Cramp & Company, Denckla Building, Philadelphia, have been awarded the general contract for the construction of power house and loft building, eight stories, 121 ft. by 236 ft. for Hale & Kilburn, to cost about $150,000. C. W. Young, Eighteenth Street and Lehigh Avenue, is in charge of the work.

PITTSBURGH, PA.—The Pennsylvania Railroad Company, it is reported, contemplates the construction of an electric power plant at Kiskiminetas Junction, at a cost of about $100,000. The proposed plant would supply electricity for lighting and heating all stations between Pittsburgh and Oil City and to operate the switch and signal systems, etc.

POTTSVILLE, PA.—The electric power plant and car barns of the Eastern Pennsylvania Light, Heat & Power Company at Palo Alto, recently damaged by fire, causing a loss of about $500,000, will be rebuilt immediately. The Lehigh Navigation Electric Company of Hauto is now furnishing energy to the company for distribution in the territory served by the plant.

ATLANTIC CITY, N. J.—The Board of Utility Commissioners has granted the Atlantic City Electric Company permission to issue $137,000 in bonds, the proceeds to be used for improvements to power station and system.

CAMDEN, N. J.—Plans have been approved by the Board of Freeholders for the erection of power plants at the county asylum and the county tuberculosis hospital.

JAMESBURG, N. J.—Plans are being considered by the Jamesburg Water Company for the installation of a new water wheel to increase the output of the electric-lighting plant.

NEWARK, N. J.—Bids will be received by the public building committee of the Common Council until Jan. 30 for work at the City Hospital, Fairmount Avenue and Bank Street, Newark, including electric wiring, electric fixtures, ice-making plant, vacuum cleaning and heating and ventilating. Messrs. Conklin & Convery, 665 Broad Street, Newark, are architects.

NEW BRUNSWICK, N. J.—Bids will be received by the county building committee, County Record Building, New Brunswick, until Jan. 25 for furnishing and installing a pumping station and lighting plant at the new county workhouse in North Brunswick Township. Plans and specifications are on file in the office of Alexander Merchant, 363 George Street, New Brunswick, architect.

ORANGE, N. J.—The installation of a garbage reduction plant, to be operated by electricity, at the municipal power station is under consideration by the City Commission.

PENNS GROVE, N. J.—The Council has approved the installation of new 400 cp. lamps at street intersection in the business district. The street-lighting service is furnished by the Penns Grove Electric Light, Heat & Power Company.

TITUSVILLE, N. J.—Arrangements have been made by the Township Committee with the Public Service Electric Company for the installation of street lamps in Titusville and Washington's Crossing.

TRENTON, N. J.—Mayor Donnelly has engaged F. W. Ballard, electrical engineer, Cleveland, Ohio, to make investigations of the local water power properties and also as to the feasibility of utilizing them for the installation of hydroelectric plants to be owned and operated by the municipality.

TRENTON, N. J.—Bids will be received by Henry B. Kummel, acting director, department of conservation and development, until Feb. 2 for the erection of a laboratory building for the department, including electrical work, heating and equipment. Plans are on file at the office of the Department of Charities and Corrections, State House, Trenton.

WESTMONT (P. O. CAMDEN), N. J.—Plans have been submitted to the Township Committee by the Public Service Electric Company for improvements to the street-lighting system, which provide for the installation of new lamps.

NEWARK, DEL.—Plans are being considered by the Town Council to increase the output of the electric-light plant and waterworks system to meet the increasing demand for service.

BALTIMORE, MD.—The Western Maryland Railway Company, it is reported, has under consideration the use of electrically operated trains on its grades over the Blue Ridge Mountains.

GRANTSVILLE, MD.—Work has begun on the installation of an electric-lighting system in Grantsville.

HARTLAND, W. VA.—The Hartland Power Company, recently incorporated with a capital stock of $500,000, is planning to build a power plant to furnish electricity to the coal mines operated by the lessees of the Hartland Colliery Company, located near Hartland. W. S. Barstow & Company, 50 Pine Street, New York, N. Y., will have charge of the work. In the same territory the General Gas & Electric Company has taken an option on a lease of 600 acres of coal land, containing 10,000,000 tons of coal. W. S. Barstow, 50 Pine Street, New York, N. Y., is president of the General Gas & Electric Company.

RONCEVERTE, W. VA.—Preparations are being made by the Virginia-Western Power Company of Clifton Forge, Va., for the construction of a new steam turbine plant, equipped with automatic stokers and complete coal-handling apparatus, near Ronceverte. Work will begin very soon on the proposed plant.

CLIFTON FORGE, VA.—The Virginia-Western Power Company will begin work in the near future on the erection of a steam turbine plant, to be equipped with automatic stokers and complete coal-handling devices. This plant will be located in the vicinity of Ronceverte, W. Va. The company has purchased material to complete its transmission lines from Alderson to Hinton and Avis, W. Va., where it has 50-year franchises and contracts with the Chesapeake & Ohio Railway Company. The line, it is expected, will be completed about April 15, and the new power house early next year. A. C. Ford is secretary and treasurer.

DORCHESTER, VA.—The Old Dominion Power Company of Norton contemplates the erection of a 22,000-volt transmission lines (50 miles long) to Norton, Wise, Coeburn and Glamorgan. Other improvements are under consideration by the company.

NORFOLK, VA.—The Virginian Railway Company, it is reported, is making investigations with a view of utilizing electric locomotives on its railroad between Elmore and Clark's Gap for the handling of heavy coal trains.

WASHINGTON, D. C.—Bids will be received at the office of the Commissioners of the District of Columbia, District Building, Washington, D. C., until Jan. 22 for furnishing telephone and signal cables. Specifications, etc., may be obtained upon application to the office of the purchasing officer, Room 320 District Building.

WASHINGTON, D. C.—Bids will be received by the Board of Awards, Department of Agriculture, Washington, D. C., until Jan. 30, for furnishing 14 motors, ranging from 2 to 20 hp. for alternating current, variable speed types, to be delivered at Summerland, Cal. Bids will also be received at the same time and place for three air blowers of 4000 cu. ft. capacity, directly connected to electric motors. Blank forms and specifications may be obtained from the chief clerk of the department.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Philadelphia, Pa., Schedule 626—two forced draft blowers, four evaporators; Schedule 635—one feed water heater; Schedule 634—two torsion meters; Schedule 627—miscellaneous tungsten tool steel. Washington, D. C., Schedule 629—40 sets semi-circular corrector magnets. Various—Schedule 629—40 magnetic compass readers; Schedule 627—miscellaneous carbon tool steel. Brooklyn, N. Y., Schedule 633—300 snap switches; Schedule 625—miscellaneous composition pipe fittings. Brooklyn, N. Y., and Mare Island, Cal., Schedule 628—miscellaneous interior communication armored cable; miscellaneous leaded and armored interior communication cable; miscellaneous plain interior communication cable; miscellaneous armored telephone cable; miscellaneous leaded and armored telephone cable; miscellaneous plain telephone cable; miscellaneous leaded and armored interior communication conductors; miscellaneous single and twin leaded and armored conductors; miscellaneous single and twin plain conductors; miscellaneous twin armored conductors; miscellaneous wire for illuminating outfits. Boston, Mass., Schedule 625—miscellaneous steel pipe, 540 lb. copper tubing. Applications for proposal blanks should designate the schedule desired by number.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

North Central

DETROIT, MICH.—Owing to the decision of the Public Lighting Commission not to supply electrical service to the county buildings after Dec. 31, the Wayne County board of auditors has decided to install an electric power plant to light the building. As direct current will be supplied by the new plant it will be necessary to change the motors now in use, which are for alternating current.

GLADSTONE, MICH.—The Board of Fire and Water Commissioners contemplates the erection of 5 miles of 6600-volt transmission line and the installation of electrically driven pumps of 100,000 gal. capacity. J. R. Mackin is superintendent of the municipal electric and water systems.

ATHENS, OHIO.—Suits have been filed by the Buckeye Hydro-Electric Company for the condemnation of property for use in its project of constructing a large hydroelectric power plant in this vicinity. W. G. Burrell, an attorney of Cincinnati, is acting for the company.

CANTON, OHIO.—The Public Utilities Commission has authorized the Canton Electric Company to take over the Sunnyside Electric Company of Wheeling, W. Va., and the Ohio Light & Power Company of Newark, Ohio, and form the Central Power Company, which was given permission to issue $2,760,000 in capital stock, to be exchanged for the capital stock of the merged companies. The Central Power Company will operate the large plant now under construction on the Ohio River, near Wheeling, W. Va., and also the plants at Wheeling and Steubenville, Ohio.

CHILLICOTHE, OHIO.—The City Council has awarded the Chillicothe Electric Railroad, Light & Power Company contract for lighting the streets of the city for a period of ten years. The new contract provides for considerable extension of the service.

CINCINNATI, OHIO.—Plans have been perfected by the Main Street Association for the installation of an ornamental street-lighting system on Main Street, from Fourth Street to McMicken Avenue (about 16 blocks). A. G. Rist is chairman of committee.

CLEVELAND, OHIO.—Bids will be received by the clerk of the board of education of the city school district of the city of Cleveland, Room 105, School Headquarters, Rockwell Avenue and East Sixth Street, Cleveland, until Jan. 29 for electric wiring in Tremont School Annex as follows: (1) 15 class rooms, auditorium, etc.; (2) 17 class rooms, etc., auditorium omitted. Drawing, specifications, etc., may be obtained upon deposit of $5 at the office of the division architect, Room 102, School Headquarters.

JAMESTOWN, OHIO.—Negotiations have practically been closed for the purchase of the property of the Jamestown Electric Light Company by the Dayton (Ohio) Power & Light Company.

MILFORD, OHIO.—The Little Miami River Light & Power Company, it is reported, has applied to the City Council for certain rights along the Little Miami River within the corporate limits of the village for the construction of dams and other improvements. Fourteen dams, it is said, will be built between Plainville and Morrow.

ST. MARY'S OHIO.—Plans are being prepared by the Froehlich & Emery Engineering Company, Second National Bank Building, Toledo, for rebuilding the municipal electric-light plant and water-works system in St. Mary's, to cost about $60,000. The work will include the installation of electrically-driven pumps of 5000 gal. per minute capacity each, a 600-kw. generator; also the installation of an ornamental street-lighting system.

SPRINGFIELD, OHIO—Extensive additions and improvements are contemplated by the Springfield Light, Heat & Power Company to its power plant between Center and Fisher Streets off of Rockaway Street. Definite plans have not as yet been decided upon. The company recently purchased a tract of land adjoining its plant.

CAVE CITY, KY.—The electrical franchise offered for sale by the city has been purchased by the Kentucky Utilities Company of Lexington. Arrangements will be made by the company to maintain a 24-hour service.

LOUISVILLE, KY.—The Kentucky Traction & Terminal Company contemplates improvements to its system involving an expenditure of about $200,000, which will include the installation of a new 4000-kw. generator and nine voltage regulators. S. H. Dailey is general manager.

STANTON, KY.—Bonds to the amount of $15,000 have been voted for the installation of a municipal electric-light plant.

ANDERSON, IND.—The Board of Works has authorized City Engineer Funk to prepare plans for an addition to the boiler room of the municipal electric plant to provide space for two new 500-hp. boilers, recently purchased; an addition will also have to be erected to the main part of the power station to make room for the new 5000-kw. turbo-generators, recently ordered. E. Burke, superintendent of the municipal electric plant, has also been authorized to purchase wire, poles, etc., for a new high-tension feed wire to the plant of the Remy Electric Company.

CLINTON, IND.—The properties of the Clinton (Ind.) Electric Light & Power Company and the Sullivan (Ind.) County Electric Company, located in Clinton, Dana, Farmersburg, Shelburn, Sullivan, Hymera, Coalmont and Jacksonville have been sold to the Wabash Valley Electric Company of Clinton.

KOKOMO, IND.—The Indiana Railways & Light Company, it is reported, contemplates the construction of a new terminal station in Kokomo.

CHICAGO, ILL.—Announcement has been made at the University of Chicago of plans for the erection of one of the largest wireless telegraph plants on the Great Lakes. The antennae of the new wireless station will be 250 ft. long, and will stretch from the top of the Ryerson tower, 100 ft. above the ground, to the top of Mitchell tower.

DANVILLE, ILL.—The Danville Street Railway & Light Company is planning to install a 5000-kva. General Electric turbine. J. E. Johnson is general superintendent.

FAIRFIELD, ILL.—The Commissioners of Wayne County are contemplating the installation of a power plant in the county building in Fairfield.

ORION, ILL.—Bids will be received by the Village Board until Feb. 5 for the purchase of the power house and distribution system in the village of Orion and for supplying electricity for street-lighting and commercial purposes. A. E. Fehman is village clerk.

PEKIN, ILL.—The installation of an ornamental street-lighting system in Pekin is under consideration.

SPRINGFIELD, ILL.—Bids will be received by the Board of Administration, Capitol Building, Springfield, Ill., until Jan. 22, for improvements at institutions named: Installation of a complete switchboard and wiring in power house at the Alton (Ill.) State Hospital. Installation of an overhead electric transmission line at the Watertown State Hospital, East Moline, Ill. Plans and specifications may be obtained upon written application to James B. Dibelka, state architect, 130 North Fifth Avenue, Chicago, Ill.

AMBERG, WIS.—An option, it is reported, has been obtained on the Davis Falls water power site for the purpose of constructing a hydroelectric power plant to supply electricity in Amberg and several neighboring towns.

JANESVILLE, WIS.—Plans, it is reported, have been prepared for the construction of a power plant and flume for the Doty Manufacturing Company, 302 North Main Street, Janesville.

EAU CLAIRE, WIS.—The holdings of the Jim Falls Power Company have been purchased by the Wisconsin-Minnesota Light & Power Company, which will enable the latter company to double the output of its plant.

IOLA, WIS.—The plant and holdings of the Iola Electric Light & Power Company has been purchased by W. N. Albertson & Company of Milwaukee, which contemplate various changes to the commercial and street-lighting systems. W. N. Albertson & Company are also contemplating taking over various utilities in Northern Wisconsin. W. N. Albertson is engineer.

PITTSVILLE, WIS.—Plans are being considered by Chester Colt of Poysippi for the installation of a hydroelectric plant to supply electrical service in Pittsville.

RACINE, WIS.—The Wisconsin Telephone Company contemplates the erection of a central station, to cost about $100,000.

AKELEY, MINN.—The establishment of a municipal electric-light plant in Akeley is reported to be under consideration.

NORTH REDWOOD, MINN.—The local electrical distribution system of the Northern States Power Company has been purchased by the Redwood Falls (Minn.) Light & Power Company. A. C. Burmeister is manager of the Redwood Falls company.

SAUK CENTER, MINN.—Bonds to the amount of $50,000 have been voted for the installation of a municipal electric-lighting plant in Sauk Center.

WAUBUN, MINN.—The contract for installation of an electric-lighting system has been awarded to L. A. Faucher of Waubun.

CEDAR RAPIDS, IOWA.—Plans are being prepared by the Iowa Railway & Light Company for the construction of a power house on North Sixth Street East, to cost about $20,000. J. D. Wardle is engineer for the company.

CEDAR RAPIDS, IOWA.—Bids will be received by E. A. Higby, Granby Building, Cedar Rapids, for the construction of an eight-story store and office building to be erected at Second Street and Third Avenue, including electric wiring, steam heating, plumbing, two electric elevators, automatic sprinkler, coal chute, dumb waiters, fan ventilators, etc. The cost of the building is estimated at from $150,000 to $200,000. Ernest Kennedy, Essex Building, Minneapolis, Minn., is architect.

FAIRFIELD, IOWA.—A special election will be held Jan. 30 to submit to the voters the proposal to grant an electric-lighting franchise.

IOWA CITY, IOWA.—The contract for electric wiring for three school buildings in Iowa City has been awarded to the Midland Electric Company of Mason City, at approximately $5,000. An item published in the issue of Jan. 13 stated that the Capitol City Electric Company of Des Moines had submitted the lowest bid, at $11,781.

MARNE, IOWA.—The installation of a municipal electric-light plant in Marne is under consideration.

MAQUOKETA, IOWA.—Bonds have been voted for the maintenance of a municipal electric-light plant in Maquoketa.

SERGEANTS BLUFF, IOWA.—Bids will soon be asked by the Board of Education of Sergeants Bluff for the construction of a school building (to cost about $75,000), including electric wiring, steam heating, plumbing, etc. William L. Steele, United Bank Building, Sioux City, Iowa, is architect.

WEST BURLINGTON, IOWA.—Bonds to the amount of $11,000 have been voted for the installation of a water-works system. The use of electrically-driven pumps is under consideration.

LEBANON, MO.—The city of Lebanon has granted a franchise to J. B. Quigley and H. D. Hallett to supply electricity for lighting, heating and pumping water. Energy is to be supplied from the hydroelectric power plant to be developed on the Niangua River, within 30 miles of Lebanon.

RICHMOND, MO.—The Missouri Gas & Electric Service Company expects to purchase a 100-hp. boiler this summer to replace its boilers now in use.

ABERDEEN, S. D.—The Dakota Central Telephone Company contemplates the construction of a new telephone exchange in Aberdeen in the spring, to cost about $75,000.

VEBLEN, S. D.—Bids will be received by C. A. Sasse, clerk of independent school district No. 1, Veblen, until Feb. 7 for the complete installation of mechanical equipment for the new grade and high school building at Veblen. Copies of plans and specifications may be obtained upon application to Gilbert R. Horton, Citizens' Bank Building, Jamestown, N. D., upon deposit of $10, of which $5 will be refunded upon return of plans.

DAYKIN, NEB.—Bids will be received by J. O. Greenawalt, city clerk, Daykin, until Jan. 24 for the construction of an electric-light plant.

LINCOLN, NEB.—The Omaha, Lincoln & Beatrice Railway Company, it is reported, will let contract early in the spring for the construction of an extension from Lincoln to Omaha, via Havelock, Greenwood, Ashland, Papillion and South Omaha, a distance of 50 miles.

SUTHERLAND, NEB.—The village of Sutherland, it is reported, is asking for bids for the construction of a power house for the municipal electric-light plant. The cost is estimated at $1,400.

FORT SCOTT, KAN.—At an election held recently the proposal to issue bonds to establish a municipal electric-light plant was carried.

HAVANA, KAN.—Steps have been taken to organize a company to construct and operate an electric-light plant and ice factory. The company will be known as the Havana Light & Power Company.

PRATT, KAN.—The city of Pratt expects to purchase immediately one 300 to 350-hp. boiler and stack for the municipal plant. E. W. Brown is superintendent.

TOPEKA, KAN.—Bids will be received by D. Lester, city clerk, South Topeka, until Jan. 25 for the installation of an ornamental lighting system on South Topeka Avenue.

Southern States

COLUMBIA, S. C.—The Storage Battery & Electric Company, recently incorporated, contemplates erecting a storage battery re-charging station to build and rebuild storage batteries, and operate an electrical service station, etc. The company is capitalized at $10,000. H. C. McCreight is president and general manager.

NORCROSS, GA.—The Georgia Railway & Power Company of Atlanta has begun work on the construction of a transformer station near its transmission line and the Norcross substation. The company is planning to extend the transmission lines to Stone Mountain to supply electricity there and also to intermediate towns.

VALDOSTA, GA.—Extensive improvements are contemplated to the cold storage plant and power station of the Valdosta Lighting Company, involving an expenditure of about $100,000. W. L. Eager is general manager.

ST. AUGUSTINE, FLA.—The City Commissioners have awarded the St. Johns Light & Power Company a contract for street lighting for a period of five years. Under the terms of the new contract 512 new incandescent lamps will be substituted for the 44 arc lamps and 248 incandescent lamps now in use.

COLUMBIA, TENN.—The capital stock of the Columbia Water & Light Company has been increased to $100,000.

BIRMINGHAM, ALA.—The Alabama Power Company is reported to have sold $2,000,000 additional bonds, the proceeds to be used for the construction of a new 70,000-hp. steam power plant on the Black Warrior River and increasing the power plant at Lock 12 on the Coosa River by 15,000 hp.; also the extension and completion of the company's distribution system, consisting of 675 miles.

FORT SMITH, ARK.—The Fort Smith Light & Traction Company, it is reported, will begin work at once on the construction of an extension of its railway from South Fort Smith to Van Buren, a distance of about 12 miles.

ARDMORE, OKLA.—The Ardmore Electric Railway Company contemplates the construction of about 30 miles of new railway line this year.

CHARLESTON, OKLA.—The City Council is reported to have granted the Peoples Service Company of Muskogee a franchise to supply electricity in Charleston for a period of 25 years.

MOORELAND, OKLA.—Bonds to the amount of $10,000 have been voted for the installation of an electric-lighting system.

WETUMKA, OKLA.—The city of Wetumka has issued $40,000 in bonds for improvements to electric-light plant, water works and sewer system.

AMARILLO, TEX.—The installation of a municipal electric-light plant and waterworks system in Amarillo is under consideration.

BEAUMONT, TEX.—Plans are being considered by the Beaumont Traction Company for the erection of an electric transmission line between Beaumont and Port Arthur, and also increasing the ouput of the two power plants.

BROWNWOOD, TEX.—The West Texas Telephone Company contemplates increasing its capital stock from $100,000 to $400,000, the proceeds to be used for extensions to its toll lines and improvements to its exchanges in a number of towns.

COLLEGE STATION, TEX.—All bids submitted for the erection of a power plant for the Agricultural and Mechanical College at College Station have been rejected by the board. The cost of the plant was estimated at $25,000. Bids were rejected for the reason that none came within the appropriation. John F. Guion of Ballinger is president of the board.

DALLAS, TEX.—Recommendation has been made for the installation of an additional generating unit to the power plant that supplies electricity for lamps and motors for the county court house, criminal courts building and the Oak Cliff and the Commerce Street viaducts, at a cost of approximately $12,000.

DUBLIN, TEX.—The City Council has granted the Texas Power & Light Company of Dallas a 50-year franchise to construct and operate an electric system in Dublin. The company has purchased the electric plant of the Central Texas Power & Transmission Company at Hico, which supplies electrical service in Dublin.

EL PASO, TEX.—The El Paso Electric Railway Company has increased its capital stock from $2,500,000 to $3,500,000, the proceeds to be used for improvements now being made and future extensions, including the installation of a substation for supplying energy for the Government Hill and Fort Bliss lines. The cost of the proposed central station in the business district is estimated at $100,000. H. A. Porter is manager.

HUBBARD, TEX.—Bids will be received by the Union Light & Power Company of Hubbard until Feb. 1 for furnishing 33,000 ft. No. 10 double braided, waterproof, insulated copper wire; one 100-hp. tubular steel cased boiler, 125-lb. pressure, 60-ft. stack of No. 14 iron lined, etc., complete; one 200-ft. ¾-in. diameter steel cable rope; one 5-hp. 220-volt motor-generator set; one flange union for 2 12/16-in. diameter shaft; four post hanger oiling boxes for 2 15/16-in. steel drive shaft; one 36-in. by 42-in. marble switchboard, equipped with all devices necessary to handle 2300-volt, alternating current, oil switches, etc. W. A. Bass is president.

Pacific States

MONROE, WASH.—Application has been made to the City Council by Frank A. Steel, attorney, Mutual Lift Building, Seattle, representing Eastern capital, for a franchise to construct and operate waterworks system and power plant in Monroe. Power site has been secured on Lake Fontal, 3 miles distant. The plans provide for an expenditure of from $125,000 to $150,000, and include a pipe line of 1,250,000 gal. capacity per day.

OLYMPIA, WASH.—The City Council has granted the American District Steam Company of Tonowanda, N. Y., a 25-year franchise to operate a combined steam heating and electric plant in Olympia. Work will not begin on the proposed plant until next spring.

RITZVILLE, WASH.—The Washington Water Power Company of Spokane contemplates rebuilding its local distribution system, which will include new pole lines, transformers and lighting system.

SEATTLE, WASH.—The Board of Public Works has awarded the contract for the annual supply of lamps for the municipal lighting department to the Pacific Lamp & Supply Company of Seattle, to cost approximately $100,000.

SOUTH CLE ELUM, WASH.—The town of South Cle Elum has petitioned the Commissioners of Kittitas County for permission to erect and maintain electric transmission lines over certain highways and thoroughfares in and near the town for a term of 50 years. A bond issue of $5,000 was recently voted for the installation of an electric-lighting system.

CANBY, ORE.—The property of the Mollalla Electric Company, owned by Miles C. Moore of Walla Walla, Wash., serving Canby and Canby River points with electricity, has been sold for a consideration of $75,000.

EUGENE, ORE.—As a result of the voluntary placing of the Northern Idaho & Montana Power Company of Sandpoint, Idaho, in the hands of a receiver in Spokane, Wash., extensions and improvements involving an expenditure of between $300,000 and $400,000 will be made to the properties of the Oregon Power Company in the Willamette Valley. Both companies are controlled by the H. M. Byllesby Company of Chicago, Ill.

HOOD RIVER, ORE.—Preliminary work has begun by the Pacific Power & Light Company of Portland on the erection of high-tension transmission lines across the Columbia River between Hood River and White Salmon to connect the two power plants of the company in Hood River and the White River plant with the power plant at Husum, Wash., which will connect all stations in eastern Washington with the Oregon power divisions and link all of the company's units along the Columbia basin.

KLAMATH FALLS, ORE.—The California-Oregon Company contemplates the installation of a new street-lighting system in Klamath Falls. The request of the Keno (Cal.) Power Company for an electric franchise here has been refused.

STAYTON, ORE.—The Stayton Electric Light Company is contemplating extensive improvements to its plant to enable it to furnish electrical service to nearby towns and farms in this vicinity. C. E. Taylor is owner and manager.

BAKERSFIELD, CAL.—The City Council has given its approval for the erection of 240 electroliers in the business district.

ELSINORE, CAL.—The Southern Sierras Power Company of Riverside has extended its electric transmission lines in Cottonwood Canyon, and, it is reported, will extend them from Alberthill to Corona.

RICHMOND, CAL.—The Great Western Power Company of San Francisco, it is reported, will begin work as soon as the weather permits on the erection of a high-tension transmission line from an intersection with its 110,000-volt line through Moraga Valley out through Moraga and down San Pablo Creek to Richmond to connect there with the line which has been built westward from Crockett. Plans have been completed and work will soon start on the construction of a large substation near Crockett.

SAN FRANCISCO, CAL.—More than 80 per cent of the property owners and merchants in the "triangle district," the section bounded by Geary, Powell, Sutter and Kearny Streets, have signed for the installation of the "Path of Gold" lighting system along those streets, according to a report made to the Downtown Association.

SANTA BARBARA, CAL.—Work will soon begin on the erection of ornamental lamps on State Street. The plans provide for metal standards on State Street to Sola Street, and for concrete standards from Ie la Guera to the Boulevard.

BOISE, IDAHO.—Bids will be received at the office of the Supervising architect, Treasury Department, Washington, D. C., until March 8 for a new system of conduit and wiring and alterations in heating system in the United States assay office at Boise, Idaho. For details see proposal columns.

KENDRICK, IDAHO.—The Potlatch Consolidated Electric Company, of Kendrick, has been granted a franchise to erect and maintain electric transmission lines on the highways of the county.

MESA, ARIZ.—The proposal of the purchase of the property of the South Side Gas & Electric Company, which includes an electric-light plant and gas plant at $113,000, to be owned and operated by the municipality will be submitted to the voters.

PHOENIX, ARIZ.—The residents of the Higley section have recently voted to form a public improvement district, which will provide for electrical service.

ANACONDA, MONT.—The City Council has passed resolutions calling for the installation of lighting systems in Districts Nos. 70, 74 and 78.

BUTTE, MONT.—The Inter-Mountain Power Company of Butte, recently organized by parties identified with the Anaconda Copper Mining Company, has contracted with the Washington Water Power Company of Spokane for the purchase of electrical energy. The service will be supplied from the plant near Long Lake, 22 miles from Spokane.

ROUNDUP, MONT.—The local electric franchise, held by the Roundup Coal Mining Company, has been purchased by Messrs. Hopka, Straley and Mageath. The new owners, it is understood, will furnish service from the power plant of the coal mining company.

Canada

NELSON, B. C.—The installation of a third unit at the municipal electric-light plant has been recommended to the City Council by the fire, light and water committee.

WINNIPEG, MAN.—Tenders will be received by Thomas S. Johnson, minister of public works, Winnipeg, until Feb. 12 for various works required in the completion of the now partially erected new Parliament Buildings in the city of Winnipeg, including heating and ventilating, electric conduit and wiring, etc. Separate bids to be submitted on each classification of the work.

GALT, ONT.—Plans are being considered by the Hydro-Electric Commission for enlarging the main substation on Dickson Street.

HAMILTON, ONT.—Plans are being considered by E. I. Sifton of the Hamilton Hydro-Electric Department, for the installation of a storage system and booster pump at the Beach pumping plant, at a cost of about $25,000. A new transmission line will also be erected. The Hydro-Electric Department is also considering the installation of a reversible operative motor-generator set and storage battery at the Hughson Street Station.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Jan. 29 for steel, iron, steel pipe, steel cable, wire, copper tubing, sheet copper, sheet lead, sheet zinc, garbage and refuse incinerator, motor generator sets, turnbuckles, taps, pliers, etc. Blanks and general information relating to this circular (No. 113) may be obtained from the above office or the office of the assistant agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

1,212,163. RELAY FOR UNDULATORY CURRENTS; Eric Magnus Campbell Tigerstedt, Copenhagen, Denmark. App. filed Oct. 19, 1916. Variation in the electric conductivity effected by the ionizer takes place by means of a grate-like or sieve-like auxiliary electrode.

14,243. THERMO-ELECTRIC COUPLE; William H. Bristol, Waterbury, Conn. App. filed April 1, 1916. May be readily and quickly installed.

14,245. PROCESS AND APPARATUS FOR MAKING BRAZED JOINTS; Friedrich Wilhelm Heuser, Gross-Lichterfelde, near Berlin, Germany. App. filed Dec. 5, 1916. Electric arc.

1,211,388. PROTECTED ELECTRODE AND PROCESS OF MAKING THE SAME; Edmund Henry Becker, Washington, D. C. App. filed Oct. 18, 1916. Comprises a negative electrode for primary coils and the like composed of copper oxid, or copper oxids, and having a superficial coating or layer of amalgamated copper.

1,211,418. CONTROL SYSTEM FOR GUN MOUNTINGS AND OTHER MECHANISM; Arthur Trevor Dawson, Westminster, London, and James Horne, Barrow-in-Furness, England. App. filed Dec. 2, 1913. Improvements.

1,211,434. TELEPHONE-EXCHANGE SYSTEM; Charles L. Goodrum, New York, N. Y. App. filed March 17, 1915. Employing machine switching.

1,211,435. TELEPHONE SYSTEM; Edward Alfred Graham, Brockley, Londong England. App. filed Nov. 18, 1914. Relates to loud speaking type wherein the transmitter of one telephone instrument is connected directly or through a condenser to the receiver of a second telephone instrument and vice versa.

1,211,440. ELECTRIC SWITCH; Jay H. Hall, Cleveland, Ohio. App. filed Feb. 24, 1913. Magnetically operated.

1,211,443. ELECTRIC INSULATION; John Allen Heany, New York, N. Y. App. filed Nov. 9, 1916. Comprising a roving, sliver, or tape-line body of fibers.

1,211,448. TIME AND BURGLAR ALARM; Willis G. Hubbs, Walnut Ridge, Ark. App. filed Sept. 16, 1915. Alarm may be given when the doors or windows of a house are being forced.

1,211,465. FLASHLIGHT; John J. McGuckin, Brooklyn, N. Y. App. filed Aug. 25, 1916. Preventing the rolling out of place of such flashlights when they are laid upon inclined surfaces.

1,211,491. RECORDING APPARATUS; Max Seidler, Frankfort-on-the-Main, Germany. App. filed Jan. 7, 1914. Enable diagrams to be produced by means of a single apparatus in such a manner that, even where partly superimposed or intersecting, they do not become confused and may readily be followed.

1,211,492. ELCTRIC BELT; Victor Sence, New York, N. Y. App. filed June 25, 1912. Generating an electric current and transmitting the same through patient's body.

1,211,507. MAGNNETO ATTACHMENT; Harry Randolph Van Deventer, Sumter, S. C. App. filed Sept. 22, 1914. Spring arm made from stamped and formed sheet metal.

1,211,534. TELEPHONE SIGNAL DEVICE; Ura M. Boyd, Dallas, Tex. App. filed May 11, 1916. Time device for public phones.

1,211,545. MANUFACTURE OF STEEL; Godfrey John Boyle Chetwynd, West Riding, England. App. filed Jan. 2, 1914. To enable articles made of steel to be produced of better and more reliable quality throughout.

1,211,607. TELEPHONE APPARATUS; Maurice K. McGrath, New York, N. Y. App. filed June 30, 1915. Telephone sets intended for use in connection with automatic telephone systems.

1,211,612. SWITCHING DEVICE FOR TELEPHONE SYSTEMS; Daniel D. Miller, New York, N. Y. App. filed June 8, 1915. Electromagnetic device which will operate efficiently upon direct current but will offer a high impedance to alternating currents of talking frequencies.

1,211,617. DYNAMO-ELECTRIC MACHINE; Alfons H. Neuland, San Francisco, Cal. App. filed Aug. 27, 1913. Possesses a very large power capacity in proportion to its size.

1,211,623. ELECTRICALLY-OPERATED PIANO PLAYER; Walter C. Reed, Dalton, Mass. App. filed Jan. 29, 1913. Improvements.

1,211,628. ELECTRIC SWITCH; Joseph Sachs, Hartford, Conn. App. filed March 25, 1915. Simple in construction.

1,211,629. ELECTRIC SWITCHING AND METER-TESTING SYSTEM; Joseph Sachs, Hartford, Conn. App. filed April 28, 1915. Comparatively small number of parts, a large variety of differently functioning appliances can be obtaind.

Record of Electrical Patents

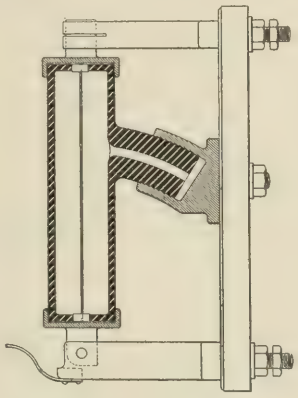
Notes on United States Patents issued on Jan. 9, 1916.

1,211,644. AUTOMATIC ALARM SYSTEM; Behrend Ulferts, Lakefield, Minn. App. filed July 27, 1915. Indicating to the engineer of a train approaching a switch point whether or not, by the action or non-action of the signal mechanism, the switch is open or closed.

1,211,675. RAILWAY SIGNAL; Elmer R. Coe, Wilkinsburg, Pa. App. filed Nov. 14, 1914. Electromagnetic device which is employed to control holding device and which when energized permits the holding device to perform its two functions just mentioned.

1,211,687. APPARATUS FOR THE ELECTROLYTIC DECOMPOSITION OF WATER; Arthur Dohmen, Cologne, Germany. App. filed Oct. 20, 1913. Filter press.

1,211,688. TELEPHONE SYSTEM; Francis W. Dunbar, Chicago, Ill. App. filed Nov. 12, 1904. Improved telephone exchange system wherein advantages of automatically and manually controlled line connectors are present and disadvantages in these classes of apparatus are eliminated.



1,211,778—Circuit Breaker

1,211,689. TELEPHONE-EXCHANGE SYSTEM; Francis W. Dunbar, Chicago, Ill. App. filed June 19, 1905. Calling lines are automatically connected with the answering ends of link circuits while the called lines are connected with link circuits by means of manually manipulated terminals such as plugs of said circuits.

1,211,694. RECTIFIER; John M. Fitzgerald, Chicago, Ill. App. filed Feb. 15, 1915. For converting alternating current into uni-directional pulsating current, and vice-versa.

1,211,752. ELECTRIC CONTROLLING MECHANISM; Oscar H. Pieper and Alphonse F. Pieper, Rochester, N. Y. App. filed Oct. 15, 1915. Dental surgical work.

1,211,754. CRYSTAL RECTIFIER; Paul C. Rawls, Des Moines, Iowa. App. filed July 6, 1914. Used in high-frequency oscillation detectors in wireless telegraphy or telephony.

1,211,759 ILLUMINATED PAD HOLDER; Thomas Robins, New York, N. Y. App. filed March 21, 1916. Incandescent electric lamp or lamps for illuminating the surface of the pad.

1,211,768. ELECTROMAGNETIC VIBRATOR; Wolfgang E. Schwarzmann and Charles M. Wild, Springfield, Mass. App. filed Aug. 10, 1914. For use in electrical ignition systems.

1,211,770. MICROMAGNETIC DETECTOR; Frederick G. Simpson, Seattle, Wash. App. filed Nov. 1, 1912. For the reception of signals of the Hertzian wave type.

1,211,778. CIRCUIT BREAKER; Halfdan A. Steen, Norwood, Ohio. App. filed March 23, 1912. Use the pressure suddenly developed by blowing of the fuse to move to off position a switch arm which normally engages stationary contacts for completing a circuit.

1,211,788. RAILWAY-TRAFFIC-CONTROLLING APPARATUS; John D. Taylor, Wilkinsburg, Pa. App. filed Aug. 28, 1913. For controlling a railway switch from a distant point.

1,211,802. SYSTEM OF ELECTRICAL DISTRIBUTION; Joseph Lester Woodbridge, Philadelphia, Pa. App. filed Nov. 26, 1913. Systems in which a source of electrical energy of variable voltage is used to supply energy for constant voltage translating devices, such as electric lights.

1,211,803. VOLTAGE REGULATION; Joseph Lester Woodbridge, Philadelphia, Pa. App. filed Dec. 4, 1914. Employ as part of the controlling circuit a resistor having a temperature co-efficient so markedly negative that over a certain range of current values the voltage across the resistor decreases to a marked extent with increase of current.

1,211,822. LIGHTNING ARRESTER; Alexander Chernyshoff, Swissvale, Pa. App. filed April 1, 1915. Utilize concentrated capacity concentrated resistance, concentrated inductance, and ground connections to comprise the elements of a lightning arrester.

1,211,863. APPARATUS FOR AND METHOD OF PRODUCING HIGH-FREQUENCY CURRENTS OF ELECTRICITY; David G. McCaa, Lancaster, Pa. App. filed Sept. 24, 1913. Arcing of a current of electricity across a spark gap, which is included in the circuit of said current, may be absolutely prevented.

1,211,940. PLUGGING-IN SWITCH; William S. Harlow, Swampscott, Mass. App. filed Dec. 1, 1913. Provides convenient means for introducing testing instrumnets into the line without interfering with the continuity of service.

1,211,963. RADIO RECEIVING APPARATUS; John A. Proctor, Revere, Mass. App. filed June 29, 1914. Operated by oscillations produced by continuous or undamped electric waves, without the employment of any form of make-and-break device.

1,211,967. OVERLOAD CIRCUIT-BREAKING APPARATUS; Edmund O. Schweitzer, Chicago, Ill. App. filed May 19, 1913. Improvement.

1,211,973. ELECTRIC HEATER; Vern Slater and Leonidas D. West, Denver, Col. App. filed June 9, 1916. Current of air is induced through a casing having an electric heating element therein.

1,211,976. NOVELTY DEVICE; John R. Spencer and James L. Ross, Bartow, Fla. App. filed April 26, 1915. Illuminated campaign buttons or pins.

1,212,062. PROCESS FOR THE PRODUCTION OF CUPROUS OXID ELECTROLYTICALLY; Bertram Hunt, Glasgow, Scotland. App. filed Oct. 7, 1916. Electrolysis of metallic copper.

1,212,072. SYSTEM FOR FIRING EXPLOSIVES IN MINES; Camden Eugene Knowles and Leroy Daniel Cornelius, Pittsburg, Kan. App. filed June 9, 1916. Air or other fluid under pressure may be utilized for operating circuit closers.

1,212,082. ELECTRICALLY-HEATED SAD IRON; Ernest V. Manzella, Chicago, Ill. App. filed Aug. 25, 1916. Electric current is thermostatically controlled.

1,212,091. TELEPHONE ATTACHMENT; John Oscar Moisson, Charleston, S. C. App. filed July 5, 1916. Causing a signal to be sounded when the user of the telephone leaves the receiver off the hook.

1,212,119. PROCESS OF PRODUCING ALUMINIUM NITRLD; Ottoker Serpek, Paris, France. App. filed April 14, 1915. Mixture of carbon and aluminous material is heated in an atmosphere containing nitrogen.

1,212,125. SWITCH FOR HEAVY ALTERNATING CURRENTS; Walther Burstyn, Berlin, Germany. App. filed Jan. 14, 1915. Electromagnetic of a pneumatic, or a hydraulic, switch.

Record of Patents Issued Jan. 9

(*Continued from the Issue of Jan. 13*)

1,211,050. APPARATUS FOR TRANSMITTING MOVEMENTS OR POSITIONS OF INDEXES BY MEANS OF MULTIPHASE-WOUND BODIES; Erich Beckmann, Hanover, Germany. App. filed Jan. 14, 1913. Improvements.

1,211,009. ELECTRIC WELDING-TOOL; George L. Thornton, Huntington, W. Va. App. filed Oct. 19, 1916. Manual tool for holding the electrode.

1,211,083. ELECTRIC SIGNAL SYSTEM; Alva H. Caven, Youngwood, Pa. App. filed Oct. 23, 1914. In which the traffic in both directions is caused at one point to be diverted to a single track.

1,211,091. Cathode Ray Device. William D Coolidge, Schenectady, N Y App filed Sept 26 1916 Pure electron discharge independent of gas ionization

1,211,092. X Ray Tube; William D Coolidge, Schenectady, N. Y. App. filed June 6, 1915. Current input high enough to heat the working face of the anode to incandescence.

1,211,102. Electric Heating Unit and Method of Manufacturing the Same; Robert William Davis, Jr., Aspinwall, Pa. App filed Aug 26, 1912 Improved heater.

1,211,088. Electric Railway; James M. Clark, Macon, Ga. App filed Jan 22, 1916. For actuating switches, signals.

1,211,116. Thermostatic Apparatus; Bruce V Edwards, Newark, N J. App. filed March 28, 1914. Volumetric changes of a fluid body will operate to control the circuit through the medium of a flexible diaphragm

1,211,117. Thermostatic Apparatus; Bruce V. Edwards, Newark, N. J. App. filed March 28, 1914. To control an electric circuit for sounding an alarm.

1,211,121. Flash-Lamp; Henry L. Everett, Philadelphia, Pa. App. filed May 4, 1916. Facilitating the removal of the cell and of the lamp, especially after the bulb of the lamp has been broken.

1,211,128. Electrical Connector; Harry Frankel, New York, N. Y. App. filed April 20, 1916. Wire and terminal connector.

1,211,140. Railway Signaling; Henry W. Griffin, New York City, N. Y. App. filed Jan 27, 1913 Signaling on stretches of single track over which traffic moves in both directions

1,211,141. Railway Signaling; Henry W. Griffin, New York, N. Y App filed Oct 19, 1916 Signaling for stretches of single track over which traffic moves in both directions

1,211,142. Railway Signaling; Henry W. Griffin, New York, N. Y App. filed Oct. 13, 1916 Stretches of single track between passing sidings.

1,211,153. Electrical Conductor; Martin Hochstadter, Berlin, Germany App filed Jan. 16, 1915. For overhead transmission lines and for underground cables.

1,211,182. Mounting-Strip for Switch-Boxes; Edward H Kruse, Fort Wayne Ind App filed Feb. 17, 1916. Use of ordinary nails.

1,211,208. Automobile or Motor-Cycle Horn; Ray H. Manson, Elyria, Ohio. App filed May 15, 1915 To cause the actuation of a diaphragm.

1,211,218. Process for Plating Metals; Clark W. Parker, Detroit, Mich. App. filed July 31 1916. To reduce the number of operations.

1,211,220. Automatic Substation; Charles W. Pen Dell, Chicago, Ill. App. filed May 13, 1915. Arranged to keep the supply practically uninterrupted.

1,211,279. Turning and Stopping Signal for Automobiles; John Boeck, Boise, Idaho. App. filed June 22, 1916. To be projected from one side of the car when turning corners.

1,211,281. Electric Switch; Benjamin S. Bowers, Laprairie, Minn. App. filed Sept. 19, 1914. For use in train dispatchers' telephone and telegraph systems.

1,211,313. Method of and Electrode for Welding Bonds to Rails; Albert B. Herrick, New York, N. Y. App. filed Nov. 29, 1912. Ren. June 23, 1915. New and useful improvement.

1,211,322. Flashlight Switch; Martin B Langdon, Pardeeville, Wis. App. filed March 14, 1916. Lever or cam member.

1,211,330. Directional Signal; James Marcello, Greenwich, Conn. App. filed May 24, 1916. For use in connection with automobiles, motor trucks and the like.

1,211,363. Battery; Charles F. Burgess, Madison, Wis. App. filed Sept. 18, 1914. Leclanche type.

1,211,376. Electron-Discharge Apparatus and Method of Operating the Same; William D. Coolidge, Schenectady, N. Y. App. filed March 30, 1915. Operation of an X-ray device.

1,211,378. System of Selective Electrical Distribution; Charles F. Kettering and William A. Chryst, Dayton, Ohio. App. filed Nov. 20, 1912. Provides a plurality of electrical sources and circuits, having controlling elements operable to accomplish certain predetermined functions.

1,211,380. System of Electrical Distribution; Percy H. Thomas, Upper Montclair, N. J. App. filed Feb. 3, 1913. For operating mercury vapor rectifiers.

1,206,911. System of Radio Communication; Greenleaf W. Pickard, Amesbury, Mass. App. filed Oct. 28, 1914; issued Dec. 5, 1916. A static-coupled transmitter of the impact excitation type, in which a quenched gap circuit is associated with a reservoir circuit, and that in turn with a detuned radiating circuit, through the agency of condensers.

1,208,187. Apparatus for Generating High-Frequency Electrical Oscillations; Frederick H. Millener, Omaha, Neb. Original application filed April 10, 1911; divided Nov. 7, 1912; issued Dec. 12, 1916. An arc oscillator for radio-telephony, of the rotating electrode type.

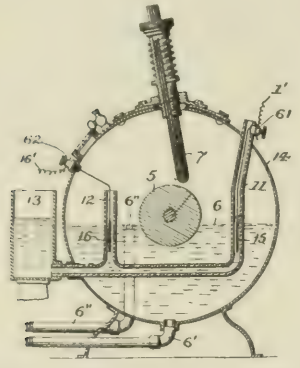


Fig. 1—Milleuer's Arc Generator

One of the electrodes dips into an electrolyte which is dissociated to produce the desired hydrogen atmosphere within the arc chamber.

1,209,324. Electron Emitting Cathode and Process of Manufacturing the Same; Alexander McL. Nicolson, New York, N. Y., and Emerson C. Hull, Montclair, N. J. App. filed Dec. 26, 1914; issued Dec. 19, 1916. A filament for a vacuum tube of the audion type, in which a metal such as platinum is treated to produce a multiple coating containing metals of the alkaline earth group, as, for example, barium and strontium.

Discussion

It is noteworthy that in the month of December only three patents having to do with the radio arts were issued. Ordinarily from three to five times this number appear each month.

The patent to G. W. Pickard, No. 1,206,911, is of particular interest. As shown in Fig. 1, which is reproduced from the specification, it is based upon the disclosure of a quenched spark gap transmitter which involves condenser couplings between its several circuits. In the diagram, *F* represents a motor generator and *T* a transformer, both of the ordinary type used in wireless telegraphy. Across the secondary of the power transformer is connected the quenched spark gap *G*, and about it the closed impulse circuit comprising the condensers *C* and *K* and the variable inductance *A*. Across one of these condensers, and coupled by it to the impulse or exciting circuit, is a second closed circuit including the condenser *D* and the variable inductance *B*. The antenna and ground are connected to the terminals of condenser *D*, no loading coil being shown. The patentee states that the impulse circuit and the reservoir circuit are co-ordinated and adjusted so that the spark-discharge energy is transferred to the latter in the shortest possible time, and that the persistent radio frequency oscillation which thereafter exists in the reservoir circuit *KBD* has its energy slowly fed into the antenna or radiating circuit. The emitted wave length is determined by the period of the closed circuit *KBD;* in an example cited this is 422 meters, while the natural period of the radiator corresponds to a wave length of 250 meters. The detuned condition thus existing is relied upon to cause slow radiation and to prevent reaction between the antenna and reservoir circuits. The impulse circuit is prevented from reacting with the reservoir circuit by the opening characteristic of the quenched spark gap. Thus, it is stated, radiation of a pure monoperiodic wave at high efficiency is secured. With a power transformer input of 1 kw. the "radiation" claimed is 800 watts.

A magnetic loop receiver is shown and described, although the claims of the patent all refer to the transmitter alone. The right-hand portion of Fig. 2 shows how the magnetic loop of large area, *L*, is associated with detector G^1 and telephones T^1 by means of the tuning variable condenser D^1. A second condenser, *U*, is shunted across the telephone windings, thus providing a by-pass for the oscillation current groups and partially tuning the telephone circuit to the wave train frequency. It is pointed out that the highest receiving efficiency is secured by suppressing reradiation from the receiver and by choosing the wave-train frequency to agree with the natural vibration rates of the telephone diaphragm and the telephone circuit T^1 *U*.

Recent Radio Patents

Notes and Comments on United States Patents on Radio Signaling and allied topics issued during December, 1916.

The mechanical structure of F. H. Millener's electrolytically gas-generating arc oscillator may be seen from Fig. 1, which is the fourth drawing of his patent No. 1,208,187. The remaining details of the wireless telephone arrangement which he proposes are shown in other drawings of this patent, and described in the several specifications which have been issued to this same pattentee within the past few months. The present application is directed toward the arc itself, and explains the way in which the roating positive electrode 5, which may be of copper, serves as one terminal of the oscillating arc which is drawn to the adjustable carbon negative 7. The copper element 5 dips into a cooling liquid, 6, which is fed into the bottom part of the arc chamber is a U-tube system 12, which

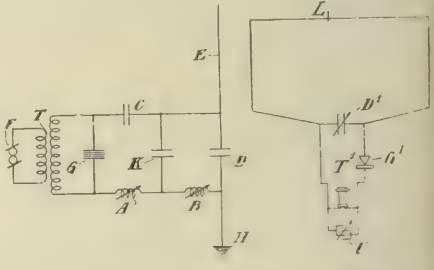


Fig. 2—Pickard's Transmitter and Receiver

prevented from rising too high on the positive electrode by the outlet 6". Within the arc chamber is a U-tube system, 12, which connects to an external reservoir, 13, containing an electrolyte such as potassium hydrate. The two arms of the tube are of different lengths, one terminating within the arc box and one leading out into the free atmosphere. Electrodes 15 and 16 are placed within these vertical arms, and immersed below the level of the electrolyte. By means of the binding posts 61 and 62, the electrodes 15 and 16 are connected to the main source of direct-current power for the arc, a controlling resistance being interposed to limit the current. By properly choosing the polarity of the electrodes 15 and 16, hydrogen will be liberated from the electrolyte within the shorter tube and will pass upward into the arc chamber. Oxygen produced in the other leg of the tube escapes into the air outside the arc box. As is well known, the presence of hyrogen in the atmosphere immediately surrounding an arc of this type aids materially in steadying the oscillations produced. Further, the rotation of the copper electrode 5 helps to maintain the generated oscillations of constant amplitude by preventing irregular burning and pitting at the arc. Thus, the entire structure provides a hydrogen oscillator for wireless telephony in such form that no external tank or generator system is needed for the supply of gas.

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Variations in Service Standards

THE Massachusetts Gas & Electric Light Commission heard testimony last week on what constitutes adequate steam reserve capacity in central station service. There is no doubt that in rebuttal, testimony absolutely at variance with the testimony given by the city's expert will be forthcoming. We refer to the case now regardless of its outcome before the commission because the spirit of the attack aims at the very foundation of the central station business. Service in the electric light and power field means service and not something approaching it. Absolute dependability and continuity are its outstanding characteristics, and preparedness for all emergencies by adequate reserve is the chief essential. That is the reason why so many industrial plants have breakdown service connections with the local lighting companies.

If central stations in large metropolitan districts rendered the character of service meted out by the railways, they never would have attained their present eminent position. Who, then, are so well qualified to pass on the amount of reserve capacity necessary in central station practice as the managers and operators themselves by whose foresight and ability the business has been built up? No central station executive wants needless equipment and certainly railway practice is no criterion of central station practice. If it were, railway companies would not be substituting central station service for their own. It is hardly to be expected that they would be giving up that which is superior for something inferior. Central station managers and engineers need not be guided by any rule stipulating the ratio between peak and reserve. They have no better guide than their own experience and they should adhere to that and not to some theoretical formula. In this it is certain they will be sustained by commissions and courts alike. It is well for them to keep ever in mind the parable of the ten virgins.

Meter Psychology

THE electric meter with its attendant periodical bill continues to be the universal point of contact between the user of electricity and the central station. The simple transactions of reading the meter and making out a bill, rise above the ordinary business transaction and become a part of the relations of the company with its public. Meter reading and billing in the abstract are questions of public policy. The electric meter is still a mystery to most customers. As a consequence this remarkably dependable piece of mechanism is an object of suspicion in many households. Much has been written on this subject, much has been done to make the customer understand the meter, but much remains to be done. In Mr. Van Wert's article in this issue practical methods of meeting the customer's views on this new-old subject are interestingly told. The care to explain how the meter works, the naming of a bureau "Adjustment" instead of "Complaint" department, the assumption that the customer is always right, all are human factors in what may be called the psychology of the meter. If a customer could visit a factory and see meters in process of manufacture, if he could take the jewels in his hands, and see the sturdy delicacy of the parts; if, in other words, he could be made to see that the meter is as near a 100 per cent truth-teller as a machine possibly can be, there would be fewer complaints. The meter and the resultant bill should constantly be considered from the broad viewpoint of public policy.

Single-Phase Motors on Lighting Circuits

A FEW years ago there was a wide variation in the rules adopted by central stations governing the installation and use of motors upon their circuits. To rectify this, the electrical apparatus committee of the National Electric Light Association took the matter under advisement and formulated a uniform set of rules. These were presented at the 1915 convention and formally adopted by the association last year. An important section of these rules deals with the regulations governing the installation of single-phase motors on lighting circuits. As is very generally known, there are two types of single-phase motors which are generally sold for operation on central station circuits—the split-phase type and the repulsion-induction type. Both types are broadly manufactured by various manufacturers of single-phase motors. The repulsion-induction motor inherently takes a smaller starting current than the split-phase motor and is usually recommended in large installations; that is, above the class covered by the small household appliances such as washing machines, small stationary vacuum cleaners, etc. Since the split-phase motor in these small sizes is a cheaper and simpler motor to use, it is to the interest of the user, the manufacturer of the driven device, the dealer selling it, the manufacturer making it and the central station supplying the service to use a motor of this kind. The rules in question provide that single-phase motors requiring not more than 30 amp. starting current may be connected to 110-volt circuits. This covers the split-phase type of motor and in this way does not handicap any individual motor manufacturer but assists in the exploitation and use of small motor-driven machines.

Having set the standard, it is incumbent upon all members of the National Electric Light Association as well as the electric lighting industry in general to abide by it. Our attention has been called to the fact that two or three of the large companies in the East still adhere to rules which are at variance with those formulated by the National Electric Light Association and which militate against the use of the split-phase motor on their lighting circuits. This is not as it should be. The manufacturers have in all things adhered to standards laid down by the American Institute of Electrical Engineers and the National Electric Light Association and having done so they have every reason to expect that their motors will be permitted on circuits for which they were intended. Any lack of co-operation, therefore, on the part of Eastern companies is to be regretted. The industry as a whole can only advance when the manufacturer, the central station company, the jobber, the dealer and the contractor work whole-heartedly hand in hand together.

Automatic High-Speed Wireless

ONE of the most effective ways of increasing the traffic capacity of any telegraph system, wire or wireless, is to substitute high-speed automatic working for hand operation. Ordinarily an automatic rapid system working at eighty words or 200 letters per minute will carry through more messages per day than will the corresponding hand-operated quadruplex, even though each pair of Morse operators reaches speeds of twenty-five words per minute. The elimination of waste time between messages, the reduction of errors and consequent saving of repeats for confirmation, and the machine-like regularity of pace all tend to increase the traffic handled by automatic apparatus. In wire operation it has been comparatively simple to reach high-transmission speeds, as in the Wheatstone system. Not a great deal of power need be controlled to form the signal characters at the sender, and ample current to operate a polarized relay or inker is usually available at the receiver. Very different conditions exist in radio-telegraphy, however. At the transmitting station it is necessary to control several kilowatts of power for even quite short distances, and when the sending range reaches thousands of miles the sending machine may signal with hundreds of kilowatts. At the receiver, too, the problem is difficult, for ordinarily the available power is only enough to give fair operation of a delicate telephone earpiece. Automatic recording by the simple process of photographing the motions of an Einthoven galvanometer string has proved unsatisfactory, largely because of the extremely large interference effects produced by atmospherics.

So far, phonographic reception seems to be the most useful plan put into use. In this type of automatic recording, the received signals are amplified until their tones are sufficiently loud to record themselves clearly upon a wax-cylinder phonograph or telegraphone. In the process of reception the phonograph is run at a speed considerably higher than normal. The records thus made are distributed among transcribing operators, who reproduce the Morse signals at normal copying speed and translate them into written English. If the high-speed signals are received at eighty words per minute on a phonograph running 300 r.p.m., the records are turned over to four transcribing operators whose reproducing phonographs run at seventy-five revolutions or twenty words per minute. This reduction of phonograph speed of course lowers the tone of the signals by two octaves. As was pointed out in a United States patent issued about a year ago, however, interfering sounds are correspondingly lowered in pitch and may even become inaudible. These methods of automatic operation are of especial interest at this time, on account of their experimental adoption in some of the large trans-Atlantic and trans-Pacific wireless telegraph stations.

Changing Lines to Suit the Load

CONDITIONS in the industrial field served by central stations are such as to lead toward larger loads and a need for a more liberal application of economic laws in transmission line extensions and changes to suit these conditions. Short lines must be extended and others remodeled, insulators substituted and voltages increased. These problems should be considered as a matter of course and their solution worked out on a basis that will not hamper the company's sales force in reaching out after lucrative business. With the larger transmission companies these modifications come naturally, special apparatus being devised in some cases whereby changes on live lines operating at 110,000 volts can be made, so imperative is it not to interrupt the service. The smaller company has a great deal to learn in this direction. Changing lines is not the bugbear that it seems. Not long ago we described a case where it was necessary not only to change from one size of insulator to another but from the pin type to the suspension type. The change to suspension units was made without interrupting service although it involved difficulties in clearances, especially as regards the ground, and necessitated increasing the height of the towers. This was done by erecting four gallows frames, tied together at the corners, around the base of the tower. At each corner a two-ton block carried its share of the total weight. The legs of the towers were cleared; the tower was steadied by solidly anchored guys provided with chain blocks for adjusting the weight, and then gradually the whole tower was lifted clear until a new section could be bolted on.

This sounds like a rather difficult job, but in point of fact it was worked off without any serious mishap and at an average cost of a little over $50 per tower for a 10-ft. extension. After the towers were thus lengthened the shifting of the line was comparatively easy, since there were two circuits on each tower and by transferring the load to one and grounding the other circuit solidly at its ends and at the tower attacked, the work was safely accomplished. The lower crossarm had to be dropped two and one-half feet on account

of the change, and for this purpose twelve new rivet holes had to be made at each tower. This was accomplished rather easily by a boiler maker's punch, set in place by men on the tower and operated from the ground. Finally a gin pole was set to shift the wires themselves, the downward pressure of which is about 400 lb. at the tower per wire. Altogether a very workmanlike job was made of the change at a cost not excessive considering the nature of the work and the difficulties of transportation encountered in some sections of the line. This is ample evidence of the flexibility of transmission line engineering nowadays more than of foolhardiness on the part of a daring line crew and foreman. It shows how common sense and carefulness are turning the impossible into entirely practical ways for systems which otherwise might be handicapped in carrying out changes necessary to the best interests of their commercial development.

Readjustment in Manufacturing Conditions

ELECTRICAL manufacturers in general have a clear understanding of the certain and uncertain elements affecting their business at the present juncture. They know that there is still an enormous unsatisfied demand, that their own costs and difficulties regarding raw materials and labor are still serious, and that a period of readjustment will confront them sooner or later. What they do not know is when readjustment will be necessary or to what extent it will be required in order that operations may be brought into alignment with the new conditions. In broad terms their position is that they have sold their output for a long time ahead and that they have prudently contracted for such raw materials as they will need within a reasonable time to meet the orders for apparatus and supplies. It has been exceedingly difficult for manufacturers to decide how far they could afford to go in protecting their requirements and how far they were justified in delaying purchases in the hope that a reaction would occur before replenishment should be unavoidable. Until conditions are more settled, this problem will remain. Those who bought and contracted to the full limit when prices were lower have, of course, every reason for satisfaction; but a declining market, when it sets in, will afford equal satisfaction to those who will then buy, so far as is possible, only from "hand to mouth."

Over-All Efficiency in Industrial Work

ELECTRICAL engineering factors form only one group in the complete problem of applying electricity in the factory. The electrical engineer and the power salesman, generally, must consider electrical applications in the factory from the broad point of view of consulting industrial management rather than from the less inclusive viewpoint of electrical engineering. A manufacturing operation must be analyzed into its component parts and the electrical applications considered with relation to the other phases of the problem, such as labor and material charges. This point was made very clear by Homer H. Kunz of the Toledo Railways & Light Company in a paper on industrial heating which he presented at the meeting of the commercial men of the Ohio Electric Light Association at Toledo. Thermal-electric efficiency in industrial heating may be quite secondary, but the electric heating may make possible an over-all efficiency for the operation which is attainable only because of the flexibility and ease of control of the electric heating elements of the installations. In some cases the thermal efficiency of the electric application may be lower than the thermal efficiency of other sources of heat, but the over-all efficiency of the operation is very much higher than that obtained in any other way.

Greater output at lower unit costs is generally the object of an overhauling of the methods in a manufacturing establishment. The power salesman must take to the manufacturer not only his knowledge of electrical engineering but a knowledge also of production engineering in which lower unit costs of output are the end to be gained. A power salesman, in order to interest a manufacturer in his product, finds his easiest approach in showing, not how efficient are his motors but how they may be applied to give a manufacturing operation greater efficiency. A complete arrangement of machines may give an over-all efficiency to a department in which electric motors for driving are only a secondary consideration. The sale is made more on the basis of production engineering than on electrical engineering alone. With the coming of electric industrial heating, the power salesman becomes a prophet for greater manufacturing efficiency. He must often break down a great deal of rule-of-thumb knowledge which will not bear engineering analysis. In this respect he applies the entering wedge to better industrial methods.

The Coming Issues

IN the first issue of next month, dated Feb. 3, will appear the second section of the article commenced in this issue describing the mechanical and electrical features of the large steam station of the Buffalo General Electric Company. Another article will recount the results of experience during eighteen months with a plan for reducing rates with the increase in number of central station customers in a large city, following the principles laid down in a leading article in the current issue. One of the leading articles of the second issue of February, which is devoted to the problems of station and operating practice, will discuss the layout, installation and performance of small engine-driven generating units. In the number dated Feb. 17, an article by Prof. Alfred Still will take up the technical and engineering problems involved in the design of high-tension terminals and bushings to meet operating requirements. The January issue of ELECTRICAL MERCHANDISING, which appeared on the 15th of this month, included among other articles an account of the methods used by a number of Boston (Mass.) dealers and contractors for renting motors and other electrical machinery.

Chronicle of Events of the Industry and of Important Movements in the Field

NEWS OF THE WEEK

Reports of Conventions and Meetings of Electrical Associations and Societies

ATLANTIC CITY CHOSEN FOR N. E. L. A. CONVENTION

President Herbert A. Wagner Decides Upon Week Beginning May 29—Milion-Dollar Pier to Be Headquarters

It has been decided by President Herbert A. Wagner of the National Electric Light Association to hold the next annual convention of the association during the four days May 29, 30, 31 and June 1 at Atlantic City, N. J.

The reception, meetings and exhibition will be held at the Million-Dollar Pier, at which place headquarters of the association will be established. In order to overcome one of the objectionable features of past meetings at Atlantic City, namely, that of the noise of the waves, all meetings will be held on the second floor of the pier instead of the first.

STATUS OF WATER-POWER LEGISLATION IN CONGRESS

President Wilson Takes Personal Interest in Bills Now Before the Senate—House Adopts Conference Report Favoring Temporary Niagara Diversion

There has been very little consideration of the water-power bill in the Senate the past week. A good start was made last week, when the bill was made the so-called "unfinished business" of the Senate, but consideration of the measure has been frequently prevented because of discussion of the legislative, executive and judicial appropriation bill, against which there have been filibusters. In addition, the Senate will now need much additional time for the consideration of the other appropriation bills which must be passed before the present session of Congress ends on March 4. All of the appropriation bills are behind time.

President Wilson has taken a personal interest in the possible passage of the various water-power bills before Congress during the past week. He has adopted the policy of spending three days a week at his room in the Capitol building, in the hope of expediting water power and other legislation, but there is much opposition to his presence at the Capitol. Some senators and representatives have made bold to say that he is interfering with the legislative branch of the government, and may oppose bills he supports because of the methods he is employing in his attempts to urge their passage.

The President has allowed it to become known that he is strongly in favor of water-power legislation at this session of Congress. He has been at pains to resent newspaper reports that he favors any particular measure now in disagreement among Senate and House conferees. The President's efforts are being bent toward bringing the conferees together, "in a spirit of mutual accommodation," to use one of his phrases.

The temporary diversion of 4400 more cubic feet of water a second from the Niagara River at the falls until July 1 was authorized in a conference report on the Cline Niagara Falls bill, adopted by the House on Jan. 18.

The bill is designed to relieve a water power famine at Niagara Falls pending permanent legislation to regulate water power.

CENTRAL UNION SALE TO BELL SYSTEM ILLEGAL

Superior Court Holds Its Ownership of Local Telephone Stock to Be Null and Void, Censuring Monopolistic Feature of System

In the case of William Read, representing minority stockholders of the Central Union Telephone Company, versus the Central Union Telephone Company the Superior Court of Cook County handed down its decision on Jan. 20, holding that the $5,200,000 of stock of the Central Union company held by the American Telephone & Telegraph Company to be null and void. This decision is based on the Illinois law that foreign corporations operating in Illinois have only such powers as Illinois corporations and the latter cannot own stock in another company in the same business. The fundamental plan of the Bell system is held by the court to be to build an illegal monopoly and the Public Utilities Act must not be construed to sanction monopoly because of the regulatory powers given the commission. Certain accounting rights are also granted the complainant.

ANNUAL SESSION OF THE PACIFIC COAST JOBBERS

Movement for More Intensive Co-operation Between Electrical Interests Takes More Definite Form—New Officers Elected

The annual meeting of the Pacific Coast Division of the Electrical Supply Jobbers' Association was held at Del Monte, Cal., Jan. 11, 12 and 13. Under a recent regrouping plan this division now includes Salt Lake City, Butte and Spokane, and from these districts a number of new members were represented, thus making this meeting the largest ever held. Franklin Overbagh, the general secretary of the Association, and Thomas M. Debevoise, general counsel, were also present.

At the open meeting with the manufacturers, S. V. Walton, of the Pacific Gas & Electric Company, San Francisco, read a paper on "Closer Co-operation Between Central Station and Dealers" leading up to a suggestion that definite steps be taken toward a closer co-operation of the three interests involved in marketing appliances and supplies, namely, jobbers and manufacturers, central stations, and dealers. It was suggested that manufacturers might extend to the small dealer and contractor more aid in the detail of display, demonstration and sales work.

Judge Debevoise in a brief address pointed out that co-operation is of two kinds, 1—illegal and inefficient or 2—legal and efficient. In co-operation of the first kind two or more interests meet and agree, or are made to agree unwillingly, on prices. The only certain result of such agreements, he stated, is that they will not be permanent. Legal co-operation, on the other hand, consists in appealing to the intelligence of competitive

interests, educating all concerned to the point where the trade policy will be of the highest type and there will be no necessity of discussing prices. Such co-operation is permanent, he said, and of general benefit to the industry.

T. E. Bibbins, of San Francisco, suggested that perhaps the newly formed Pacific Coast Section of the N. E. L. A. offered a channel through which it would be possible to extend to the contractor and dealer the help which this class of the industry urgently needs. With this purpose in mind, there was discussion of a plan to appoint a committee from each of the three classes of interests involved to arrange closer co-operation in the marketing of electrical appliances.

At the annual banquet on the last day of the meeting strong commendation was made of the work done by W. L. Goodwin of San Francisco, in organizing Pacific Coast interests engaged in the electrical field. Mr. Goodwin was on the point of leaving to take up new work in New York. Golf trophies were presented, with appropriate comment, to the following members: F. N. Averill, Portland, T. M. Debevoise, New York, R. J. Davis, San Francisco, J. G. Morris and S. V. Walton, San Francisco.

The election of officers resulted as follows: Chairman, Samuel H. Taylor, Electric Railway and Manufacturers' Supply Company, San Francisco; secretary, Albert H. Elliott, San Francisco; and T. E. Bibbins, Pacific States Electric Company, San Francisco, was named as member of the general executive committee from the Pacific Coast Division.

INDIANA RANGE CAMPAIGN PLANS

State Association's New-Business Men's Meeting at Kokomo Devoted to Broad Topics

Muncie was the meeting place on Jan. 23, of the second convention of the new-business committee of the Indiana Electric Light Association. Short talks on business-getting methods of interest to central station commercial men were offered, and many valuable ideas were presented.

The paper by R. W. Mercer, the General Electric representative at Indianapolis, together with its discussion showed the opportunity actually before the central stations in the exploiting of the electric furnace in the steel industry and also electric heating ovens in the steel, automobile and other industries.

An interesting discussion involving merits of both Snyder and Heroult furnaces took place and it was proved that each has definite advantages in doing particular work. It was mentioned that no further development of the forge furnace may be expected until these can be imported either satisfactory refractory materials or good substitutes made in this country.

The proposed plans for the state-wide campaign on electric cooking were discussed broadly and these plans are to be referred to the central station executives for approval at once. The scheme calls for the appointment of a representative of the Society for Electrical Development to open an office in Indianapolis for a few weeks and take charge of the publicity and promotion work. Advertising will be placed in newspapers, street cars, on billboards, etc., preceded by educational articles.

The central stations are to back up the movement by holding baking contests in each town and the town winner will receive as her prize a free trip to Indianapolis. Here she will enter another baking contest against other town winners—the prizes for which will be electric ranges. The manufacturers are being asked to place particular emphasis on Indiana as a sales field during this campaign.

The ideas advanced by Thomas F. Kelly of Dayton, Ohio on "Profitable Central Station Advertising," were eagerly received. He said that the new-business man should by all means be an advertising man. Furthermore, it was pointed out that central stations should early learn to take advantage of the newspaper as their best medium for reaching their customers. The use of plenty of literature and booklets is advisable. Copy should be clear and forceful and windows should show what is for sale in an attractive manner.

The paper by J. P. Ohmer on "Wiring of Existing Buildings," brought out the following figures: In Elkhart, 1000 old houses were wired during 1915, the net gain in Muncie was 900 and in Kokomo, 1380 new customers were added to the company's lines.

It appears from the discussion that the largest number of house-wiring contracts are signed in towns where stress is placed on securing them from customers living in houses of four or five rooms and when a cheap price is quoted for cord drops with a payment plan advanced for settling the bill. This places electric light within reach of all and about 80 per cent of the new customers install fixtures anyway, thus voluntarily increasing the cost to them.

ANNUAL MEETING OF WESTERN ELECTRICAL INSPECTORS

The National Electrical Safety Code, Wiring for Induction Motors and Lamp Socket Ratings Bring Out Interesting Discussions at Toledo, Ohio

The relation of feeder sizes to connected load, field trials of the National Electrical Safety Code, wiring for squirrel-cage induction motors, and socket ratings were topics discussed from interesting viewpoints at the twelfth annual convention of the Western Association of Electrical Inspectors at Toledo, Ohio, on Jan. 23 and 24. The discussion of the first topic brought out data regarding demand factors for various classes of electricity users. H. P. Gear of Chicago maintained that inspection departments have in a great many cases been in error, when they assumed that the demands of installations at certain times equals the connected load. Data were presented sufficiently general in character to be of service as guides in selecting equipment of proper ratings.

The safety code was discussed from the viewpoint of the Bureau of Standards and the electrical inspector by W. J. Canada, Washington, D. C., and from the viewpoint of the utility company, by R. J. McClelland, New York. In a communication read by H. P. Gear, Mr. Canada expressed the opinion that all sections of the code will be easy of application and administration by existing inspection departments with the exception of the section on lines. This section, he believes, should be made the subject of special study by inspectors who will administer it. Mr. McClelland, who stated that he did not speak for the N. E. L. A. but as an individual utility man, expressed preference for a national code rather than many codes. In regard to the present safety code, while he considered some specific rules too severe, he said it is most valuable as a basis for voluntary agreements between utilities and as a guide to designing and operating central station men. To make it more valuable he suggested that the Bureau of Standards issue in pamphlet form those rules in the code which apply to such specific subjects as crossings, joint pole lines, etc. These pamphlets would be useful to companies seeking to make a joint agreement. They would also be valuable to commissions and inspection bodies who wish to adopt rules on some specific points, but do not care to adopt an entire code. In this man-

ner Mr. McClelland believed the influence of the code and the tendency toward standardization could be more rapidly broadened.

A lengthy discussion on interpretation of rules for determining what sizes of leads to use in squirrel-cage motor wiring brought no definite result. Speaking on lamp socket ratings Dana Pierce, New York, pointed out that the life of sockets is entirely fixed by the generally unintelligent use or misuse they receive at the hands of electricity consumers. He expressed the belief that some of the present troubles with sockets can be eliminated by advocating heavier sockets. The trend seems to be toward a 660-watt key socket containing a better switch. On the other hand he said the present status of the metal market and the manufacturing situation makes this a particularly inopportune time to urge upon manufacturers changes in design of standard products. At the close of this talk many inspectors expressed a real need for better sockets and on the suggestion of V. H. Towsley of Chicago, placed the association on record as recommending a 660-watt socket, without specifying the time when such a recommendation would go into effect.

VALUATION OF CLEVELAND ILLUMINATING PROPERTY

Tentative Totals of Value in the Pending Rate Case Are Made Public by the Ohio Public Utilities Commission

A tentative valuation of the property of the Cleveland Electric Illuminating Company has been announced by the Ohio Public Utilities Commission in the Cleveland rate case. The totals which are shown in the table published herewith compare roughly with a present capitalization of about $19,000,000 which, however, will probably be increased substantially by unfunded capital expenditures representing extensive improvements made by the company,

TENTATIVE VALUATION OF PROPERTY DEVOTED TO ELECTRIC SERVICE AS OF JULY 1, 1914

	Reproduction Value	Depreciation	Present Value
Land	$921,728		$921,728
Structures	2,248,972	$104,801	2,144,171
Equipment	12,696,866	1,294,939	11,401,927
Current and nominal assets	381,749	28,365	353,384
Total electric	$16,249,315	$1,428,105	$14,821,210
Less coal	27,631		27,631
Sub total	$16,221,684	$1,428,105	$14,793,579
Plus undistributed overhead charges	17,457	1,537	15,920
Total physical property	$16,239,141	$1,429,642	$14 809,499
Intangibles			
Preliminary expense	$59,808		$59,808
Omissions	153,174	$13,485	139,689
Engineering	531,781	46,816	484,965
Legal expenses	98,756		98,756
Administration expenses	185,095	16,295	168,800
Taxes 2.90 on $15,675,397.49	454,587		454,587
Financing	1,034,660		1,034,660
Interest, 12 p. c. on $18,193,258	2,183,191		2,183,191
Cost to attach business	1,112,070		1,112,070
Working capital	274,037		274,037
Total intangibles	$6,087,159	$76,596	$6,010,563
Total property used and useful in electrical operations	22,326,300	1,506,238	20,820,062
Property used in other than electric operations	1,782,550	159,765	1,622,785
Sub total	$24,108,850	$1,666,003	$22,442,847
Property not used or useful	289,344	47,650	241,694
Total	$24,398,194	$1,713,653	$22,684,541

The commission reserves the right, in the event that it shall determine the inventory to be incomplete or inaccurate, or that the valuation is incorrect, to make such changes as may be necessary before the tentative valuation shall become final.

STANDARDIZED BATTERY SERVICE RECOMMENDED

How a Universal Battery Exchange System Will Benefit Manufacturers and Facilitate Vehicle Sales

Standardized battery service was recommended by Day Baker of Boston, at the New York meeting of the electric vehicle section council, National Electric Light Association, Jan. 25, on the ground that it would permit universal application of the plan of selling electric vehicle facilities on the mileage basis regardless of the make of battery and truck. The remarks made before the council dealt in detail with recommendations made by W. H. Blood, Jr., at the time of the latter's inaugural as president of the, then, Electric Vehicle Association of America. According to reports Thomas A. Edison agrees with the general principles laid down there.

Mr. Baker pointed out that while the electric way of handling transportation appeals to the average mechanically inclined business man, more rapid progress in the use of electric vehicles will require a larger volume of educational advertising and the greater popularization of the battery-operated truck through removal of certain existing handicaps. Aside from the rather indifferent method of merchandising electric trucks, it may be said that the cause for the stagnation in the advance of the electric truck business is due to the battery, or perhaps to the reputation of the older forms of batteries which have been handed down; the limitations as to mileage and charging and the uncertainty of maintenance costs. The National Electric Light Association through the electric vehicle section should come to the rescue of the electric truck, by providing a method of overcoming the obstacles which stand in the way of its more general adoption.

A system of battery exchange will greatly popularize the electric truck, if it is possible to have battery compartments of a standard size for each capacity vehicle. The experiments which have been made with the battery exchange system have shown that the general idea is excellent and represents a desirable method of handling commercial vehicles. However, to build up the vehicle industry as a whole, and that is the only way for the association to treat the subject, it must not be developed along any but the broadest lines, and in a manner which will place the electric truck and the N. E. L. A. battery exchange system beyond the criticism of the public.

"It can readily be seen," said Mr. Baker, "that with such a battery exchange system, the makers of batteries would have a feeling of security in ordering materials, building in advance of actual orders, and even assembling batteries for the various sizes, knowing that they could be used in any make of vehicle." At present there are four methods employed for the quick exchange of batteries in electric trucks: First, that developed by the Electric Vehicle Company of Hartford, Conn., which is used by the Boston Edison company, the R. H. Macy Company of New York, and the Amoskeag Manufacturing Company of Manchester, N. H., with a few other scattered installations; second, the facilities provided by R. McAllister Lloyd; third, the facilities devised by M. L. Stone of the W. F. Stone Company, Boston; fourth, the roll-in or slide-in battery scheme which is used on a number of Couple-Gear trucks in Boston and which has been developed for battery-exchange service in Chicago.

The first two methods require for proper operation the use of one or more hydraulic lifts. With the construction employed it is impracticable to truss the frames, as is often found desirable, especially if the

weight is to be kept within desired limits. With the two latter methods no hydraulic lift nor expensive loading machine is required. The third plan is extremely simple, permits of application to any make of truck and trussing the frames, and does not necessitate the purchase of extra cradles at a cost of over $100 each for the additional batteries.

Mr. Baker disclaimed being an advocate of any special form of carrier for holding batteries, believing that if this matter is handled by the committee on standards a carrier will be adopted which will embody the greatest simplicity without weakening the chassis design. Manufacturing rights can doubtless be obtained for any of the patented devices at a price per vehicle which would add only a very small percentage to the manufacturing cost of each truck.

The desirable system of exchange of batteries carries with it the possibilities of presenting to the vehicle purchasing public a real innovation of value and interest, without any strings to retard its legal adoption or popularity. Coupled with the possibilities of presenting "Electricity by the Mile," it opens the way for a co-operative advertising campaign by the association members and the vehicle and battery makers which could not fail of results. The association now has within its power, as the real arbiter of the destiny of the electric truck, to establish battery compartment standards. These must permit the interchange of any make of battery which is constructed on lines and with characteristics approved by the association, in any of the accepted forms of storage battery road trucks.

With standardized battery cradles any central station could sell electric truck service by the mile, a method already demonstrated with some success in Hartford and Boston. This method would be sure to become popular, as it converts kilowatt-hours into terms which all vehicle users readily understand. It would give the world the possibilities of real battery exchange systems, make the electric truck popular, bring orders to all the makers of trucks and batteries, unite the electric vehicle industry, and conserve the benefits of the valuable off-peak load, which is sure to result from the proper merchandising of electric trucks and energy.

PROPOSE STATE TAX FOR CITY-OWNED UTILITIES

California Board of Equalization Recommends Equal Rating for Municipally-Owned Utilities and Private Property

In the annual report just issued by the California State Board of Equalization, the following significant recommendations are made:

"There seems to be no reason in equity why the municipally owned utility should not bear its just proportion of a State tax. If the separation law is to continue it should not be permissible for the State's political subdivisions to undermine the law by reaching in and pulling out some of the main props.

"It must be remembered that the constitutional provision under which the State is collecting its principal revenue from taxation has a provision that if at any time the revenues derived under the present system (and receipts from all other sources) prove inadequate to maintain the State government, then and in that event a general deficiency tax ad valorem shall be levied upon all of the property in the State sufficient to meet such deficiency.

"We state the proposition, therefore, that it is manifestly unfair for San Francisco and Los Angeles, or any other subdivision of the State, to take over a public utility taxed solely for State purposes without paying to the State the amount of taxes which would ordinarily accrue under private ownership. To do so creates a great liability for a deficiency in the State's revenues, and if resort is had to an ad valorem deficiency tax an unwarranted burden is cast upon the people of the State who do not live in the cities concerned.

"We recommend the enactment of a law by which the municipalities owning and operating public utilities shall be required to report to this board and pay a tax commensurate with the State's other taxpayers."

INDIANA ENGINEERS DISCUSS PUBLIC UTILITY PROBLEMS

Three-Day Session at Lafayette Devoted to Broad Topics, Among Which Were Street Lighting and Utility Regulation and Practice

Delegates to the thirty-seventh annual convention of the Indiana Engineering Society, convening at Purdue University, La Fayette, Ind., on Jan. 18, 19 and 20, were received and welcomed in an opening address by Dean Coulter of the engineering schools, after which Prof. L. W. Wallace, president of the Indiana Engineering Society, further welcomed the members in a short address, citing the great strides made in the engineering professions in the last few years. He referred to noted examples of recognition being accorded to the engineer by the nation, first in the formation of the Naval Consulting Board, and secondly in the Industrial Preparedness Survey, which was made this year.

The program opened with an address by Gen. Anson Mills, U. S. A., retired, on "Industrial Development in the Republic's Life in One Hundred and Twenty-eight Years," followed by a paper by Prof. A. N. Topping, entitled "Modern Tendencies in Street Lighting." He traced the development of the street light through its early stages to the gas-filled tungsten lamp of the present day.

He referred to the contractual relations as being a frequent cause of unsatisfactory street lighting in that they did not adequately specify the service to be furnished or the means of ascertaining whether that service is being furnished. Good contracts provide for a possibility of making changes in equipment within certain cost limitation to take advantage of the improvement and progress in the art of lighting. It was suggested by Professor Topping in his paper that the Indiana Engineering Society might very appropriately prepare a set of standards for use in Indiana towns and villages.

Samuel B. Mott, in a paper on the subject of "Street Lighting in Small Towns," showed in detail the value of street lighting in a small town from the central station company's viewpoint. Mr. Mott considered the securing of the contract as the important thing to both central station and the town. Among other elements influencing the making of a contract was mentioned the area to be served, distance between lamps, size and method of suspending lamps, the schedule whether moonlight or all night. The location of lamps and distance between them is as important a feature as the means of suspending the lights. Lights should be placed at a height of 18 ft. or 20 ft.

The first day's session closed with a report from the committee on electrical engineering and electrical railways through its chairman, Prof. D. D. Ewing. The speaker referred to the growing demand of heavy apparatus in the electrical field. The development of electric railways, he said, had somewhat abated, due to the high cost of materials.

On Friday morning E. B. Smith, Marion Machine

Foundry & Supply Company, spoke on "Human Engineering." At the same session Prof. C. F. Harding presented a paper entitled "The Evolution of Public Utility Regulation," in which he traced the development from individual to corporation control and reviewed the progress made in solving the problem of proper regulation. What is needed, he pointed out, is well-directed commission regulation, and if a change takes place in the direction of less stringent regulation of our utilities, he was of the belief that it will result from the following causes:

(1) Demands from consumers and regulating bodies for better and more varied service at existing rates. (2) Inabilities of utilities to meet these demands with a fair profit under strict regulation. (3) Dissatisfaction with commission regulation for the reason that too much was expected of it by the public. (4) Dissatisfaction with commission regulation for the reason that such regulating bodies are too often made up of men not experienced in the engineering and financial problems of utilities. (5) Difficulty in obtaining desired results through regulation because of an attempt to apply radical though theoretically correct methods of utility management in the immediate future.

In concluding this paper Professor Harding said: "I believe that properly regulated monopoly has come to stay for our public utilities as a happy means between cut-throat competition, with duplicate systems for which the consumer has to pay for in the end, and governmental ownership, which is bound to be inefficient, generally speaking, because of its dependence upon political prestige. Engineers have a real part to play in the success or failure of either solution of this very vital problem."

In the afternoon session on Friday the featured addresses were those of Peter Junkersfeld of Chicago and H. O. Garman, chief engineer Indiana Public Service Commission.

"Public Utility Service as Affected by Local Conditions" was the subject of Mr. Junkersfeld's address. The quality of a utility service is dependent upon local conditions, upon the habits of the users, and in this manner, Mr. Junkersfeld stated, a service will improve or deteriorate in the same proportion as the habit of the community improves or deteriorates. The influence of density of business is pronounced in its effect upon capital invested, he pointed out, saying, "the larger the capital invested in proportion to the annual revenue the more important the matter of density." The following table was given for a comparison of relative costs as to density of population:

	A, Per Cent	B, Per Cent	C, Per Cent
Generating station	12.3	12.3	12.3
Transmission system	3.2	3.2	3.2
Substation	..	4.4	4.4
Distribution to block in which home is located	..	9.3	9.3
Distribution within such block	..	58.6	12 0
Meters	..	9.0	9.0
Lamps	..	3.2	3.2
	15.5	100.0	53.4

"A" Consumer of untransformed energy.
"B" Relative cost to one man in a block of five consumers.
"C" Relative cost to one man in a block of fifty consumers.

The total investment charge in "C" is nearly one-half of that in "B," due to the difference in percentage cost of "distribution within the block." The reason for this reduction in costs, it was pointed out, is due to the fact that for mechanical reasons the poles, the primary wires, and secondary wires necessary for five customers to the block are also sufficient to supply fifty customers to the block, showing a very great influence of density on investment required to render electric service to homes.

Mr. Junkersfeld also discussed the question of sale of energy in bulk for which the investment charge is one-sixth of that of individual sale of energy. Metering and billing methods offer an important problem, the cost of which and making the collection is about 16 cents per bill each month. Mr. Junkersfeld thought it more expedient to render bills quarterly, thereby saving a considerable sum which would ultimately revert to the benefit of the consumer. It was clearly demonstrated by the speaker that the public is constantly using more electricity, due undoubtedly to the use of household appliances. The residence rather than the commercial customers are hardest to please.

H. O. Garman, chief engineer Indiana Public Service Commission, presented as his theme "Some Observations on Public Utility Control in Indiana." After viewing the conditions existing in the State for the past three and a half years and discussing the use of the commission, Mr. Garman stated that the solution of public utility problems has not been reduced to a formula as yet, but that some certain principles were taking form. The commission does not assume a paternal attitude toward the utility management, but merely a regulating relationship only pursuing investigation where complaint is made.

Friday evening a banquet was held at the Hotel Fowler. The address of the evening, "The Ethical Status of the Engineering Profession," was given by Prof. F. H. Newell, Urbana, Ill.

The convention closed on Saturday with the election of the following officers for 1917: President, C. F. Harding, La Fayette; vice-president, W. H. Insley, Indianapolis; secretary, Charles Brossman, Indianapolis; trustees, L. W. Wallace, La Fayette; J. W. Mueller, New Castle; J. S. Spiker, Vincennes; J. W. Toyne, South Bend, and J. W. Moore, Indianapolis.

WHAT CONSTITUTES ADEQUATE STEAM RESERVE CAPACITY?

Central Station Engineering Policy Reviewed by Massachusetts Commission—Cost of Generating Equipment in Large Stations

A vigorous "drive" against the Edison Electric Illuminating Company of Boston's investment in generating plant capacity was a feature of a hearing before the Massachusetts Gas and Electric Light Commission Jan. 15, in connection with the street lighting rate arbitration in progress by the board. Reginald J. S. Pigott, power superintendent of the Remington Arms Company, Bridgeport, Conn., was called by the City of Boston as an expert witness and an entire day was devoted to his examination by Corporation Counsel John A. Sullivan in support of the opinion that in comparison with other large plants, the Boston installation exceeded the necessary safe limits of reserve. The city also maintained that the cost of the plant was excessive. Cross-examination took place Jan. 16, and the verbatim testimony, now on file in the office of the board, contains an analysis of power plant adequacy seldom equalled in interest in rate regulation cases. It is expected that in the near future the company will present rebuttal testimony in defense of its policy with respect to reserve capacity and construction costs.

Mr. Pigott's main testimony was based upon his experience as engineer in charge of design and construction for the Interborough Rapid Transit Company, of New York. He maintained that a reserve capacity equal to the peak plus the rating of the largest single generating unit in the station in general affords a proper standard. At the Fifty-ninth and Seventy-fourth Street stations of the Interborough, the com-

bined rated capacity in 1913 was 172,500 kw. and the combined peaks were 149,000 kw., giving a reserve of 15.8 per cent of the combined peaks. Taking the overload capacity of the equipment into account, the witness said that the two Interborough stations could deliver 194,500 kw. The system peaks on the Boston Edison stations in the winter of 1914-1915 was 65,342 kw., the peak at the L Street station in South Boston being 60,100 kw. Mr. Pigott said that judging by his experience and by modern practice, the L Street station would have been adequately equipped if its capacity had been 75,100 kw. at this time, but with the units making up the station, 81,000 kw. would have been the nearest practicable figure. The actual rating of the units in the station totalled 105,000 kw. The witness severely criticized the retention of the original L Street 9000-kw. engine-driven plant and the purchase of the so-called No. 8 turbine (15,000-kw. rating) prior to the 1914-1915 peak. He said that the allowable units aggregating 81,000 kw. would have carried 7 or 8 per cent more load than this rating if necessary and pointed out that 9000 kw. additional is available from the Boston Elevated Railway through a frequency changer. In the winter of 1915 the peak load on L Street totalled 67,700 kw., with the same installed capacity of 105,000 kw. The demands of the Boston street lighting load were only 3223 kw., for arc lamps and 309 kw., for incandescents, as of 1914.

Cost of Large Generating Equipment

The witness estimated the cost of the L Street station, pro-rated to 81,000 kw. as $5,315,396. He contended that by rebuilding two 7500-kw. turbine sets to 12,000 kw. rating each, the company had expended $132,517 more than as though it had purchased two new 12,000-kw. machines at a total cost of $461,730, including foundations and auxiliaries. When the above machines were rebuilt the condenser base with its tubes forming the condenser proper was retained and larger auxiliaries were substituted. The original cost of the two 7500-kw. units complete was $299,621, and the cost of reconstruction was $294,625, the witness said. The cost of removing the two 7500-kw. units would doubtless have been less than their scrap value. When four 7500-kw. engine units were removed from the Seventy-fourth Street station in 1913 the purchaser in each case removed the unit and in addition paid the company $10,000 per unit. The value of the copper alone exceeded this figure.

Mr. Pigott contended that a further elimination in necessary investment at L Street is represented by $512,650 corresponding to the cost of the eighth turbo-unit, of 15,000 kw. rating. He also said that the cost of the engine plant, containing six 1500-kw. units, should be eliminated, representing $1,245,014. The investment in motor-driven Brush arc generators at L Street, $154,918, should have been made a substation charge. The witness said he was convinced that there is enough margin in the equipment of the L Street turbine station to-day to safely carry the peak without the units which he would withdraw, taking into consideration the Boston Elevated emergency connection and 1400 kw. available at the Sudbury hydroelectric plant of the Metropolitan Water Board, with the further possibility of using about 3600 kw. in the Atlantic Avenue station and bearing in mind the overload capacity of the older turbine units at L Street. The total deductions of the witness figured $2,408,723. Mr. Pigott put the unit cost of the necessary capacity at L Street at about $66.60 per kilowatt, including outside coal-handling and storage facilities at present rented to the contractor who supplies the Edison company with coal.

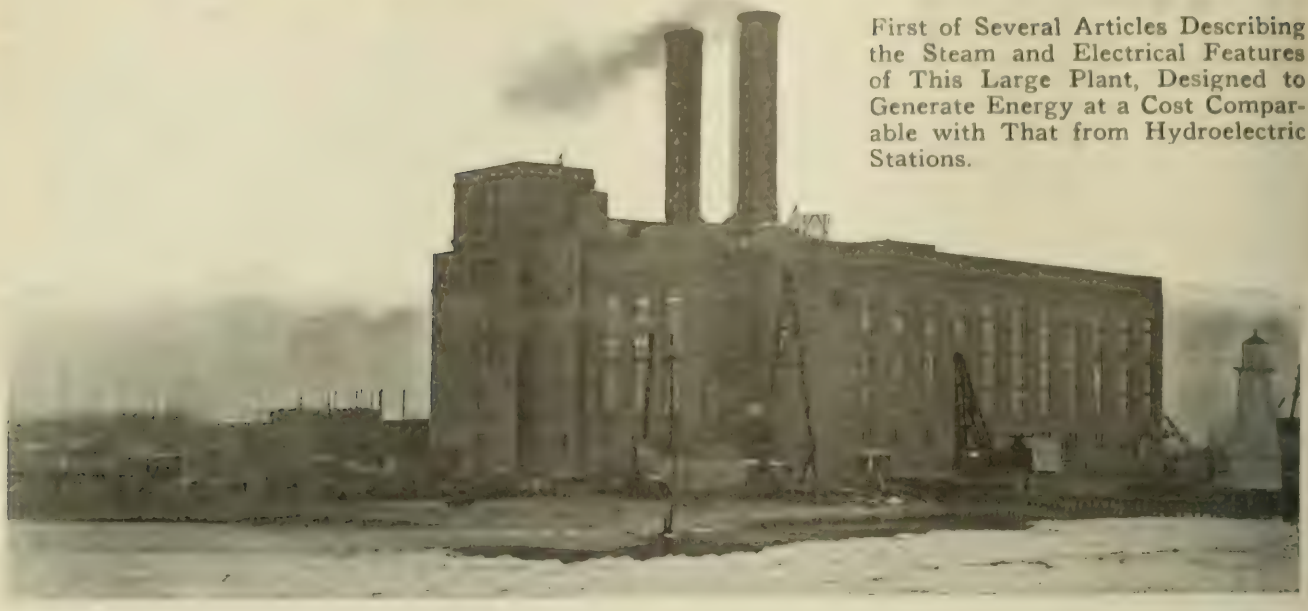
In the balance of his direct testimony, Mr. Pigott discussed various items of station equipment which in his opinion cost the Boston company excessive amounts, including early boilers, stokers and turbines. He claimed that the Commonwealth Edison Company of Chicago had purchased 7500-kw. turbine sets at $87,500 each, compared with $100,000 at Boston and that on a 12,000-kw. unit the Boston company paid in 1907, $168,500 as against $140,000 for Chicago, for similar machines. The witness also criticized the later coal contracts of the Boston company for including a bonus and penalty clause based on analyses of nut and slack and run of mine coal. The witness said that with such a contract the company may be obliged, if using run of mine, to pay more for the same heat content, as it is possible for the nut and slack to reach the same heat content as the former.

The generating cost at L Street in 1914 was 0.48 cents per kilowatt-hour, which the witness considered good practice for the equipment combination there used. Run of mine coal cost the company $2.85 per ton and nut and slack cost $2.70. Had underfeed stokers been used, however, the witness said that the cost of production would have been cut down by 7 or 8 per cent for fuel alone and from 10 to 12 per cent including labor. "Overfeed stokers," Mr. Pigott said, "require one stoker operator and one coal-passer for about every five stokers and underfeeds require one coal-passer and one stoker for every twelve stokers. The ratio of coal cost to total production cost may rise to 80 per cent in some stations equipped with underfeed stokers." Mr. Pigott also attacked the use of storage batteries for emergency reserve service in Boston on the ground that the advances in station design have now increased the reliability of "straight" generating equipment to a point where stand-by batteries are a needless outlay. He also maintained that the street-lighting load can be handled at relatively low cost on account of its value as a long-hour, steady load in the hours of low demand upon the station.

Under cross-examination, Mr. Pigott admitted that if various turbo-units were connected to buses of different voltages with inter-bus connections through transformer banks, the amount of reserve capacity required might be altered. F. M. Ives, counsel for the Boston Edison company, brought out the point that at present one 1500-kw. engine-driven unit is run to supply energy to the 2300-volt bus, the turbines supplying the 6900 and 13,800-volt buses. The witness averred that the installation of additional transformer capacity would be preferable on account of the superior economy of turbo-generation. The point was also brought out that just prior to 1914 the Boston company had been about to close a contract for 20,000 kw. with the New Haven railroad, and the prospect of important commercial loads of this magnitude was conceded by the witness as an additional incentive to increase station capacity in anticipation of service demands. On the whole, however, the witness refused to abate his opinion that the purchase of the eighth turbine (15,000 kw. rating) was negotiated a year before it was necessary. Mr. Ives stated that the Commonwealth company of Chicago has a peak load of about 370,000 kw. and that it has nevertheless ordered 200,000 kw. for early installation. A large anticipated increase of commercial load might explain this, the witness thought. In the course of the cross-examination Mr. Pigott said that the Interborough Fifty-ninth Street station cost $150 per kilowatt originally, but that the addition of low-pressure turbines to the existing units reduced this to $87.50. The witness also admitted that an interruption of supply is a serious matter, but would not declare that wise management always refrains from taking any chances on reserve capacity.

The 210,000-Kw. Buffalo Steam Station

First of Several Articles Describing the Steam and Electrical Features of This Large Plant, Designed to Generate Energy at a Cost Comparable with That from Hydroelectric Stations.



THE erection of a steam plant almost in the shadow of Niagara Falls is an event which would in itself command interest even though the design were not the last word in steam station engineering. Low-cost power has been realized at this most famous of American waterfalls since the initial development about a quarter century ago. The limitations placed upon the further development of Niagara power by both the United States and Canadian governments and the rapidly expanding business of the Buffalo General Electric Company have combined to make the construction of a large steam station imperative. Such a station is now being completed on the bank of the Niagara River about 7 miles north of Buffalo, with an initial installation of 60,000 kw. of generating equipment. An additional 35,000-kw. unit is now on order and will be in operation early in 1918. This plant embodies the latest ideas in large steam station engineering which are expected to make possible large economies and an energy cost comparable with the cost of power now purchased at Niagara by the Buffalo company in its operation. The plant was designed and constructed in its entirety by the Stone & Webster Construction Company of Boston, with the late Henry G. Stott of New York City acting as consulting engineer for the Buffalo General Electric Company.

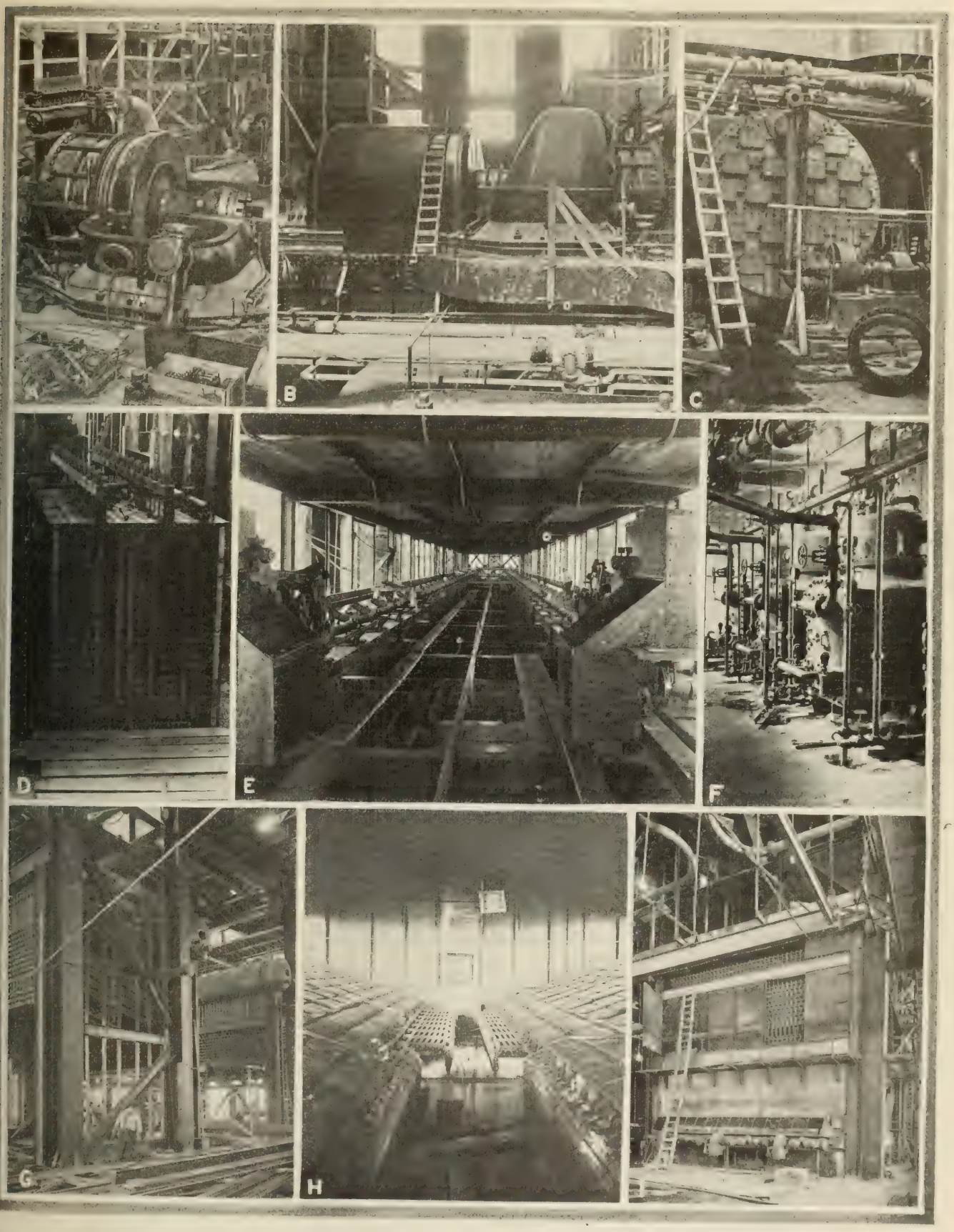
The main features of the station are the use of high steam pressure and superheat, high ratings of stoker and boilers, special piping, a special water supply system, unusual and flexible electrical arrangements. The accompanying illustrations show the apparatus during installation and some of the features of the construction.

All the energy at present contracted for by the Buffalo company from the Niagara plants is below the requirements of the former by at least 25,000 hp. Under present conditions the total load carried by the various power companies operating at Niagara has reached the practical limit of what these stations are capable of taking care of economically, and energy purchased from the Niagara companies would of necessity be more expensive than energy bought on the present basis. The new plant will insure sufficient energy to carry all peaks at present and to meet additional load demands for some time to come.

The station is located at Tonawanda, between the Niagara River and the Erie Canal. The site affords ample room for expansion and excellent facilities for the transportation of fuel by rail and water, as well as a practically unlimited water supply. The initial installation consists of three 20,000-kw. horizontal turbo-generators. The ultimate capacity of the station is 210,000 kw., and as already mentioned a 35,000-kw. unit will be added at once. Construction was begun in January, 1916, and the first turbine was placed in commission Nov. 20, a remarkable record in normal times, and especially so in 1916, considering the abnormal material and labor conditions.

The building is of steel frame construction throughout, with outside walls of brick. Main units are supported by structural steel, and all floors and roofs, coal hoppers, bunker and ash hoppers are of reinforced concrete. The interior walls are of brick and tile. The station is broadly divided into a boiler house, turbine room and electrical bay, the present building being large enough to accommodate an additional turbine unit with its auxiliaries and three additional boilers. The boiler house is 230 ft. long by 113.5 ft. wide, the turbine room being 216 ft. long by 75 ft. wide and the electrical bay 216 ft. long by 25 ft. wide. To secure a firm foundation for the building 167 concrete caissons were sunk to bed rock.

Coal is at present delivered by rail with a temporary storage maintained by means of locomotive cranes working upon trestles. The coal-handling system within the station was installed by the Mead-Morrison Manufacturing Company. A standard-gage track runs through the station parallel to the north wall. Cars may be dumped two at a time on this track into hoppers below the boiler room floor level, each hopper holding several carloads. A set of track scales is located just outside the building. Below the hoppers are located a duplicate installation of crushers discharging into two bucket elevators, one for each crusher. Each crusher is of the duplex single roll type, belt-driven by a motor, and is capable of crushing 200 tons of semi-bituminous coal per hour from run-of-mine size to 2 in. Each elevator is motor operated and is capable of lifting 200 tons of coal per hour approximately 135 ft. from the crushers to a belt conveyor above the coal bunkers. One belt conveyor, 30 in. wide and 200 ft. long, is provided for each



Views of Buffalo Steam Station During Construction

A—Steam end of one of the three 20,000-kw. generators with turbine blades exposed.

B—Assembled 20,000-kw. turbo-generator with condenser pit in foreground.

C—One of the main-unit condensers with turbine driven pump at right.

D—9435-sq. ft. economizer showing scraping mechanism.

E—Coal conveying and distributing apparatus over bunkers.

F—Two-effect evaporators furnishing boiler make-up water.

G—One of the double-end 11,403-sq. ft. boilers before stokers and setting were installed.

H—Construction of double-end grates.

I—Boiler after stoker and setting were installed.

elevator, a traveling tripper being provided with each conveyor to distribute the coal evenly over the bunkers. The belt conveyors are motor driven and push-button control is provided at four points along the runway beside each conveyor, so that in emergency the belt conveyor, bucket elevator and crusher feeding that conveyor can be stopped. An automatic device prevents the bucket elevators traveling in the opposite direction in case power is shut off. In the coal-handling bay of the station crane rails are provided for a future traveling coal unloader to be operated above the coal cars to shorten the time of unloading when necessary. Ultimately a modern coal yard with traveling bridge crane and a storage capacity of at least 50,000 tons will be arranged, and this will be connected with a coal-handling wharf on the Niagara River by traveling belt conveyors fed from hoisting towers designed for barge unloading.

Coal is fed into the stoker hoppers from a central overhead bunker of 2500 tons capacity through inclined spouts flaring into outlets over the hoppers. The boilers are set with firing aisles running crosswise of the station, which enables both ends to be readily fired from one central bunker.

Five Babcock & Wilcox cross-drum, double-ended boilers are at present installed, space for three more units being available in the present building. These boilers were designed to furnish steam at 275 lb. working pressure and with 275 deg. Fahr. superheat, each having 11,403 sq. ft. of heating surface and 484 4-in. tubes 20 ft. long connected to a steam drum 60 in. in diameter and about 30 ft. long. The ratio of heating surface to grate surface is about 36 to 1. Each boiler is fired by two fifteen-retort stokers made by the Sanford Riley Stoker Company. The cross-drum type of boiler was the only practicable type for the conditions, the chief factor in the selection being the high pressure at which these units are to be operated. With the stoker installation provided, these boilers can be operated at a very high rate of evaporation per square foot of heating surface.

The steam pressure of 275 lb. which was adopted was considered the highest available at this time without going into very special construction for boilers and steam lines. The steam temperature at the above pressure and superheat is 689.5 deg. Fahr. Each boiler was given a hydrostatic test after erection of 500 lb. per square inch, including mud drums. The setting walls are built of firebrick throughout, and are inclosed by an insulation consisting of 0.25-in. asbestos millboards, outside of which are laid magnesia blocks averaging 4-in. thickness. The entire setting is inclosed in an airtight steel plate casing with removable panels carried on the channels of the boiler room floor, which provides for expansion. The boiler fronts are of steel plate lined with magnesia 2⅝ in. thick. The disposition of the tubes and the arrangement of the baffle or flame bridges leaves the two lower rows of tubes exposed to the radiant heat of the furnace over their entire length, providing also a chamber at the bottom of the second and third passes for the accumulation of soot and cinders.

By reason of the high ratio of grate area to heating surface the rate of combustion per square foot of grate area will be lower than if the boilers were equipped with stokers under one end only, and there will be a correspondingly higher furnace efficiency and much lower cost of furnace upkeep. When burning coal at the rate of 700 lb. per hour per stoker retort, it is expected that each boiler will show an actual evaporation of approximately 140,000 lb. of steam per hour, which, under the service conditions existing, is an equivalent evaporation of about 160,000 lb. of steam per hour from and at 212 deg.

Arrangements of the stokers, economizers, fans, pumps, and piping and methods of operating the plant apparatus will be described in later issues of the ELECTRICAL WORLD with features of the electrical equipment.

WATER RHEOSTAT FOR FLUID-LEVEL REGULATION

Apparatus Designed to Serve Same Purpose as Float Switches, and Particularly Adapted to Use with Storage Tanks

Among electrical devices which have been patented recently is a cone-shaped water rheostat (patent No. 1,194,324), which is intended to serve the same purpose as float switches or other fluid-level regulating devices. According to the patentee the apparatus is particularly adapted to regulating the level of conducting fluids in storage tanks, but can also be used to automatically control bilge or sump pumps, wet-vacuum pumps, water level in boilers and the like. Since the rheostat is required to carry only a control-circuit current it is not large, being housed in a small cylindrical case which communicates with the vessel in which the fluid level is to be regulated.

As indicated in the illustration shown herewith the rheostat electrodes are nested, but are separated by a small gap depending on the conductivity of the liquid in which they will be immersed. When a conducting

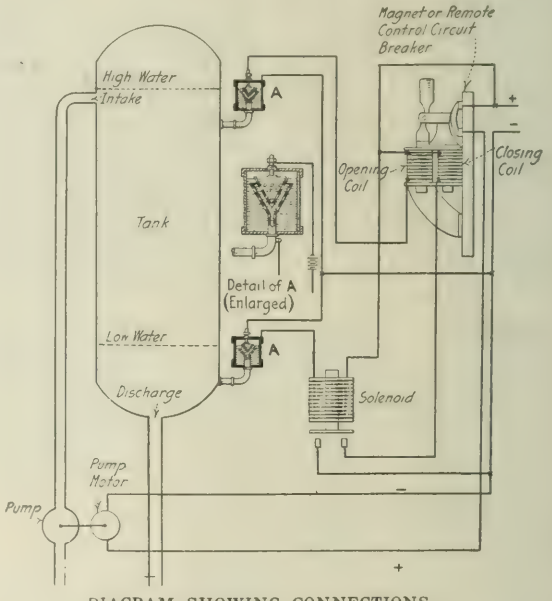


DIAGRAM SHOWING CONNECTIONS

liquid rises in the rheostat the electrodes are connected, allowing a current to flow through the control circuit, thereby operating the alarm bell, pump motor or any apparatus that may be desired. When the rheostat is used to start a motor directly without any intermediate relays the steam generated in the rheostat can escape through openings at the top. Where not much current has to be handled the conical electrodes are made 1/32 in. thick, 3 in. in diameter and 3 in. in altitude. Copper, iron or aluminum cones are used, depending on the importance of preventing electrolytic products. It may be pointed out that a metal may be selected for the electrodes which will not disintegrate rapidly in the liquid used. Furthermore, there are no movable conductors or contacts which can be damaged by arcing. Since perforations are provided in the conical electrodes circulation is assured and collection of deposits prevented in the gap between the electrodes.

Central Station Growth and Rate Reductions

A Plan Which Links the Time for Rate Reductions with the Increase in the Number of Consumers—Principles Underlying the Method Which Has Been Adopted at Milwaukee and St. Louis

THERE are several methods by which the customer may be given the benefit of the economies of quantity energy production and the extension of service by the central station. Most of these methods, however, either involve considerable additional clerical work in their application or lack the important element of maintaining existing and prospective customers' interest in the plan. Where the customers' interest cannot be maintained the beneficial effect sought to be achieved by the plan is, in large part, lost.

The plan adopted in Milwaukee is exceedingly simple. It serves the purpose of (a) maintaining existing and prospective customers' interest because of its being simple and readily understood; (b) of fixing a goal to be striven for by customers and company alike and which serves as a ready means for noting and advertising progress; (c) of sustaining the company's revenue during the period while the business is being built up to the point of justifying the promised adjustment in rates.

The plan under which the company has been working provides a definite reduction in the primary step of its residence-rate schedule whenever a given increase in business, as measured by the number of customers of all classes, has been achieved. This plan offers good reason for urging existing customers to assist in procuring new ones.

When the company had 32,000 customers on its system its primary gross rate was 11 cents per kilowatt-hour. It promised its customers and the public that when the number of customers had increased to 40,000 it would reduce the primary step of the rate 1 cent, or to 10 cents gross. At the same time the company promised that when the number of customers had increased to 50,000 the primary step of the rate would be again reduced to 9 cents gross. The difference between the gross rate and the net rate, as applied to the primary step, is per cent, this discount being allowed for prompt payment. The theories underlying the plan may be discussed briefly as follows:

Necessity for Making Lower Maximum Rates

The general tendency during the past few years in central-station rate-making has been in the direction of lower maximum rates. This has not been brought about by considerations of the cost of service, since all central-station operators realize that the short-hour user may be carried at a loss, even with an initial maximum rate of 12 or 14 cents per kilowatt-hour. It has been due to popular demand for a smaller differential between wholesale and retail rates, and in some places to the belief, shared by some central-station men, that the lower maximum rates stimulate business, as a whole, even though the service may be in some instances rendered at a loss. While it is true that the rate practices of one central-station company do not affect the rate practices of another in a competitive way, the company with the higher maximum charge is likely to suffer by comparison. Any criticism of electric rates by agitators is usually based on comparison of maximum charges. It has been found desirable, therefore, to reduce the maximum steps in rate schedules as rapidly as the business will permit.

In the Middle West two central station companies have instituted a new policy in regard to rate reductions, announcing to the public that reductions will take place at certain stages in the companies' growth. One has said: "When the company's customers reach 40,000 in number the rates will be reduced from 11 cents to 10 cents, and when the customers increase to 50,000 the rate will fall to 9 cents." A statement like this outlines the policy and program in simple language, and it makes the customer a partner with the company in an endeavor to get lower rates. The two companies referred to are the Union Electric Light & Power Company of St. Louis, Mo., and the Milwaukee Electric Railway & Light Company. The present article gives an analysis of the Milwaukee plan. Part II will give the results of eighteen months' experience with the plan at St. Louis.

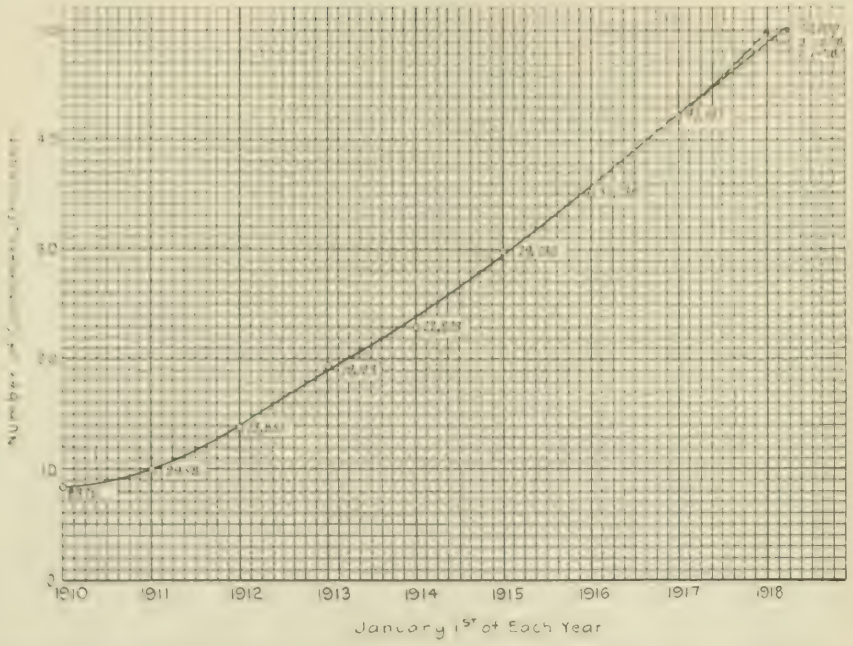
—Editors

Making the Customer Earn His Own Reductions

There is a commercial advantage in providing a definite policy of rate reductions with increase in business. Such a principle of salesmanship has been utilized before in the sale of manufactured products, and has had a marked effect in increasing sales wherever it was tried. There is no doubt in the Milwaukee case that an incentive to the customer to boost for electric service has been created. Moreover, the resulting reductions have been more appreciated because earned, than voluntary reductions otherwise made at irregular periods. While the customer may not be aware of the economic factors underlying electric-service costs, he does know that general wholesaling produces larger profits than smaller business at given unit costs, and he appreciates that the same principle applies when the electric company secures increased patronage. The customer feels, therefore, as he should, that he has earned the reduction in rate promised. Voluntary rate reductions offered without contingent responsibility on the part of existing and prospective customers, on the other hand, often leave the impression that past profits have been abnormal and the suspicion that the company could make far greater reductions under pressure if inquiry were seriously made into the reasonableness of its rates. In Milwaukee there has been an advantage in that the rate schedules of the company have been a matter of adjudication by the state commission in various cases and the rates have not been found to be unreasonable. Milwaukee customers, therefore, appreciate that the reductions are possible because of newly created economies to which they have, in part at least, contributed.

Probable Tendency to Long-Hour Use in the Future

While decreases in the maximum rate result in the short-hour user being carried at a lesser loss, it may be pointed out that this character of customer is gradually becoming of smaller importance. Under many systems of step rates the maximum rate is found to apply to all consumption during the summer months and the only benefit derived from the secondary or tertiary step is experienced during the longest winter months of December and January. In Milwaukee the customer who pays for all of his current at the primary rate is a rare exception. Under the Milwaukee company's residence room rate the primary or maximum



Curve showing the number of customers of The Milwaukee Electric Railway & Light Company in the city of Milwaukee and its suburbs as of Jan. 1 of each year from 1910 to 1917 inclusive. From the growth thus far it is estimated that the number of customers will in 1918 reach 50,000.

step applies to a load factor of about 7 per cent of the customers' demand and both the primary and secondary steps fall within a load factor of about 12 per cent of the customers' demand. As a result the great majority of the residence customers have the benefit of the secondary rate during every month of the year and the tertiary, or 2-cent step, during the late fall, winter and early spring seasons. A considerable number of customers now pay for some current under the tertiary rate during every month of the year. Due to the increased use of appliances and particularly through the development of electric cooking, it may be expected that an increasingly large proportion of the energy sold for residence use in the future will be paid for at the tertiary rate.

Influence of Density on Cost

It will be noted that the reductions made are in line with the cost of service. A considerable part of the cost of furnishing electric service arises from the cost of the distributing system necessary to reach customers scattered over a wide area. Few extensions of distribution systems are justified on the basis of an immediate return on the investment. They are built with a view that customers will be added and make them pay. The existing network of distribution lines constitutes by far the major item in the fixed charges of the cost of service. As a greater number of service connections is made, the density of business which is achieved has the effect of reducing the costs which justify high maximum charges. As these costs are reduced with increasing saturation of the territory, the customer is entitled to lower maximum rates. This is the principle upon which the Milwaukee plan of giving reductions in rates as the number of customers increases, has been worked out. As the rates are lowered the cost of electric service becomes more and more within the reach of the remaining customers not yet connected to the lines.

A factor of importance, of course, as regards future reductions, is the growth of the city and the effect, in the case of residences, of competing forms of illumination. If the population of the city is at a standstill, if it consists largely of vacant real estate which is not likely to be used for building purposes, the greatest reduction cannot be obtained. Likewise, if the service is to be divided by competing companies, the same low rates cannot, of course, be obtained as occur when the service is all supplied from one system.

In Part II of this article, which will follow in an early issue, will be given the details of how this plan has been carried out by the Union Electric Light & Power Company of St. Louis, Mo. This article will also give the gratifying results of eighteen months of experience with this plan at St. Louis.

State University Issues Bulletin to Educate Citizens on Electrical Matters

In line with its desire to be of use to the people of the State, the department of industrial and commercial service of the University of Oregon has just issued a 95-page bulletin entitled "Elementary Primer of Electricity for Light and Power Customers." This bulletin is being distributed free of charge by the University, which is located at Eugene, Ore.

The general purposes of this bulletin is to encourage the development and use of the water-power resources of the State.

The bulletin is presented in non-technical language and is reputed to be the first extensive attempt on the part of a State to educate its citizens on electrical matters. The bulletin is not committed to any cause and was prepared as an educational effort. There are many examples and diagrams calculated to indicate, especially to rural residents, the principles of electricity, types of rates, reasons for various types, and other economic features of the electrical business.

Among the matters taken up in the various chapters are definitions of electrical units, analogies between electric power and man power, fixed and variable charges, effects of load factors, types of power and lighting tariffs, and rules and regulations of the public service commissions. There is a complete chapter on electricity in the home, covering lighting, heating, cooking and general appliances.

Getting the Business in South America

Ways and Means of Starting and Developing Trade in the Large South American Markets, Where United States Manufacturers Now Have an Opportunity

BY A. H. KELEHER

A MANUFACTURER who desires to get business in South America, but who has had no previous experience in that market, should first find out whether there is a demand for his product. He can do this by calling on export agents and commission houses in New York City. He can find out what the probable volume of demand would be and how his material must be changed and adapted for the South American market.

However, any manufacturer who has material which would meet with ready sale in South America ought to be in that market already. If he is not, then either his material is not suitable for sale in South America or there is some broad controlling reason why he does not wish to sell there.

If the manufactured product is good and the prices are reasonable, there are men who are looking for good material all the time. Such men would have worn a path to the factory before now. There are manufacturers who have material which is salable in South America, but who do not wish to sell it there. I know of a well-known manufacturer of electrical glassware who gets so large a business in North America that he is not interested in South American prospects.

After a manufacturer has found for himself whether there is a demand for his material in South America, the question of the volume of sales he can make should decide the methods which he will follow in entering the market. He could either send his own man direct, give his agency to a manufacturer's export agent who travels for allied lines in South America, or merely solicit business through the New York commission houses that are constantly in the market for such material as he produces.

COMMISSION HOUSE ARRANGEMENT

If a manufacturer is working on a very small capital it would be better for him to make some arrangement with a commission house because he will be paid cash in New York for his material. But in exchange for this security of payment he will get a minimum amount of business. This might be a good way to begin. I have known manufacturers who began in this way and after their business became developed to a certain point gave the agency to a manufacturer's agent.

A manufacturer's agent is in a much better position to specialize than a commission house that sells anything from needles to haystacks.

Only very large firms that make material which is in great demand in South America and that are in a position to compete with the world should send their own men to South America, for otherwise expenses would be too heavy for the volume of business secured.

If a manufacturer sends his own salesmen, he is confronted with the problem of securing a good man, one who speaks Spanish and Portuguese and is gentlemanly, diplomatic and tactful. It is difficult to get such men in this country.

A manufacturer should advertise his products in South America. Usually manufacturers claim that they cannot afford to advertise there. I have known manufacturers who are tremendous advertisers in this country but who were unwilling to do very much in South American markets. This is to be regretted; I have always claimed that advertising pays double in South America. In the Argentine, for instance, the people are peculiarly receptive to advertising. Rates in the principal magazines and newspapers, of which there are many that are good in South America, are extremely reasonable. If a manufacturer has a special trade mark he can make it known by constant advertising and afterward it will have preference over any other brand in the Argentine. I have in mind particularly one popular American electrical article in the Argentine and Brazilian markets. Three years ago people talked price only but now in many cases they demand this article by its trade name.

In order to succeed, a manufacturer must have not only a good selling agent, but he must have also a good export manager imbued with the export idea. To illustrate this point, the export manager for a large American manufacturer is one of the cleverest in the business. He has made this reputation in three years. He not only has a successful South American business but he has expanded his export trade throughout the world. He has the export idea developed to its highest extent. With such a man at the head of the export department, success cannot be denied. In the same line of electrical material I know several other manufacturers who are getting little or no business in South America. I do not believe that they have "the export idea."

ADAPTATION IS NECESSARY

In order to develop trade an American manufacturer should use "adaptation" for his motto. By this I mean that he should adapt his languages, methods and articles to the needs of the people with whom he is to deal and in doing this he should have a different adaptation for each country.

In a great many respects, Brazil should be treated differently from Argentine. For instance, many manufacturers do not attach the proper importance to the difference in languages in Brazil and Argentine. A manufacturer should get out a small Portuguese catalog for Brazil and a Spanish catalog for all of the rest of South America.

What steps other than the securing of representation is it necessary for the manufacturer to take—that is to say, in the way of obtaining licenses for the traveler, shipping connections, provision of an export organization at the home office, study of credit and exchange, training of employees, special methods of packing, etc.? It is scarcely worth while to go into detail on these questions because they are so simple and they cease to become problems as soon as you get a good person or firm to take up the representation in South America.

As to how long it will take a small manufacturer to develop a market for his products in the principal South American centers, that depends, of course, on the value of the selling proposition. If the material is good and the prices are right and the export manager has the export idea and the selling agent is a good one, three years will bring very good results. There should be no expense to this if the proposition is a sound one; that is, if the expenses are carried over three years. One manufacturer of electrical glassware made his expenses during the first year and in the next two succeeding years made good profits.

In one respect, the present is an opportune time for a manufacturer to enter the South American markets and in another respect it is an inopportune time. This is our opportunity because our most intelligent competitor, who lives in Europe, is otherwise engaged, leaving the market for us. It is inopportune because it offers us an opportunity for getting a very bad reputation for giving poor service and poor delivery. I refer to conditions which exist whereby an American manufacturer receives an order for a shipment to a South American country, and due to the fact that his domestic business is so flourishing, takes from six to eight months to make deliveries in South America. The American manufacturer is getting an unprecedented amount of business from all parts of the world, and he is making many mistakes in his export trade. European manufacturers are making capital of this condition. Many South American customers state that they will take their business away from us immediately after the war because of the poor way in which we handle it.

Finally, conditions have improved in South America during the last two years. But, due to many reasons, they are far from normal at the present time. However, there have been very few losses during the last year, and in general it is quite safe to do business with the average South American importer because he is extremely honest. He is, therefore, entitled to credit, his demands in this respect usually being ninety days.

Is the Central Station Customer "Always Right"?

An Answer Based Upon an Ohio Company's Twelve Months' Experience with Its New Bureau of Adjustments

By Frank Wert

Mahoning & Shenango Railway & Light Company, Youngstown, Ohio

BELIEVING that the customer with a complaint, and the company itself should have a common meeting place, the Youngstown (Ohio) central station one year ago established its Bureau of Adjustments, creating also in this way an agency for the reparation of errors, for the adequate explanation of misunderstandings, and for making plain the simplicity of some of those processes which appeal to the uninitiated public as deep mysteries.

In the following paper, read before the meeting of Ohio new-business managers at Toledo last week, Mr. Wert recounts the experiences of twelve months' operation of the bureau, and expresses his belief that the customer *is* always right till it is proved otherwise.

FOR many years the affairs of public utilities were looked upon, both by those within and those without, as something apart from ordinary businesses; but that is no longer so. More and more successfully are the men engaged in this line of endeavor forcing recognition of the fact that the central station is properly a business, and that the service the central station sells is strictly analogous to the goods on the merchant's shelves; the uses in which the kilowatt-hour are consumed parallel those of food, or coal, or clothing in the household; the effect of economic conditions, of labor costs, of prices of materials, on production costs, prices to the consumers and profits of the central station are no whit different, broadly speaking, than the effect of these forces on any other industrial or commercial enterprise.

If these statements are true, and I believe they are, then the application of mercantile methods to the business of the central station in its transactions with its patrons is proper. If "the customer is always right" in the retail dry goods store, is he not always right in the electric light company's office?

Respects in Which Our Business Is "Different"

On broad, general grounds our business is similar to that of any merchant, but, of course, in a more restricted sense there are distinct differences, and several of them have direct bearing on the relations of the companies to the consumers. In the first place the customer is not thoroughly conscious of the delivery of our commodity for his consumption. The grocer's boy makes his rounds and leaves substantial evidence, in the form of coffee, sugar, flour, potatoes, of the fact that something has been bought and must be paid for. The delivery of electricity is silent, unseen, and coincident with the desire to use it. There is no consciousness on the part of the customer of receiving something before it possibly can be put to use. The only concrete transaction is the receipt of the bill long after the service has been thus insensibly used.

Secondly, the means of measurement is not such as is to be possessed personally by the consumer or to be checked and verified readily by him. Kitchen scales, yardsticks and quart measures may easily be employed to give assurance that full quantities are being received; but we do not have electric meters stowed away in the cupboard to be brought forth and used at any time we may feel that the amount of electricity being used and the amount being paid for vary. The nearest approach in form to the electric meter in common use, perhaps, is the watch, but even here the owner may stop at any jeweler's window and ascertain for himself just how much, if any, his timepiece departs from the standard.

In the third place the customer of a public utility cannot, usually, change from one dealer to another at will. He forgets, perhaps, that this lack of competition for his trade is more than made up by regulation by public utilities commissions and that this is a surer safeguard for the consumer than unregulated competition. This probably accounts in a measure for the fact that many patrons of a public service corporation will not accept as axiomatic that its business properly should be considered on the same plane as that of a department store and therefore that some will descend to practices, which, if directed toward any merchant, would be admittedly, even in their own minds, cheating and theft.

If you accept these statements as approximately correct, then, is it not even more important for the central station than for the department store to provide a common meeting place for aggrieved patron and company; to establish an agency for making reparation for errors; to assure adequate explanation of misunderstandings,

nd to make plain the simplicity of some of those rocesses which appeal to the uninitiated as deep mys-eries?

It seemed so to our company and a little more than a ear ago we established what we call the "Bureau of djustments." We avoided the designation of "Com-aint Bureau," for we did not want to give the impres-on that a patron must "kick" to get a hearing. "Come and talk it over with us and let us both see whether e cannot find out what is wrong" was the gist of our nvitation to our patrons.

Immediately, of course, arose the question: "Is the ustomer always right?"—for, despite the fact that the usiness house, which promulgated the pronouncement hat the customer is always right, has repudiated the es-ence of that slogan, the thought has taken its place mong the rules of business and the question of just ow far the customer shall be considered right must be nswered if the sharp corners in the relations between uyer and seller are to be blunted and smoothed.

Our conception of a Bureau of Adjustments led us o make it independent of the jurisdiction of the ac-ounting and treasury departments, against which the rievances of customers naturally would be directed. We wanted to be in a receptive mood and we did not want to be too greatly handicapped by an affectionate egard for methods of doing business which might come nder the fire of patrons. We wanted to find out to hat extent rules and customs proved irksome to our onsumers. But above all we wanted to find out just ow far the customer must be considered right, and herefore we wanted a sort of intermediary between the omplainant and the defendant department.

In the year just closed the bureau received 1482 com-laints. Of this number 635, or 42.8 per cent, were ettled in the bureau without the necessity of reference o the departments affected. The remaining 847 were eferred to one or more departments for information, nvestigation or advice. Of the whole number 67 per ent, or approximately 1000, were from consumers of ectricity.

Nearly one-half of these complaints, or to be exact, 35, were based solely on the contention that the "bill as too high," while 227 challenged the accuracy of the illing, leaving something more than 300 for the vari-us other grounds for grievances. Fully 75 per cent of he cases affecting the electric department revolved di-ectly around the question of how much money was due he company.

And out of those 746 cases only one complainant ex-ressed the fear that his bill was too small. When our upervisor of adjustments heard that man's story he hrew his arms around him and wept on his shoulder.

Some of the Incidents

A man whose bill normally should be about $3.50 ame in to complain of a bill he had just received for 14. He had been a steady consumer and his account howed only the seasonal fluctuation. His meter read-ng was found to be absolutely correct and his meter roved on test to be 99.9 per cent accurate. His instal-ation revealed no cause for a sudden increase in con-umption. Furthermore the check reading showed that is use of electricity had returned to normal.

Was that customer right in his contention that his ill was too high? One hundred and fifty more units han usual had passed through his meter. Of that there as no doubt. Whether a ground that had burned off s an acceptable explanation or not, it appeared certain hat this customer had had no use of those 150 units nd our bureau took the view that he was right and ave him credit accordingly.

Within a few days another customer presented an lmost similar case, apparently. His bills seldom had gone above $1.50, but this time it called for $13.65. He was sure he had not used the current.

"Have you been using an electric heater?" he was asked.

"Oh, yes," he replied. "My wife and I think it is very pretty and we let it on all night."

He freely told how long and for about what hours he had used this device. The result in watt-hours, and kilowatt-hours was figured out for him and his parting comment was: "That's one on me."

Again a man came into the bureau who had consist-ently been receiving a minimum bill. This time the bill called for $1.01, or 1 cent more than he had previously paid.

"It's not the cent," he explained, "but I don't intend to pay you more than is coming to you."

His account for some months back was gone over as carefully as though the amount involved was of real consequence and the principle of the minimum charge and the measurement of current was explicitly ex-plained. He was satisfied about that cent, but he made another startling discovery. He usually had not con-sumed as much current as he could have done and still have paid only a dollar. This fact impressed him and he announced that he did not intend to let anything like that get by him again. He would buy an electric iron and use up his full dollar's worth each month. We were satisfied, for we felt sure that he had taken himself out of the dollar class for good and all.

Is a Customer Right When He's Wrong?

But the question remains, were these customers right? Did they have a real grievance? We feel that in these cases and in innumerable others which might be cited, the customer in his own mind was absolutely convinced that he was right. The grievance actually existed and the fact that it could be removed by explanation made it no less real than if a refund had been necessary to make reparation.

That the removal of such grievances is important I believe is demonstrated by the fact that only a negligible number of our customers have returned after they once have received a full explanation which has satisfied their doubts and suspicions. It is not hard to satisfy a com-plainant when a real error is found; it is only when the error is in their own understanding that the problem is difficult. To aid in this work our bureau uses charts showing the varying hours of darkness and daylight, a board equipped with lamps of varying sizes and glass-incased meter and similar devices.

Naturally, when a customer goes beyond the mere assertion that his bill must be wrong and tries to sup-ply a diagnosis, he turns to the meter. Either, he de-cides, it must be "fast" or else the reader was careless.

To the average customer the meter is a mysterious thing. He is apt to conjure up all sorts of weird things that the meter can do or that can be done to the meter. Some of them go so far as to think that the meter should be eliminated as wholly undesirable, and install "jump-ers" as their solution of the evil.

Our own idea of a solution is somewhat different—it is to rob the meter of its mystery and not the company of its income. Our bureau never misses an opportunity to explain the working of the meter and the manner of reading it. These explanations are made with the meter in the bureau's office, lamps of various sizes are placed in action, the consumer is asked to count the revolutions of the disk and to compute the consumption and a book-let is given to him explaining how the meter should be read.

"That's all right with your meter here in the office," said one skeptic, "but how about mine at home?" That's the one that's fast."

"But, my dear man," was the reply, "I am telling you

all this so that you can do the same thing at home." And then for the first time, his suspicion showed signs of giving way.

"Do you mean," said another as he received the explanation and the booklet with spaces for him to mark his meter readings, "that you are willing that I should read that meter?"

"Of course," he was told. "We are anxious to have all of our customers able to read their meters."

"Well, if that is the case," he came back, "what is the use of my doing it?"

A Good Memory Will Help Prevent Repeated Impositions

There are other classes of complaints which are a bit more difficult. Every month in the last year we have had one or more complaints based on the allegation that the demand rating was wrong. Out of twenty-one such cases one allegation was well founded. Every other one was based on the mere fact that the next door neighbor, whose house "is just the same size and who burns more light than I do," had a lower rating.

Every month also we have had people demand the discount privilege after the discount period had expired. This class of complaints has revealed quite a percentage of complainants who are not right and furthermore who apparently know that they are not right. What they want is a special privilege, an exception in their case. It is difficult sometimes to convince them that the improper granting of a discount would be discriminatory and therefore illegal. Sometimes they admit cheerfully that the rule should be enforced against all but themselves.

One man claimed the discount on the ground that his bill had not been mailed to him. The case was investigated and doubt as to whether the bill had been mailed was aroused. The customer was assumed to be right, his version was accepted and he received the benefit of the discount.

Seven or eight months later he came again. He had mislaid his bill and had forgotten to pay it. He would be gratified, he said, to receive the benefit of the discount. He was not gratified, and furthermore our assumption that we had done the just thing some seven months before was shaken. Apparently this customer was far from right.

Another customer claimed the discount, saying that five days before the discount period expired his house had been quarantined and that therefore he had not had a chance to avail himself of the discount. Of course he could have paid the bill in the early part of the discount period, but—well, the doubt was resolved in his favor and he certainly felt that nothing more than justice had been done him.

The Customer Is Right Until He Is Proved Wrong

We do not feel that our thirteen or fourteen months of experience and observation have found the absolute answer to "Is the customer always right?" but it has led us to certain definite conclusions with regard to our relations with our customers.

We have invited all our patrons to come to us with any misunderstanding or grievance. Every bill carries that invitation and so does every transfer issued on our railway lines as well as occasional newspaper advertisements. We have made 145,000 meter readings and issued approximately as many bills in the last twelve months and 1000 electric customers have made complaints, though many of them have been little more than inquiries. On the basis of these separate transactions with our customers there thus has been less than seven-tenths of 1 per cent of complaint, perhaps less evidence of dissatisfaction than sometimes might be expected.

Among these complainants there have been very few who avowedly have remained dissatisfied. For the most part the efforts of the adjusters have been successful and those who voluntarily have expressed appreciation of fair treatment have far outnumbered those who have refused to be mollified. Some, when the light of understanding has dawned upon them, have asked pardon for needlessly taking up our time, while others have come back with the statement that "you straightened that other matter out so nicely for me that I thought I would ask you to look into this also."

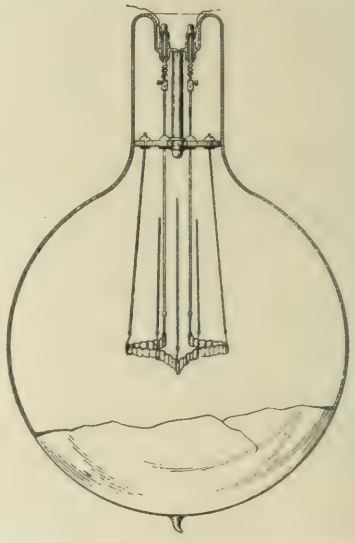
We have noted only a comparatively small number of cases in which it was evident that the complaint was made in bad faith. In nearly every case the grievance is real and convincing in the mind of the complainant or else he would not come near us. True, some of them feel that they must "stand up for their rights and fight" but when they find that they not only are welcome, but that they may tell all that they feel and then they are questioned for further details, they usually lose this combative feeling and are willing to discuss their grievances as business matters.

We started our Bureau of Adjustments on the basis that each grievance is real, is truly presented and must be heard in that spirit. It cannot be heard in any other spirit, if good is to be accomplished. As former President Taft put it in a recent address: "You cannot convince a man if you base your arguments on the assumption that he is a fool."

Our answer then to the question "Is the customer always right?" in so far as we can give one, is that the customer is always right till it is proved otherwise.

Incandescent Lamp with Ribbon Filament

Frederick G. Keyes discloses in patent No. 1,206,333 a method of increasing the light-giving quality of tungsten filaments by forming the latter into crimped ribbons. Naturally the potential has to be diminished in consequence, whereas the current rises to from 3 to



RIBBON FILAMENT TUNGSTEN LAMP

50 amp. A further evident advantage is that the filaments are less fragile than those in ordinary commercial use. In this way lamps of exceedingly high candle-power are obtainable without visibly shortening the life of the lamps. The patent has been assigned to the Cooper Hewitt Electric Company of Hoboken, N. J.

Features of New Jersey Company's New Station—II

Arrangements Made at the Essex Station of the Public Service Electric Company for Providing Continuous Excitation and Assuring Reliable Operation of the Station Auxiliaries

By P. H. Chase

Member of the Engineering Department of the Public Service Electric Company of New Jersey

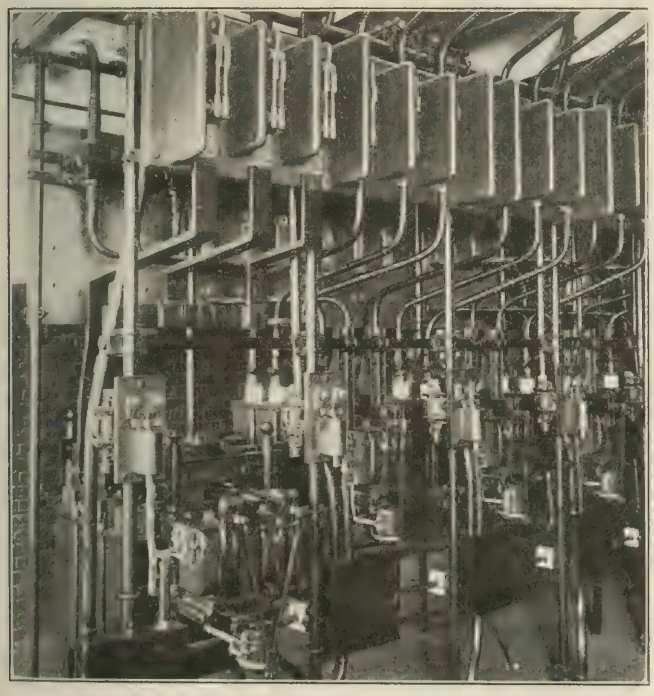
In the last issue of Electrical World were described the general layout of the Essex station, main electrical connections, switching and protective schemes, type of control and high-tension testing equipment. This article deals with the arrangements for successively connecting independent sources of excitation energy, assuring the operation of the plant auxiliaries, signaling and communicating between departments and illuminating the station.

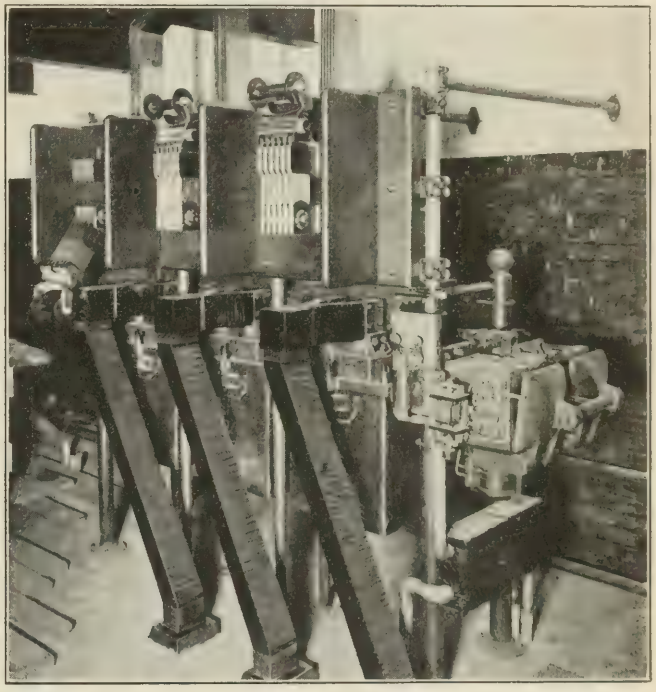
Provisions for Assuring Reliable Excitation

Regular, emergency and spare excitation is furnished so there is little possibility of interruption to service due to excitation. Regular excitation is furnished by the shunt-wound exciters directly connected to the generators, thus trouble with the excitation of one unit cannot affect the other units except through its effect on the 13,200-volt buses. Trouble with the excitation of a generator, however, will automatically cause the substitution of the emergency supply. Emergency excitation is obtained from a 250-volt exciter battery located in the switch house, to which the field of any generator can be connected, either automatically or by the switchboard operator for a short time, until the spare excitation supply is made available. Spare excitation is obtained from the 150-kw. shunt-wound, motor-driven exciter in the turbine room, which may be started up, connected to any generator field, and wholly controlled by the switchboard operator to take the place of the faulty direct-connected exciter.

In case the voltage across the generator field drops to a low value, a low-voltage relay instantly closes a circuit breaker connecting the exciter battery to the generator field and causing the direct-connected exciter circuit-breaker to open from reverse current; thus the effect of trouble on the direct-connected exciter is quickly eliminated automatically. While the emergency battery is carrying the load temporarily the operator can start the spare exciter, parallel it with the battery and then disconnect the battery. The latter will then be in readiness for trouble on another generator field. The spare exciter control connections are arranged so that they may be transferred to the panel controlling the generator which it is exciting.

A contact-making voltmeter is provided for maintaining the exciter-battery voltage near that of the direct-connected exciters so excessive voltage fluctuation will be avoided when a generator is suddenly connected to the battery. The end-cell switches are in duplicate to permit charging the battery at the same time it is discharging, as well as for interchangeability. The battery is designed to supply 900 amp. at 250 volts for thirty minutes, which is sufficient to excite one 25,000-kva. generator at full load for over one hour, or two generators for one-half hour.





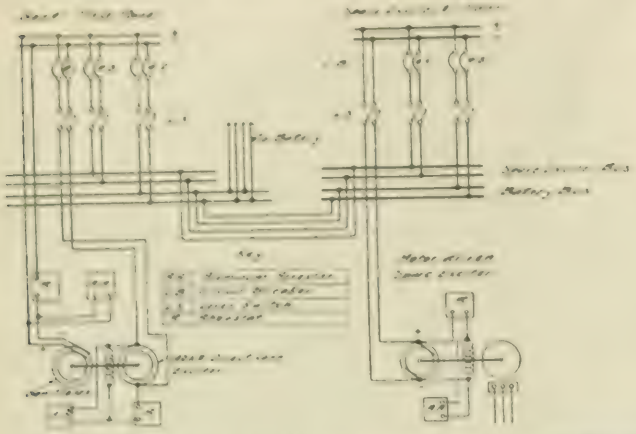
FIGS. 1 AND 2—SECTION OF HIGH-TENSION STATION-SERVICE SWITCHING APPARATUS AND TRANSFORMER SECONDARY SWITCH

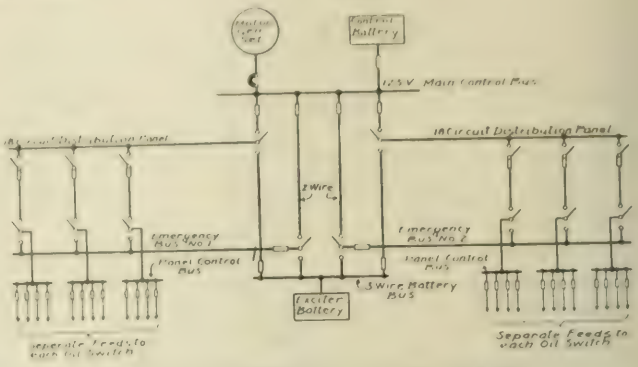
Aluminum-cell arresters are connected across the field terminals of each generator to absorb the "inductive kick" or rise in voltage resulting from short-circuits on the high-tension windings and disturbances in the field circuit. Others are also connected across the fields of the exciters to prevent reversal of polarity. This novel application of aluminum-cell arresters has proven much superior to the usual discharge resistance by protecting the field against high voltages and by simplifying connections.

Features of Station Power System

Since electricity is used to drive many of the boiler-house and turbine-room auxiliaries in addition to furnishing station lighting, maintaining the integrity of

the station power system is second in importance only to that of the control system. Consequently a very complete scheme of main and relay connections is provided to minimize and restrict power service interruptions. A voltage of 440 was selected on account of the greater safety afforded the station force than with 2400 volts.





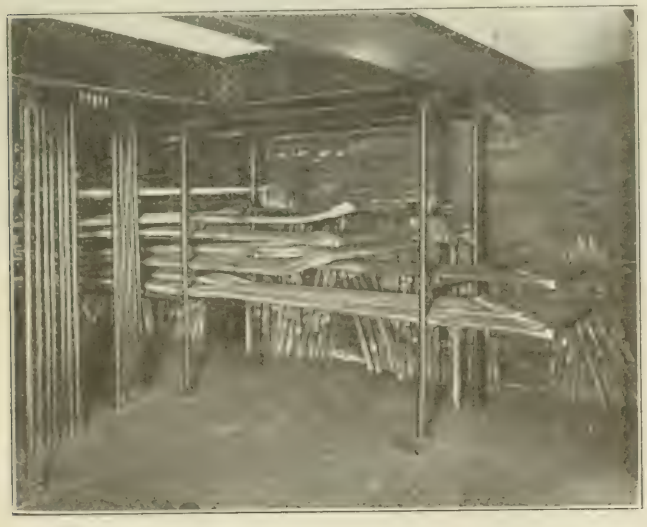
FIGS. 3 AND 4—ARRANGEMENTS FOR EXCITING TURBO-GENERATORS AND FOR ENERGIZING CONTROL SYSTEM

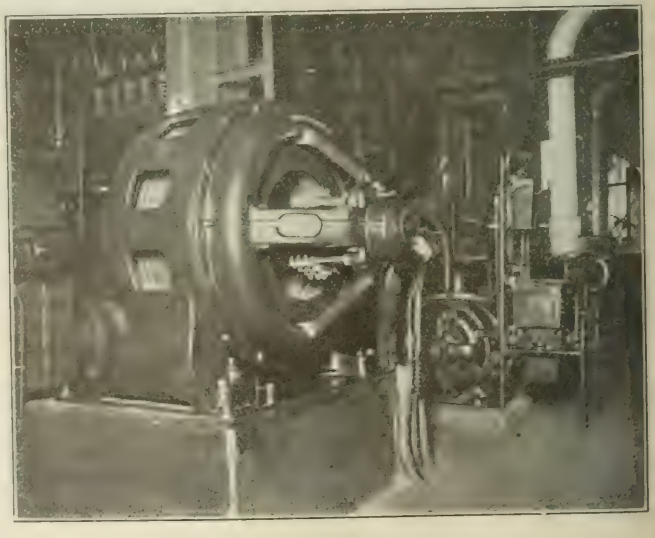
and also on account of the great saving in cable and bus investment compared with 220 volts. Where required, variable speed control of motors is obtained either by changing the motor winding connections or by secondary resistance. Close speed adjustments are obtained by mechanical means.

Control equipment for the station-service apparatus is located on the first and second floors of the switch house. The switchboard on the second floor controls the station power and lighting equipment and exciter battery charging, partly duplicating the service of one of the boards in the main control room.

The station power system is supplied at present by two 3000-kva. 13,200/400-volt water-cooled transformers, one being a spare. A third unit will be installed this year, space being provided in the switch house for a total of four 3000 kva. transformers. The transformers are supplied from the 13,200-volt buses through the feeder oil switches, and the 5 per cent reactance coils. Provisions have been made to serve them directly from the tie feeders from other stations in case of emergency. The transformers are equipped with water-flow indicators and thermometers, which operate an alarm in case a transformer in service has no cooling water or becomes overheated. On account of the large connected horsepower in motors, the load on the station power system even with the present installation is considerable and the ultimate load will be about as large as that now carried as commercial load by the company's largest sub-station.

The wiring layout for the station power circuits is shown in an accompanying diagram. The transformer secondary leads and the 440-volt buses consist of six 0.25-in. x 5-in. copper bars per phase. On account of their great weight and the tremendous mechanical forces which may result from short-circuits on the 440-volt system with so much generator and transformer capacity, the bus bars are ruggedly supported. The transformer leads and the tie bus are carried on double supports and covered where possible. The group buses are inclosed in a concrete structure with doors and are mounted on supports bracing them three ways. All of the oil switches are electrically operated. From the 440-volt feeder switches in the switch house, power is distributed directly to the individual motors or to local distribution centers from which the motors are supplied. One direct-power feeder is provided for the two motor-driven auxiliaries for each turbine—a circulating pump and a dry vacuum pump. An emergency feeder for each dry vacuum pump is obtained from the feed to another unit.





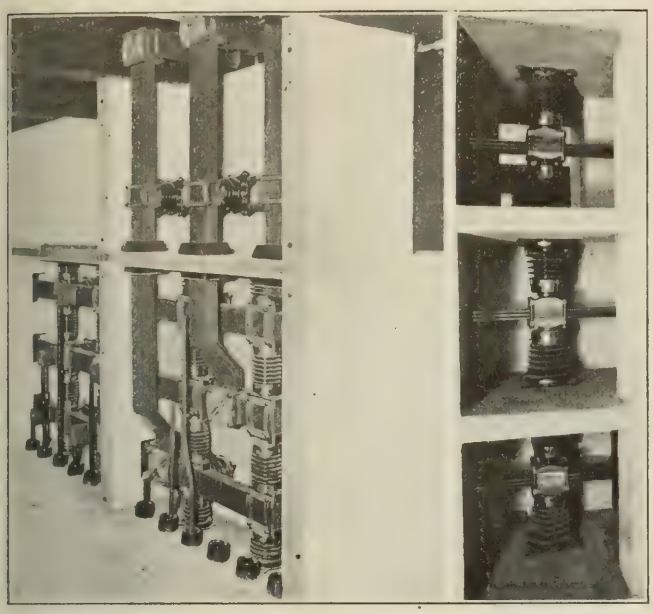
FIGS. 5 AND 6—PORTION OF CONDUIT ROOM UNDER CONTROL ROOM AND SOME MOTOR-DRIVEN AUXILIARIES INCLUDING A CIRCULATING PUMP

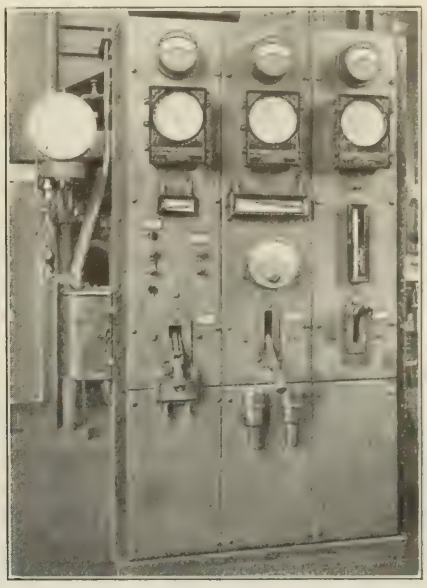
The power-distribution system for the boiler house required particular attention on account of its importance and the large loads. The power-distribution center for the equipment in the first section of the boiler house is located on the north or river side of the boiler-house basement. Provisions will be made for a similar

distribution center in each of the two future sections, and for four large main feeders from the switch house 440-volt power buses to each of these centers. Each of these feeders consists of three 500,000-circ. mil. three-conductor cables.

Power is distributed from the boiler-house distribution center, through electrically operated oil switches, either to individual motor feeds or to distribution panels from which several motors are supplied. The air compressor and the fire pump have individual feeds. The oil switches for these panels are controlled from the boiler-room engineer's office. Individual switchboards are mounted near each boiler. From these panels are controlled the respective group oil switch and the switching equipment for the stoker, forced-draft and induced-draft motors. Indicating and recording meters are also mounted on these panels to give steam flow, draft, temperature, motor current and stoker shaft speed. Many valves in the steam and water piping are motor-operated to permit rapid remote control of valves in emergencies. They are also supplied from the exciter battery. Control is obtained by double-throw lever switches or controllers, with indicators to show the position of the valves. The control for all motor-operated steam valves in the boiler house is also located in the boiler-room engineer's office. A controller permits operating the stoker-drive motor at four speeds, while a throw-over oil switch allows the forced draft blower motor to be run at two speeds.

It is apparent that the reliability of the power service throughout the station depends very largely upon the methods used for protecting the transformers, group buses, main feeder oil switches, distribution centers and branch circuits against interruptions. The power transformers are equipped with instantaneous differential relays which will open both the 13,200-volt primary oil switch and the 440-volt secondary oil switch only in case there is a short-circuit in the transformer or in its primary or secondary leads. Each 13,200-volt primary oil switch is equipped with an overload relay with a high time setting to clear any trouble which has not been cleared by the various 440-volt oil switches. The 440-volt tie-bus oil switches are equipped with inverse time overload relays so that a severe short-circuit on





FIGS. 7, 8 AND 9—ARRANGEMENT AND SUPPORT OF 440-VOLT BUSES AND TYPE OF BOILER CONTROL PANEL

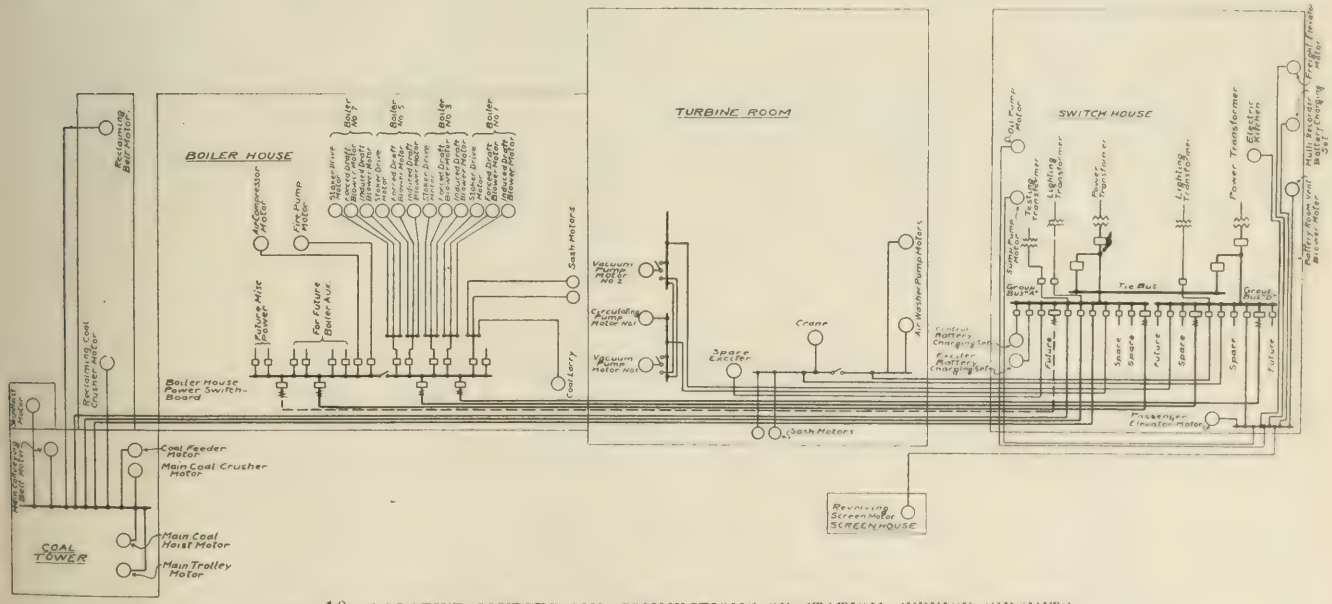


FIG. 10—RELATIVE COURSES AND CONNECTIONS OF STATION-SERVICE CIRCUITS

TABLE I—ELECTRICAL EQUIPMENT OF COAL TOWER AND BUNKER

Equipment	Type	Rating	Operating Condition	Manufacturer
1 hoist engine	Two-drum	24-in. drums, 200 r.p.m.	240 tons per hour	Maine Electric Company
1 H. T. motor	Induction	110 hp., 200 r.p.m.	Direct connected to engine	General Electric Company
1 traversing engine	Single-drum	30-in. drum	Gear-driven motor	Maine Electric Company
1 T. T. motor	Induction	75 hp.	Constant speed	General Electric Company
1 feeder	Apron	5 ft. wide, 16 ft. long	Gear-driven motor	Stephens-Adamson Mfg. Company
1 feeder motor	Induction	7.5 hp.	Constant speed	General Electric Company
2 crushers	Two-roll	36-in. by 36-in. rolls	Gear driven motor	Robins Conveying Belt Company
2 crusher motors	Induction	35 hp.	Constant speed	General Electric Company
1 conveyor	Belt	30-in. by 161 ft. long	300 tons per hour	Robins Conveying Belt Company
1 conveyor	Belt	30-in. by 120 ft. long	200 tons per hour	Robins Conveying Belt Company
1 conveyor motor	Induction	20 hp.	Constant speed	Westinghouse Electric & Manufacturing Company
1 conveyor motor	Induction	10 hp.	Constant speed	Westinghouse Electric & Manufacturing Company
1 automatic skip hoist	Balanced	2-ton buckets	100 tons per hour	Maine Electric Company
1 skip-hoist motor	Induction	25 hp.	Constant speed	General Electric Company
1 elevator	Electric freight	7.5-ton	50 ft. per minute	H. J. Reedy Company
1 elevator motor	Induction	10 hp.	Constant speed	Lincoln Electric Company

a feeder of one group will trip the tie-bus oil switch for that group bus and thus not affect the other tie-bus oil switches. All the 440-volt feeders are protected by inverse definite-time overload relays so adjusted that in



FIG. 11—ARRANGEMENT OF STORAGE BATTERY CELLS AND END-CELL COPPERS

case of a severe short-circuit the tie-bus oil switch for that group bus will open first, isolating that group bus. The feeder oil switch will therefore rupture only the short-circuit current from one transformer, instead of three or four. Differential relays are also connected to current transformers at each end of the boiler-house feeders so they will isolate a feeder in case there is a short-circuit thereon. All of the boiler-house branch circuit oil switches are protected by inverse-time overload relays. Protection against short-circuits in cables supplied from distribution panels is obtained by overload fuses, while overload and low-voltage protection at the motors is obtained by the usual starting compensators, oil switches, or contactors.

Watt-hour meters and ammeters are provided throughout the station in the circuits of the various turbine-room, boiler-house and coal-tower motor-driven auxiliaries to enable the operating department to check their operation. On account of the large number of meters required and the balanced loads on the motors, single-phase watt-hour meters with "Y-boxes" are used.

Arrangements for Illuminating Station

The lighting system, which is 250-125-volt three-wire, is regularly supplied from two 200-kva. single-phase transformers, fed from the 440-volt 60-cycle power buses. Provision is made for a third transformer. In emergencies direct-current energy may be supplied from the exciter battery. The regular lighting makes up about four-fifths of the total lighting throughout the station. From the main lighting buses, main feeders are run in duplicate to each lighting-distribution panel, thence branch feeders are run to each panel board.

Emergency lighting makes up the remaining one-fifth of the lighting. As long as there is proper voltage on the main lighting buses, one set of contactors is closed,

TABLE II—PRINCIPAL ELECTRICAL EQUIPMENT OF BOILER HOUSE

Equipment	Type	Rating	Operating Condition	Manufacturer
8 stokers	Underfeed	16 retort 15,000 lb. coal per hour	Continuous dumping	Sanford Riley Stoker Company
4 Reeves transmissions		Class F, No. 6½	Variable speed	Reeves Pulley Company
8 stoker motors	Induction	12hp.	Four speed	General Electric Company
8 forced draft blowers	Turbovane	60,000 cu. ft. minute	Two-speed, motor driven	B. F. Sturtevant Company
8 F. D. B.-motors	Induction	150 hp.	Two-speed	General Electric Company
8 induced draft fans	Multivane	106,000 cu. ft. gases 400 deg. F.	Constant speed, motor driven	B. F. Sturtevant Company
8 I. D. F.-motors	Induction	100 hp.	Constant speed	General Electric Company
1 fire pump	Two-stage centrifugal	1,000 gal. per minute	110 lb. total head	Lea-Courtenay Company
1 fire-pump motor	Induction	100 hp.	Constant speed	Westinghouse Electric & Manufacturing Company
1 air compressor	Straight line	225 cu. ft. per minute	100 lb. pressure	Ingersoll-Rand Company
1 alternating-current motor	Induction	75 hp.	Constant speed	Westinghouse Electric & Manufacturing Company
2 service pumps	Single-stage	500 gal. per minute	110 lb. total head	Lea-Courtenay Company
2 S. P. turbines	Horizontal	22 hp.	190 lb. gage, 150 deg. superheat	Westinghouse Electric & Manufacturing Company
1 air compressor	Straight line	100 cu. ft. per minute	100 lb. pressure	Ingersoll-Rand Company
1 alternating-current motor	Induction	15 hp.	Constant speed	Westinghouse Electric & Manufacturing Company
2 coal larries	Weighing	15-ton	Motor driven	Robins Conveying Belt Company
2 ash locomotives	Electric storage battery		Storage battery	Westinghouse Electric & Manufacturing Company
1 charging equipment	Motor generator	15 kw.	For electric locomotives	General Electric Company

TABLE III—MAIN ELECTRICAL EQUIPMENT OF TURBINE HOUSE

Equipment	Type	Rating	Operating Condition	Manufacturer
generators		25,000 kva.	13,200 volts, three-phase, 60 cycle, 1800 r.p.m.	General Electric Company
turbines	Curtis-horizontal	25,000 kw., twelve-stage	190 lb. steam, 150 deg. superheat	General Electric Company
condensers	Two-pass surface	32,000 sq. ft., 255,000 lb. per hour		Westinghouse Electric & Manufacturing Company
exciters	Direct connected	100 kw., 250 volts compound wound	Operated as shunt machines at 1800 r.p.m.	General Electric Company
exciter	Shunt wound	150 kilowatts, 250 volts	Reserve equipment	Allis-Chalmers Mfg. Company
exciter motor	Induction	220 hp., 1175 r.p.m.	Reserve equipment	Allis-Chalmers Mfg. Company
circulating pumps	Horizontal-centrifugal	24,000 gal. per minute, 43 ft. max. hd.	Motor driven	Westinghouse Electric & Manufacturing Company
C. P. motors	Induction	350 hp.	Constant speed	Westinghouse Electric & Manufacturing Company
air pumps	Le Blanc	37.5 cu. ft. free air per minute	Motor driven	Westinghouse Electric & Manufacturing Company
air pump motors	Induction	100 hp.	Constant speed	Westinghouse Electric & Manufacturing Company
crane	Electric traveling	100 ton, 94 ft. span	2-50 ton, 1-10 ton, hooks	Morgan Engineering Company
air washers	Spray system	60,000 cu. ft. air per minute	Motor driven pumps, 10 hp.	Spray Engineering Company
oil pumps	Centrifugal	3-in. 150 gal. per minute	Motor driven	Lea-Courtenay Company
oil pump motors	Induction	7.5 hp.	Constant speed	General Electric Company

onnecting all the emergency lighting system therewith. Iowever, when the voltage drops below this value, this et of contactors opens, and another set instantly closes, onnecting the emergency lighting system to the exciter attery. As soon as the voltage on the main lighting uses rises again, the second set of contactors opens and he first closes again. Thus the emergency lighting system insures that there will be at least some lighting hroughout the station, however serious any interruption may be.

Indirect lighting fixtures are used in the control room nd offices. In the control room, provision is made to onnect part of the lights to the control battery in case f very serious trouble to the lighting system. The urbine room has large ornamental 500-watt tungsten racket fixtures on the pilasters and 200-watt units on he roof trusses. The lighting effect is pleasing, as ray brick with white and green brick for trim are used n the walls. Large tungsten units are used in the oiler house.

Signaling and Communication System

Very complete signaling and communicating systems re provided to keep the switchboard operators in close ouch with the load dispatcher, turbine room and boiler ouse. To notify the operators in case of opening of il switches, grounds on feeders and other operating roubles, annunciators and a bell common to all have een connected with each class of electrical equipment. The signaling system includes a switch on each generator panel in the control room controlling signals on a large illuminated sign in the turbine room and duplicate signals on the individual turbine signal stands. A turbine-room whistle is automatically sounded with each signal from the control room. On each turbine signal stand is a switch for return signals to the control room and for signaling to the pump attendant in the turbine-room basement. The operator in the control room can also indicate on bulletin boards in the boiler house the load carried by the station. An emergency alarm system is installed throughout the station to call help in emergencies. Interphone service is provided in the various offices, control room, load dispatcher's office, throughout the switch house, etc. Trunk lines connect with other important load-dispatching centers. Provision has been made for a telautograph system between the control room and load dispatcher's office to transmit switching orders and information rapidly. All station clocks and curve-drawing meters are synchronized and operated from a master clock.

Provision has been made throughout the station for a 25-volt multi-recorder system to record to one-quarter of a second the sequence of the movements of oil switches and the action of other important apparatus. The records thus obtained are expected to throw valuable light on the action of switches, relays and other equipment where records in the past have been inadequate or totally lacking.

TABLE IV—ELECTRICAL EQUIPMENT IN SWITCHHOUSE

Equipment	Type	Rating	Operating Condition	Manufacturer
Generator oil switches	O-2 double break	2000 amp., 16,500 volt	Solenoid-operated	Westinghouse Electric & Manufacturing Co.
Feeder selector oil switches	E-6	1200 amp., 25,000 volt	Solenoid-operated	Westinghouse Electric & Manufacturing Co.
Feeder oil switches	E-6	600-amp., 25,000-volt	Solenoid-operated	Westinghouse Electric & Manufacturing Co.
Switchboard panels and control	Slate, oil finish			General Electric Company
Power-service transformer oil switches	"Y"	5,000-amp., 600-volt	Solenoid-operated	Condit Electrical Manufacturing Company
Boiler-house main-feeder oil switches	"Y"	1,500 amp., 600-volt	Solenoid-operated	Condit Electrical Manufacturing Company
Branch power-service feeder oil switches	D-12	300, 500 and 1,000-amp., 600 volt	Solenoid-operated	Condit Electrical Manufacturing Company
13,200-volt disconnecting switches				General Devices & Fittings Company
Switchboard instruments and instrument transformers		15,000-volt		Weston Electrical Instrument Company
Power-service transformers		3,000-kva., 13,200-460-volt three-phase, 60-cycle	Water-cooled	Allis-Chalmers Mfg. Company
Lighting transformers		200 kva., 440-250-125-volt single-phase	Self-cooled	Moloney Electric Company
Exciter battery	160-cell 15-G Exide	900 amp., thirty-minute, 250 volts	Wooden tanks	Electric Storage Battery Company
Control battery	60-cell, 11-G chloride	100 amp., eight-hour	Wooden tanks	Electric Storage Battery Company
Multi-recorder battery	12-cell, 11-G chloride	100 amps., eight-hour	Wooden tanks	Electric Storage Battery Company
Exciter battery end-cell switches	Horizontal	1500, amps., fourteen-point	Motor-operated	Electric Storage Battery Company
—Exciter-battery charging set	Induction motor driven	75-kw., 450-volt generator, 440-volt motor	Direct connected	Allis-Chalmers Manufacturing Company
—Control-battery charging set	Induction motor driven	35-kw., 175-volt generator, 440-volt motor	Direct connected	Allis-Chalmers Manufacturing Company
—Multi-recorder battery-charging set	Induction motor driven	7kw., 35-volt generator, 440-volt motor	Direct connected	Allis-Chalmers Manufacturing Company
—Ash-handling locomotive charging set	Induction motor driven	15-kw., 135-volt generator, 440-volt motor	Direct connected	General Electric Company.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Construction of a Simple Flexible Coupling

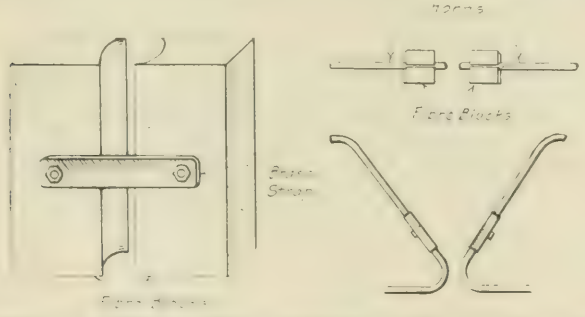
BY LEONARD A. DOGGETT

In the electrical laboratory of the United States Naval Academy at Annapolis, Md., it has been found convenient to mount a number of machines on wooden bases, which in turn are mounted on four heavy castors. When two machine sets are so mounted the lack of rigidity in the base made good alignment difficult. In the case of two 2-hp., 1000-r.p.m., 6-pole motors a special flexible coupling remedied the trouble.

This flexible coupling consisted of two perfectly plain brass disks 6 in. in diameter and 1.25 in. thick drilled to take the 1.125-in. shafts to which they were keyed. In the face of each disk, but not quite all the way through, were drilled four 0.5-in. holes 90 deg. apart. For these four holes four laminated pins, made of the ordinary electrical sheet steel, were prepared. When riveted together, they formed a bundle 5/16 in. by 5/16 in. by 2.25 in. The two motors were then lined up as closely as possible with the faces of the couplings $\frac{5}{8}$ in. apart and the laminated pins in place. In this position the motors were fastened to the wooden base by lag screws. This has proved to be a simple and satisfactory coupling.

Scheme for Preventing Birds from Grounding Lines

Two 0.5-in. horn-fiber blocks, 5 in. by 2.5 in. each, connected together by a spring-brass strap make up a device devised by T. F. Johnson, superintendent of lines, of the Georgia Railway and Power Company, to prevent small birds from being a source of trouble on transmission lines. By alighting on the horn gaps of lightning arresters, birds have grounded the lines through their bodies and caused the automatic switches to trip out in a number of cases. When the device mentioned is installed, as shown in the accompanying illustration, the heads of the bolts holding the strap are countersunk and sealing wax is poured over them. The

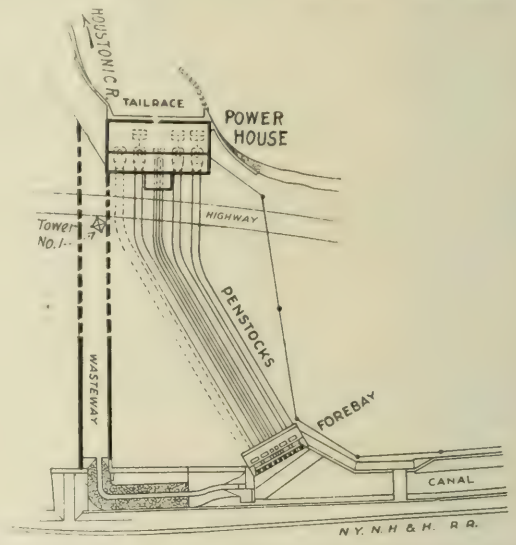


DEVICE TO PREVENT BIRDS GROUNDING LINES AT HORN GAPS

inside edges of the blocks are grooved so as to fit on the horn. By bending back the outer edges of the blocks, the inside edges are forced apart far enough to enable them to slip over the horn. On releasing, the spring strap causes the blocks to be clamped firmly on the horn. The device is placed with its bottom edge at the smallest point of the gap and with the strap on the lower side. The only part of the gap left unprotected is above the blocks, where it is so wide that no harm can be done by a bird alighting upon the horn.

Preventing Ice Troubles at a Connecticut Hydroelectric Plant

Breaking and massing of surface ice around the head gates to its penstocks have caused the Housatonic division of the Connecticut Power Company so much trouble in past years that measures have been taken recently to prevent repetition. Two methods have been em-



ARRANGEMENTS FOR DISPOSING OF ICE THAT CLOGS A FOREBAY

ployed. One is to prevent the cause and the other is to get rid of bad effects when the first method proves inadequate.

The first, or preventive, method is carried out by allowing several inches of ice to form on top of the canal (thus minimizing the formation of frazile or needle ice) and maintaining the canal level as nearly constant as possible so the ice will not break. This is facilitated by the indicating devices described on page 1007 of the Nov. 18, 1916, issue of ELECTRICAL WORLD. The second, or curative, method consists of diverting the broken ice over a spillway. While this action is assisted by the canal approaching the head gates at right angles to the penstocks, the spillway is exposed to the full impact of ice floating down the canal. Furthermore, so much ice has to be disposed of in severely cold weather that it could not be dumped at the foot of the spillway. These difficulties have been avoided to a great extent by building a structure across the forebay to skim the water entering the penstocks and to break up large pieces of ice approaching the spillway. Below this spillway has been built a concrete wasteway which discharges into the river downstream from the plant. Since a drainage tunnel had to be provided for emptying the forebay, anyway, it was extended underneath the discharge way a short distance and there connected

with the wasteway. If the ice discharged into the wasteway fails to pass on to the river unassisted, the forebay drainage gate will be opened and the velocity head secured by means of the tunnel utilized to start the ice down the wasteway.

The skimmer previously mentioned consists of slightly separated wooden strips attached to a structural-steel framework so they extent 8 ft. below the surface of the canal. The structure is installed so the waterway to the spillway converges, thus breaking up large pieces of ice by wedge action. So that the structure will withstand the pressure of ice it has been strengthened by the rods anchored in the opposite bank of the canal.

Since considerable of the frazile ice which is encountered at this plant is caused by agitation of the water at the entrance to the canal some consideration has been given to covering this part of the canal. While no definite step has been taken in this direction Superintendent J. K. Mackie believes that the largest "needle-ice factory" in the whole waterway would be eliminated by such a covering. Very little opportunity is afforded the formation of needle ice at other points as the pond above the canal is very large and deep and the surface usually covered with ice in cold weather.

Comparative Efficiencies of Motors and Steam Engines for Sugar Mill Drives

To show in a concise manner the saving that can be effected in a cane-sugar mill by using electric motor instead of steam-engine drive the Kelvin Engineering Company, Inc., New York City, has recently compiled the data given in the accompanying table. The calculations were simplified by assuming a plant with one 34-in. by 78-in. crusher and four 32-in. by 78-in. mills, the crusher and mills being driven by separate engines or motors. It should be pointed out that electric operation would show up to still better advantage if each machine were driven by an individual motor.

From the calculations it can be seen that if the mill operates the equivalent of 120 twenty-four-hour days, the total saving in steam will be $120 \times 24 \times 8500 = 24.28$ million pounds of steam. Assuming that the boilers will evaporate 6 lb. of water per pound of coal, this would mean a saving of about 2000 tons of fuel per year, to say nothing of decreased labor in handling same and ashes. As sugar mills burn bagasse, there would be an equivalent saving of bagasse. Looking at it in another light, less boiler capacity would be needed or greater output could be handled with same boilers.

Of course, if the juice heating and evaporating plant is so designed that it requires a large amount of steam, great economy in steam consumption will not be any great advantage. In any modern plant with well-designed heaters, pre-evaporators, multiple effects, pans, etc., however, no more exhaust steam would be required than could be obtained from the steam turbines.

COMPARATIVE ECONOMIES OF STEAM AND ELECTRIC SUGAR MILL DRIVES

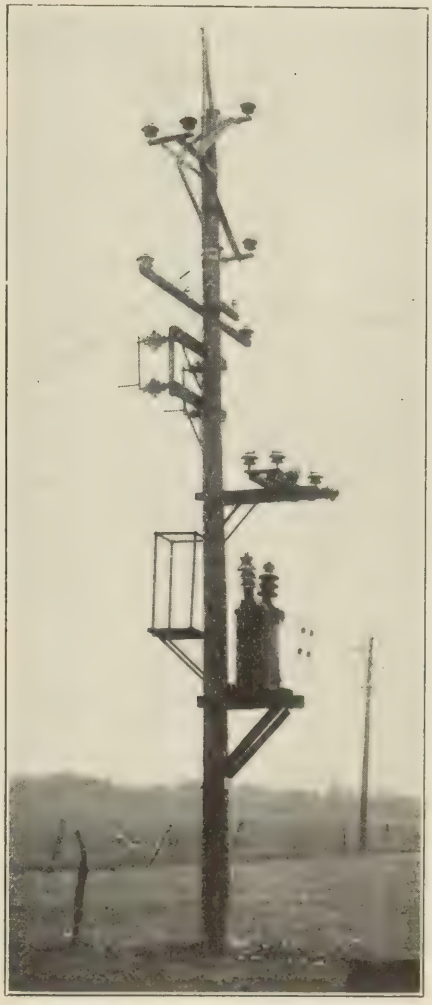
Operating Conditions	Machine Driven	
	One 34 In. x 78 In. Crusher	Four 32 In. x 78 In. Mills
Steam engine drive:		
Type of engine	Corliss	Corliss
Speed, revolutions per minute	45	45
Indicated horsepower	158	580
Mechanical efficiency, new, per cent	90	90
Brake or developed hp	142	523
Steam pressure at throttle, pounds, gage	100	100
Steam pressure at exhaust, pounds, gage	8	8
Steam consumption, pounds per horsepower-hour	40	40
Total steam consumption, pounds per hour	7,022	25,778
Electric motor drive:		
Capacity of motor, horsepower	150	580
Efficiency of motor, at load carried	92	93
Efficiency of gearing, per cent	98	98
Brake horsepower required	14	.....
Efficiency of transmission system (wiring), per cent	98	98
Efficiency of generator, per cent	92	92
Steam consumption, pounds per horsepower-hour developed by the turbine	30	30
Horsepower developed by the turbine to supply power to motor	175	635
Total steam consumption, pounds per hour	5,250	19,050
Saving in steam consumption with electric drive (pounds per hour)*	1,772	6,728

*Represents 8500 ÷ 32,800 = 26 per cent saving.

Small Individual Consumer Substations on a 33,000-Volt Transmission Line

BY M. H. WAGNER
Transmission Engineer The Dayton Power & Light Company

The Dayton (Ohio) Power & Light Company makes every effort to serve those desiring energy along its high-tension transmission lines. Farmers usually apply for service when a transmission line passes their houses. This practice on the part of the central station companies to serve individual consumers along transmission lines has caused manufacturers to develop a small transformer to give a single transformation from 33,000 to 230/115 volts that can be economically installed.



A 5-KVA. SUBSTATION ON MAIN TRANSMISSION LINE POLE

The accompanying illustration shows a one-pole, 5-kva., 33,000/230-115-volt, single-phase, 60-cycle, outdoor substation erected to serve a rural customer. No additional right of way or extra supporting structure is necessary for this type of installation, since it is installed on one of the main-line poles. In laying out the installation the aim was to make it inexpensive without cheapening it to a degree that might impair service. The disconnecting switches are of the simple design, since their only duty is to de-energize the horn-gap fuses. These horn-gap fuses were inserted to protect the transformer from overload, and it has been found best to use wire to withstand the weather. The position of the transformer with respect to the line offers

considerable additional protection, for besides the regular line conductors there is above it a No. 6 B & S copper-clad overhead ground wire. The cost of this type of outdoor substation without the transformer follows:

Iron work, lumber, etc.	$24 07
Electrical apparatus (not including transformer)	16 30
Labor (hauling, erecting and installing transformer)	42 25
Total	$112 62

This installation has weathered the past season's severe electrical storms without difficulty other than an occasional fuse failure, which was expected. Altogether, the service rendered by this installation has been sufficiently satisfactory to warrant its being considered as standard by the company.

TREATING BOILER FEED WATER

Simple Method of Calculating Amount of Lime and Soda Ash to Use for Treating Boiler Water

Plant operators should find no difficulty in softening boiler water in an intelligent manner if the instructions given in the recent A. S. M. E. paper by Arthur C. Scott and J. R. Bailey are followed. Before explaining the method of calculating the amount of water softening chemicals to add to water, the authors pointed out that the amount of scale-forming material may serve as a basis for classifying boiler waters. For instance, less

Factors for Calculating Water-Softening Chemicals

Salt	Factor, Lump Lime, (CaO)	Factor Hydrated Lime, $Ca(OH)_2$	Soda-Ash Factor, Na_2CO_3
Sodium carbonate (Na_2CO_3)	0.529	0.699	.....
Magnesium chloride ($MgCl_2$)	0.589	0.778	1.113
Magnesium sulphate ($MgSO_4$)	0.466	0.616	0.881
Magnesium bicarbonate ($Mg(HCO_3)_2$)	0.767	1.014	.....
Magnesium carbonate ($MgCO_3$)	1.330	1.757	.....
Calcium bicarbonate ($Ca(HCO_3)_2$)	0.346	0.457	.....
Calcium carbonate ($CaCO_3$)	0.560	0.740	.....
Calcium sulphate ($CaSO_4$)	.....	.....	0.779
Calcium chloride ($CaCl_2$)	.....	.....	0.955

than 8 grains per gallon represents very good water, 8 to 15 grains good, 15 to 20 fair, 20 to 30 poor, 30 to 40 bad, and over 40 very bad. Scale due to temporary hardness in water will deposit as a loose sludge that can be readily blown off. When the ratio of magnesium and calcium bicarbonate to other salts of these two elements is less than 4 to 1 the scale will be hard and very adhesive.

If only the bicarbonate of calcium and magnesium are present their effects may be offset by adding lime alone. If the other salts are present, however, the lime must be supplemented by soda ash. The amounts of

Sample Water Analysis

	Grams per Liter	Grains per U. S. Gallon
Sodium chloride	0.0744	4.339
Sodium sulphate	0.1110	6.473
Magnesium sulphate	0.3525	20.557
Calcium sulphate	0.4422	25.788
Calcium bicarbonate	0.2535	14.784
or Calcium carbonate	0.1565	9.126

lime and soda ash that must be added to soften water can be obtained by multiplying the amounts of salts found by analysis by the corresponding factors in Table 1.

For example, suppose the water analysis is as shown in Table 2. Then the treatement needed for each constituent will be as follows:

Grams Required per Liter of Hard Water

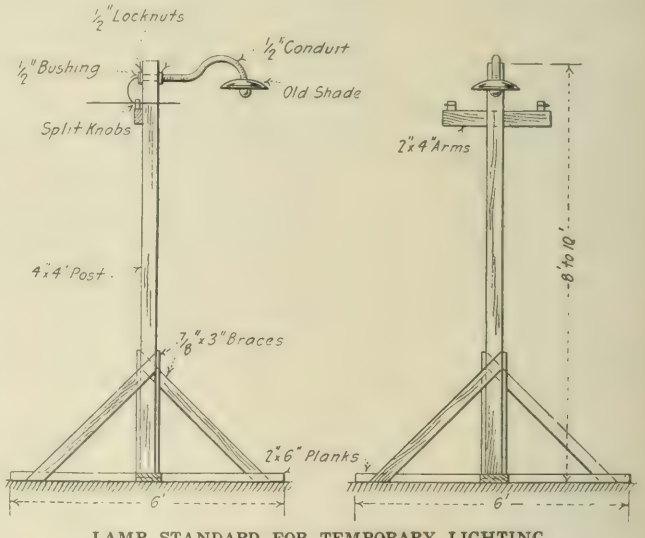
	Soda Ash	Lump Lime	Hydrated Lime
Sodium chloride	None	None	None
Sodium sulphate	None	None	None
Magnesium sulphate	0.3106	0.1643	0.2171
Calcium sulphate	0.3445	None	None
Calcium bicarbonate or Calcium carbonate	None	0.0877	0.1158
Total	0.6551	0.2520	0.3329

While the results are expressed in grams per liter, they can also be expressed in grains per gallon, parts per 100,000, or parts per 1,000,000. Since the engineer usually wishes to know the result in pounds of lime or soda ash per 1000 gal. of water it is necessary to multiply by 8.347 with grams per liter, divide by 7 with grains per gallon, multiply by 0.08347 with parts per 100,000, and by 0.008347 with parts per 1,000,000. In either the slacked or unslacked form, however, lime has only about 70 per cent efficiency due to impurities and minor combinations, therefore slightly over 40 per cent more than calculated is necessary. Soda ash is about 90 per cent efficient, so about 11 per cent more than calculated is needed. In order to avoid the cost of tankage, which the use of clear lime water would entail, it is customary to use milk of lime.

Arrangement for Temporary Illumination

BY C. B. DEAN

Lamp standards constructed according to the accompanying design have been found very satisfactory by the writer where temporary lighting had to be furnished. As shown the standard has a base consisting of crossed planks and an upright post carrying the lamp



LAMP STANDARD FOR TEMPORARY LIGHTING

and service wires. Weights of any description may be placed on the base to prevent the standard overturning. The service wires are supported by split-knob insulators carried on a small crossarm, while the lamp and shade are supported by a conduit goose neck which passes through the upright post being fastened thereto by locknuts. Connections with the lamp run through the gooseneck. A small conduit was used so it could be bent easily to direct the light on any desired spot.

Where groups of lamps could be used they have been supported from span wires strung between tall 4-in. by 4-in. posts equipped with 2-in. by 4-in. crossarms. The heights of the lamps were adjusted by changing the sag of the span wires or by adjusting the crossarms.

COMMERCIAL AND BUSINESS POLICY

A Department of Plans and Methods for Widening the Application of Electricity and for Extending Electric Service

INCREASING THE CENTRAL STATION'S NET REVENUE

Plans Suggested by Ohio Commercial Managers for Making the Earnings More Than Keep Pace with the Rising Costs of Coal and Copper

In opening the meeting of the Ohio new-business committee at Toledo, on Jan. 18, F. R. Coates, president of the Toledo Railways & Light Company, offered the suggestion that consideration should be given to means for increasing central station companies' revenues sufficiently to offset the constantly rising cost of operation. This subject is particularly important at this time, said he, when utility companies which are prohibited from raising their rates find themselves confronted by increased prices in all of the commodities they buy. Although the discussion which followed did not dwell exclusively on that point, several ideas which bear directly on that topic were brought out. They are given in the following paragraphs:

E. T. Hollingsworth of Newark, Ohio, expressed the belief that an appliance or appliances should be sold with each job of house wiring. There are several advantages in this practice; it is easy to add $5 or $10 worth of appliances to a house-wiring contract because the amount is not large in comparison to the total and because the salesman who has his prospective customer at the point of signing a house-wiring contract already has won confidence and can advise the purchase of appliances in a manner that will impress the purchaser with the salesman's sincere interest in his household problems. The plan has the further advantage of accustoming the customer from the very beginning to bills which include energy used for purposes other than lighting; it turns the minimum-bill customer into a profitable patron; and it assures the use of more energy on the first and highest step of the rate schedule.

In order to learn how much appliance business is being done with the present method of selling, J. E. North of Springfield, chairman of the meeting, asked for reports on 1916 appliance sales. Representatives of four cities, namely Springfield, Youngstown, Toledo and Massillon, responded. From these reports it was learned that the total population of the four cities was about 406,000; the total meters installed was about 59,000; and the total number of appliances sold was about 18,000. It may, therefore, be calculated that in these four cities in 1916 there was sold one appliance for every 22.5 people or one appliance for every 3.3 lighting customers. Opinions expressed as to the revenue derived from appliances indicated that some believed they would return as much as $7 per kilowatt per year, while others believed the return might be as low as $3.50 per kilowatt per year. It was agreed that electric irons return from 30 cents to 40 cents a month.

G. H. Mau of Coshocton said his company, which has a heavy power load as compared to its lighting load, expects to increase its net revenue in 1917 by studying the load curve of the system and striving to add new business which will fall in the valleys of that curve. Attempts to smooth out the peaks of the curve will also be made by offering certain industries attractive contracts if they will perform operations requiring large blocks of power during off-peak hours. Grain grinding, coal cutting and industrial heating will be the principal businesses in which this plan can be worked out.

In speaking of the effect of industrial electric heating load on the central station company's business, H. S. Kuntz said the experience of the Toledo company had been that it increased not only the load factor but also the power factor of the entire system. In addition to this the electric heating business has produced a satisfactory merchandising profit and an income from energy which when considered on the kilowatt-year basis is not to be despised.

CHANGING FROM FLAT RATE SERVICE TO METERED BASIS

Legitimate Uses of Service Equally Well Cared for in Sacramento, Cal., After Reducing Energy Consumption by 42 Per Cent

In 1913 the Sacramento district of the Pacific Gas & Electric Company made an inventory of the quantities of electrical energy consumed and the uses to which it was applied in the territory served from the Sacramento substation. It was decided as a result of this examination that a large percentage of the current actually distributed in the district was not accounted for in the consumers' monthly accounts as carried on the company's books. At that time a flat-rate basis for residence lighting was in effect, the usual rate being $2 per month for each ten-socket installation and 15 cents each for all additional outlets.

It was decided that a large part of this non-productive current could be saved by the installation of meters, and that it would at the same time be possible to keep the consumer entirely satisfied with conditions by teaching him how to use metered service effectively. Accordingly, after giving due notice of the new schedules, the system was gradually changed over from flat rate to metered basis.

Customers Better Satisfied

When first announced there was much dissatisfaction with the meter basis. The consumers feared their bills would be higher than on the flat rate and the company found it necessary to give constant and careful attention to complaints in order to effect the change and at the same time keep the customers satisfied. The plan was entirely successful, however, and now that the change to a meter basis is practically completed, the district manager recently said, "I venture to say that between 80 and 90 per cent would not go back to the flat rate for the reason that their bills are considerably less on meter and at the same time they are receiving all the necessary service for less money." When the campaign was begun, 26 per cent of consumers were on a metered basis. After 86 per cent of the total number of consumers had been put on a metered service basis the consumption per consumer was 42 per cent less than it had been at the outset.

In the early stages of this campaign all manner of arguments were brought up to discourage and prevent

the company from putting in the meters. For example, under the flat rate basis it was the custom to burn porch lights in the residence districts all evening, and when the installation of meters was proposed the objection was advanced that the residence district would be darkened to a great extent and this attractive feature for which the city had become noted would disappear. In answer to this objection the company pointed out that by the use of a 10-watt Mazda lamp practically the same effect could be secured and the cost per month would be insignificant. In order to demonstrate its good faith on this point and meet the consumer halfway, the company in many cases supplied these 10-watt lamps gratis.

Economies in Lighting

The same possibilities for economies were pointed out to the consumer in his interior lighting. For example, that he should use lamps of low capacity in halls and bathrooms and wherever a high intensity of light was not required. In fact, with the proper selection of interior units the majority of the consumers were able to have their homes lighted in an even better way than before, while the cost was no more than it was on the flat-rate basis.

Meters installed for checking purposes on the lines of consumers whose flat-rate contracts had not yet expired, developed some remarkable cases of excess use of current. It was not uncommon to find a rooming house on a $2 to $2.50 monthly rate heating rooms by electricity, in some cases using current continuously during cold weather. In one instance a consumer who was paying $8.25 for light was shown by the test meter to be using, on the lighting rate, $324.65 worth of electricity per month. In another case, a rooming house with three electrically heated rooms, the flat rate was $2.15 for the eleven outlets on the official record. The test meter, however, showed that the actual consumption was $94.25 worth of energy per month.

Company's Income Actually Reduced

Since the installation of meters the total income from the sale of energy has been considerably reduced, thus proving the company's contention that it would be cheaper for the consumer. However, the company has profited by the more than proportional reduction of energy consumption. Before installing the meters whenever an interruption occurred on the transmission lines, it was impossible to carry the district load on the steam-station system even if service was confined to the downtown district, street-car system and part of the residential district. Under the reorganization of the service, whenever interruptions occur in the transmission lines, it is now possible to carry the entire load from the local steam standby station.

Tools in Automobile Factory Tempered Electrically for 1.57 Cents Each

The following data on the cost of treating steel tools electrically was obtained in one of the large automobile manufacturing plants. The table showing the exact test readings is given herewith. From these data it will be observed that the electric tempering furnace was operated 98.5 hours on nineteen days, or an average of 5.18 hours per day. In that time 1978 high-speed steel tools of various types were treated. The cost of energy for hardening these tools, with energy at 3 cents per kilowatt-hour, was $26.63. Adding to the cost of energy the cost of renewing carbon-heating elements, which was $4.48, the total cost of operation for the period was $31.11. The cost of treating each tool was, therefore, 1.57 cents.

The weight of the tools was not taken on any except the last five runs. In these the total weight of tools treated was 352 lb., and the cost per pound of treating the tools in the last five runs was 2.33 cents per pound. All of these tools were treated in a Hoskins type FC-204 electric furnace, the internal dimensions of which were 6.5 in. by 5 in. by 11 in. The maximum rating of the furnace is 15 kw., but in treating high-speed steel such as these tools were, with which temperatures of 2100 to 2300 deg. Fahr. are required, the average demand is between 9 kw. and 10 kw.

The reason an electric furnace was selected by this manufacturer for treating tools was that it produces uniform and controllable temperature and permits control of the furnace atmosphere. These factors are important in tool work, because the efficiency of a metal-working machine varies directly with the efficiency of the tool with which it is equipped. Moreover, a variation of 50 deg. Fahr. from the proper temperature in treating certain grades of steel tools will produce a difference of from 30 per cent to 70 per cent in the life of the tool. Advocates of electrically treated steel point out that since the electric furnace permits of accurate

DATA ON TOOLS HARDENED AND COST OF ENERGY FOR ELECTRIC FURNACE

Current On	Current Off	Hours Run	Circular Cutters	Reamers	Shell Reamers	Reamer Blades	Keyway Cutters	Taps	Circular Form Tools	Thread Chasers	Profile-Cutters	Pointing Tools	Tools for Tool Stock	Hollow Mills	Total Tools Hardened	Cost of Energy Used	Cost of Energy per Piece	Weight of Tools Hardened Weight in Pounds	Cost of Energy per Pound
12:30	5:30	5	15	3	3	78	....	....	....	....	....	....	....	....	99	$1.35	0.0136	.....	.....
12:30	7:00	6.5	4	6	18	....	12	25	1	19	12	9	....	....	109	1.76	0.0161	.....	.....
12:30	5:30	5	....	22	18	....	....	3	1	....	....	12	....	....	56	1.35	0.0241	.....	.....
12:30	4:30	4	3	8	18	....	....	8	4	....	....	....	6	....	47	1.08	0.0229	.....	.....
10:00	5:30	6.5	1	9	....	323	....	....	2	....	....	....	....	....	335	1.76	0.0052	.....	.....
12:30	8:00	7.5	11	20	18	67	....	....	11	....	....	....	....	....	127	2.03	0.0160	.....	.....
1:30	5:30	4	1	8	12	68	....	....	3	....	....	....	....	....	92	1.08	0.0117	.....	.....
3:30	5:30	2	....	....	....	2	....	....	5	....	....	6	8	....	21	0.54	0.0257	.....	.....
12:30	7:30	7	24	....	36	54	....	1	1	....	....	3	19	....	138	1.89	0.0128	.....	.....
1:00	5:30	4.5	....	....	12	96	....	....	12	2	....	....	....	....	122	1.22	0.01	.....	.....
12:30	6:30	6	5	....	....	150	28	5	3	5	....	....	....	1	197	1.62	0.0082	.....	.....
1:00	5:00	4	....	....	....	....	9	12	3	5	....	....	....	....	29	1.08	0.0372	.....	.....
7:00	11:00	4	....	....	....	48	....	....	4	11	....	....	....	1	64	1.08	0.0153	.....	.....
12:30	7:00	6.5	2	64	....	41	....	2	3	3	....	24	....	12	151	1.76	0.0116	.....	.....
1:30	6:30	5	27	5	....	....	....	....	4	....	....	4	....	8	48	1.35	0.0281	110	0.0122
12:30	6:30	6	70	12	....	13	2	....	6	....	5	....	....	9	117	1.62	0.0138	100	0.0162
12:30	7:00	6.5	56	....	....	13	....	....	2	....	6	3	....	18	98	1.76	0.0179	80	0.0220
2:00	5:30	3.5	2	4	....	....	....	....	8	8	12	6	....	6	46	0.95	0.0208	26.5	0.0358
1:00	6:00	5	....	....	....	4	44	....	7	....	....	24	....	3	82	1.35	0.0164	35.5	0.0380
Total	....	98.5	221	161	135	957	95	56	83	53	35	91	33	58	1978	$26.63	.....	352.0	.....

temperature control, it is frequently more economical to treat tools electrically than by other methods even if the other methods are apparently less expensive.

While these data were received from the plant of a large manufacturer, furnaces of this type have found practical use in plants so small that all of the tools can be treated by operating the furnace one day a week.

"One-Minute Service Chats" with the Customer

The Union Electric Light & Power Company has been running a series of "One Minute Service Chats" in the St. Louis newspapers, discussing in friendly fashion and in easy language the relations of the central-station company with its customers and public, and outlining some of the problems of electric service which the customer does not always realize. One of the best of this educational series was the advertisement reproduced herewith, which points out how the small user, despite the fact that he pays a higher rate, may be really a less profitable customer for the company to carry than is the low-rate business of the large user taking many kilowatts during long-hour periods. Advancing the argument a step further, any possible objection on the part of the large customer to this proportioning of costs is finally met by reminding the reader that each new customer means ultimately lower rates for all customers of the central-station, both large and small.

ONE-MINUTE ELECTRIC SERVICE CHATS

Our Favored Customers

In most lines of trade, prices are fixed by two factors—cost to the seller and value to the buyer.

These factors help fix electric service costs. But there's a third factor just as important.

This third factor is the central station's need to encourage the use of electric service by more customers, for more different purposes, more hours a day—in order to get more use of the big plant investment.

This third factor shades the other two. Central stations as a rule aim to get from each customer at least the actual cost of serving him. When we do that, no customer can complain that he has to help pay the other fellow's bill.

Most of you, very likely, think we make our money off the customers who pay us the highest primary rate per kilowatt hour. These are our residence customers, most of whose bills average $1.00 to $2.50 per month.

We don't. These are our favored customers. They get service closer to actual cost than any others on our books. Central stations are serving a great many of them at an actual loss.

That loss is a necessary part of the cost of building up new business. Each year most of these customers use more service, for more different purposes, more hours a day, thereby earning lower rates and, by increasing the whole volume of the company's business, helping to earn lower rates for all other customers.

Such profit as central stations earn is got chiefly from big customers using large quantities of energy a good many hours a day, at automatically earned rates.

These big customers might complain that they have to help pay the small customers' bills. They don't complain, because they understand that each new customer ultimately means lower rates for all customers, and that the service has been sold to them strictly on its merits and on the basis of its value to them.

(Copyrighted)

The Electric Company

UNION ELECTRIC: Main Office—12th and Locust Branches: 4912 Delmar, 3028 N. Grand 3012 S. Grand

A CHAT CONCERNING RATES AND COSTS

The small user, the central station's favored customer, obtains his service closer to actual cost than even the wholesale user with his lower rate

"WIRE-YOUR-HOME-TIME" FROM APRIL 1 TO MAY 15

Society for Electrical Development Offers $1,250 in Prizes for Largest Number of Contracts Obtained During Six-Month Period

The Society for Electrical Development has announced cash prizes totaling $1,250 in connection with its annual spring house-wiring drive set this year for the period from April 1 to May 15. The contest is open to all house-wiring contract salesmen employed by central stations or contractors.

The country will be divided for campaign purposes according to population so that cities and towns of nearly equal size will have equitable chance of competition. Under the plan as arranged the prize money will be divided equally between five classes:

1. Cities of 15,000 or under.
2. Cities of between 15,000 and 50,000.
3. Cities between 50,000 and 100,000.
4. Cities of between 100,000 and 500,000.
5. Cities of 500,000 and over.

The highest prize for each group of cities, going to the solicitor who can show the largest number of contracts secured between April 1 and May 15, will amount to $150. There will be a second prize of $50 for each group; also five additional prizes of $10 each.

The $1,250 prize campaign will be one of the main features of "Wire-Your-Home-Time," advance details of which were worked out by the society's special house-wiring committee which met on Jan. 18, at the society's offices in New York.

The committee decided to extend the time of this year's campaign to six instead of four weeks, as last year. This was done in order to give all sections of the country, both North and South, an equal opportunity to profit by local weather conditions. The extension of the season necessitated changing the name from "Wire-Your-Home Month," last year's title, to "Wire-Your-Home-Time."

The society will issue a preliminary broadside announcing that the purpose of the campaign is to secure the co-operation of the entire industry in obtaining more outlets for electric service during one of the most active periods of the year. Following this there will be issued a "How To" handbook for the trade giving suggestions for putting on local campaigns, suggested sales display and advertising helps.

It is stipulated that for the purposes of the campaign a contract shall be defined as a "new contract for at least three rooms with four sockets or outlets, or over, in a house already built." The contestant makes affidavit that each contract secured conforms to those conditions, and reports must be mailed not later than May 16 to receive consideration.

All reports should be addressed the "Wire-Your-Home-Time" Contest Committee, Society for Electrical Development, 29 West Thirty-ninth Street, New York.

The "Wire-Your-Home" campaign committee consists of: G. M. Sanborn, chairman, Sanborn Electric Company, Indianapolis, Ind.; E. W. Lloyd, Commonwealth Edison Company, Chicago, Ill.; A. L. Oppenheimer, Enterprise Electric Construction Company, Cleveland, Ohio; H. C. Heidrich, Electric Motor & Repair Company, Newark, N. J.; T. J. McManis, Edison Lamp Works, Harrison, N. J.; Elliott Reid, Westinghouse Lamp Works, New York; N. H. Boynton, National Lamp Works, Cleveland, Ohio; E. W. Rockafellow, Western Electric Company, New York; Robert Montgomery, Louisville (Ky.) Gas & Electric Company; M. S. Seelman, Jr., Edison Electric Illuminating Company, Brooklyn, N. Y., and J. M. Wakeman, general manager and H. W. Alexander, director of publicity of the Society.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

RECEPTION OF CABLE SIGNALS

Application of Detectors Commonly Used in Radio-Telegraphy—Results with Ticker and Audion Amplifier

BY LOUIS W. AUSTIN AND LOUIS COHEN

THE possibility of applying radio-telegraphic methods for the reception of cable signals was suggested to the writers some time ago by Col. G. O. Squier. Acting on this suggestion, a series of laboratory experiments has been arranged to test out the possibilities of the various detectors commonly employed in radio-telegraphy. It was soon found that the ticker and audion, the most sensitive detectors for high frequency currents, are also suitable as detectors for low frequency and direct currents.

The function of the ticker is simply to interrupt the current a large number of times per second producing an audible note, which is then detected in an ordinary telephone associated with it in the usual way. An audion amplifier may be also interposed through transformers between ticker and telephones, and thus greatly amplify the signal. In either case it was found that a high degree of sensitiveness was obtained. We have made use of the slipping contact ticker which was employed before for similar purposes, as described by L. W. Austin in the *Physical Review*.

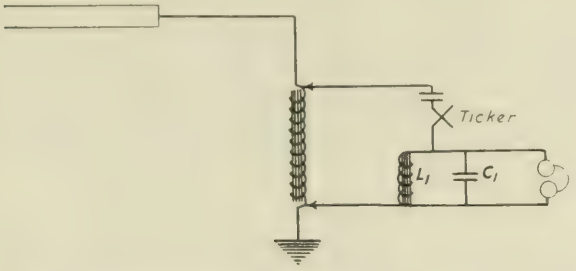


FIG. 1—CONNECTIONS FOR RECEIVING CABLE SIGNALS BY MEANS OF TICKER

Several circuit arrangements which more or less simulated cable conditions were soon tried, and the results obtained were sufficiently encouraging to warrant undertaking tests on a cable. Through Colonel Squier's interest in these experiments permission was obtained from the Signal Corps, U. S. A., to carry on tests on the government Alaskan cable. This cable extends from Sitka, Alaska, to Seattle, Wash., and is 1086 miles long. The electrical constants of the cable are: $K = 0.45$ mf. per mile and $R = 7.0$ ohms per mile, and the KR value of the cable is almost the equivalent of a trans-Atlantic cable. Figs. 1 and 2 show circuit arrangements.

In one case where the ticker alone is employed the interrupted current of the received signal is directly audible in the telephones, while in the other cases, the arrangement shown in Fig. 2, an audion amplifier is introduced to further increase the sensitiveness. In either case to get the best results it was found necessary to use the reversal method. The simple Morse code was used, and the sending key so arranged that for every successive signal the current was reversed.

The inductances and capacities of the circuits marked L_1C_1 and L_2C_2 are adjusted to be in resonance for the frequency of the interruptions produced by the ticker. With the arrangements of the circuits shown in the diagrams a remarkable degree of sensitiveness was obtained. One dry cell at the transmitting end was sufficient to produce clear signals.

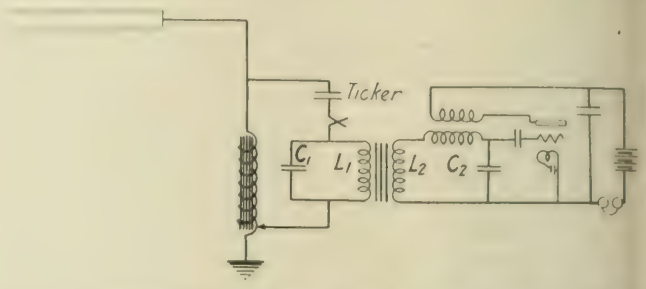


FIG. 2.—CONNECTIONS FOR RECEIVING CABLE SIGNALS WHEN AUDION AMPLIFIER IS USED WITH TICKER

This method of receiving cable signals is applicable to the Squier system of cable telegraphy, where an unbroken alternating current is used, as well as to Morse signals by the reversal method.

Generators, Motors and Transformers

Strap Field Windings.—R. H. WILLARD.—Copper strap is often used for winding fields of large current capacity. Where the strap is so thin that it is not rigid enough to support itself, it is wound flat and insulated between turns with asbestos tape, as illustrated in Fig. 3. This is a rugged construction mechanically, making it good for applications such as railway motors, where vibration and mechanical service are very severe. This coil is practically heatproof, but it does not radiate heat as well as the edge-wound coil shown in Fig. 4. In this coil the strap is wound on edge and insulated with asbestos strips cut to shape and cemented in place with shellac. After the coil is completely wound it is pressed down in a steel frame and all the inflammable material burnt out with a gas flame at a considerable temperature, leaving a coil which is almost indestructible by heat. Since the edges of the strap are bare this type of coil radiates heat well. In large machines where the series field is quite heavy, strap may be woun

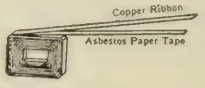


FIG. 3—METHOD OF WINDING AND INSULATING STRAP

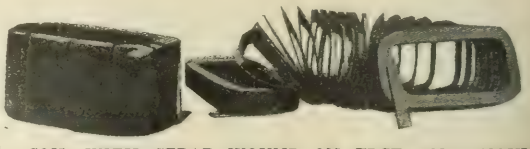


FIG. 4—COIL WITH STRAP WOUND ON EDGE AND INSULATED WITH ASBESTOS STRIPS

on edge with simply an air space between turns for insulation. The turns are separated at intervals by wooden or fiber separators bound in place. In this type of coil the copper is entirely exposed to the air, thus

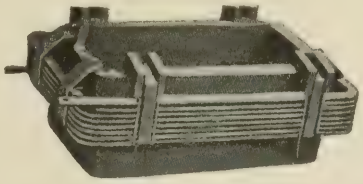


FIG. 5—COPPER IN THIS COIL ENTIRELY EXPOSED TO AIR

securing the maximum heat radiation, as shown in Fig. 5.—*Electric Journal*, January, 1917.

Lamps and Lighting

Luminous Efficiency of the Radiation from the Electric Arc.—ENOCH KARRER.—An account of an investigation carried out in the laboratory of the United Gas Improvement Company of Philadelphia. For determining the luminous efficiency one has to determine the total radiation and the radiation through the "luminosity" screen. In doing this for arc lamps there is to be met the difficulty of continuous variations in the arc.

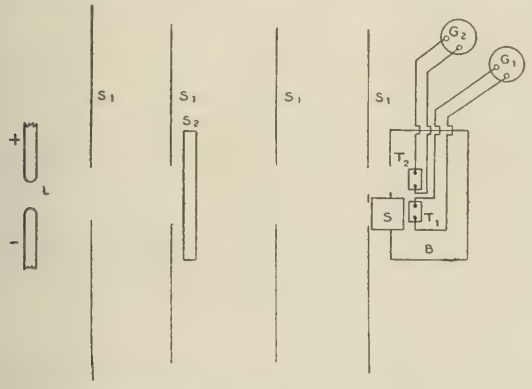


FIG. 6—DIAGRAMMATIC SKETCH OF THE SET-UP OF THE APPARATUS

In the present author's method this is overcome by providing a duplication of apparatus so that two thermopiles are available, two sensitive galvanometers, and two observers so as to record approximately simultaneous conditions of the light sources as to its radiation with and without the luminosity screen. The arrangement is shown in Fig. 6. L is the light source studied; S_1, screens; S_2, double-walled shutter; B, sheet-iron box

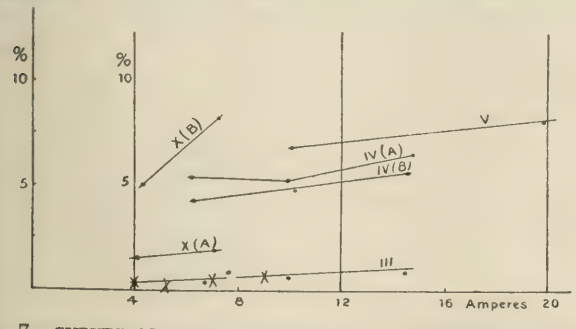


FIG. 7—CURVES SHOWING RELATIONSHIP BETWEEN LUMINOUS EFFICIENCY OF RADIATION FROM AND CURRENT THROUGH THE ARC

inclosing thermocouples T_1 and T_2; S, cell containing the luminosity solution. The thermocouple T_1, together with the galvanometer G_1 constitute radiometer I and the thermocouple T_2, with galvanometer G_2, constitutes radiometer II. Some of the results are shown in Fig. 7, which shows the relationship between the luminous efficiency of the radiation from and the current through the arc. Curve III refers to solid carbon electrode, IV, V to yellow flame cored carbons, VI, VII, VIII and IX to yellow and white flame homogeneous carbons, X to magnetic electrodes.—*Journal Franklin Inst.*, January, 1917.

Generation, Transmission and Distribution

Car Handling on Ore Docks.—CHARLES E. COLE.—The author discusses the use of rope haulage versus electric locomotives and points out the various advantages of electric locomotives.—*Elec. Journal*, January, 1917.

Steam Turbines on Ship Board.—W. J. DAVIS, JR.—The unprecedented demand for more cargo ships has vigorously raised the question as to what form the power plant shall take—reciprocating engines, direct-connected turbine, or turbine with reduction gears. In this article certain limitations of the first two forms for cargo ships are pointed out, and the merits of the turbine reduction-gear drive are explained. The construction and arrangement of Curtis "ahead" and "astern" turbines with Alquist reduction heats is described and illustrated.—*Gen. Elec. Rev.*, January, 1917.

Installations, Systems and Appliances

Large German Electric Central Station.—Work at the Golpa-Lessenitz lignite deposits and the large electric central station which is to be supplied with fuel from these deposits has been somewhat retarded on account of underground water and unfavorable weather. The power station has a capacity of 180,000 kw. The concern belongs to the Berlin Electricity Works. While the work is going on energy has been generated mostly by means of fuel from other sources. During the last year efforts have particularly been aimed at supplying as soon as possible the current necessary for the Bavarian Nitrogen Company and the Electro-Saltpetre Company (making nitric acid from air for military purposes). The contract with the latter concern, which is located in the vicinity of the power station, is for 240,000,000 kw.-hr. annually. The station began work in December, 1915, with a continuous load of 15,000 kw., which by the end of the financial year, June 30, had risen to 25,000 kw. The current year also will be marked by continued construction and a gradual increase of the energy generated.—London *Electrician*, Dec. 22, 1916.

Electrophysics and Magnetism

Characteristics of Iron in High-Frequency Magnetic Fields.—RALPH BOWN.—Formerly it was quite generally believed that iron was unable to follow rapid magnetic changes. Experiments which showed an apparent decrease in the permeability of the iron with an increase in the frequency of the magnetic cycle furnished a basis for a theory that iron was magnetically sluggish. Further and more accurate experiments proved, however, that the effects which had previously been ascribed to a peculiarity of the material were in reality caused by eddy currents in the sample. Theoretical calculations were made which demonstrated that eddy currents in an iron test piece increased as the square of the frequency, and that for even the lower frequencies it was necessary to use quite thin laminations in magnetic circuits in order to eliminate deleterious effects. Furthermore, it was found that due to eddy currents and the magnetic properties of iron, the magnetization in high-frequency fields was confined to a thin surface layer of the piece. This "magnetic skin effect" reduced the cross-section of the iron which was magnetically active even though the laminations were extremely thin. Careful experimental measurements

compared with theoretical calculations proved that the real permeability of iron remained unchanged at frequencies up to about 10^6, and that previous results had been in serious error due to neglect to the factors mentioned. This fact having been established, efforts were made to see what practical use could be made of iron in high frequency work, and to that end some extensive experimental investigations of the saturation curves and core losses were made upon specimens laminated as thinly as was commercially practicable. It is a demonstrated fact that the permeability of all metals is unity for the magnetic cycles imposed upon them by heat and light waves. In the region between frequencies of about 10^6, where the true permeability of iron is practically the same as at zero frequency, and frequencies of about 10^{15}, where the true permeability of iron approaches unity, the experimental value of μ decrease smoothly with the frequency. What happens to μ in the range of frequencies between the longest heat waves and the shortest Hertzian waves which have yet been made is a question which has many interesting features but which has not yet yielded to the experimenter.—*Journal Franklin Inst.*, January, 1917.

Electrophysics and Magnetism

Relation of Dielectric Losses in Condensers to the Conditions of Charge and Conduction.—F. TANK.—An abstract of a long paper in *Annalen der Physik*, Vol. 48. The author describes various methods of measuring directly the losses in condensers exposed to an alternating electric field, and studies their quantitative relation with the conditions of charge and the conductivity of the dielectric. Among the phenomena characteristic of charged condensers, the existence of an "after-charge" current, following the normal charging current, deserves attention. As regards the effect of conduction through the dielectric, it is to be noted that there is no constant current corresponding with a constant electric field, and that the current diminishes with time. The two phenomena are so far distinct that, in general, the first only exhibits itself in the case of solid dielectrics, and the second in the case of liquid dielectrics; it is, however, possible that the two effects may overlap to some extent. The first effect is explicable according to the Schweidler-Wagner theory of dielectric "after-action," the second is based on ionic conduction. This after-action exhibits proportionality with the intensity of field and also "reversibility"; the calculation of these losses with alternating currents on a theoretical basis is therefore possible. The conduction effects, on the other hand, are not reversible; in an alternating field they merely give rise to a purely heating loss. These considerations are confirmed by our knowledge of the course of the phenomena during a small interval of time. While during a small interval a constant conductivity is observable in the case of liquid dielectrics, we find with solid dielectrics that the shorter the period of time the greater the momentary after-charge current appears to be, without any recognizable limit being apparent. The loss in alternating fields may exceed that due to stationary conditions by more than a hundred times. Since this loss increases with the frequency (being approximately proportional thereto), it follows that at high frequencies condensers using solid dielectrics exhibit losses far greater than those with liquid dielectrics, even though at a low frequency the reverse may be the case. A comparison of theoretical data with the results of actual experiment shows that the losses in solid dielectrics must be ascribed almost entirely to this after-affect in the dielectric. Apart from the relatively small losses that arise from a certain degree of conduction being present, there is no evidence of losses arising simply through the alternation of the field, such as, for example, the absorption of electric oscillations in the dielectric, analogous with those which occur in connection with dispersion phenomena in many liquids. These effects occur at such exceedingly high frequencies as to be comparable with intramolecular processes, and are not met with in practice with ordinary alternating currents. It appears, therefore, that the losses encountered are of quite a different character, and when described in terms of "dielectric after-effect" or "viscous hysteresis" these expressions should not be allied with any special conception in molecular physics.—London *Electrician*, Dec. 8, 1916.

Electrochemistry and Batteries

Brittleness Produced by Electroplating.—M. DEKAY THOMPSON and C. N. RICHARDSON.—Spring steel becomes brittle when used as cathode in a hot cyanide solution, either sodium cuprocyanide or simply sodium cyanide. The effect is more pronounced with the simple salt. Brass and phosphor bronze are not affected. The authors tried to find the reason for the brittleness, but have not yet found the explanation of the effect. It is not caused by the liberation of hydrogen nor is the carbon content or the crystalline structure changed by electrolysis.—*Met. & Chem. Eng'ing*, Jan. 15, 1917.

Units, Measurements and Instruments

Electric Units and Standards.—A pamphlet of sixty-eight pages. The first chapter deals with the system of units (units and standards in general, the electrostatic and electromagnetic systems, international electric units). The second chapter sketches the evolution of the present system of concrete standards. The third chapter deals with units and standards of the principal electric quantities (resistance, current, emf., quantity of electricity, capacity, inductance, power and energy, resistivity). The fourth chapter deals with magnetic units. There are four appendices on conversion factors, legislation on electric units, bibliography, and symbols.—*Circular, Bureau of Standards*, No. 60, Sept. 25, 1916.

Telegraphy, Telephony and Signals

Telegraphs and Telephones in British Colonies.—R. W. WEIGHTMAN.—The first two sections of a long paper read before the (British) Institution of Electrical Engineers. After referring to British post-office practice, the author deals with the appointment of engineers, with working staffs and sources of supply. He then considers telegraph and telephone administration in the crown colonies, and amalgamation of railway telegraphs with postal telegraphs. The next section of the paper is devoted to overhead construction. The telegraph and telephone systems of the crown colonies—South Africa, Canada, Australia and New Zealand—are described at some length, and in conclusion the important question of lightning protection is considered. The paper is to be concluded.—London *Electrician*, Dec. 15 and 22, 1916.

Miscellaneous

Discontinuance of British Electrical Journal.—"After exactly ten years of weekly publication, *Electrical Engineering* is forced to take leave of its readers. Like so many other enterprises in these difficult times, we have struggled hard against adverse circumstances. One by one, however, we have seen the members of our staff taken from us for military duties, and the proprietors at last find themselves obliged to close down while their newspaper is at the height of its popularity."—London *Elec. Eng'ing*, Dec. 28, 1916.

J. Grant De Remer has opened an office for general consulting practice at 55 Liberty Street, New York, where he will carry on the engineering work formerly handled by the firm of Martin & De Remer, 100 Broadway.

A. C. Martin, formerly commercial manager of the Rockford (Ill.) Electric Company, has been appointed manager of the Steubenville district of the Ohio River Power Company, a subsidiary of the American Gas & Electric Company.

J. E. Davidson, vice-president and general manager of the Pacific Power & Light Company, Portland, Ore., and one of the best-known utility men in the country, will resign from the Portland company to assume new and important duties with the Electric Bond & Share Company in New York. Mr. Davidson became associated with the Pacific Power & Light Company more than six years ago in the capacity of commercial manager. He was formerly with the public utility companies at Port Huron, Mich., and served as secretary-treasurer of the Michigan Electric Association. Later he became president and manager of the Consolidated Lighting Company of Montpelier, Vt. He was president of the Vermont Electrical Association in 1909 and president of the New England Section of the N. E. L. A. in 1910-1911. Since going to the Pacific Coast he became president of the Northwest Electric Association in 1911-1912, was elected a member of the executive committee of the National Electric Light Association at the San Francisco Convention in 1915, and chairman of the Portland Section of the N. E. L. A. in the same year. He is at present chairman of the executive committee of the Northwest Electric Association, and is still a member of the executive committee of the National Association, besides being on a number of committees. As vice-president of the Pacific Power & Light Company Mr. Davidson was in charge of matters of engineering, new business, purchasing, taxes, stores, maintenance and operating. His popularity on the Pacific Coast is as great as in New England and in Michigan, and his removal to New York will be felt as a loss by managers in the Northwest.



J. E. DAVIDSON

Men of the Industry

Changes in Personnel and Position— Biographical Notes

Frederick O. Eaton has been promoted to be general manager of the Rumford Falls Light & Water Company of Rumford, Me.

D. P. Tierney has been appointed superintendent of the Sayre (N. Y.) Electric Company, with which he has been connected for the past eight years.

G. M. Dahl has resigned as vice-president of the Electric Bond & Share Company, New York City, to become vice-president of the Chase National Bank of New York City.

L. A. Ferguson, vice-president of the Commonwealth Edison Company, Chicago, has been elected a director of the Civic Industrial division of the Chicago Association of Commerce.

George E. Willard has been appointed electrical superintendent of Quakertown Borough, Quakertown, Pa., succeeding T. B. Taylor, formerly electrical superintendent of the borough.

Martin J. Wolf has been appointed vice-president of W. N. Matthews & Brother of St. Louis, Mo. Mr. Wolf has been connected with the St. Louis firm since April, 1914, when he joined its staff as jobbing sales manager. As statesman-at-large and as chairman of the "100 Point" committee Mr. Wolf's work in the Jovian order has attracted wide attention.

Stanley P. Farwell, for two and one-half years chief of the service division of the State Public Utilities Commission of Illinois, has left the commission to join the engineering staff of Arthur Young & Company, Chicago. Mr. Farwell was graduated in electrical engineering from the University of Illinois, and after some time in central station work became an instructor in engineering subjects, first at the Central University of Kentucky, and later at the University of Illinois. At Illinois he also carried on post-graduate studies and the degree of Ph.D. was conferred upon him in 1914. While with the commission he organized and supervised the work of the service division and aided in formulating the commission's service rules and its rules for overhead electrical construction.

Obituary

John B. Sullivan, president of the Ashland (N. H.) Electric Light Company, is dead at his home in Ashland. He was born at Holderness, N. H., fifty-eight years ago.

Brother Potamian (Dr. Michael Francis O'Reilly), professor of physics at Manhattan College, New York City, and author of many scientific articles and books, died on Jan. 20. He was born in 1847 in County Cavan, Ireland, and received his education in London, Montreal and New York, earning the degrees F.S.C. and D.Sc. After teaching in Quebec and St. Louis he was sent to London in 1870, where he remained for twenty-three years on the staff of the Brother's College of that city. In 1893 he was given charge of the courses in mathematical and experimental physics at De LaSalle Normal College at Waterford, and three years later he was chosen to direct the same courses in Manhattan College. Besides numerous articles in the engineering and scientific press, Brother Potamian was the author of "Gleanings in Electrical History," "Franklin and DeRomas on the Lightning Kite," "The Weight of the Earth," "The Rotation of the Earth," "The Electrical Work of Benjamin Franklin," and others. He was also joint author of "Electrical Illumination," "The Makers of Electricity," "The Makers of Astronomy," and the "Catalogue of the Wheeler Gift" presenting a brief history of works on electricity and magnetism.

Robert S. Orr, general manager of the Duquesne Light Company, Pittsburgh, Pa., died at Pittsburgh on Jan. 24. Mr. Orr was a native of Clarion County, Pa., and was a graduate of Washington and Jefferson University. For the first two years after his graduation he taught in the Washington and Jefferson Academy, after which he became principal of the Allegheny County (Pa.) public schools. In 1904 he left the teaching profession to accept the post of contracting agent for the Allegheny Light Company, the predecessor of the Duquesne Light Company, and a short time later he was made acting superintendent of the company. In less than a year Mr. Orr was given the post of general superintendent of the company, and it was in the course of his work in that position that he developed a system of concrete reinforcement of decayed poles which is now largely used in this country. For several years Mr. Orr served on the executive committee of the N. E. L. A. He was a past-president of the Pennsylvania Electric Association, and was a member of the Engineers' Society of Western Pennsylvania, the American Electrochemical Society and the A. I. E. E.



R. S. ORR

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

The New Features of 1917 Fan Designs

Improvements in fans this season are noteworthy on account of the fact that the changes made are not radical from the mechanical and electrical standpoint, but will have much to do with the saleability and attractiveness of the popular types of fans. Few new fans



FIG. 1—OSCILLATING MECHANISM—MARELLI FAN

will be placed on the market this year. There seems to be a tendency by some manufacturers to use steel in places where brass was formerly employed, such as for guards. A notable feature is the ease of converting several of the new types from desk to bracket service. One company has developed fan blades and a guard attachment for sewing machine motors, another has designed a blade which it is claimed takes the hum out of fan motors. The majority of makers point out slight changes in designs to improve the appearance of desk and bracket types. Few changes have been made in ceiling fans.

H. Boker & Company, Inc., New York City.—A 10-in. fan with heavily nickel plated brass blades, guards and fittings is being offered to the trade by this company as distributers for Ercole Marelli & Company of Milan,



FIG. 2—ROBBINS & MYERS 8-IN. FAN

Italy. This fan has full swivel and trunnion movements, is instantly convertible from desk to bracket type, and has a two-speed switch with "off" position. This fan, it is claimed, is noiseless on 60-cycle alternating current and remarkably quiet on direct-current circuits. Attention is also called to the oscillating mechanism shown in Fig. 1. By turning the thumb screw to the right the angle of oscillation is cut down degree by degree to a minimum of 10 deg. total oscillation. When the thumb screw is turned to the left the angle of oscillation is increased in a similar manner to a maximum of 120 deg. total oscillation. Both adjustments can be made while the fan is in operation. The oscillating mechanism may be locked in any position. In Fig. 4 is shown a self-rotating ceiling fan for use in large rooms. While the fan is running a slow rotary movement is obtained, the motor revolving around the vertical axis of the suspension rod.

Emerson Electric Manufacturing Company of St. Louis, Mo.—Emerson swivel-trunnion (non-oscillating) fans

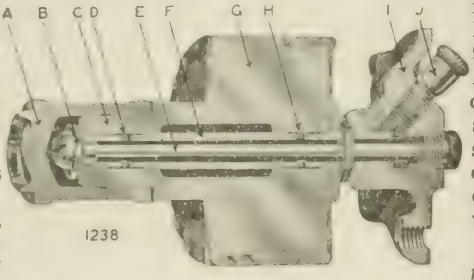


FIG. 3—CROSS SECTION OF EMERSON FAN

for 1917 are of the same design as sold last year. The 8-in. fans are no longer listed for alternating current or direct current, but the 9-in. fan offered last season is made in both oscillating and non-oscillating styles for alternating and direct-current circuits. Emerson 12 and 16-in. non-oscillating fans are equipped with carrying handles on top of the motors. The oscillating fans for 1917 are all new models with certain minor improvements which have been made without changing the electrical design or decreasing the flexibility and durability of the oscillating device. Details of the oscillating device are shown in Fig. 14. Emerson oscillators of 12 and 16-in. sizes in all types have carrying handles for convenience in lifting the motor. The adjusting collar of the oscillating device, which permits changing the position of the motor on the base to point the fan where the breeze is wanted, makes frequent lifting of the motor unnecessary. The popular six-blade, slow-speed, ultraquiet residence type in the 12-in. size is included in the 1917 line, and has been equipped with a new style base and handle. This year the line of oscillating fans for alternating current has been completed by the addition of a 16-in., six-blade, slow-speed oscillator, which is expected to be useful in theaters, assembly rooms, banks, churches and other places where it is necessary to use a quiet fan but where maximum obtainable breeze is highly desirable. Emerson direct-current oscillators, in 9, 12 and 16-in. sizes, carry the same improvements as the alternating-current fans referred to. In addition to the 9, 12 and 16-in. four-blade direct-current oscillators, a six-blade, slow-speed, 12-in. direct-current style is offered for private offices, hotel bedrooms and such places where an ultra-quiet fan is necessary.



FIG. 4—MARELLI FAN

Robbins & Myers Company, Springfield, Ohio.—One new model has been added to the Robbins & Myers line of 1917 fans. This is an 8-in. non-oscillating design, shown in Fig. 2, with a drawn steel frame. With the addition of this fan, the entire line of Robbins & Myers fans are now furnished in the drawn steel construction. The 8-in. fan, known as model 28, is the universal, series type. It is also made to operate on low-voltage storage battery circuits. A switch in the base provides two running speeds. Model 26, alternating current, and model 27, direct current, is a 9-in., five-blade oscillator. Model 26 has a universal series motor and will operate on 100 to 120 volts direct current as well as 100 to 120 volts alternating current, 25 to 60 cycles. It is also made for 220 volts alternating current service, and model 27 for 220 or 32 volts direct-current circuits. Models 21, alternating current, and 22, direct current, are non-oscillating fans which are made in 12-in. and 16-in. sizes for operation on all standard voltages and frequencies. They can be furnished with four or six blades as desired.

Model 24, alternating current, and

model 25, direct current, are oscillating fans made in 12 and 16-in. sizes, with four or six blades, for operating on all standard voltages and frequencies. All desk and oscillating fans are

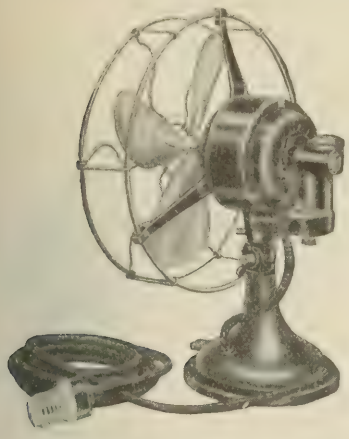


FIG. 5—CENTURY 9-IN. OSCILLATING CONVERTIBLE FAN

supplied with a separable plug and 10 ft. of new code, black reinforced cord. All are adjustable, for desk or wall bracket mounting. The standard finish is black with gold stripes around the body.

The company's line of ceiling fans is the same as offered in 1916. Style "H" is a plain type alternating-current fan, which when furnished in ornamental design is known as style "G." Style "B" is a plain type direct-current fan.

A direct-current ornamental fan, known as style "C," is also supplied. A 12 and 16-in. ventilating fan will be furnished in the same design as in previous years.

Eck Dynamo & Motor Company, Belleville, N. J.—A new development is the —ming blade, shown in Fig. 7, to eliminate the objectionable humming which has existed in fan motors The illustration does not plainly indicate how this is accomplished since the face view in the picture shows only the shape of the blade, and the fact that the four blades are not of exact peripheral diameter, but it does not show that the pairs of blades travel in different planes. It is claimed that it is the combined effect of the shape

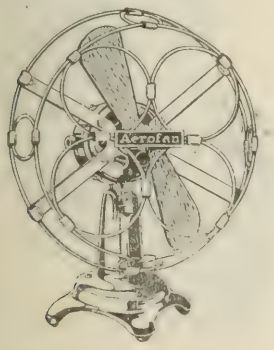


FIG. 6—RUSSELL ELECTRIC 8-IN. FAN

of the blade, differences in peripheral diameter and the fact that they travel in different planes, that eliminates the hum so often evident and objectionable in fan motors.

Western Electric Company, New York City.—This company has provided its 6-in. fan with a knuckle joint, allowing it to be used either as a bracket or desk fan, and making it possible to tilt the fan or incline it at various angles. Since this design is primarily a residence fan its attractiveness has been improved by finishing it in frost bronze instead of the conventional black and polished brass.

Several changes have been made in the construction of the Western Electric oscillating fan for 1917, these being, however, small improvements in details of construction. Probably the most significant improvement in the oscillating type is the method of adjusting the arc of oscillation by means of a knurled head screw on the back of the fan in the bottom position. This screw is easily reached and easy to turn, making it possible to adjust the arc of oscillation without stopping the fan. If a foreign object should retard the oscillating movement the fan will continue to operate as an ordinary desk fan. In the construction

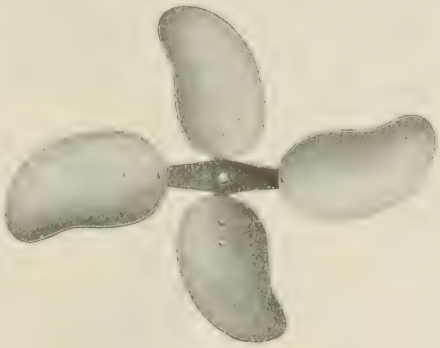


FIG. 7—BLADE OF ECK FAN

of both oscillating and desk fans wing thumb screws have been used for making the various adjustments. The guards of the 1917 Western Electric desk and oscillating fans, except for the 6-in. fan, are black Japan instead of brass. It is believed that this is a positive improvement, as brass guards become tarnished and are difficult to clean, whereas the black Japan finish will always look good and is easily cleaned. This year, instead of glued felt on the bottom of the desk and oscillating fan, six hollow rubber washers are used inserted in the base and permanently glued there. Three of these six rubber feet have holes which continue up through the base of the fan for fastening it down where such a method is desired.

Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.—During the past year or two a distinct demand has developed for a low-priced electric fan for use in the home. The Westinghouse Electric & Manufacturing Company has included in its regular line of 1917 fans such a type, known as the "Westinghouse-Whirlwind," which is an 8-in. fan weighing about 6 lb. Black steel blades are used as well as a black steel guard instead of brass. The speed control switch is omitted so that the fan has only one speed. It has a hinge joint so that it can be mounted on a wall if desired and the patented felt base with which all Westinghouse fans are provided.

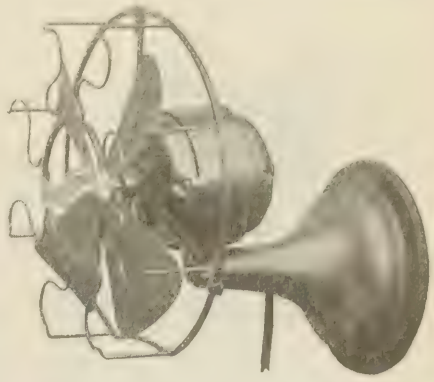


FIG. 8—WESTINGHOUSE 8-IN. FAN

Hamilton-Beach Manufacturing Company, Racine, Wis.—This company has developed a fan blade and guard attachment to fit its sewing machine motor. As shown in Fig. 11, this device is so constructed that it is easily attached and held by the pressure of two springs. The fan is nickel-plated to harmonize with artistic furnishings.

Russell Electric Company, Chicago Ill.—The fan shown in Fig. 6 is known as the Aerofan, and supplied in the 8-in. non-oscillating size, with a perfectly formed 8-in. aeroplane propeller. An advance made by this company is the possible speed regulation of its universal motors by bringing out the field taps. This affords good speed regulation on both direct and alternating current, and is most economical of current since it gives full efficiency on all speeds.

Century Electric Company, St. Louis Mo.—A feature of this company's 1917 9-in. oscillating desk and wall-bracket fan is a construction such that a change of direction of oscillation can be made without adjusting any part of the fan. This is done by simply turning the motor on the swivel stud. The oscillating mechanism consists of a steel worm with bronze gears readily accessible. The body and stand is of drawn steel, with the blades and guard



FIG. 9—WESTERN ELECTRIC 6-IN. FAN

of brass, dipped and lacquered. The 60-cycle fans make seven complete oscillations per minute. Existing designs of stationary, oscillating and ceiling fans have not been changed.

General Electric Company, Schenectady, N. Y.—Most of the 1917 types listed by this company are practically identical with those of last season, only such changes as engineering experience

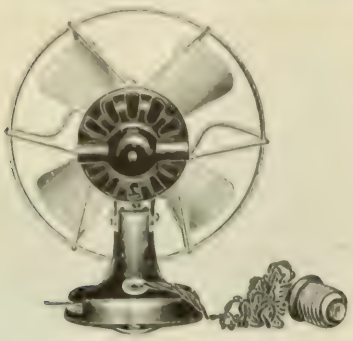


FIG. 10—GILBERT FAN

has shown advisable having been made. The 9-in. fans were especially designed to meet the demands of those who consider the 8-in. fan too small for effective service. The control switch which is mounted in the base is of the improved lever design with notched guide, insuring a positive setting for each speed. The ease of conversion from desk to bracket type is a feature the maker points out for its 12 and 16-in. designs.

A. C. Gilbert Company, New Haven, Conn.—This company's new model "C" Polar Cub fan now has two speeds and a stop. The frame is rigidly die-cast, thus eliminating fifty-seven different parts, it is claimed. Its bearings are an integral part of the die castings. The fan is adjustable to any angle so that a breeze can be thrown in any direction. The base has a hook for attaching to wall if desired. The net weight of this fan is 3 lb. 5 oz. A strong spot-welded guard is provided.

Pittsburgh Electrical Specialties Company, Pittsburgh, Pa.—This company makes a line of 8-in., 6-in. and 4-in. fans. The 8-in. fan is a combination desk and bracket type, with a three-speed universal motor, and weighs 5.75 lb. The finish is full nickel or black Japan with brass blades. To supply the demand for a smaller and lighter fan than the 8-in., a 6-in. design is made that weighs only 3.75 lb. This fan has a single-speed universal motor, a round base and is finished in full nickel or black Japan with brass

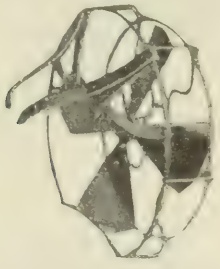


FIG. 11—HAMILTON-BEACH BLADES AND GUARD

blades. A still smaller fan is made by this company, designed especially for the use of travelers. It has blades 4 in. in diameter, weighs only 2.5 lb. and is finished in full nickel or black japan with brass blades. The motor is single-speed, of the universal type.

Manhattan Electrical Supply Company, New York City.—No radical changes in design and construction have been made in the 1917 fans offered by this company. In Fig. 13 is shown a direct-current desk fan in use as a wall fan. This fan is made in two sizes, 12-in. and 16-in. The 8-in. direct-current fan is supplied with a knuckle joint, which permits the body to be moved vertically, but is not adapted for use as a wall fan.

Peerless Electric Company, Warren, Ohio.—About the only changes made by this company in existing designs is the discontinuance of the 8-in. fan and the substitution of a 9-in. fan. This 9-in. fan will be built in two types: The cast frame commutator type, which will be a universal fan, and will operate on either alternating or direct current; and the drawn steel type, which will be built on the straight induction principle for use on alternating-current service. The commutator type will be furnished for direct-current circuits. Both the drawn steel and cast-iron fans will be built in oscillating and non-oscillating types. All the different sizes of this company's oscillating and non-oscillating fans this year will be equipped with black guards and brass blades.

The Carleton Company, Boston, Mass.—This company will continue to offer its moderate priced universal fans in 6-in. and 8-in. sizes, with slight

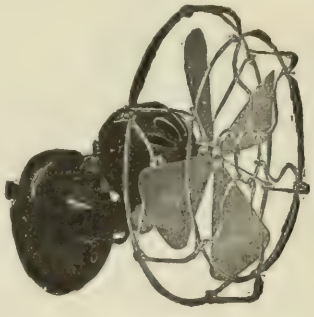


FIG. 12—CARLETON 8-IN. FAN

changes in adjustment and in winding. The motor case is a die casting, and the standard finish is black enamel with guard and blades in nickel on brass, this, it is claimed, being the most permanent bright finish yet known. The 6-in. fan is furnished in the oscillating desk and bracket type. All sizes and styles will be made for operation on any voltage from 4 to 120.

Adams-Bagnall Electric Company, Cleveland, Ohio.—This company calls particular attention to its 1917 alternating-current Gyrofan and oscillating fans. The main changes that have been incorporated in the Jandus and Adams-Bagnall designs cover improvements in detail which give higher operating efficiency and better mechanical service. Fundamentally the fans are not new. They have been in service in sufficient numbers to permit a careful study and analysis of reported troubles which have made it possible to eliminate weak points and strengthen the mechanical features which are so essential in fans of this type in the field. The oscillating fan of the Jandus type which is known to the trade has been improved by details in the course of

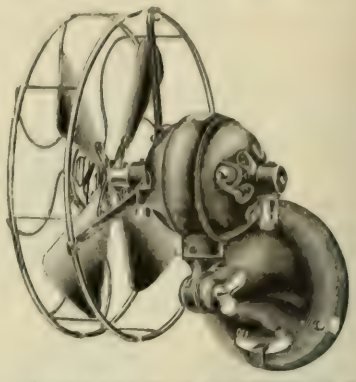


FIG. 13—MANHATTAN CONVERTIBLE FAN

years, as well as in the substitution of a roller or resilient pin which increases the number of points of contact and the resulting service. The Gyrofan line is available in column and ceiling types, with and without light attachment.

Designs of fans that have already proven satisfactory in service are being offered this season by a number of companies. The Crucet Manufacturing Company of New York City has made no changes in its existing fan designs, but announces that later it will bring out one or two extra types. The Knapp Electric & Novelty Company of New York City, makers of battery fans, has made no changes for the 1917 season. The Fidelity Electric Company of Lancaster, Pa., has developed no new fans. Attention is called to the fact that its type "B" ceiling fans have proven popular with the export trade. The Menominee Electric Manufacturing Company of Menominee, Mich., The Lindstrom-Smith Company of Chicago, and the Kokomo Oscillating Fan Company,

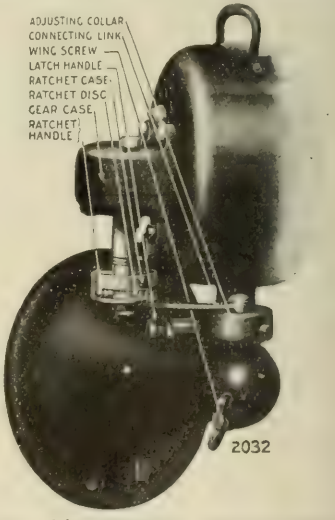


FIG. 14—EMERSON OSCILLATING MECHANISM

Kokomo, Ind., have made developments in fans which are not, however, available at this time but will be described in later issues of the ELECTRICAL WORLD.

NEWS OF THE INDUSTRY

A Review of Activities in the Electrical Manufacturing, Selling and Central-Station Fields

Public Service Commission News

District of Columbia Commission

The Public Utilities Commission, on its own initiative, has made an investigation preliminary to prescribing standards to secure the accuracy of all watt-hour meters for the measurement of electrical energy in the District, as required by the Public Utilities Law. A set of regulations, following closely those promulgated by the United States Bureau of Standards, has been prepared and will take effect after Feb. 1.

New Jersey Commission

Statistics of Public Utilities of New Jersey for 1915, Part 1, have been published by the Board of Public Utility Commissioners. This volume contains the assets and liabilities accounts, names of principal officers, income account and important changes for the year of every class of public utility company of which the gross operating revenue for the year exceeded $10,000.

Idaho Commission

The Public Utilities Commission recently ordered the Rupert Electric Company to lower the flat rate it has been charging its patrons, reduce the flat charges made against its customers for power service, and refund to its patrons all money it has collected from them in the form of deposits on meters. The electric company has been charging a flat rate of $1.50 per month for its service. That rate was cut to $1.00 by the commission. A flat rate of 75 cents a month, based on horsepower, known as the "service charge," has been charged on motors. The commission ordered that rate cut to 25 cents a month. Heretofore, the company demanded a deposit of $10 before installing a meter. The commission ordered the custom discontinued and all money received on deposits returned to patrons at the rate of 75 cents a month. Where the service has been discontinued, the money is to be returned in full at once.

Illinois Commission

The State Public Utilities Commission has authorized the Saline Electric Company to purchase the municipal electric plant belonging to the City of Ashley, County of Washington. Although the original plant cost $13,000, the commission authorized its sale at $6,000. Hereafter the public of the city of Ashley will be served from the general transmission system of the Saline Electric Company. In its opinion the commission says:

"The said plant was installed some twelve or fifteen years ago and, to use counsel's words, * * * 'has been a 'white elephant" on Ashley's hands ever since.' The city of Ashley, under date of Oct. 13, 1916, granted the Saline Electric Company a franchise which runs for twenty years from the date thereof, and the representative of the city of Ashley has stated that the public thereof desires to dispose of its municipal electric plant. It is the purpose of the Saline Electric Company to improve generally the electric service rendered in the city of Ashley, and, in time, to reduce electric rates somewhat. The said Saline Electric Company has signified its intention of abandoning the obsolete direct-current generating and switchboard equipment at an early date and of installing, in lieu thereof, a new electric transmission line to connect the electric distribution system in the city of Ashley with the general transmission system of the said company."

California Commission

In its decision permitting the absorption by the Pacific Gas & Electric Company of the Oro Electric Corporation, as reported in the ELECTRICAL WORLD for Jan. 20, the Railroad Commission says that it is clear from the evidence that a very substantial benefit and advantage will accrue to the Pacific Gas & Electric Company by this consolidation, but that the consent of the Railroad Commission, which is a *sine qua non*, should not be granted unless the public interest is advanced thereby.

It is not sufficient that the Pacific Gas & Electric Company is to derive a benefit from the bargain, says the Railroad Commission. "The fundamental test which overrides any benefit to any single party is whether or not the public interest will be served by the consolidation. The consolidation will result in the elimination of any possible competition between the Pacific and the Oro companies. If the public is to be deprived of the benefits of possible competition, it has the right to expect in lieu thereof substantial benefits resulting from the proposed consolidation.

"There is a further matter of considerable importance to which attention should be directed. Certificates of public convenience and necessity were heretofore granted by the Railroad Commission to the Oro Electric Corporation covering large areas in Sacramento Valley, which up to the present time have had little or no electric service. These certificates were granted on application by the Oro Electric Corporation that it intended to develop these sections of the State, and would be able to do so if certificates were granted as prayed for. The Railroad Commission granted these certificates in the hope and expectation that these portions of the State would be developed by the Oro Electric Corporation. These hopes have not been realized. The Pacific company is now failing to take over any except a few franchises owned by the Oro corporation, and is asking that certificates of public convenience and necessity heretofore granted by the Railroad Commission be revoked except to a certain small extent.

"The Pacific company should be very liberal in making extensions into the undeveloped territory which the Railroad Commission hoped that the Oro corporation would develop, and the Pacific company should look largely to the development of the future as well as to the immediate business of the present. Unless electric companies which, during good behavior, may enjoy a practical monopoly in the thickly populated districts in this State, are willing to make extensions liberally into outlying undeveloped sections of the State, there is very serious question as to whether the policy of regulated monopoly of such public utilities as may be referred to as natural monopolies, which policy is now the settled policy of the State, will be a blessing to our people in the long run."

Edison Birthday Party.—The seventieth birthday of Thomas A. Edison, which occurs on Feb. 11, will be celebrated during the evening of Feb. 10 at the Edison Storage Battery Works, East Orange, N. J. It is expected that some 1500 people will be present, including employees and some of Mr. Edison's old associates. The entertainment will consist largely of Edison moving pictures and selections on the Edison phonograph.

Electrical Aid in Ice Cutting.—Ice harvesting has been in progress for the past week or two at Sandusky, which is one of the largest natural ice centers in the lake region. Practically all of the machinery used in hoisting, storing and loading cars is now operated electrically, central-station power being used. One of the producing ice companies is now installing an additional 100 hp. for use next year.

New York City Energy Output.—The total energy output of the electric companies operating in New York City sold to the public during 1915, according to the report of the Public Service Commission for the First District of New York, was 727,004,884 kw.-hr., an increase of 7.73 per cent over the preceding year. The number of customers was 306,217 as against 265,254 in 1914. The total revenue from sales of energy to the public was 344,936,019, an increase of something more than $100,000 over the receipts of 1914. This is the first time since the commission was created that the annual revenue from the sale of electric current has exceeded that from the sale of gas.

Validity of Contracts with Municipal Plant Questioned.—The case of the City of Cleveland (Ohio) against the Tropical Paint & Oil Company to collect the penalty of $256 for terminating a five-year contract with the municipal light plant before its expiration was heard before Judge P. A. White of the Common Pleas Court at Cleveland last week. Attorneys for both the company and the city intimated that the case will be carried up in the event that the decision is against their clients. It is, therefore, probable that the Supreme Court will eventually say whether the 19,000 contracts with the plant are valid or not. In answering the suit, attorneys for the company declared that the city rates for energy are not valid because they were not fixed by ordinance, as required by the Ohio constitution. They argued further that the city board of control is without authority to fix rates, which they claimed must be established by legislative action, subject to the approval of the electors if a referendum is demanded. The contracts are invalid also, the attorneys contended, because they lack mutuality. Penalties are fixed for the termination of contracts before they are due by the users, but the city is exempted from liability for interruptions in furnishing energy. It was said that interruptions of the service caused the company to abandon the use of municipal station energy. Attorneys for both sides were asked to submit briefs, and a decision is expected within a week or ten days.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest

Brooklyn Edison Employees.—W. F. Wells, vice-president of the Brooklyn Edison company, addressed the annual meeting of the company, N. E. L. A. section, on the progress made in the company during the past twenty-five years, the time which Mr. Wells has been with the company. In 1892 the Brooklyn Edison company had but 100 employees, whereas now there are over 2500. Mr. Wells brought out the fact that the company has approximately $16,000 invested for every employee. He also mentioned the new issue of bonds about to be made by the company, urging the advisability of employees investing their savings in the securities of the company.

Milwaukee Citizens Demand Reappointment of Consulting Engineer.—In May, 1916, the council of Milwaukee, Wis., authorized the appointment of a consulting engineer to assist the department of public works in preparing plans and specifications for the city's $1,500,000 street lighting system. Money was appropriated to pay the engineer for a period of six months. That period expired on Jan. 1, 1917, and no official steps have yet been taken to reappoint the engineer, in spite of the fact that it was not possible to complete the work begun during the first six months. At the present time a non-partisan organization, composed of representatives from all local civic and professional clubs, and known as the Mayor's advisory board, is demanding that the city's former consulting engineer, F. A. Vaughn, be reemployed and be instructed to complete the work.

Counselor's Opinion Destroys St. Louis Conduit Space Monopoly.—A formal opinion by the assistant city counselor of St. Louis destroys the monopoly of conduit space in downtown streets by the Union Electric Light & Power Company and overrules opinions by former city counselors. The assistant city counselor's opinion agrees with a similar opinion by a former city counselor and is one of a series of conflicting opinions on the enforcement of the Keyes ordinance enacted many years ago. The board of public service in the opinion is advised it may permit other electric light companies to install conduits in streets which were not assigned under the Keyes ordinance and in streets and alleys which may have been assigned but are not used for conduits. This will open up about one-half of the streets of the city and is deemed a victory for the Cupples Station Light, Heat & Power Company, which for some time has been fighting for permission to install conduits to compete with the Union Electric.

Bill to Permit State to Operate Utility Plants.—State ownership and operation of public utilities is made possible under terms of a bill before the Kansas House. The bill provides that where service by public utility corporations is not satisfactory the property may be taken over and operated either by the State or by any city. The measure permits the State or a city to purchase a public utility outright or to secure possession through condemnation proceedings. All corporations doing business as public service corporations are affected by the measure.

Engineers Discuss Industrial Americanization.—At a dinner given on Jan 19 by Mr. and Mrs. Vincent Astor in their New York home to 160 engineers and college professors the topic of "Industrial Americanization" was broadly discussed. Gano Dunn, president of the J. G. White Engineering Company, who presided, in announcing the purpose of the gathering said: "Industrial Americanization is a part of the present-day movement toward the humanization of industry. It aims to make what is commonly called 'welfare work,' not an exercise of the employers' 'paternalism,' but a legitimate part of business organization everywhere." A number of prominent engineers delivered addresses, among whom was M. I Pupin.

Summary of Bills So Far Introduced at Albany Affecting Electrical Interests.—A number of bills affecting public utility operation have been introduced in the New York Assembly. Those affecting electric light and power corporations are as follows: Assembly No. 101. Amending subdivision 1, section 10, general corporation law, by permitting a railroad corporation, street railroad corporation or manufacturing corporation which generates electric power to use in its business to sell surplus current to the State or any city, town or village or any lighting district or private person or corporation, and to obtain a franchise for that purpose. Assembly No. 159. Adding new section 24-a to public service commissions law, requiring the commission to render decisions within one year from filing of complaint unless the time is extended by the court and providing that the commission's decision may be reviewed by certiorari and regulating the procedure. Assembly No. 235. Adding new section 269 to the highway law, providing for the acquisition by the State of toll bridges for vehicles and foot passengers which constitute a connecting link between two State highways, upon petition of the supervisors of the county or counties in which the bridge is situated. Bridges so acquired shall not be used by railroads, telephone, gas, electric light or other public service corporations except upon the payment of rental, to be determined by the State Highway Commission. All of these measures are still in committee, there having been as yet no regular calendar in either the Senate or Assembly. Public hearings will no doubt be held on the more important measures before any action is taken on them.

Officers of Electrical Contractors' Association of Wisconsin.—At the recent annual meeting of the association the following officers were elected: President, Paul Honold, Sheboygan; vice-president, A. M. Kailing, Milwaukee; treasurer, H. F. Trester, Milwaukee; secretary, J. C. Staff, Milwaukee; director, R. J. Nickles, Madison; director to National Association, Paul F. Harloff, Madison.

Tri-State Convention in April.—The Tri-State Water and Light Association of the Carolinas and Georgia will hold its seventh annual convention at Macon, Ga., on April 17, 18 and 19. E. M. Anderson of Abbeville, S. C., is president, and W. F. Stieglitz of Columbia, S. C., is secretary-treasurer. The association's committee on electrical affairs is W. Rawson Collier, Atlanta; R. T. Long, Anderson, S. C., and W. H. Gallant, Charlotte, N. C.

Mid-Winter Meeting of Portland Electrical Men.—At the annual mid-winter meeting of the Portland, Ore., sections American Institute of Electrical Engineers, and National Electric Light Association, held at the Multnomah Hotel recently, the dinner served was prepared by demonstrators from the electrical companies in Portland and pupils of the domestic science department of the public school. Electric cooking apparatus was used.

Meeting of Portland Engineers.—The American Institute of Electrical Engineers, National Electric Light Association, and Oregon Society of Engineers, Portland sections, held their sixth biweekly luncheon on Jan. 17 in the Oregon Hotel. The luncheon was conducted by the General Electric Company, E. F. Whitney, chairman. W. D. B. Dobson, secretary of the Portland Chamber of Commerce, gave an address on "Industrial Activities of the Northwest."

Officers of Western Society of Engineers.—Announcement of the election of the following officers of the Western Society of Engineers for 1917 was made at the annual banquet of the society on Jan. 10: President, Henry J. Burt, structural engineer for Holabird & Roach; first vice-president, Denney W. Roper, superintendent of the street department of the Commonwealth Edison Company; second vice-president, James N. Hatch, consulting engineer; third vice-president, Wilford W. DeBerard, *Engineering Record;* treasurer, Carlson R. Dart, consulting engineer.

Smelter Smoke and Fume Problem.—At a joint meeting of the New York sections of the American Institute of Mining Engineers and the American Electrochemical Society on Jan. 26 a symposium was held on the smelter smoke and fume problem. The following papers were presented: "The History and Legal Phases of the Smoke Problem," by Ligon Johnson, consulting attorney, International Nickel Company and American Smelting & Refining Company; "Theoretical Aspects of Electrical Precipitation," by W. W. Strong, Scientific Instrument & Electrical Machine Company; "The Cottrell Process in Practice," by Linn Bradley, Research Corporation.

Associations and Societies

A complete Directory of Electrical Associations is regularly printed in the first issue of each month on the next to-last text page.

Southwestern Convention in April.—The thirteenth annual convention of the Southwestern Electrical & Gas Association will be held April 26, 27 and 28, at Dallas, Tex.

Steel Conductors Discussed at Toronto.—"Steel Conductors for Transmission Lines" was the subject of a paper by H. B. Dwight, Canadian Westinghouse Company, before the Toronto section, A. I. E. E., on Jan. 19.

The Electrical Development & Jovian League of San Francisco.—At the regular luncheon held Jan. 17, J. J. Dwyer, president of the Board of State Harbor Commissioners, gave a talk on San Francisco's harbor improvements, enumerating the variety of uses to which electricity is put on the waterfront.

Springfield Engineers Elect Officers.—The Springfield (Ill.) Engineers Club installed the following officers for the ensuing year at the regular meeting Jan. 15: President, B. H. Peck, electrical engineer, State Public Utilities Commission; first vice-president, B. G. Campbell, assistant manager, Springfield Gas & Electric Company; second vice-president, F. R. Atwood, chief engineer, Central Union Telephone Company; recording secretary, J. R. Hughes, assistant engineer, State Public Utilities Commission; corresponding secretary, Curtis Prout, electrical engineer, Illinois Traction System; treasurer, C. A. Crytser, power plant engineer, Springfield Gas & Electric Company; sergeant at arms, A. N. Detweiler, superintendent, National Zinc Works.

Joint Dinner of Engineers at Boston.—Prof. Elihu Thomson, consulting engineer, General Electric Company; Dr. Hugh Cabot of Boston, Mass., and E. H. Ewertz, superintendent of the Fore River Shipbuilding Corporation, Quincy, Mass., will be the principal speakers at the eighth annual informal banquet of engineers of Boston and vicinity, which will be held at the Boston City Club on the evening of Feb. 7. Professor Thomson's subject has not been announced, but Dr. Cabot will speak upon recent experiences at the battlefront in France and Mr. Ewertz will give an illustrated talk on submarines. President Hale of the Boston Society of Civil Engineers, President Hollis of the American Society of Mechanical Engineers, and President Buck of the American Institute of Electrical Engineers will speak informally, and the toastmaster will be Prof. C. A. Adams of Harvard University. Ira M. Cushing, 84 State Street, Boston, is chairman of the dinner committee, and all engineers in Boston and vicinity are invited to attend, whether or not members of the above societies.

Dry Battery Manufacture.—The Jan. 23 meeting of the Dallas Electric Club and Jovian League was turned over to an educational address on the manufacture of dry batteries.

Electric Propulsion of Ships.—W. L. R. Emmett addressed the General Electric Alumni Association of the Apprentice Training System Jan. 26 at Schenectady on the topic "Ship Propulsion—Electrically Driven."

Relation of Central Station Activities to the Public.—Peter Junkersfeld addressed the Jan. 11 meeting of the Fort Wayne section, A. I. E. E., on the subject "Central Station Activities and Their Relation to the Public." The February meeting will be addressed by Harry Bower of the Overland company on "Sleeve Valve Motor."

Organization of Doherty Managers.—Fifteen managers and assistant managers of Doherty companies in Kansas, Missouri, Nebraska and Oklahoma, representing nine subsidiaries of the Doherty corporation, attended a meeting in Kansas City recently, at which plans were made for a permanent organization to meet semi-annually.

Western New England Electric Inspectors Elect Officers.—At the winter meeting of the Western New England section of the National Association of Electrical Inspectors held at Northampton, Mass., Jan. 10, the following officers were elected: President, L. N. Heebner, South Manchester, Conn.; vice-president, H. M. Mahoney, Turners Falls, Mass.; secretary and treasurer, R. J. Forsyth, Greenfield, Mass.

Anti-Glare Legislation.—E. J. Edwards, Nela Park, Cleveland, Ohio, on Jan. 26 addressed the Pittsburgh Section of the Illuminating Engineering Society on "Automobile Headlights and Anti-Glare Legislation." There was scheduled a demonstration of recent headlight apparatus and special open discussion by Director Hubbard and T. H. B. Patterson of the department of public safety, city of Pittsburgh; Capt. B. R. Marshall, department of traffic regulation, city of Pittsburgh; Dr. P. G. Nutting, chairman I. E. S. committee on glare; C. Elmer Bown, transportation and lighting expert, city of Pittsburgh, and Secretary Wolf of the Automobile Club of Pittsburgh.

Missouri Contractors' Annual Meeting.—The following program was arranged for the sixteenth annual meeting of the Electrical Contractors' Association of the State of Missouri, held Jan. 20: "Is a Retail Department Profitable to the Electrical Contractor?" by Charles A. Pierson; "What Should Be the Relations of the Jovians and the Electrical Contractor?" by C. A. Spaulding; "Why Should Not the State and Local Associations Be Chartered by the National Association?" by A. P. Denton; address on "Workmen's Compensation and Mutual Insurance," by Pierre R. Porter; "Union Labor versus Open Shop," by W. L. Hutchison; "What Should Be the Relations of the Jobber and the Electrical Contractor?" by L. E. Reid; "Should We Have a State Law Governing Electrical Construction?" by William A. Koenemann.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

INCREASED MANUFACTURING COSTS OF WASHING MACHINES

Prices Have Been Raised Since Beginning of Year Owing to Higher Production Costs, Which Have Advanced from 17 Per Cent on Some Items to 80 Per Cent on Others

Along with practically all of the other electric appliances, washing machines, as was reported in the ELECTRICAL WORLD for Jan. 13, on page 105, have been raised in price since the beginning of the year. The increases have been made necessary because of the increased cost of manufacturing materials and labor. As evidence of the extent to which production costs have advanced the following table is presented showing the percentages of increase in the quotations on manufacturing materials that enter into the fabrication of electric washing machines.

Woodstock	24 per cent
Castings	60 per cent
Galvanized iron	22 per cent
Copper	75 per cent
Motors	20 per cent
Switches	17 per cent
New code wire	64 per cent
Cold rolled, flats, hex, and square steel	43 per cent
Gears	20 per cent
Wringers	22 per cent
Miscellaneous	80 per cent

EXPORTS OF ELECTRICAL GOODS STILL INCREASING

November Figures Reach New High Record of $4,421,535, Bringing Eleven Months' Total to $35,494,803—$40,000,000 Mark Probably Reached in 1916

Again all past records have been shattered for the value of exports of electrical merchandise manufactured in the United States. In November last, the latest month for which figures are available, electrical goods to the value of $4,421,535 were exported from this country, as compared to the $2,744,847 in November, 1915. The previous high mark was during the preceding month, October, when the value of electrical exports was $4,045,645.

Particularly noticeable in the November trade were the exports of batteries, insulated wire and cable, telegraph instruments, and miscellaneous supplies. Battery exports were valued at $308,005 in comparison with $184,903 in the corresponding month of 1915 and the previous high record in 1916 of $173,734. Exports of insulated wire and cable were valued at $725,503, as compared with $302,089 in November, 1915, and the previous high record in 1916 of $575,024. Telegraph instruments were exported to the value of $54,562, in comparison with $12,154 in November, 1915, and the previous high record of 1916 of $25,488. In miscellaneous merchandise, the November, 1916, exports were $2,188,826, against $1,357,825 during November, 1915, and the previous high record of 1916 of $1,996,722.

The total for the first eleven months of 1916 was $35,494,803, in comparison with $22,164,250 in the corresponding period of 1915, and $18,342,552 in the corresponding period of 1914. With the exception of generators, fans, interior wiring supplies, arc lamps and carbon-filament lamps, every item enjoyed an export trade of greater value in the first eleven months of 1916 than in the first eleven months of the previous year.

Based on these figures, it is now estimated that the electrical exports for 1916 probably reached the $40,000,000 mark.

While this figure is considerably larger than that for any previous year, it must not be forgotten that comparisons are made of value only. Since the first of 1916 prices advanced considerably, and therefore a certain value in 1916 would represent a smaller quantity of goods than the same value in 1915. In some lines, such as metal-filament lamps, there has been an increase commensurate with the increase in values. In other lines, however, such as insulated wire and cable, it is doubtful if there has been any great increase in quantity, although the values show an increase as large as 67 per cent. Furthermore even in the lines in which decreases were shown a comparison of volume of goods would probably show a greater decrease.

The accompanying figures were compiled by the Bureau of Foreign and Domestic Commerce.

	November		Eleven Months Ended November	
	1915 Value	1916 Value	1915 Value	1916 Value
Batteries	$184,903	$308,005	$1,254,835	$1,812,793
Dynamos or generators	58,850	182,653	1,755,808	1,561,806
Fans	55,849	21,169	354,341	290,349
Insulated wire and cable	302,089	725,503	2,586,723	4,312,845
Interior wiring supplies, etc., including fixtures	79,580	55,069	805,924	790,907
Arc lamps	2,115	731	20,591	14,321
Carbon filament lamps	13,186	14,492	134,870	113,262
Metal filament lamps.	98,703	121,623	744,190	1,287,132
Meters and other measuring instruments	85,113	76,272	588,666	781,409
Motors	293,540	410,211	3,045,163	4,403,444
Telegraph instruments (including wireless apparatus)	12,154	54,562	122,689	193,689
Telephones	30,308	189,923	822,901	1,512,862
Transformers	170,632	72,496	687,203	964,798
All other	1,357,825	2,188,826	9,240,346	17,455,186
Total	$2,744,847	$4,421,535	$22,164,250	$35,494,803

CHINA A MARKET FOR AMERICAN ELECTRICAL GOODS

Banking Connections Essential—Practically All Business Done on a Friendship Basis—Alliance with Established Trading Companies Thought Advisable

Julean Arnold, American commercial attaché of the Bureau of Commerce of the United States at Peking, speaking to a representative of the ELECTRICAL WORLD recently, said, "In spite of the fact that China has now only about twenty electric lighting companies, none of which are hydro-electric plants, there is a real market for electrical goods in that country. This business cannot be secured," he continued, "by remaining in America and sending catalogs to the Chinese. Neither does it pay to write letters to them or to solicit in any way other than by sending salesmen directly to their cities. Practically all business in China is done on a friendship basis, and American commercial concerns in order to secure the business must have American representatives among the Chinese people to work up friendships upon which sales can be made.

"Broadly speaking, there are two practical ways of going after Chinese trade. One of these would be for engineering, banking and manufacturing concerns to form a company for financing, building and operating electrical, mining, and other industrial plants in that country. The market for electricity exists in China; there is only needed the services of an entrepreneur.

"The other plan would be for individual electrical manufacturers to form alliances with companies which are now

in the business of exporting and importing goods at Chinese ports. There are a number of such concerns now well established in the business but are without agencies in electrical goods."

A list of these firms can be obtained from Mr. Arnold.

It should be possible, said Mr. Arnold, for electrical concerns to make arrangements with these companies similar to that which the larger electrical manufacturers of the United States have made with other exporting and importing concerns. It should be a part of such an agreement, however, that the electrical company would be represented in the Chinese office by an American sales engineer. A Chinese salesman of American electrical goods has no success among his own people, even though he may have an American education, because his own people will not believe his statements about the goods as quickly as they will believe the statements of an American. Mr. Arnold said further that the chances of interesting Chinese capitalists in building electric lighting plants for their own cities is splendid, particularly if the American who is handling the proposition in China can speak the language of that country.

CONDITIONS OF JOBBING TRADE IN NEW ENGLAND

Difficulties Continue to Be Felt in Securing Deliveries and Adequate Supply of Both Labor and Raw Materials

Practically no sign of abatement in the rush of business is evident at the moment in the New England jobbing field, although well-informed circles are convinced that a recession is bound to come if prices continue to increase. Difficulties continue to be felt in securing deliveries and there is a shortage of both labor and raw material. The competition of munition-making plants continues to be felt, especially in the lower-priced grades of labor, notably office boys, stocks and order clerks. Transportation and manufacturing delays are still militating against the jobber's reaping the full benefits of the present great demand for appliances and material, which continues even in the salaried class which have profited little by "prosperity," the cost of these delays being estimated at at least $1,000 a week in one prominent house, with reference to its 1916 business. Trained salesmen are in much demand, not only in connection with present trade requirements, but in preparation for future curtailment.

The fundamental influence of the war in Europe with respect to price advances is generally appreciated. Jobbers feel that the small contractor should give them credit for doing their best to fulfill requirements in the face of unprecedented obstacles. Buying is closer in New England than in the Middle and Far West, but it is still impossible to predict the date at which a slackening of demand will occur. The opinion is gaining ground that the opportunity is ahead for unifying the New England electrical trade more closely than has been accomplished in the past, although definite constructive steps are yet to be taken.

COPPER QUOTATIONS

Prices Continue to Advance Owing to Technical Condition of Market

Copper quotations continue to advance and, contrary to general opinion, have gone well over 30 cents. After the drop from the high levels late in 1916, when electrolytic reached 36 cents for immediate delivery, a slight reversal was expected. At that time it was evident that many consumers had over bought as a protection, for as the market quotations began to decline numerous small lots of resale copper were offered. It therefore seemed to be apparent that although the big producers were sold out for the first half of 1916 the market had been supplied and until the third quarter set in or Europe developed a new demand for copper it was expected the market would be sluggish, with prices hovering generally between 26 cents and 30 cents.

However, from the results of the last two weeks it is evident that the copper market is stronger technically than was believed. On Tuesday, January copper was quoted at 32.5 cents and February copper at 31.5 cents. Quotations for the separate quarters were as follows: First quarter, 31 cents; second quarter, 29.5 cents; third quarter, 27.75 cents, and fourth quarter, 26.75 cents.

These quotations are purely the results of the technical condition of the market. There has been no evidence of any large demand for copper, and what buying has taken place has been very small.

Customers are not only not buying for present requirements but there is no interest being shown in future deliveries. The uncertainties surrounding the possibilities of peace are deterring buyers from stocking heavily for future delivery at present prices. Caution is everywhere being exercised and for that reason it is not improbable that the present advancing market is but an attempt to force buyers to enter the market for second half copper.

VALUE OF SALES CONVENTIONS

Both Executives and Salesmen Benefit from the Accumulated Local Experience

This is the month of sales conventions. It is not a new idea but has been in practice for some years. Among the electrical distributers this activity has taken a firm root and each year January sees a number of other jobbers and manufacturers added to the list. Where a distributer has sales forces covering the entire country, each district may have its convention. Where the distributer has a local trade the convention is held at the home office. A number of distributers of electrical goods have conventions semi-annually, and some quarterly.

There is absolutely no doubt about the value of these meetings. Whatever the expense might be in getting the men together, it is repaid many times. At these conventions the men not only have an opportunity to discuss their local problems of distribution with others doing work of a similar character but the sales executives have an opportunity to become more intimately acquainted with (1) the problems involved in distributing the company's products; (2) the sales character of the individual distributers; (3) the individual centers of distribution; (4) what the men feel should be a change in design and other details of an almost equal value.

Besides what the company learns from its men in such a meeting it benefits in many other ways. Above all, such meetings breed a spirit of loyalty, a belief that the policies and the goods of the company are right. They sell the salesman his house and so long as the salesman is in this frame of mind half of the sales battle is won. The men meet other men who are working different territories and the exchange of views regarding selling methods, credit and collection methods, saleability of certain products, question of price, standard packages, competition, etc., makes the sales force far more efficient. The men go back to their territory fortified with the experience of dozens of others. Mistakes are therefore less liable to happen. The answers are ready for new problems before they arrive. Such benefits cannot be measured by the company in dollars and cents, but the annual statement bears evidence of it.

Furthermore, these meetings afford the executives an opportunity to pick with more intelligence men for better positions with the company's sales organization. It is here that the salesman shows whether he has just been selling goods or whether he has been studying the market carefully.

One of the tangible benefits of such gatherings is the receipt of the opinion of the staff regarding some new product the company proposes to market. Not infrequently as the result of these conferences does the company decide not to market the appliance. More frequently is some modification made in the model before it is announced to the trade. By such helpful suggestions the industry is annually saved large sums of money.

This year particularly will these conventions be of inestimable value in the matter of prospective business. The views of the local distributers will help the manufacturers and jobbers more accurately to gage their 1917 requirements. In view of the many uncertainties that clothe the new year such information is of the greatest importance.

Manufacturing and Industrial

M. B. Austin & Company, Chicago, Ill., have issued a new price list on wires and wiring supplies.

Diehl Manufacturing Company announces the change of address of its Chicago storeroom and repair department to 314 South Clinton Street.

Landers, Frary & Clark, New Britain, Conn., have issued a new price list on "Universal" appliances, a number of items showing changes effective Feb. 1.

Stoneware Electric Stove Company, Dover, N. J., has opened an office in Denver, at the Century Building, and one in San Francisco, at 279 Minna Street.

The H. T. Paiste Company, Philadelphia, Pa., manufacturers of electrical specialties, will build a one-story addition to its factory situated at Thirty-third and Cherry Streets.

The Metropolitan Electrical Products Company, Inc., 101 West Forty-second Street, New York City, announces that it has secured the representation of the Adjustable Fixture Company of Milwaukee.

The Electric Storage Battery Company, Philadelphia, Pa., has under construction new buildings which, when completed, will give it more than 20 acres of floor space, an increase of more than 60 per cent.

Kandem Electric Company, Inc., distributors for the Menominee Electric Manufacturing Company, has moved its New York office from 29 East Twenty-first Street to 58-60 Reade Street, in order to be in a position to make prompt deliveries and carry a larger stock.

W. L. Batt has been made sales manager of the Hess-Bright Manufacturing Company, and will have entire charge of its sales after Feb. 1. Mr. Batt has been connected with the Hess-Bright organization since its early days, and has for many years engaged in doing much of the pioneer work that was necessary to develop the industry in this country.

Chicago Pneumatic Tool Convention.—The annual convention of the sales and factory organizations of the Chicago Pneumatic Tool Company was held at the Great Northern Hotel on Jan. 11, 12 and 13. The program included a trip to the company's plant at Chicago Heights and a banquet at the Great Northern on Saturday evening. Dec. 31 closed the biggest month and the biggest year in the history of the company.

The Electric Crane & Manufacturing Company of Milwaukee, Wis., has been organized by a group of former officials and engineers of the Pawling & Harnischfeger Company, including S. H. Squier, M. A. Beck, Arthur Mayer, Leo Mayer and Arthur A. Fritsch. The company has purchased the plant of the former Fred M. Prescott Steam Pump Company, at Sixty-fourth and National Avenues, West Allis. The initial capital stock is placed at $300,000, with an ultimate capitalization of $1,000,000.

NEW YORK METAL MARKET PRICES

	Jan. 16 Selling Prices Bid	Asked	Jan. 23 Selling Prices Bid	Asked
	£ s d		£ s d	
London, standard spot copper	130 0 0		130 0 0	
Prime Lake	28.50	to 29.50†	31.00	to 31.50†
Electrolytic	29.25	to 29.75†	32.00	to 33.00†
Casting	27.50	to 28.00†	28.50	to 29.00†
Copper wire base	38.00†		38.00†	
Lead	7.50		7.50	
Nickel	50.00		50.00	
Sheet zinc, f.o.b. smelter	21.00		21.00	
Spelter, spot	9.92½	to 10.00†	9.92½	to 10.00†
Tin straits	44.50†		45.50†	
Aluminum, 98 to 99 per cent.	51.00	to 55.00†	50.00	to 54.00†

OLD METALS

Heavy copper and wire	22.50	to 23.00†	23.00 to 24.00†
Brass, heavy	13.50	to 14.50†	13.50 to 14.00†
Brass, light	10.50	to 11.00†	11.00 to 11.50†
Lead heavy	6.37½	to 6.50†	6.85 to 7.00†
Zinc, scrap	6.50	to 6.75†	7.00 to 7.25†

COPPER EXPORTS

Total tons to Jan. 23 18,829

†Nominal.

Corporate and Financial

Ashland (Wis.) Light, Power & Street Railway Company.—A block of first mortgage 5 per cent bonds, due Jan. 1, 1939, is being offered at 95 and interest, yielding about 5.4 per cent.

Blackstone Valley Gas & Electric Company, Pawtucket, R. I.—The company proposes a change in the par value of its common stock from $100 to $50, a special notice having been sent out to stockholders for a meeting to be held on Jan. 29 to ratify the suggested change. The preferred stock will remain at a par value of $100 per share. In an explanatory letter to the stockholders, sent out at the same time as the notice of the meeting, William T. Crawford, secretary of the company, says that the proposed change is desirable in order that the common stock of the company may have an equivalent par value to the common stock of other large public utilities companies operating in this State, investors being accustomed to that basis in such stocks. A special act of the Legislature must be secured to allow the change to be made, and the officers of the company cannot ask for this action until the stockholders have approved the matter. If the change is made, the holders of common stock will turn in their certificates at the office of the company, and will receive for each $100 share two shares of the new stock. Each of the new common shares will carry the right to one vote, while each of the preferred shares, with par at $100, will have the right to two votes.

General Gas & Electric Company, New York, N. Y.—The combined revenues of the subsidiary companies in 1916 were derived from the following sources: Electric sales, 65 per cent; gas sales, 20.2 per cent; railway traffic, 12.5 per cent; steam heating, 2.3 per cent.

Kansas City (Mo.) Light & Power Company.—The Public Service Commission of Missouri has authorized the Kansas City Light & Power Company to increase its capital stock from $2,000, the figure at incorporation a year ago, to $4,977,300. This is the amount of bonds authorized to be issued, the bonds having already been placed. It is figured from this action of the commission that probably the valuation of the company will be placed at $7,465,950, which will be 50 per cent more than the authorized issuance of capital stock, and it is recalled that the company had asked a valuation of $7,500,000. If this valuation is placed, it is said to be likely that the rate suggested by the company, which will involve a reduction of about 20 per cent in present rates, will be allowed. The final report on rates probably will come shortly after March 1, when the company will announce its plans for erecting a central station.

Minnesota Utilities Company.—A merger of the Home Electric & Heating Company, Eveleth, Minn., Chisholm (Minn.) Electric Company and the Western Mesaba Electric Company of Coleraine, Minn., has been effected by the Minnesota Utilities Company, a Minnesota corporation, with an authorized capitalization of $1,000,000.

Northern States Power Company, Chicago, Ill.—By action of the board of governors of the New York Stock Exchange the issue of $18,000,000 first and refunding twenty-five-year, Series A, 5 per cent bonds of Northern States Power Company, dated April 1, 1916, has been listed on the Exchange.

Ohio River Power Company.—The American Gas & Electric Company, through its subsidiary, the Ohio River Power Company, will begin on Feb. 1 operation in Steubenville, East Liverpool, Toronto, Wellsville, Empire, Ohio, and Chester, W. Vo. Leases with ultimate purchase agreements have been taken on the electric light and power properties of the East Liverpool Traction & Light Company and the Steubenville & East Liverpool Railway & Light Company, which now supply the above communities. All of these towns are on the Ohio side of the Ohio River except Chester, and are situated north of the Wheeling district. The properties will continue to be operated in two districts. The Steubenville district, consisting of Steubenville, Toronto and Empire, will be under the management of A. C. Martin, formerly commercial manager of the Rockford (Ill.) Electric Company, and the East Liverpool district, embracing the remaining towns, will be under the management of C. E. Torrey,

formerly assistant manager of the Central Power Company of Canton, Ohio. The two districts have a combined population of 80,000.

Pacific Gas & Electric Company, San Francisco, Cal.—During the first half of January, 1917, sales of first preferred 6 per cent stock of the company to consumers surpassed previous records. In this time the company made 255 sales of this stock, aggregating $545,200, which leaves only 7453 shares on hand. Total sales since the first offering was made in June, 1914, have aggregated $14,254,700. A great deal of this stock, which was originally placed in the East, has been repurchased by California investors, and the management believes that eventually the bulk of the issue will be held in California.

Pennsylvania Utilities Company, Easton, Pa.—The energy requirements of the company in 1916 were 47,650,000 kw.-hr., as compared with 42,570,000 kw.-hr. in 1915, an increase of 12 per cent. The energy came from three sources—steam generation yielding 77.7 per cent of the total requirement, water 20.6 per cent, and purchased power 1.7 per cent. The output from steam was 17½ per cent more than in 1915, while water generation fell off 3½ per cent and purchased power takings were 10 per cent less. There are five generating stations. The Dock Street plant is the largest, and generated 27,755,000 kw.-hr. from steam in 1916. This was 58 per cent of the total energy requirements, and equivalent to an increase of 14 per cent in output over the previous year. The South Side station produced 14,134,090 kw.-hr., or 29.5 per cent of the system requirements, from steam and water. The total South Side output was 20 per cent more than the previous year, but the amount obtained from water (39 per cent) was 7.5 per cent less than a year ago, and steam production (61 per cent) was 44 per cent more than the previous year. The Bangor station (steam), yielding 1.3 per cent of the total, fell off 46 per cent in output from that of 1915. Columbia (water power) produced 1.7 of the total, but fell off 29 per cent from last year; and Stroudsburg (also water), producing 7.5 per cent of the total, increased its output over 1915 by 15 per cent.

Sierra and San Francisco (Cal.) Power Company.—In accordance with the authority received from the California Railroad Commission last October to issue $1,000,000 first mortgage 5 per cent, forty-year gold bonds, the company has filed with the commission an application to reimburse its treasury $52,014.92 from the sale of these securities. The previous authority of the commission conditioned that the bonds should be sold so as to net the company not less than 85, and that their proceeds were to reimburse the company for expenditures, as directed by the commission from time to time. The bonds were sold at the figure fixed by the commission, and the money is in bank to the credit of the company as a special fund. In September, October and November last, the company says, it spent the above mentioned sum, $52,014.92, for improvements. These capital expenditures were distributed over a great deal of the company's territory. On Jan. 10 of this year the company had on deposit $850,000 of this fund, and the authorization now asked will be the first payment of the bonds' proceeds.

Standard Gas & Electric Company, Chicago, Ill.—A block of $200,000 of 6 per cent gold notes, due Oct. 1, 1935, is being offered at 96 and interest.

Texas Power & Light Company, Dallas, Tex.—All regular employees of the company, and members of the employees' families or households now have an opportunity to purchase the preferred stock of the company on a partial-payment plan. This stock pays dividends at the rate of 7 per cent annually, the dividend being paid to stockholders quarterly. The stock will be sold at the par value of $100 per share, on terms of $5 down and $5 per month per share purchased. No individual can subscribe for more than ten shares. Employees subscribing will receive dividends on the full face value of the stock from the date the first payment is made, and no interest will be charged on the deferred payments.

Topeka Kansas Railway & Light Company.—The initial issue of $1,284,000 of first lien and refunding sinking fund 5 per cent gold bonds dated Aug. 1, 1916, and due Feb. 1, 1933, is being placed at 94 and interest.

United Water, Gas & Electric Company, Hutchinson, Kan.—An issue of $972,000 of 5 per cent first and refunding mortgage gold bonds dated Sept. 1, 1916, and due Sept. 1, 1941, is being offered at 96 and interest to yield about 5.3 per cent. Of this issue there is at present outstanding $991,000. A block of $350,000 of 6 per cent cumulative preferred stock is now on the market completing the financing of the property.

Wabash Valley Electric Company, Sullivan, Ind.—The Indiana Public Service Commission has authorized the purchase of the Sullivan County Electric Company of Sullivan, Ind., and the Clinton (Ind.) Electric Light and Power Company by the Wabash Valley Electric Company. Stockholders of the Sullivan County company will receive stock in the Wabash company to the amount of $117,000 par value and bonds to the amount of $161,200. Stockholders in the Clinton company will receive stock in the Wabash company to the amount of $124,000 par value and bonds to the amount of $38,800. The commission has authorized the Wabash company to sell $9,000 par value of stock to pay costs of organization and consolidation and $50,000 bonds at not less than 80 for extension and betterment of service.

York Pennsylvania Railways Company.—The annual report of the company and subsidiaries for the year ended Nov. 30, 1916, has just been submitted to the stockholders. Among the subsidiaries is the Edison Light & Power Company of York. During the year there was expended in betterments and extensions $136,500, of which $101,575 was put out for the light and power property. The earnings statement for the combined properties follows:

	1916	1915
Gross earnings	$967,496	$828,300
Operating expenses	$445,947	$411,346
Allowances for depreciation	40,541	20,658
Taxes	50,760	46,110
	$537,248	$478,114
Net earnings	$430,248	$350,186
Interest and bond discount	259,075	239,474
Net income	$171,173	$110,712

Surplus Account

Balance, Dec. 1, 1915	$136,532
Salvage	519
York Steam Heating Company	100
Net income for the year	171,173
	$308,324
Dividends paid	100,000
Balance, Nov. 30, 1916	$208,324

New Utility and Industrial Companies

The Elkader Light & Power Company of Elkader, Iowa, has been incorporated with a capital stock of $300,000 by F. H. Schmidt, C. G. Schmidt and R. F. Schmidt.

The Standard Electric Power & Chemical Company of Vancouver, Wash., has been chartered with a capital stock of $4,000,000 by D. F. Smith, C. D. Charles and John A Jeffrey.

The Electric Properties Company of Cedar Rapids, Iowa, has been chartered with a capital stock of $60,000. The officers are John M. Redmond, president, and M. N. Thompson, secretary.

The Woodville (Okla.) Electric Light & Power Company has been incorporated with a capital stock of $1,500 by R. L. Buck, J. W. Bacon, M. U. Ayres, Guy D. Jackson and J. H. Vann of Woodville, Okla.

The Sparling Electric Company of Buffalo, N. Y., has been incorporated by J. A. Schreiber, J. M. Riexinger and F. T. Sparling of Buffalo, N. Y. The company is capitalized at $10,000 and proposes to do a general electrical contracting business.

The Best Electric Wire Company of Jamesville, N. Y., has been incorporated by E. C. Spencer, G. A. Cowles and A. A. Reed, 136 Cortland Avenue, Syracuse, N. Y. The company is capitalized at $250,000 to manufacture wire, wire rope, cable, conduits, etc.

The Justice Export & Sales Company has been incorporated with a capital stock of $5,000 to act as agent for electrical appliances, devices, lighting fixtures, etc. The

incorporators are: C. G. and W. J. Justice and E. C. Wilson, 94 Clendenny Avenue, Jersey City, N. J.

Worthley & Holland of Marlboro, N. J., have filed articles of incorporation with a capital stock of $10,000 to manufacture and deal in mill supplies and electrical apparatus. The incorporators are: Abbott Worthley, Alfred J. Holland and Robert C. Schanck, Jr., of Marlboro, N. J.

The Great Eastern Light & Power Company of Nashville, Tenn., has been chartered with a capital stock of $5,000 for the purpose of developing water power and other natural resources. The incorporators are: W. A. Batten, B. B. Askew, C. C. Collins, J. B. Seidstad and R. J. Van Horn.

The World's Cheapest Power Company of America has filed articles of incorporation under the laws of the State of Delaware. The company is capitalized at $500,000 and proposes to operate water-power plants. The incorporators are: Harry Ebert, August Muer and Henry Muer of Frederick, Md.

F. S. Cassaway, Inc., of Newark, N. J., has filed articles of incorporation with a capital stock of $100,000 for the purpose of manufacturing and dealing in storage batteries and automobile accessories. The incorporators are: William A. Smith, Thomas S. Woodruff and Florence L. Ennis of Newark.

The International Power & Construction Company of Libby, Mont., has been incorporated by C. Edward Lukens, Leo H. Faust, M. Lukens and M. H. Faust. The company is capitalized at $250,000 and proposes to engage in manufacturing and mining and milling business and to own and develop public utility properties.

The Wright-Hibbard Industrial Electric Truck Motor Company of Buffalo, N. Y., has been chartered, with a capital stock of $300,000, to manufacture and deal in autos, industrial motors, water motors, steam turbines, locomotives, etc. The incorporators are: R. F. Hibbard, G. A. and W. H. Wright, 48 South Division Street, Buffalo, N. Y.

The Northwest Power Company of Augusta, Me., has filed articles of incorporation under the laws of the State of Maine. The company is capitalized at $500,000 and proposes to control, equip, deal in and operate all public work conveniences. The officers are: L. J. Coleman, president; M. F. Hearin, treasurer, and C. L. Andrews, clerk, all of Augusta.

The Central Utilities & Securities Company has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $100,000. The company is considering increasing its capital stock to $500,000, and contemplates taking over various utilities in Wisconsin and other States, to promote and finance railroads, gas, steam, hydroelectric light, power and ice plants. The offices of the company are located in the First National Bank Building, Milwaukee, Wis. W. N. Albertson is president of the company.

Trade Publications

Wiring Devices.—Catalog 24, descriptive of handy electric wiring devices, is being distributed by Pass & Seymour of Solvay, N. Y.

Line Supplies.—Matthews Catalogette, effective Jan. 8, 1917, is now being distributed by W. N. Matthews & Brother, Inc., of St. Louis.

Pickling Machine.—The Mesta Machine Company of Pittsburgh, Pa., has issued its bulletin M, descriptive of its improved pickling machines.

Warming Pad.—The Scientific Products Company, Steubenville, Ohio, has prepared an illustrated folder descriptive of its safety electric warming pad.

Instruments.—The Esterline Company of Indianapolis, Ind., has prepared catalog No. 369 descriptive of Model EB Esterline graphic efficiency instruments.

Water Heaters.—Induction electric water heaters are well described and illustrated in a folder issued by the Coin Machine Manufacturing Company of Portland, Ore.

Reflectors.—*Eye Comfort* for January is now being distributed by the National XX-Ray Reector Company of Chicago and New York. It contains information on comfortable lighting for clubs, lighting the average show window and two January advertisements.

Supplies.—The Cumberland Electric Manufacturing Company of Clarksville, Tenn., has prepared a bulletin descriptive of its low-voltage transformers and electrical specialties.

Mercury Vapor Lamps.—The Cooper-Hewitt Electric Company of Hoboken, N. J., has prepared Bulletin No. 67, descriptive of its P, L, H and K lamps for direct-current indoor lighting.

Sight Box.—The Leeds & Northrup Company, 4901 Stenton Avenue, Philadelphia, Pa., is distributing bulletin No. 631 descriptive of the Leeds & Northrup Lummer-Brodhun photometer sight box.

Lamp Hangers.—Automatic safety disconnecting hangers are illustrated and described in an eight-page bulletin recently published by the Thompson Electric Company, 5606 Euclid Avenue, Cleveland, Ohio.

Hangers and Pillow Blocks.—The S. K. F. Ball Bearing Company of Hartford, Conn., has issued a well-prepared and illustrated bulletin descriptive of its self-aligning ball-bearing hangers and pillow blocks.

Fans.—"Marelli Fans" is the title of a catalog prepared by H. Boker & Company, Inc., 101 Duane Street, New York City. This company distributes Ercole Marelli & Company of Milan, Italy, products in this country.

Wiring Supplies.—M. B. Austin & Company of Chicago are distributing a set of new loose-leaf bulletins to supplement many now in service. These bulletins are descriptive of this company's wiring devices and fittings.

Dish Washer.—The Walker Brothers Company of Syracuse, N. Y., has issued an illustrated book entitled "Washing Your Dishes," descriptive of its electric dish washer. This book is well illustrated and carefully prepared.

Pipes.—Catalog No. 14, descriptive of Redwood-Douglas fir pipe, has been prepared by the National Tank & Pipe Company of Portland, Ore. This catalog has been carefully prepared and is well illustrated in colors.

Transformer Switches.—The K-P-F Electric Company, 37 Stevenson Street, San Francisco, Cal., has issued a bulletin describing in detail its complete line of K-P-F pole-top fused transformer switches for voltages from 2200 to 33,000.

Air Washers.—Spraco equipment for washing and cooling air, especially applicable for steam turbine generators and other electrical machinery, is carefully described and well illustrated in bulletin No. 250 recently issued by the Spray Engineering Company, 93 Federal Street, Boston, Mass.

Batteries.—The Electric Storage Battery Company of Philadelphia, Pa., has issued bulletin No. 162 entitled "The Progress Made in Our New Buildings Since June, 1916." This company has also prepared bulletin No. 161 descriptive of its chloride accumulator for railway car lighting.

Hardware and Supplies.—"Fierro En Paz" ("Iron in Peace") is the title of a very carefully prepared and illustrated book that has been issued by the Dunham, Carrigan & Hayden Company of San Francisco, Cal. The book contains a brief résumé of this company's history intertwined with the history of California and particularly of San Francisco, and commemorates the sixty-seven years of progress in the business of this company.

Arc Lamps and Lighting Systems.—Under the title of "Arc Lamps and Lighting Systems" the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., has just issued a catalog that should interest all connected in any way with the lighting industry. All apparatus necessary for the operation of the various street-lighting systems in use are listed, including constant-current regulators and controlling panels and fixtures for Mazda C lamps, in addition to the regular line of flame carbon and metallic flame arc lamps. Diagrams are also included of the various types of street-lighting systems which should be of great use to prospective purchasers. A complete comparison of the different systems, pointing out their particular value in the various places in which they are used, is given. Luxsolite fixtures with Holophane refractors are listed, together with a complete line of outdoor fixtures, ornamental poles and pole accessories.

New England

PORTLAND, ME.—The Chamber of Commerce is considering the question of the organization of an Industrial Development Association to acquire ownership of a suitable tract of land and the erection of power building thereon in which space will be leased to manufacturers.

MONTPELIER, VT.—The Central Power Corporation of Vermont has entered into a contract with New York parties to supply electricity for the purpose of developing the asbestos fields at Lowell, Vt. Energy will be supplied from the company's plant at Stevens Mills. Charles H. Thompson of Montpelier is interested in the power corporation.

SHELDON SPRINGS, VT.—Work has begun on the erection of an electric transmission line from Sheldon Springs to Sheldon. Electricity to operate the local system will be supplied by the Missisquoi Pulp & Paper Company of Sheldon Springs.

BROCKTON, MASS.—The installation of an electric-lighting plant in the Young Men's Christian Association Building is under consideration. M. A. Davis, Eldon B. Keith and E. W. Thomas have been appointed to investigate the feasibility of putting in such a plant.

TAUNTON, MASS.—Extension of the municipal electric-light and power system to Wade's Corners is under consideration. The cost is estimated to $2,800.

PROVIDENCE, R. I.—Preliminary arrangements have been made for organizing the Bakerville lighting district.

BRIDGEPORT, CONN.—The Board of Aldermen has voted to recommend the extension of the ornamental lighting system on State Street from the present terminus at the City Hall to Courtland Street, which would require 24 lamps. The installation of ornamental lamps on East Main Street is also under consideration.

EAST HAMPTON, CONN.—The East Haddam Electric Light Company has petitioned the State Legislature for permission to change its name to the Central Connecticut Power & Lighting Company.

PLAINFIELD, CONN.—Orders have been placed by the Danielson & Plainfield Gas & Electric Company for a 1500-kw. Allis-Chalmers steam turbine and additional boilers. J. H. Burdick is superintendent.

Middle Atlantic

BINGHAMTON, N. Y.—The electric transmission line which will connect the new plant and substation of the Binghamton Light, Heat & Power Company is now being staked out. The proposed line will be about 5 miles long and will have two independent circuits. The greater part of the material has been purchased.

BROOKLYN, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, Park Avenue and Fifty-ninth Street, New York City, until Feb. 5, for installing electric-light equipment in Public School 116, Knickerbocker Avenue, Ralph and Grove Streets, borough of Brooklyn. Blank forms, plans, etc., may be obtained at the above office, and also at branch office, 131 Livingston Street, Brooklyn.

BUFFALO, N. Y.—The Public Service Commission has authorized the Salmon River Power Company to issue $216,000 in bonds, at not less than 87. The proceeds to be held in treasury pending an investigation by the commission into their use, which is stated to be the acquisition of the Pulaski Electric Light Company and certain new construction.

EAGLE BRIDGE, N. Y.—The installation of an electric-lighting system in Eagle Bridge is under consideration. It is proposed to secure energy from Greenwich, via Cambridge and down the old turnpike.

FREDONIA, N. Y.—The Public Service Commission has authorized the Niagara & Erie Power Company of Fredonia to exercise a franchise for an electric plant and distribution lines in the towns of Hanover and Stockholm.

GAROGA, N. Y.—Plans are being prepared by Morrell Vrooman, 10 North Main Street, Gloversville, for a 2000-hp. hydroelectric development on the Garoga Creek at Garoga. Work on the proposed project will begin in the spring.

LONG BEACH, N. Y.—The Long Beach Power Company has applied to the Public Service Commission for permission to erect electric transmission lines on the property of the Estates of Long Beach and of the Lido Corporation.

NEW YORK, N. Y.—Bids will be received by Robert Adamson, fire commissioner, eleventh floor, Municipal Building, New York City, until Feb. 2 for furnishing 1250 fire alarm boxes of non-interference succession type. Blank forms and further information may be obtained at the above office.

NEW YORK, N. Y.—Bids will be received by Robert Adamson, fire commissioner, eleventh floor, Municipal Building, New York City, until Feb. 2 for furnishing and installing subsidiary pipes and fire-alarm posts south of Fourteenth Street in the borough of Manhattan. Blank forms and further information may be obtained at the above office.

NEW YORK, N. Y.—Bids will be received by William Williams, commissioner of water supply, gas and electricity, Room 2351, Municipal Building, New York City, until Feb. 2, as follows: (1) For furnishing 15 automobiles of the two-passenger type, with a flare board body in rear covered seat; (2) for furnishing ten one-ton motor trucks with bodies and other appurtenances complete. Blank forms and further information may be obtained at the above office.

PORT HENRY, N. Y.—Bids will be received at the office of the clerk of the Board of Education of Port Henry, N. Y., until Feb. 14, for construction of high school. Separate bids to be submitted on heating, electrical work and plumbing. Plans and specifications may be obtained at the office of the Board of Education, Port Henry, and at the office of Tooker & Marsh, architects, 101 Park Avenue, New York City. R. A. Hall is clerk of board.

SAG HARBOR, N. Y.—The Long Island Lighting Company of New York City has petitioned the Public Service Commission for permission to purchase the property and holdings of the Sag Harbor (N. Y.) Electric Light & Power Company; also to consolidate the company with the Long Island Company. The company also asks for permission to issue $25,000 in capital stock and $4,000 in bonds.

SOUTHAMPTON, N. Y.—The Long Island Lighting Company of New York, N. Y., has applied to the Public Service Commission for approval of the purchase of the property of the Suffolk Light, Heat & Power Company of Southampton, and for permission to issue $150,000 in capital stock and $225,000 in bonds. The company also has asked for authority to take over the property of the North Shore Electric Light & Power Company and to issue $75,000 in capital stock and $270,000 in bonds.

THIELLS, N. Y.—Bids will be received by Frank A. Vanderlip, president of the board of managers of Letchworth Village, 7 Wall Street, New York City, until Feb. 14 for construction, including heating, plumbing and drainage and electric work for cottages E, F, G and H at Letchworth Village, Thiells. Drawings and specifications may be consulted at Letchworth Village; at the office of F. B. Kirkbride, secretary, 7 Wall Street, New York City; at the New York office of the Department of Architecture 1224 Woolworth Building; also at the Department of Architecture, Capitol, Albany, where drawings and specifications may be obtained. Lewis F. Pilcher is state architect.

TOMPKINSVILLE, N. Y.—The erection of a new electric transmission circuit, 6000 volts, on both sides of Staten Island, to improve and increase its electrical service, is reported to be under consideration by the Richmond Light & Railroad Company of New Brighton.

ALLENTOWN, PA.—The extension of the ornamental street-lighting system into other sections of the city is under consideration by the city planning commission. Col. H. C. Trexler is at the head of the commission.

DOYLESTOWN, PA.—Local residents have filed a petition with the Public Service Commission asking for improvement in the service now furnished by the Pennsylvania & New Jersey Power & Light Company; also for the operation of the local power plant of the company, which has practically been abandoned.

DU BOIS, PA.—The power house of the Buffalo & Susquehanna Coal Company in Du Bois was wrecked by an explosion on Jan. 17, causing a loss of about $50,000. All the pumps were destroyed.

FARRELL, PA.—The American Sheet & Tin Plate Company is contemplating the construction of a large electric power and boiler house in Farrell to supply power to both the tin plate and sheet mills.

FREELAND, PA.—The Freeland Water Company is considering discarding steam power for operating the three pumping stations and utilizing electricity, to be supplied by Harward Electric Company of Hazleton.

LEWISTOWN, PA.—Plans are being prepared for the construction of a new building, 100 ft. by 150 ft., 12 stories high, to cost about $85,000, for the Young Men's Christian Association. The cost of the equipment is estimated at $10,000, and will include boilers, pumps, filters, electric wiring, electric motors, sweepers, etc. Bids for the proposed work will be received about March 1. J. B. Kamma, York, Pa., is architect.

NEWVILLE, PA.—The Borough Council is considering the establishment of a municipal electric-light plant to supply electricity in Newville and surrounding territory.

NORRISTOWN, PA.—The Counties Gas & Electric Company has acquired property on the Schuylkill River at Conshohocken, to be used in connection with the erection of a new plant. The proposed plant, it is said, will be equipped for an initial generating capacity of 1000 hp.

PHILADELPHIA, PA.—Steps have been taken by the South Sixtieth Street Improvement Association to have the gasoline street lamps on Sixty-first and Sixty-second Streets, between Cedar and Billings Avenues replaced with electric arc lamps.

PHILADELPHIA, PA.—The Public Service Commission has approved the application of the Pennsylvania Heat, Light & Power Company and thirteen other companies to transfer their properties to the Philadelphia Electric Company, all of these comanies being located and doing business in Philadelphia.

PITTSBURGH, PA.—The City Council is considering improvements to the street-lighting system in connection with the new street-lighting contract. The present contract will expire Feb. 1, 1917. It is proposed to replace the arc lamps now in use with nitrogen filled lamps. The Duquesne Light Company furnishes the street-lighting service.

TOWER CITY, PA.—The Gratz Electrical Company, recently organized, is contemplating the installation of a power system to supply electricity in the western section of Schuylkill County.

TULLYTOWN, PA.—The Borough Council is considering the installation of an electric-lighting system to supply electricity for lighting the municipal buildings and residences in the borough. The plans also provide for a street-lighting system.

WILLIAMSPORT, PA.—The electric department of the Sweet Steel Company of Newberry, with repair shop and pattern shop, was destroyed by fire, causing a loss of about $25,000.

DOVER, N. J.—The Morris County Traction Company has closed down its plants at East Dover and Chatham and now secures energy from a substation erected at the foot of Mine Hill, which is operated by the New Jersey Power & Light Company. The line will be extended from this point to serve Kenvil and Sucasunna.

JAMESBURG, N. J.—A proposal has been presented to the Borough Council by Louis H. Saab for the installation of an electric plant and distribution system in Jamesburg. Application for a franchise has been made in the name of the Louis H. Saab Engineering Company.

PERTH AMBOY, N. J.—The Board of Aldermen has authorized the fire committee to purchase an electric testing outfit, at a cost of about $300.

PERTH AMBOY, N. J.—Property owners and merchants on lower Smith Street, between High and State Streets, are planning for the installation of a street-lighting system, using high candlepower lamps. The Public Service Electric Company, it is understood, is interested in the proposed improvement.

SEASIDE PARK, N. J.—Bids will be received by the borough of Seaside Park, N. J., until Feb. 3 (extension of date) for completing the installation of a new 125-hp. boiler, a 250-hp. heater, a 75-kw. generator, etc., at the municipal electric-light and water plant. Aaron Wilbert is borough clerk.

WASHINGTON, N. J.—Bids will be received by the Borough Council until Feb. 19 for lighting the streets and public buildings, either by gas or electricity for a period of five years. Jacob H. Hahn is borough clerk.

MARTINSBURG, W. VA.—The Potomac Light & Power Company, which recently took over the property of the Martinsburg Power Company, is planning to erect an electric transmission system from the high-tension transmission lines of the Hagers-

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

town & Frederick Railway Company at Williamsport, Md., to connect with its system at Martinsburg, W. Va., distant, so as to secure auxiliary power from the railway company's power plant at Sterrett, Md.

HOPEWELL, VA.—E. I. Du Pont de Nemours & Company of Wilmington, Del., it is reported, is planning to establish a plant to manufacture explosives. Orders for structural steel have been placed for an electric generator to develop 10,000 hp.

NORTON, VA.—Plans have been completed by the Old Dominion Power Company, recently incorporated with a capital stock of $500,000, whereby it will take over the properties of the Norton (Va.) Light & Power Company, the Coeburn (Va.) Light & Power Company, the Clintwood (Va.) Light & Power Company, the Glencoe (Va.) Light & Power Company, the Norton (Va.) Water Power Company, and the New York Mining & Manufacturing Company, and consolidate them. Beginning Feb. 1 they will be operated under the name of the Old Dominion Power Company. D. Tazewell of Dorchester, Va., is president and general manager of the Old Dominion company.

ROANOKE, VA.—Arrangements are being made by the Roanoke Railway & Electric Company for the installation of a large number of new nitrogen-filled mean-descent street lamps to replace the old-style carbon arc lamps.

North Central

ANN ARBOR, MICH.—The Detroit Edison Company, 18 Washington Boulevard, Detroit, it is reported, will soon award contract for construction of a hydroelectric plant on the Huron River, to cost about $140,000.

DETROIT, MICH.—Extensive improvements are contemplated by the Detroit United Railway Company at its power station B at Atwater and Riopelle Streets, work on which will be started early in the spring. The cost of the proposed work is estimated at $150,000, and will include a smokestack, 250 ft. high, with 14½ ft. diameter at the top. Eight 250-hp. boilers will be removed and six 600-hp. boilers will be erected in their place. The main object of the work is the elimination of smoke.

PONTIAC, MICH.—The Oakland Motor Car Company is building a large addition to its factory in Pontiac, which includes an engine plant, machine shop and power plant.

AKRON, OHIO.—The State Utilities Commission has granted the Northern Ohio Traction & Light Company permission to issue $1,000,000 in capital stock. The company contemplates extensive improvements and extensions to its system.

AKRON, OHIO.—The Ravenna-Warren division of the Cleveland, Alliance & Mahoning Railroad Company of Alliance, it is reported, has been sold to the Northern Ohio Traction & Light Company of Akron. The latter company, it is said, will extend the railway from Warren to Youngstown.

AKRON, OHIO.—Bids will be received by the director of public service of Akron, Ohio, until Feb. 14 for furnishing and erecting two water tube boilers of 300 hp. each, to be installed in the Cuyahoga River pumping station near Kent. Copies of plans and specifications, etc., may be obtained from the engineering department, Waterworks office, 102 East Mill Street, Akron, upon deposit of $5, or may be seen at the office of the director of public service.

CHATTANOOGA, OHIO.—Plans are being considered to install an electric-light plant in Chattanooga to supply electricity in the town and neighboring farms with electricity. Post office address Chattanooga, R. F. D. from Rockford.

CINCINNATI, OHIO.—The Cincinnati, New Orleans & Texas Pacific Railway Company, it is reported, is considering plans for equipping its railroad between Cincinnati and Chattanooga for electrical operation. The proposed project includes the construction of a large hydroelectric power plant.

COLUMBUS, OHIO.—The City Council has authorized bids for the construction of the foundations for the new boilers, generators and other equipment in connection with the proposed extensions to the municipal electric-light plant. Herman Gamper is engineer in charge of the work.

CONNEAUT, OHIO.—The Ohio Hydro-Electric Company, recently incorporated with a capital stock of $1,100,000, contemplates the construction of hydroelectric power plants on Conneaut and Ashtabula Rivers, near Conneaut. It is proposed to build the dams and hydroelectric stations about 5 miles southwest of this city. Options have been taken on farm lands along the banks of both rivers. F. R. Carver is interested.

HOLGATE, OHIO.—The village of Holgate has granted the Northwestern Ohio Light Company, of Van Wert, a franchise to furnish electric service here. The village has operated a municipal electric plant for 15 years.

SANDUSKY, OHIO.—A tentative site has been acquired by the Vulcan Forge Company of Sandusky, recently incorporated with a capital stock of $250,000, on which it will soon begin the construction of a plant to make steel forgings. A forge shop 60 ft. by 200 ft., die room and power plant will be erected. C. H. Lowe is president.

TOLEDO, OHIO.—Plans are being prepared for a system whereby Toledo will be connected by high-tension transmission lines solely for supplying energy to the local industries. Wires for the new high-tension belt will be strung as soon as the new power house of the Toledo Railways & Light Company is completed.

BUTLER, KY.—The installation of an electric light plant in Butler is under consideration. C. E. Record is reported interested.

HORSE CAVE, KY.—The property of the Horse Cave Light & Power Company has been purchased by the Kentucky Utilities Company of Louisville for $10,000.

JAMESTOWN, KY.—The installation of an electric-light plant in Jamestown is under consideration. J. E. Russell and others are reported interested.

LEXINGTON, KY.—Plans are under consideration for the construction of two large hydroelectric plants on the line of the Queen & Crescent Route with a view of operating the trains by electricity. It is proposed to build a dam across the Dix River, east of Danville, at a cost of about $1,000,000, and establish a hydroelectric power plant at this point. A movement is also on foot to develop the water power of Cumberland Falls and utilize the power to generate electricity. The officials of the Queen & Crescent Route, it is said, contemplate operating all trains between Cincinnati, Ohio, and Chattanooga, Tenn., a distance of 300 miles, with electricity. Louis Herrington of Richmond, George A. McRoberts of Danville and others are reported interested in the project.

SALEM, IND.—The Stout Furniture Company contemplates rebuilding its plant. The work will include the erection of a two-story frame mill building, 62 ft. by 480 ft.; also a brick structure, 62 ft. by 200 ft., in which the power plant, kilns, etc., will be housed. The work will be done by the company under the supervision of Guy Shrum.

GALESBURG, ILL.—Plans are being considered by the Board of Local Improvements for the installation of an ornamental lighting system on North Broad Street, Public Square, South Broad and East Tromp Streets and several other streets in the city.

STILLMAN VALLEY, ILL.—The capital stock of the Stillman Valley Electric Company has been increased from $8,000 to $16,000.

WAUKEGAN, ILL.—The Chicago, North Shore & Milwaukee Railroad Company of Highwood has submitted a proposal to the City Council asking for a new franchise in Waukegan. Among the features of the proposed new ordinance are possibilities of the construction of a new power house and car house in Waukegan and the extension of the Washington Street car line.

BARTON, WIS.—The Acme Brick & Sand Company, it is reported, has awarded contract for construction of addition to boiler house to A. Berres. Two 160-hp. boilers will be installed.

EAU CLAIRE, WIS.—Plans are being considered for the erection of a girls' dormitory, laundry and power house at the Sacred Heart Hospital, to cost about $35,000. Foeller & Schober, 123 North Washington Street, Green Bay, are architects.

KIMBERLY, WIS.—The Kimberly-Clark Company of Neenah has awarded contract for construction of power house, 60 ft. by 80 ft., at its paper mill in Kimberly, to cost about $25,000, to C. R. Meyer & Sons Company, 50 State Street, Oshkosh.

SHEBOYGAN, WIS.—The Phoenix Chair Company has engaged Vaughn & Meyer, Majestic Building, Milwaukee, consulting engineers, to prepare plans and take charge of remodeling the entire mechanical equipment of its plant. An item published Dec. 9 stated that the company was contemplating the installation of a 500-kw. generator, a 200-hp. engine, etc.

BADGER, MINN.—The installation of an electric-light plant in Badger is under consideration.

PINE CITY, MINN.—An agreement has been entered into, it is reported, whereby the Eastern Minnesota Power Company of Pine City will purchase the Mora electric light plant. The company contemplates extending its transmission line through Henrietta, Mora and Ogilvie in the spring.

SHELLY, MINN.—The installation of an electric lighting system in Shelly is under consideration. Will probably grant a franchise.

TOWER, MINN.—The City Council has awarded a contract for an oil-burning engine, generator and switchboard. The new unit will be used as an auxiliary to the present hydroelectric plant.

WABASHA, MINN.—Bids will be received by John W. Murdock, clerk of Board of Education, Wabasha, until Feb. 7, for installing heating, plumbing and electric wiring, in both the new and old school buildings, according to plans and specifications on file in the above office. Builders and Traders Exchange, Minneapolis and St. Paul; copies may be obtained from Chandler & Park, architects, Racine, Wis., by remitting $3.

FESTUS, MO.—The municipal electric light plant is reported to have been sold to the Missouri Electric Company. Improvements are contemplated by the new company, which, it is understood, will extend its transmission lines to some of the smaller towns in the county. A 24-hr. service will also be established.

KANSAS CITY, MO.—The Public Service Commission has granted the Kansas City Electric Light Company permission to increase its capital stock to $4,979,000.

SPRINGFIELD, MO.—Plans are being prepared for the erection of a factory building at Comer, Booneville and Pine Streets for the D. M. Oberman Manufacturing Company. Water and Booneville Streets. The work will include the erection of a 60 ft. by 120 ft., 4 stories high, building to cost about $60,000. The equipment will cost about $40,000 and will include steam heating plant, electric wiring, electric generator, electric elevator, automatic sprinkler, etc. Bids, it is understood, will be awarded the latter part of this month. J. L. Heckenlively, Woodruff Building, is architect.

SWEET SPRINGS, MO.—The installation of another Snow oil engine and an alterating-current generator in the municipal electric-light plant is under consideration.

WARRENSBURG, MO.—The installation of a municipal electric-light plant in Warrensburg is under consideration.

MARMARTH, N. D.—W. R. McKenzie, owner of the local electric-light plant, has submitted a proposition to the City Council for the purchase of the plant.

OMAHA, NEB.—The Union Pacific Railroad Company, it is reported, is contemplating the installation of a power house in Omaha, to cost about $462,000. R. L. Huntley of Omaha is chief engineer.

OMAHA, NEB.—Bids will be received by R. B. Howell, general manager of the Metropolitan Water District, Omaha, until Feb. 7 for a complete pumping unit (30,000,000 gal. capacity per day) for the Florence station.

ARKANSAS CITY, KAN.—The contract for erection of electric system for the Milliken Refinery in Arkansas City has been awarded to the Electric Supply Company, 23 East Fourth Street, Tulsa, at $4,000. The work will include the installation of motors, generators, erection of pole line, wiring, etc.

ELK CITY, KAN.—The installation of an electric-light plant in Elk City is under consideration. W. W. McDaniels of Terlton, Okla, is reported interested in the project.

JETMORE, KAN.—The installation of a new engine in the municipal electric-light and water plant is under consideration.

McCRACKEN, KAN.—At an election held recently the proposal to issue $30,000 in bonds for the installation of an electric-light plant and waterworks system was carried. W. B. Rollins & Company, 209 Railway Exchange Building, Kansas City, Mo., are engineers.

SILVER LAKE, KAN.—The City Council is considering plans for completing the municipal electric-light plant. The generator for the plant was purchased last fall.

WICHITA, KAN.—Bids will be received at the office of the secretary of the board of education, Wichita, until Feb. 3 for the construction of an 18-room intermediate high school building. Bids for heating and ventilating system, plumbing and electric wiring will be received at the same time. Plans and specifications may be obtained at the office of Lorentz Schmidt, architect, Wichita, upon deposit of $25.

Southern States

GREENVILLE, N. C.—The Council has engaged Gilbert White of Charlotte, engineer, to prepare plans for proposed improvements to the municipal electric-light plant and waterworks system. The proposal to issue $52,000 in bonds will be submitted to the voters.

GREENVILLE, S. C.—The Greenville-Carolina Power Company, which erected and controlled the Saiuda dam and power plants, near Greenville, it is reported, will be liquidated at once and the properties taken over by the Southern Public Utilities Company of Charlotte, N. C.

ATLANTA, GA.—R. C. Turner, superintendent of electrical affairs, in his annual report, advocates the installation of an additional 15,000,000-gal. pump with 1000 hp. at the river pumping station and waterworks and the installation of a generator at the crematory plant to generate electricity to operate the two pumps. He also recommends the passing of a city ordinance calling for the electrification of all steam railways within the city limits.

AUGUSTA, GA.—The Augusta-Aiken Railway & Electric Company will erect an electric transmission line from Augusta to Sandersville and Tennille, provided sufficient business is guaranteed.

MACON, GA.—Plans are being considered for replacing the five-lamp cluster ornamental lighting system with new standards carrying a single lamp.

NORMAN PARK, GA.—Plans are being considered for rebuilding the municipal electric-light plant and water works system.

TENNILLE, GA.—The citizens have voted to authorize the Mayor and Council to contract for the installation of an electric-lighting system. The city has recently voted to issue bonds for waterworks system and sewers.

HOMESTEAD, FLA.—Bids will be received by the Town Council of Homestead at the office of the town clerk until Feb. 5 for construction of a municipal electric-light plant. W. B. Caves is town lerk.

KNOXVILLE, TENN.—The Cumberland Telephone & Telegraph Company contemplates the erection of a toll line between Knoxville and Bristol (117 miles) to cost about $30,000; also rebuilding the toll line from Knoxville to Dandridge, and the section from Knoxville to Sevierville, to cost approximately $5,000.

LANETT, ALA.—The City Council is considering taking over the local electric-lighting system, owned by the Lanett Cotton Mills.

HEBER SPRINGS, ARK.—The Arkansas Public Utilities Company, recently incorporated, has purchased the property of the Heber Springs Light Comany. The plant is being enlarged preparatory to establishing a 24-hour service. R. R. Amos of Little Rock is president of the new company.

ROGERS, ARK.—A proposal to install and operate an electric-light plant in Rogers, to cost about $100,000, has been submitted to the City Council by Edgar Masoner of Bentonville and W. A. Wilson of Springdale.

EDGERLY, LA.—A company has recently been organized to establish an electric-light and power plant in Edgerly. Equipment for the plant, it is understood, has been purchased. Lee Alford, F. P. Hayes, and W. D. Parker are reported interested in the company.

MONROE, LA.—The proposal to levy a tax to provide funds for rebuilding the municipal electric-light plant, construction of water mains and filtering plant, sewer system, paving, etc., will be submitted to the voters.

ADA, OKLA.—The Oklahoma Light & Power Company, controlled by Mainland Brothers of Oshkosh, Wis., is contemplating the construction of a hydroelectric plant on the Canadian River, 4½ miles north of Ada, at a cost of $3,000,000. Electricity developed at the plant will be transmitted to Ada, Shawnee, Oklahoma City, Guthrie, El Reno, Pauls Valley, Coatgate, McAlester and other cities.

HASKELL, OKLA.—At an election held recently the proposal to issue $20,000 in bonds for the installation of a municipal electric-light plant was carried.

MIAMI, OKLA.—The installation of a 250-kw. generator and engine in the municipal electric-light and water plant is under consideration.

NEW WILSON, OKLA.—At an election held recently the proposal to issue $10,000 in bonds for extensions to the water and light system was carried.

OSAGE, OKLA.—The City Council has made arrangements with the Oklahoma Utilities Company for furnishing electricity for lamps and motors in Osage. A contract has also been awarded for street lighting.

CARRIZO SPRINGS, TEX.—The local electric-light plant has been purchased by W. A. Cunningham of Bowie. New equipment is being installed in the plant.

CUERO, TEX.—The Texas Southern Electric Company, which operates electric light and power systems in Cuero, Victoria, Beeville, Corpus Christi, Yorktown and other towns in South Texas, has changed its name to the Texas Gas & Electric Company. The company, it is said, is contemplating extending its system during the coming year. R. H. Morris is local superintendent.

DALLAS, TEX.—Plans have been prepared by the Southern Traction Company and the Texas Light & Power Company, both of Dallas, for the construction of a power plant on the Oklahoma side of the Red River north of Denison. The site for the proposed palnt has been acquired and the Oklahoma Legislature, it is said, will grant the easement asked.

LUBBOCK, TEX.—The City Council has voted to install a municipal electric-light plant, to be operated in connection with the waterworks system and sewage disposal plant. The cost is estimated at from $30,000 to $40,000.

Pacific States

INDEX, WASH.—an ordinance providing for an issue of $10,000 in bonds for the installation of a municipal electric-light plant is under consideration by the Council.

MONROE, WASH.—The Western Light & Power Company of Washougal has petitioned the City Council for a franchise to supply electricity and water in Monroe. The Council is of the opinion that before granting the franchise it should consider the advisability of installing a municipal plant, and has instructed the ordinance committee of the Council to make investigations regarding the establishment of such a plant.

PORT ANGELES, WASH.—Extensive improvements will be made to the street-lighting system, for which $25,000 in bonds were recently voted. Dell Church, city electrician, will have charge of the work.

SEATTLE, WASH.—The contract for electrical work in connection with the West Seattle High School, West Seattle, has been awarded to the Arrow Electric Company, 1627 Fourth Avenue, Seattle, at $14,965.

ALBANY, ORE.—A petition has recently been presented to the City Council favoring municipal ownership of the light and water systems and asking the Council to take steps to acquire the local plants.

BAKER, ORE.—The Pacific States Timber Investment Company of Baker, it is reported, will build a mill of 150,000 ft daily capacity, at a cost of about $150,000. The plans provide for a central power plant and planing mill. The company has received a contract from the United States Government for 125,000,000 ft. of timber.

BAKER, ORE.—Plans have been completed for the construction of a sawmill for the Oregon Lumber Company in Baker to replace the plant destroyed by fire last September. The plant will have a capacity of 200,000 ft. daily and will cost about $200,000. It will be equipped for electrical operation throughout. An auxiliary electric plant to generate about 500 hp., it is reported, is included in the project. D. C. Eccles of Ogden, Utah, is president.

COFFEE, CAL.—Improvements are contemplated to the Jubilee Mine, which has closed down for the season, including widening the ditch sufficiently to supply power to a 150-hp. electric plant which will be erected in the summer. The compressor and mill and ore cars will be operated by electricity instead of by water.

SUMMERLAND, CAL.—Bids will be received by the Department of Agriculture, Washington, D. C., until Feb. 2 for furnishing one kelp harvester fully equipped with propellers, engines, electric lights and cutter to be delivered at Summerfield, Cal. Blank forms, specifications, etc., may be obtained from the chief clerk of the department.

GRANGEVILLE, IDAHO.—The Grangeville Electric Light & Power Company, it is reported, contemplates the construction of a concrete dam across the Clearwater River, 375 ft. long and 55 ft. high, at a cost of between $40,000 and $60,000. It is estimated that 10,000 hp. can be developed. T. E. Bayliss is superintendent.

POCATELLO, IDAHO.—The City Council has passed an ordinance authorizing the Mayor and city clerk to enter into a contract with Joseph Burns of Pocatello for the purchase of a water right on the Portneauf River, a power site, a hydroelectric generating plant and transmission system. Under the terms of the proposed contract the city is to take 2000 kw. of electrical energy generated at the plant for a period of ten years. At the expiration of the contract the entire property is to be turned over to the city without further charge. The proposed project involves the installation of a distribution system by the city

SALT LAKE CITY, UTAH.—Preparations are being made to equip the Salt Air Railroad for electrical operation. The entire property of the Saltair Beach Company has been taken over by the Salt Lake, Garfield & Western Railway Company. D. A. Strauss is engineer of the Salt Lake, Garfield & Western Railway Company.

SALT LAKE CITY, UTAH.—Preparations are being made by the Utah Power & Light Company for rebuilding the Olmstead power plant in Provo Canyon, at a cost of $350,000. The new plant will have an output of 8000 hp. The company is also planning to reconstruct a 25-mile section of its interstate trunk line, in order to transmit the extra load now demanded, in cities south of Salt Lake City, including Eureka, Bingham, Arthur, Helper, Magna, Garfield and other towns. The cost is estimated at about $90,000.

SHELBY, MONT.—The installation of a new electric-light plant in Shelby is under consideration. Equipment for the proposed plant, it is understood, has been purchased. James A. Johnson is interested.

SENORITO, N. M.—The J. G. White Engineering Corporation, 43 Exchange Place, New York, N. Y., has been awarded a construction and engineering contract by the Senorito (Mex.) Copper Corporation in the Nanciement district, 90 miles from Albuquerque. The contract includes the installation of a mill and power plant, a 2-mile tramway, necessary mining machinery and equipment of the company's coal mine to provide fuel for the power plant. The Greenawalt Electrolytic method of leaching and electric disposition will be used.

Canada

BALA, ONT.—The Bala Electric Light & Power Company, recently organized with a capital stock of $25,000, proposes to establish an electric plant to supply electricity in the village of Bala and vicinity.

CHATHAM, ONT.—The by-law to extend the hydroelectric system, at a cost of $15,500, has been approved by the ratepayers.

HEPWORTH, ONT.—Plans are being prepared by the Hepworth Light & Power Company for the installation of an electric plant to cost about $12,000. The proposed plant will be located on the Sauble River 2 miles from Hepworth.

IROQUOIS FALLS, ONT.—The Abitibi Pulp & Paper Company, it is reported, is contemplating the construction of two dams and a power lant.

KITCHENER, ONT.—The purchase of three 500-kva. transformers to supplement the present equipment of the municipal plant is under consideration by the Light Commissioners.

LONDON, ONT.—Plans are being considered by Public Utilities Commission for additions to the municipal hydroelectric system, to cost about $50,000.

OIL SPRINGS, ONT.—The by-law enabling the Council to install hydroelectric power, at a cost of $10,000, has been approved by the ratepayers.

SCARBOROUGH, ONT.—The township of Scarborough has entered into an agreement with the Hydro-Electric Power Commission of Ontario for energy. Work will soon begin on the erection of the transmission line.

TORONTO, ONT.—The installation of a new lighting system at Ward's Island is under consideration.

TORONTO, ONT.—The Gutta Percha & Rubber Company is contemplating extensions to its power plant.

TORONTO, ONT.—Arrangements have been completed by the Toronto Harbor Commissioners with the Imperial Munitions Board whereby the latter will erect an electric steel and forging plant with an initial capacity of 300 tons per day, on the reclaimed land. The equipment will include ten six-ton, three-phase, 25-cycle Heroult type, electric furnaces. Each furnace will consume about 2000 hp., which will be supplied by the Ontario Hydro-Electric Power Commission.

WATERLOO, ONT.—The by-law to appropriate $6,500 for the purchase of the Snider mill dam has been approved by the ratepayers.

GREENFIELD PARK, QUE.—The installation of an electric-lighting system in Greenfield Park is under consideration. The cost is estimated at $25,000.

1,212,202. Submarine, Subterranean, and Aerial Telephony; Reginald A. Fessenden, Brookline Mass. App filed May 12, 1916. Transmission of speech through water as between submarines, etc.

1,212,226. Calculating Machine; Benjamin F. Hutches, Jr., Allendale, N. J. App. filed Sept. 29, 1910. Electricity furnishes the power for setting the registering device.

1,212,229. Apparatus for the Production of Oxygen and Hydrogen Gases; William Jones, New York City, N. Y. App. filed Oct. 16, 1913. Electrolysis of water.

1,212,254. Electric Heater; Albert W. Person and Julius E. Person, Harvard, Neb. App. filed April 8, 1916. Series of heating coils are provided extending in parallel relation.

1,212,260. Thermostat; Henry E. Reeve, New York City, N. Y. App. filed July 26, 1912. For electric alarm circuits.

1,212,276. Connector; Jason C. Stearns, Worcester, Mass. App. filed Aug. 22, 1914. For use in reflecting head lights for automobiles.

1,212,282. Electric Fan and Motor Therefor and for Other Purposes; George S. Tiffany, Summit, N. J. App. filed Oct. 9, 1911. Self starting.

1,212,300. Combined Cut-Out and Lightning-Arrester for Telephone Systems; Harry Spencer Wheaton, Dallas, Iowa. App. filed May 3, 1916. Improved device of this design.

1,212,326. Trolley-Pole-Controlling Device; Edward Albert Colton, Galesburg, Ill. App. filed May 14, 1915. Lower the trolley pole instantly from its operative elevation whenever the trolley wheel becomes disengaged.

1,212,342. Sound-Transmitting System for Moving Pictures; Ely D. George, San Francisco, Cal. App. filed Aug. 2, 1916. Simple and inexpensive apparatus.

1,212,343. Trolley Retriever; Charles E. Gierding, Mansfield, Ohio. App. filed March 23, 1914. Efficient in operation.

1,212,363. Automobile Signaling Device; Laurence J. Killian, Boston, Mass. App. filed Dec. 27, 1915. Give notice to those in the rear.

1,212,375. Illuminating Appliance; Earl C. McKinnie, Chicago, Ill. App. filed June 17, 1916. Used in connection with indirect and semi-indirect systems of lighting.

1,212,426. Process for Producing Homogenous Bodies of Chemically-Pure Tungsten Metal of Any Desired Shape; Otto Voigtlander and Hugo Lohmann, Essen-on-the-Ruhr, Germany. App. filed Dec. 2, 1913. Improvements.

1,212,438. Method of and Means for Determining and Indicating the Depth of Water; Arthur R. Bauder, North Haven, Conn. App. filed Sept. 22, 1911. Principle that the electrical conductivity of a body of water varies in proportion to its depth.

1,212,467. Testing of Insulation; Sydney Evershed, Chiswick, London, England. App. filed March 21, 1914. Improved method and means for ascertaining the condition of insulation.

1,212,476. Dynamo; Victor C. Goodridge, Chicago, Ill. App. filed Sept. 2, 1913. Alternating-current dynamo which will generate a current of high frequency, without requiring dangerously high speed.

1,212,493. Telephone-Exchange System; Lewis H. Johnson, Bloomfield, N. J. App. filed May 26, 1916. For facilitating the completing of connections between subscribers.

1,212,492. Telephone-Exchange System; Lewis H. Johnson, Bloomfield, N. J. App. filed May 26, 1916. Improvements.

1,212,494. Telephone-Exchange System; Lewis H. Johnson, Bloomfield, N. J. App. filed May 26, 1916. Central energy type in which an operator's telephone set is automatically connected to and disconnected from a calling telephone line.

1,212,495. Telephone-Exchange System; Lewis H. Johnson, Bloomfield, N. J. App. filed July 24, 1916. Automatic ringing for signaling purposes.

1,212,531. Selecting Mechanism; Fred R. McMurry, Westwood, N. J. App. filed Feb. 26, 1915. Wiping contacts between insulated segmental structures and current collecting or distributing devices is obviated.

1,212,541. Therapeutical Appliance; Frederick H. Morse, Boston, Mass. App. filed Jan. 28, 1916. Portion of the apparatus by which contract is made with the body.

Record of Electrical Patents

Notes on United States Patents issued on Jan. 16, 1916.

1,212,544. Dynamo-Electric Machine; Alfons H. Neuland, San Francisco, Cal. App. filed Dec. 26, 1914. Successive north and south poles which follow each other in the same plane.

1,212,547. Automatic Insulator; Rufus A. Parent, South Tacoma, Wash. App. filed May 23, 1916. Plurality of blocks.

1,212,554. Electrical Control Mechanism; Charles Prache, Paris, France. App. filed Aug. 19, 1913. Remote control.

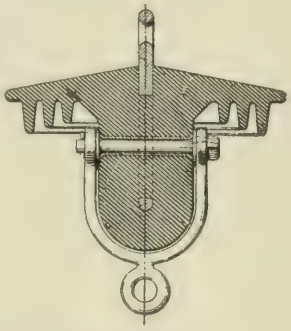
1,212,555. Magnetic Chuck; George G. Pragst, Providence, R. I. App. filed Nov. 9, 1914. Rotary.

1,212,567. Electric Switch; Daniel Schneider, Spokane, Wash. App. filed April 1, 1916. In connection with radiators.

1,212,603. Fuse; Howard H. Baker, Buffalo, N. Y. App. filed Dec. 7, 1916. Renewable fuse strip.

1,212,610. Electrode; Charles W. Dake, Chicago, Ill. App. filed Jan. 31, 1914. For arc lighting.

1,212,632. Combined Switch and Lock Device; Theodore A. Hammond and William P. Hammond, Passaic, N. J. App. filed Oct. 9, 1906. For use in the ignition circuit of explosion engines.



No. 1,212,703. Disk-Type Chain Insulator.

1,212,673. Insulator Supporting Bracket; Charles L. Peirce, Jr., Pittsburgh, Pa. App. filed April 6, 1916. For use on cross-arms.

1,212,694. Fuse; Alf Schaanning and Stanley Austen Stigant, Manchester, England. App. filed Dec. 2, 1916. Horn type.

1,212,699. Electrical Connection; Elda G. Smith, Syracuse, N. Y. App. filed Jan. 8, 1914. Used as a plug in conjunction with a terminal box.

1,212,703. Disk-Type Chain Insulator; Louis Steinberger, Brooklyn, N. Y. App. filed Sept. 21, 1912. Adapted to be arranged in flexible concatenated relation.

1,212,704. Disk Strain-Insulator; Louis Steinberger, Brooklyn, N. Y. App. filed Dec. 31, 1912. Disk type.

1,212,705. Telephone-Receiver Casing; Louis Steinberger, Brooklyn, N. Y. App. filed Jan. 13, 1913. Comprising a body part for retaining the receiver mechanism.

1,212,706. Disk Strain-Insulator; Louis Steinberger, Brooklyn, N. Y. App. filed April 9, 1913. Flexible in construction.

1,212,707. Detachable Connection for Chain-Links; Louis Steinberger, Brooklyn, N. Y. App, filed April 9, 1913. Detachable member which may be readily manipulated for connecting the units together.

1,212,709. Electric-Horn Control; Benjamin Franklin Stephenson, Edmonton, Alberta .Canada. App. filed Oct. 30, 1915. Improved arrangement adapted to be connected to the steering post.

1,212,728. Telephone-Exchange System, Walter P. Albert, Chicago, Ill. App filed Dec. 16, 1912. Automatic switching mechanism is employed for effecting connections between subscribers.

1,212,733. Telegraph System; John H. Bell, East Orange, N. J. App. filed May 16, 1916. For repeating or relaying telegraphic signals.

1,212,746. Lightning-Arrester; David C. Davis, Swissvale, Pa. App. filed April 29, 1915. Horn-Gap discharge terminals.

1,212,755. Method of Manufacturing Inductance-Coils; William Fondiller, New York, N. Y. App. filed Sept. 12, 1914. Maintain constant the inductances of the line windings during the process of manufacture of the coils.

1,212,763. Device for Locating Concealed Conductors; Frank J. Gregory, New York, N. Y. App. filed Aug. 26, 1915. Causing a special form of current to traverse the concealed pipe or conductor.

1,212,774. Magnetically - Controlled Mercury-Vapor Apparatus and the Like; Julius Jonas, Baden, Switzerland. App. filed Sept. 12, 1914. In a vacuum vessel.

1,212,785. Telephone Attachment; John L. McMillan, Syracuse, N. Y. App. filed May 6, 1914. Sound amplifying attachments.

1,212,804. Method of Flanging the End of a Metal Tube; Thomas E. Murray, New York, N. Y. App. filed Nov. 4, 1916. Improvement.

1,212,809. Telephone-Exchange System; Frank N. Reeves, Newark, N. J., and Alben E. Lundell, New York, N. Y. App. filed Sept. 11, 1915. Controlling systems for automatic or semi-automatic telephone exchanges.

1,212,821. Spring Fastening; John Schade, Jr., Brooklyn, N. Y. App. filed Dec. 23, 1914. For electrical conductors.

1,212,836. Lighting System for Vehicles; George Gordon Stewart, Roseburg, Ore. App, filed July 20, 1915. Automatically closing an electric circuit by the movement of certain parts of the gear shifting mechanism.

1,212,867. Electric-Switch Contact-Holder; Adolf P. Witte, Chicago, Ill. App. filed Feb. 11, 1916. Carbon contact block may easily and quickly be removed from its holder.

1,212,869. Electric Welding-Machine; Harry R. Woodrow, New York, N. Y. App. filed Oct. 23, 1916. Eliminates the operator, and automatically controls the rate of feed travel of the work.

1,212,870. Device for Picking Up or Lifting Pins, Needles, Etc.; William Zolper, Wilmington, Del. App. filed June 15, 1916. Embodying a magnet.

1,212,874. Mechanical Rectifier; Frank Adsit, Chicago, Ill. App. filed Sept. 15, 1913. Free from sparking at all loads.

1,212,907. Battery-Lamp; William R. Clymer, Cleveland, Ohio. App. filed June 5, 1914. Combination of a flashlight with lens adjusting means, and to a resistance rheostat therefor.

1,212,908. Automatic Telephone System; Jerome E. Cooley, Manhattan, Kan. App. filed Jan. 23, 1914. Improved means for giving the calling subscriber a busy signal.

1,212,958. Alarm System; Carl A. Kallnbach, Detroit, Mich. App. filed May 8, 1913. Duplex automatic electric fire-alarm.

1,213,002. Insulator; Frank C. Pierce, Campbird. Col. App. filed May 31, 1916. Body of the insulator is provided with a slot.

1,213,011. Device for Connecting Outside Wires to Buildings; Philip C. Ragotsky, Philadelphia, Pa. App. filed July 6, 1916. Telephone wires.

1,213,019. Sparking Device: Andrew L. Riker, Bridgeport, Conn. App. filed Jan. 19, 1907. For igniting the explosive charge in an internal combustion engine.

1,213,035. Instantaneous Electric-Socket .Attachment; Philip Stroup, Cleveland, Ohio. App. filed Nov. 22, 1915. Inherent properties of being readily attached and detached from a socket in a very short interval of time.

1,213,062. Bridge Signal Apparatus; Noah O. Baty, Springfield, Mo. App. filed Feb. 8, 1916. For railroad bridges.

1,213,066. Wireless Automatic Railway Registering System; Clinton L. Bopp, Waterloo, Iowa. App. filed Feb. 24, 1913. Block signaling systems.

1,213,073. Switch; Minus Carr, Maud, Miss. App. filed Jan. 28, 1916. Controller for electrical ignition systems.

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Saving the Net Earnings

THERE is a familiar story of a banker who concerned himself only with the net earnings of a utility in which he was interested. He assumed that the management would see that the gross earnings were expanded and the operating expenses held to a reasonable ratio. What interested him was the amount applicable to dividends on the stock. Now, it can normally be expected that the natural rate of increase in gross business will mean a corresponding rate of increase in net revenue, so that the return on the securities shall be properly protected. In well-managed central station properties we look for steady improvement in position. Regular conditions would not call for comment. But the present is surrounded by so many doubtful circumstances that it is well for every manager to take stock of his prospects. It is to the net that attention will be directed. For higher expenses are the inevitable product of the times. To make the net earnings what they ought to be will require the most searching campaigns for business and the avoidance of waste—labor and material.

The Coal Situation

THE annual report of the Detroit Edison Company reveals a condition quite common to central station companies in the East with reference to coal prices and deliveries. In some sections the conditions have become so acute as to warrant action on the part of the industry as a whole against the railroad companies to whom this condition may be attributed. The Detroit Edison Company, for instance, last fall was put to enormous expense in buying coal because of shortage of cars and congestion of railroads which seriously interfered with its fuel supply. The interference ranged from 25 per cent curtailment of shipment from mines on one coal railroad because of car shortage all the way to absolute stoppages for days at a time, for weeks in one case, in shipments from other roads. Notwithstanding that its fuel contracts were for ample quantities and were made with twenty-two mines on four coal-carrying railroads, the company still must buy coal at high prices wherever it can be found.

Central station companies are not the only ones who are suffering because of embargoes on coal or from car shortage. Most industries using fuel have been similarly handicapped. Public utilities whose service is so essential to society should, however, have the first claim on coal, and railroad companies should not be slow in recognizing the righteousness of such a claim. There is no denying that there is a great market for coal at the present time, and following the law of supply and demand there naturally should be an increase in the price. Central station companies realize that they will have to pay more for coal in the coming year than they did last year, but it is not the price that worries them so much as the uncertainties of delivery.

One would think that the spirit of comradeship which exists between public utilities would be sufficient to guarantee fair treatment to one by the other without recourse to the vested authorities. Complaints by customers to commissions over failures of service are not sought by central station companies, and certainly complaints by public utility companies against the railroads should not be viewed with equanimity by the railroad companies. If continuity and reliability of service is to be assured to the general public there must be continuity and reliability in the coal supply contracted for. Central station companies loathe to increase rates to consumers; but if because of the failure of the railroad companies to deliver fuel the central stations must buy at greatly increased prices on the open market, rates might possibly have to be increased. The railroads would then have to contend with the general public as well as with the central station companies, and the voice of the former will be very potent with the Interstate Commerce Commission.

Finding Ourselves in Foreign Trade

IT is significant of our widening interest in overseas markets that the most popular session at last week's Fourth National Foreign Trade Convention was the one devoted to the problems of the smaller manufacturer and merchant. For this means that the business man of small and average capital is now giving an attention to foreign trade possibilities which he might have given with advantage to his pocketbook many years ago. However, what he could have done in the past is far less important than what he is going to do with the beckoning opportunities which now invite his courage and faith. The greatest work of introducing manufacturers into foreign lands, the pioneer missionary effort, has been done for the industries in this country by the corporations of large capital. Cultivation of these markets is the privilege of all. Large companies are giving freely of their advice in order that the opportunity may be grasped. Government officials and bureaus both give and promise a greater degree of co-operation than ever before. Bankers are keenly alert to the possibilities. Clearly it is "up to" the average manufacturer to benefit from the waiting markets.

Rates and Volume of Service

THE articles on central station growth and rate reduction opens a subject of great interest both to the producer and consumer of electrical energy. Despite the fact that the prices of material and labor involved in the industry have been steadily rising of late at a rather terrific pace, electricity supply is one of the very few things rated as necessities which have consistently declined in cost to the consumer through a period of unparalleled rise in other things. The principal economic justification of this lies in the fact that supply and distribution of energy on a great scale enables the product to be sold more cheaply. The effect of increasing output on cost of production is well understood, but its effect on distribution is less considered, although quite as important. In delivering electricity over a given area the cost of the network per kilowatt-hour delivered decreases rapidly as the output rises, both by reason of the general cost of construction aside from mere conductor copper, and also from the improved diversity factor given by a large number of consumers with varying requirements. The steps instituted by the Milwaukee company as described last week are therefore justified in principle, and in practice there is no reason to doubt their efficacy in building up central station business.

In obtaining miscellaneous business on an electrical supply system the primary rate has a very large influence; if too high it scares off the smaller consumers, who in the aggregate supply a profitable business, although individuals may seem unprofitable. In the second place a moderate primary rate encourages the user to a consumption which earns a chance at the secondary rate, which tends to build up still further density of service. It has been the almost universal experience that a reduction from the primary rate within reasonable limits has resulted in the long run in the increase of net profits. Moreover, the tendency among commissions has been very strongly toward enforcing lower primary rates in the interest of the people at large, who are, one and all, through the relations between the company and the public, to be regarded as silent partners in determining its economic status. The scheme which has been worked out in Milwaukee is really a profit-sharing device whereby the public shares in the prosperity of the company. Just what primary rate is justified is conditioned on local circumstances, but obviously a system whose lines can be loaded to their full capacity by securing new business is in a position profitably to grant lower rates than when the service is kept scattered and meager by the scarecrow of high prices. The Milwaukee program, of making definite reduction in price based on definite increase in the number of consumers, has the advantage of looking forward and tending to check premature agitation for lower rates which actually may hinder the development of the business by forcing extreme conservatism in the matter of secondary and tertiary rates. The present tendency is toward simplification of the rate system and lessening the differences between these several rates. This tendency can only be carried to its legitimate outcome by large increases of load. In whatever form the general scheme is worked out the advantage of a consistent and open policy in securing public patronage and goodwill is self-evident.

Duplex Radio-Telegraphy

THE message-carrying ability of a single wire connecting two widely separated telegraph stations was doubled and then quadrupled by the introduction of the duplex and quadruplex systems. Soon after wireless telegraphy was first successfully practised, a number of inventors realized that similar increases in traffic moving power would be helpful to radio signaling. They set for themselves the tasking of devising and developing suitable modes of multiplex operation; and as a result the patent office has for years been issuing specifications descriptive of many and various proposals directed toward effective multiple simultaneous transmission.

When a single wireless station must receive throughout the period it is sending messages, however, as in true duplex operation, the designer encounters difficulties. In the first place, the wireless transmitter is brutally powerful when contrasted to the wireless receiver. As a consequence of this lion-and-lamb characteristic, suggestions for duplex radio-telegraphy have often provided an alternation in operation of sender and receiver, each set of instruments being connected to the antenna wires several times in the fraction of a second which forms a single Morse dot element, but none of these commutator plans has met with commercially practical success, so far as is known.

There has been developed, however, a duplex radio method which gives excellent results. This system involves the separation of sending and receiving stations (at the same end of the wireless "line") by a number of miles, so as to protect the delicate detectors from direct interference. Different wave lengths are used for transmission in the opposite directions, syntonic discrimination being thus applied. The operation of each sending station is controlled from its corresponding local receiving plant, the Morse key sending its signal impulses over a wire line connecting the two local installations and actuating the main sending apparatus through a relay system. Thus, in the trans-Atlantic stations which connected the United States with Great Britain before the beginning of the war, the American sending plant is located at New Brunswick and the receiver at Belmar, N. J., some 30 miles distant. The operators are on duty at Belmar only, and the two stations are connected by a short wire line. Similarly, the British sender and receiver are respectively at Carnavon and Towyn, Wales, about 20 or 30 miles apart, and connected by wire line. Carnavon sends on one wave length, which is received by Belmar but not by Towyn; and New Brunswick radiates waves of a very different frequency, which are heard by Towyn but not by Belmar. Thus, after suitably choosing the wave lengths and separating the local stations, two continuous streams of messages may be kept passing through the ether in opposite directions.

Competing with Niagara

THE huge new station of the Buffalo General Electric Company, of which the preliminary description appeared in last week's issue, is notable on account of the extraordinary pains that have been taken to secure highly efficient generation of electric power. At first thought it seems a shade worse than carrying coals to Newcastle to build a steam generating station within short range of the great hydroelectric plants at Niagara. It must be remembered, however, that these plants are seriously handicapped in ultimate output by the small-minded policy of the government in checking the use of water, and that the great industries which have grown up about Niagara demand even more power than can conveniently be furnished. The energy contracted for by the Buffalo company from the Niagara plants up to the present time is some 25,000 hp. below Buffalo's full requirement, and if this extra amount had to be taken from the Niagara transmission it would be well up to, if not beyond, the economical capacity of the hydraulic plants and unquestionably would have to be purchased, if at all, at a price which is within competition by steam. Consequently the present plant, with its initial capacity of 60,000 kw. and with a final rating rising to 210,000, has been undertaken with extremely high efficiency as its chief motive. Further, the art of automatic boiler-room operation has been carried very far so that not only is the plant of high thermo-dynamic efficiency but it is unusually economical from the standpoint of labor.

Fundamentally, it is a typical turbo-generator plant specialized for the extremely economical use of fuel. The three generating units are each of 20,000 kw., to be followed at once by a unit of 35,000 kw. The boiler system is notable for the large size and high thermal capacity of the units. The plant has only five boilers, but each of these is capable under service conditions of evaporating about 160,000 lb. of water per hour from and at 212 deg. The actual working pressure, however, is 275 lb. and provision is made for 275 deg. Fahr. of superheat. Each of these figures is substantially the maximum available without going into extremely special constructions. The fuel is dumped from cars into a crusher which reduces the run-of-mine coal to uniform size, and this is lifted by a conveyor to a 7500-ton bunker at the top of the boiler house. Thence it is distributed to the stokers by gravity and from this point the operation of the system is as nearly automatic as it can be made. The forced-draft fans are automatically controlled in response to the steam pressure. All the boilers have a complete system of automatic-draft regulation, and the entire fuel feed system is designed to operate with as little human attention as is possible. The firing system is guaranteed to give an over-all boiler efficiency ranging from 70 to 77 per cent, according to load. This very high figure combines with the high turbo-generator efficiency to give the station about the highest over-all efficiency from coal pile to busbars as yet recorded.

One quite unusual feature of the plant, aside from the provisions for firing, lies in the use of distilled water for the boiler feed. The engineers foresaw that the raw water from the Niagara River would cause scale, which would materially reduce the efficiency of the plant and necessitate shut-downs for cleaning, consequently an evaporating plant of the capacity of 15 tons of water per hour was provided. The distillate not needed at once for the boilers is being stored in a tank system intended at all times to contain enough distilled water to fill a boiler immediately. A complete system of metering the feed water is in use and the provisions for the saving of heat at every stage of the system are remarkably complete. Both feed water system and the main steam piping are in duplicate, the latter being of valves, and the whole piping system is elaborately heat steel with extra heavy flange bolting, and special steel insulated, the main steam pipes having 4 in. of magnesia coating. With respect to the elimination of thermal losses all along the line from the stokers to the turbo-generators this station appears to be equalled by few and excelled by none. It impresses one as a singularly well-planned generating station which ought in economy of operation to repay many times over the care that has been spent upon it.

Public Policy and Other Articles in This Issue

SEVERAL articles on public policy matters are published in this, the first issue of the month, in accordance with our regular practice. Frederick Darlington, consulting engineer of the Westinghouse Electric & Manufacturing Company, has given the "Electrical World" an interview which deals directly with the timely topic of "preparedness." Mr. Darlington believes that the excess of central stations should be used in nitrate production, and that the government, for military reasons, should encourage development on these lines rather than concentrate its efforts on a single large government-operated plant. Arthur Williams, general commercial manager of the New York Edison Company, has written for publication in this number an interesting discussion on the subject of "Government in Business: A Question of Policy." It presents the simple issue which governmental ownership and operation involve. If they are applied as a matter of deliberate policy and are extended they involve far-reaching business operations, touching necessities and luxuries. The regular monthly compilation of central station earnings and energy output appears in this issue. It gives the results for November, which showed that the industry was still making the large increases that had marked previous months.

The foremost engineering article in the current issue is the second installment of the extended description of the new steam station of the Buffalo General Electric Company. A third installment will be published in a later issue. The article in the present number takes up construction and operating features of the steam end of the station.

The contents of the paper have been regrouped in a manner which will be more convenient for the reader.

The 210,000-kw. Buffalo Steam Station—II

Construction and Operating Features of the Steam End of the Station, Including Use of Economizers and Make-up Water Evaporators, Provisions for Maintaining Balanced Draft and Construction of Piping System

SOME of the conditions existing at Buffalo that made it necessary to erect and operate a steam station almost within sight of Niagara Falls were described in the last issue of ELECTRICAL WORLD with features of the elaborate coal-handling apparatus and double-ended boilers. This article deals with other features of construction and operation in the boiler room.

The stoker setting is the largest duplex installation ever made, the width of the furnace being 23 ft. 10⅞ in., and its combined depth 13 ft. 4 in., the total grate area being 318.6 sq. ft. The distance from the top of the grate to the front header is 10 ft. 10 in., and from the top of the grate to the rear header 6 ft. The stokers are guaranteed to give an overall boiler efficiency of from 70 to 77 per cent, dependent upon the amount of water evaporated per hour.

The stokers are driven by 5-in. by 6-in. Sturtevant independent throttling engines equipped with flywheels and designed to develop 25 hp. on 275 lb. pressure saturated steam, the maximum speed being 540 r.p.m. Forced draft is supplied to the stokers by an installation of three Green radial flow, high-efficiency fans, each driven through reduction gearing by a 300 hp. Terry steam turbine. Air is normally taken from the main electrical generating units, which discharge through a duct system under the basement floor into gratings beside the stoker fans.

The stoker engines are located on the main boiler room floor and are connected to the drive shaft with Link Belt silent chains. The stokers are driven by chains from shafting in the basement. The bearings on the stoker driving shafting are all of S. K. F. Ball Bearing Company's make, sixteen bearings being furnished per boiler. The shafting transmits from 7.5 to 20 hp., and at speeds between 66 and 360 r.p.m. The stoker drive for each boiler is independent of the other boilers.

All the boilers are equipped with a system of constant furnace draft regulation provided by the Engineer Company of New York, the forced draft being controlled by the steam pressure by varying the speed of the fan. One furnace draft controller is provided for each boiler. In this station the draft controllers are designed to keep a constant draft over the fire. This draft is maintained constant by the adjustment of a damper in the smoke connection from the boiler, the damper being operated by water pressure through a hydraulic cylinder and system of levers.

A large iron pipe is built into one side wall of the boiler setting, and the movable vane, inclosed in a sheet-steel casing, is set in front of this pipe so as to be affected by the difference between furnace and atmospheric pressures. An adjustable weight keeps the vane in a definite position, and change of the draft condition over the fuel bed changes the location of the vane and operates the pilot valve.

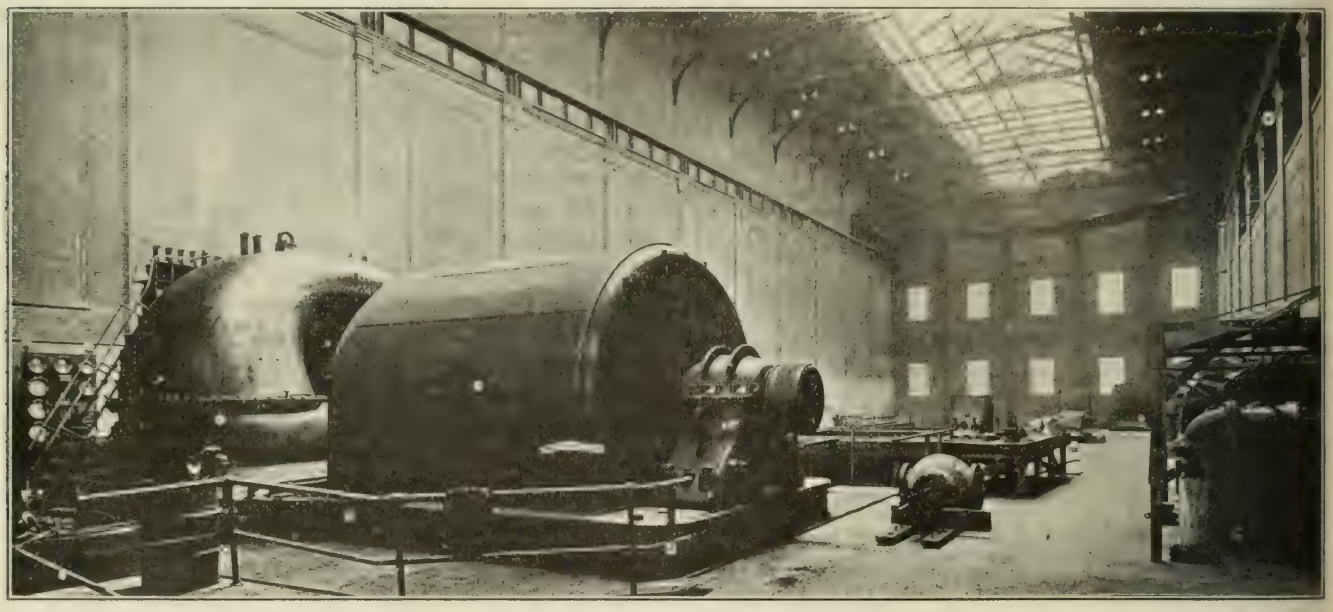


FIG. 1—TURBINE ROOM SHOWING ONE OF THE 20,000-KW. GENERATORS WITH COMBINED TURBINE-MOTOR DRIVEN EXCITER AT RIGHT

The speed of the fan turbines is controlled by a common shaft actuated by a special Mason compensating regulator. The regulator has two diaphragms, one actuated by the pressure in the main steam header and the other by the pressure in the steam chest of the fan turbine. The regulator will hold the main steam pressure constant through a reasonable range of load, will prevent excessive blast pressure with light fires, and cuts down the hunting tendency of the fan to a minimum.

Five Green economizers are installed, one per boiler. Each contains 9435 sq. ft. of heating surface in 576 12-ft. tubes. The tubes are set twelve in a section, the forty-eight sections being in three groups of sixteen each. The groups are connected in series so that the water enters each group at the bottom and rises to the top. Cold water enters at the end from which the gases leave. The working pressure is 325 lb. The economizers are provided with sectional covers on both sides, these being 4 in. thick and composed of steel plate with as-

bestos insulation between. The scraper drive consists of a 3-hp. General Electric motor connected to the driving head by sprocket chain. The economizers are arranged in pairs above and across the firing aisle for each pair of boilers, and the flues and uptakes are so arranged that the by-passing of any unit is easily accomplished. Soot hoppers are provided under each economizer, and any soot settling there is carried down into the ash hoppers by a special soot ejector system.

Five induced draft Niagara conoidal fans are installed to draw away the gases from the economizers. Each fan is of the single inlet overhung type, direct connected to a variable speed motor, and runs from 87 to 450 r.p.m., according to the load. The static pressure created varies from 0.25 in. to 1.5 in., according to speed, and the power required by the fan varies from 1.8 hp. to 130 hp. The fans are located on a flooring above the boilers and at one side of the coal bunker, as shown in the station cross-section.

Two superposed brick-lined steel stacks with outside flues are provided, the stacks each being 185 ft. high above the grates and 18 ft. in diameter inside linings.

Use of Make-Up Water Evaporators

Make-up water is supplied from the Niagara River, being distilled in a Griscom-Russell evaporating plant. The use of distilled water was justified by the intention to run the boilers at very high rates of evaporation, and to accomplish this no loss in boiler efficiency could be tolerated. The major losses which were recognized were those due to scale accumulations, which would not only give poor heat transfer, but necessitate boiler shutdowns for cleaning and also blow-down losses. The evaporating plant has a capacity of 15 tons of distilled water per hour, the water to contain less than 5 grains of solids per U. S. gallon upon evaporation to dryness, and guaranteed evaporation is 2.5 lb. of distilled water per pound of steam supplied.

Three two-effect evaporating equipments are installed, each capable of distilling 10,000 lb. of water per hour. The apparatus includes a feed-water heater, a heat exchanger, a desuperheater, three high-pressure evaporators, a condenser, a special distiller for furnishing drinking water, and an aërating filter.

The raw water, after passing through the feed heater, flows to a pump which forces the raw water through a heat exchanger, the high and low-pressure evaporators and the condenser. The three high-pressure evaporators are all fed from the same header, receiving water from the raw water pump, and the amount of raw water flowing into each evaporator is controlled by float valves. Any excess water not evaporated by the high-pressure equipment passes over to the low-pressure units, where final evaporation occurs. The vapor is carried away to the condenser. The heat exchanger is a small condenser, and as much vapor as can be condensed by the raw water passing through the heat exchanger is drawn by induction into the heat exchanger and condensed

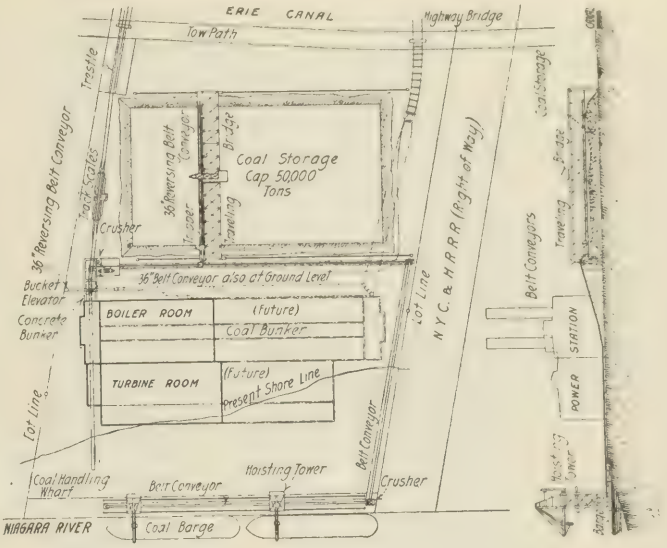


FIG. 2—ARRANGEMENTS FOR SECURING COAL

there. The balance of the vapor is condensed in the condenser, the discharge from the hot well system being used for this purpose.

Two floats are provided in the condensate receiving tank, one of which controls the steam supply to the condensate removal pump, preventing the pump from running away and insuring a definite amount of water in the tank at all times. Should a large amount of distilled water accumulate in this tank, due to only a small amount of makeup water being used in the station feed heaters, the other float control on this tank will shut off the live steam to the evaporators and stop evaporation of additional raw water. The desuperheater is drained continually. A storage tank system with Pneumercator water level indicator and alarm is provided for water distilled in excess of that required. It is planned to keep sufficient water in these tanks at all times to fill one boiler.

Three three-stage Jeansville feed pumps driven by Westinghouse turbines are provided, each having a capacity of 1000 gal. per minute. The feed water pip-





FIGS. 3 AND 4—ONE OF THE COAL CRUSHERS (AT LEFT); COAL CONVEYORS AND DISTRIBUTORS OVER BUNKERS (AT RIGHT)

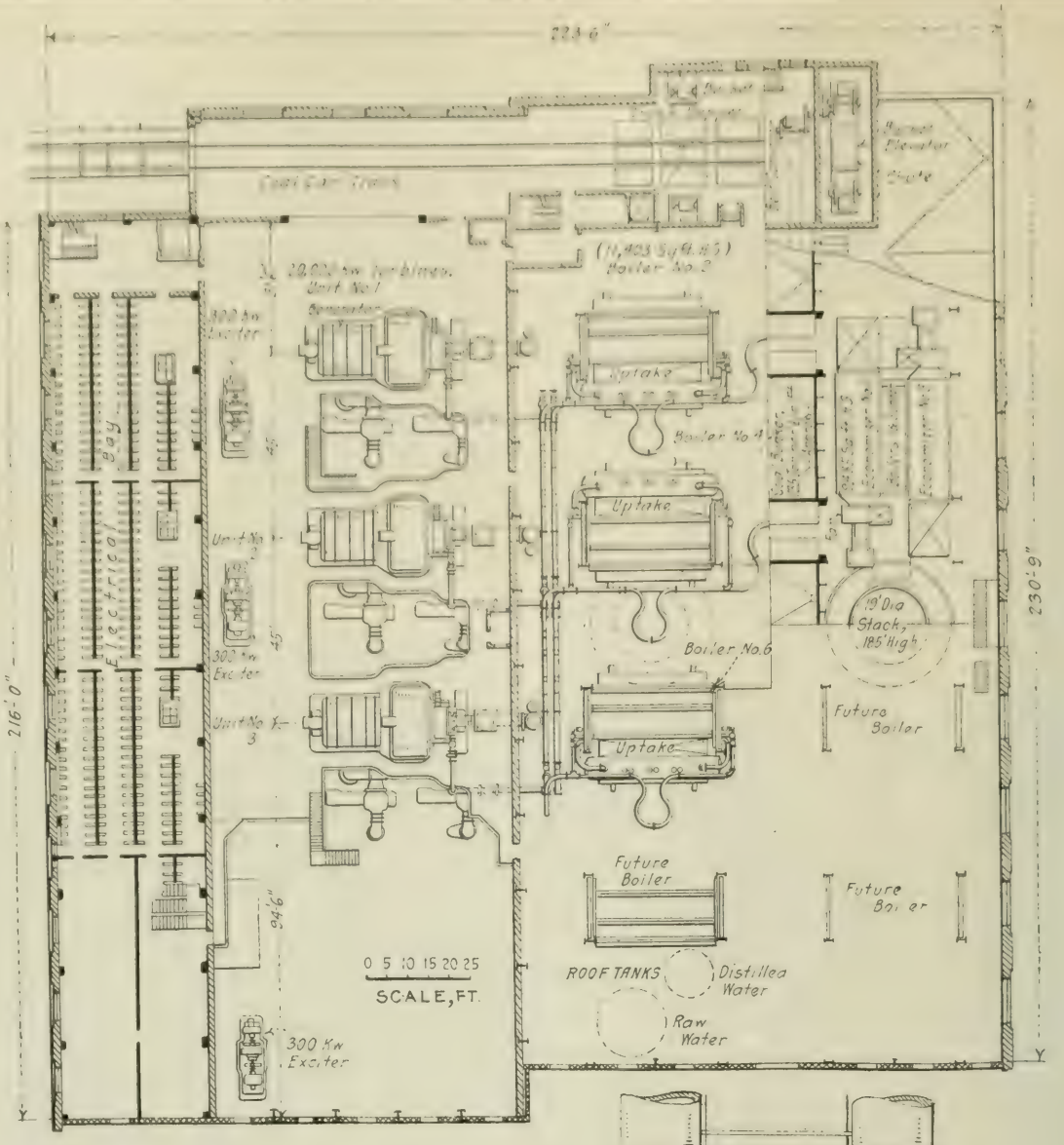
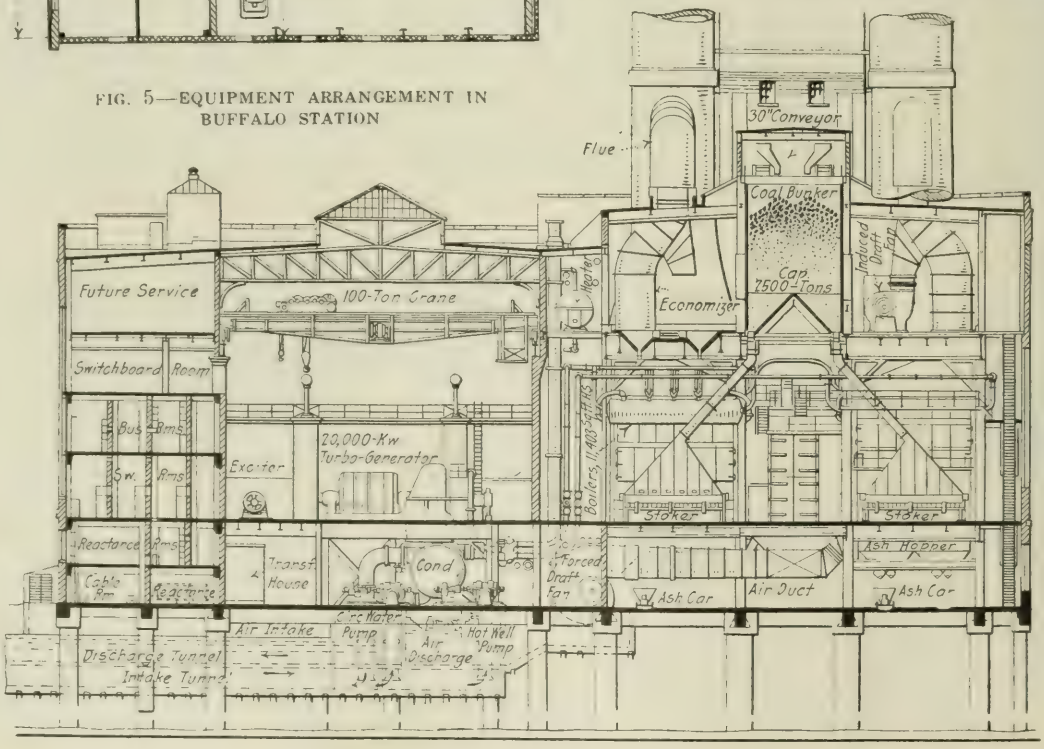


FIG. 5—EQUIPMENT ARRANGEMENT IN BUFFALO STATION



ing is arranged so that any boiler can be supplied either directly or through the economizer above it from a duplicate system of headers and branch lines.

UTILIZATION OF EXHAUST STEAM AND CONDENSATE

The condensate from the turbines is delivered to an installation of three 10,000-hp. Cochrane horizontal open heaters. These are connected up to take the exhaust from the auxiliaries, enough of which are run non-condensing to furnish enough steam to heat the condensate to the desired temperature. The exhaust steam used in feed water heating is also condensed and forms a part of the feed water supply. The amount of make-up water required will be a minimum, the use of evaporators for make-up water obviating the necessity of blowing down boilers except at rare intervals.

Each feed water heater is capable of raising the temperature of 300,000 lb. of water per hour from 40 deg. to 210 deg. Fahr., but under normal conditions of operation the temperature of the entering water will exceed 40 deg. and the temperature of the water leaving the heater will not exceed 160 deg. Fahr. The best efficiency of the economizers is attained when water

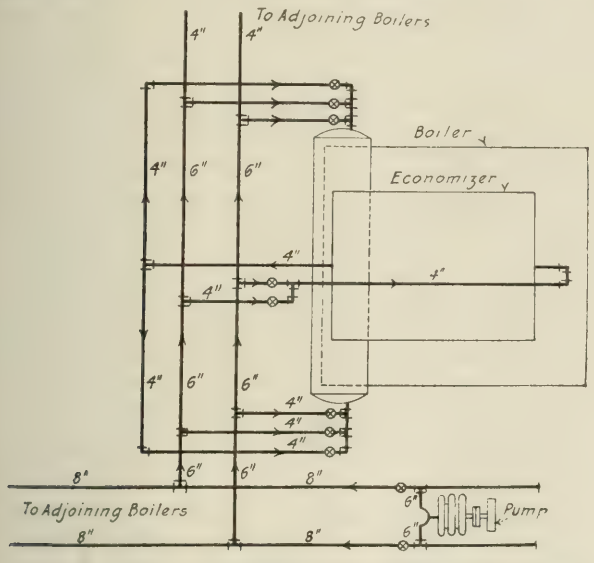


FIG. 6—PIPING ARRANGEMENT FOR FEEDING BOILERS

enters at 160 deg. Fahr. Any excess steam over that required to heat the water to 160 deg. Fahr. is introduced into the main turbines through a special low-pressure inlet, and further surplus, if any, is exhausted to the atmosphere. Exhaust steam supply is derived from turbines operating at 3 lb. back pressure and driving exciters, forced draft fans, boiler feed pumps, low service, hot well, condenser water circulating and air removal pumps. This steam being entirely free from oil makes the usual oil separator supplied with feed water heaters unnecessary, but to enable the exhaust of the stoker engines to be used in the make-up along with the exhaust from turbo-auxiliaries, a Cochrane oil separator is provided for the former.

In addition to the condensate the drips of the high-pressure steam piping and condensation from a steam-heating system used in the station are returned direct to the heater. Should the water level in the latter fall below a fixed point, distilled water is allowed to enter the heater through a float valve, and if the supply of distilled water should be insufficient to keep the water in the heater at the desired level, raw water from the river can be introduced through an emergency connection.

From the heaters the feed pumps force the water into 8-in. duplicate supply headers from which connections are run to the boilers. Each boiler is fed from each end of the cross-drum. Two Venturi meters are provided for each boiler, the designers arranging for measuring the feed delivered at each end, with register-indicator-recorders placed on the gage board and provided with dials visible from the front. For testing purposes tees and valves provided in the feed lines enable the water to

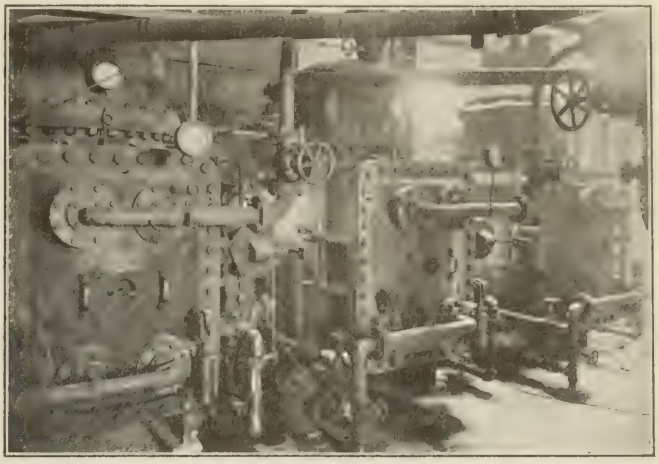


FIG. 7—EVAPORATORS FOR PURIFYING BOILER MAKE-UP WATER

be conducted to a testing weir after passing through the meters.

Water enters the boilers at about 270 deg. Fahr. A flow of water corresponding to the rate of evaporation is assured by Copes feed water regulators and pump governors. The regulators are on the same level so that they act in unison. Each Venturi meter will handle 170,000 lb. of water per hour, the tubes being of semi-steel and the throats of bronze.

The checking of the flow of feed water into the boilers is followed by an increase in pressure in the feed lines. Should the demand for steam fall off to such an extent that one feed pump can supply all the feed water required and at a reduced speed, the Copes pump governor will throttle the steam supply to the pump. One 3-in. governor is furnished in the steam line to each of the three 1000-gal. turbine-driven feed pumps and controls steam at 275 lb. pressure and 275 deg. Fahr. superheat.

The valves are so designed that the difference in

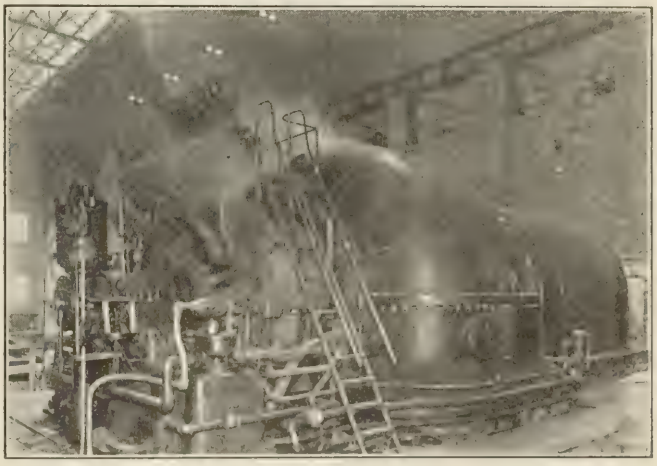


FIG. 8—STEAM END OF 20,000-KW. TURBO-GENERATOR

pressure between the steam at the boiler outlet and the water at the feed pump outlet shall exceed the steam pressure by a constant predetermined amount. Should this difference in pressure increase, the valve will throttle the steam to the turbine and decrease the pump speed.

Each feed water regulator is capable of passing 170,000 lb. of water per hour with an excess pressure of 25 lb.

The feed water and main steam piping systems are in duplicate throughout and arranged so that any boiler can operate on either system. The main and auxiliary high-pressure piping and fittings were furnished by the Lumsden & Van Stone Company. Two 8-in. leads run from each of the five boilers. Two 8-in. leads are joined to a 10-in. lead connecting to one of two 12-in. headers. The boilers on one side of the boiler are connected to one header and those on the other side to the other header. A 12-in. lead is taken from the lower part of each header and run under the turbine room floor toward each turbine. Halfway between the turbine and header the two 12-in. leads are joined to a 14-in. lead carried up to the turbine. Expansion in the 8-in. boiler leads, the 10-in. connections to the headers and the 12-in. headers is cared for by expansion loops.

Full weight steel piping is used, all sizes over 12 in. being 0.5 in. thick. Special Van Stone flanges are used for joints in the pipe lines, the general dimensions being in accordance with the A. S. M. E. standard for 250 lb. pressure, but with ⅞ in. established as the minimum size of bolt to be used. Fittings are all extra heavy pattern, cast steel, and are tested to 500 lb. hydraulic pressure at the factory. Extra heavy semi-



FIG. 9—HIGH-PRESSURE STEAM MAINS WITH MOTOR OPERATED VALVE AT LEFT

steel pipe and fittings supplied by the above firm are also used between economizers, boilers and feed pumps, and in the economizer and boiler blow-off lines. The piping carrying circulating water to and from the condensers is provided with expansion joints to take care of the displacement of the condensers, which are spring-mounted, the joints being made up of rubber tubing carried in a metal frame with flanges for connection to adjoining piping.

Full load can be carried on either steam header, but under normal conditions both will be operated, valves to the turbine being electrically actuated.

Robinson asbestos gaskets are used on the high-pressure steam lines. All piping, fittings and valves 5 in. and larger carrying steam at maximum temperature are covered with magnesia 4 in. thick, flanges being covered 2 in. thick. A covering 1.5 in. thick is used on feed water suction piping, a 2-in. covering being provided on all exhaust and feed discharge piping, fittings and valves, feed water heaters, evaporator equipment and uptakes.

The Pittsburgh Valve, Foundry & Construction Company furnished the valves for the feed system, these being extra heavy pattern with semi-steel bodies and good for a working pressure of 400 lb. with water at temperatures ranging from 248 to 273 deg. Fahr. Lumsden & Van Stone supplied the feed piping. Pratt & Cady check valves are installed in the boiler feed piping next the stop valves and on the feed pump discharges. These check valves work normally under 350 lb. water pressure with temperatures varying from 160 to 270 deg. Fahr. Pratt & Cady check valves in the drip piping handle condensation from steam piping working normally at 275 lb. pressure and at 275 deg. Fahr. superheat.

The valves in the air piping between the condensers and the air removal pumps were supplied by the Pittsburgh Valve, Foundry & Construction Company. This piping is so arranged and valved that the LeBlanc pump used in normal operation can be shut off and the air withdrawn by a reciprocating pump and measured in order to test the air leakage of the condenser. All gate valves for use on high-pressure steam piping were furnished by the Nelson Valve Company. These valves have cast steel bodies, bonnets and yokes and flanged ends. The disks are of the split wedge pattern and are made of Monel metal, the valve seats and stems being of this material. Each valve is provided with an extra long condensing chamber with free blow valve and swing-bolted stuffing box, and the design is such that the valve stem stuffing box can be packed while the valve is open and under pressure. The bodies of 8-in., 10-in. and 12-in. valves are tapped for by-pass and the valves are supplied with cork-handled wheels. Six of the 12-in. valves are motor operated and set in the leads to the three 20,000-kw. generators, each generator being supplied by two leads. The motors are fitted with remote control for operating and shutting from the turbine gage board. All high-pressure globe valves were supplied by the Edward Valve & Manufacturing Company, these being used in numerous auxiliary steam supply lines, with Monel metal seats, stems and disks, valves 1.5 in. and under being with forged steel bodies. All final joints in high-pressure lines 2 in. and under are made with "Edward" double-tight unions, the union joints being of a special spring seat design for use without gaskets.

The boiler room instrument equipment is unusually complete. The stokers are provided with Hopkins electric tachometers geared to the stoker speed shafts, two fixed scales showing the speed of the shafting and the rate of firing in pounds per hour. An adjustable scale is also supplied to show the air pressure in inches of water in the stoker wind box. Each boiler is provided with one of these tachometers, the coal scale being graduated from 0 to 24,000 lb. per hour and the speed scale from 0 to 400 r.p.m. The carbon dioxide in the flue gas from the boiler plant is measured and recorded by a Uehling flue gas recorder, and an auxiliary indicator is included. Either recorder or indicator may be connected to any boiler at any time. Each boiler is also equipped with Bristol recording thermometers showing the flue gas temperatures entering and leaving the economizer, and the temperature of feed water on each side of the economizer. Separate recorders show the temperature of water in the feed water heaters. The usual pressure gages are also provided.

Ashes are to be used for filling land about the station for some time to come. These will be removed from hoppers in the basement beneath the furnaces by rocker dump cars of 80 cu. ft. capacity, running on 24-in. gage tracks and hauled by a 3-ton, double-trolley, direct-current mine locomotive built by the Jeffrey Manufacturing Company; this locomotive has a drawbar pull of 1200 lb. and capacity of 7 tons on a 5 per cent grade.

In the next section of this article the turbine, condensing, electrical and miscellaneous features of the station will be described.

Central Station Growth and Rate Reductions—II

Experience at St. Louis with the Plan of Linking Rate Changes with Increase in Customers —How the Method Was Put into Effect and What It Has Accomplished in a Year and a Half

FOR the last eighteen months the Union Electric Light & Power Company of St. Louis, Mo., has been pursuing a definite preannounced plan in regard to rate reductions. The plan irrevocably links the time for each reduction with the company's growth in number of customers. When a certain fixed number of customers is obtained the rates are reduced by a certain previously announced amount. It is the opinion of the officials of the company that this plan, which seemed the most expedient when it was adopted, has proved its worth. The following paragraphs present the details of the plan and show what material results have been accomplished.

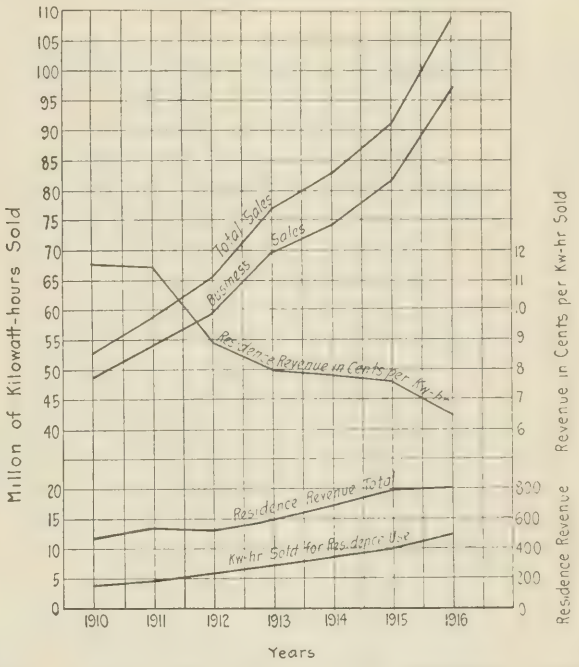
The first announcement of the new policy came on Aug. 14, 1915. At that time sweeping changes in all rate schedules were made, to go into effect Sept. 1, 1915. To the residence rate, which had been a two-step schedule operating on an "active-room" basis with the primary rate at 10 cents and the second step at 6 cents, a third step was added. The primary and secondary charges were left as they were, but under the provisions of the tertiary charge all energy in excess of 7 kw.-hr. per month per active room used by residence customers was to be billed at 3 cents per kilowatt-hour.

In this announcement of future policy it was stated that of 120,000 homes in St. Louis only one-third, or 40,000, were using Union electric service. The announcement added that if the company could serve a greater percentage of these homes it could serve each at a less cost and hence could reduce its rates. Considering this fact, the announcement continued, the company had decided to reduce the top rate of 10 cents to 9 cents when its total number of customers, which was then 60,700 increased to 65,000. Again, when the number increased to 70,000 the top rate would be reduced to 8.5 cents; and still again, when a total of 75,000 was reached, the top rate would be made 8 cents gross. After this rate was reached it was expected that further reductions would be made more slowly and result in the eliminating of the primary step when substantial saturation was reached.

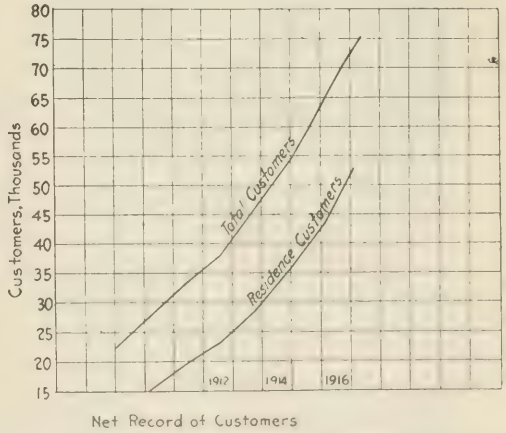
How the Plan Was Carried Into Effect

It was on this basis that the company went before the public to enlist its co-operation. The plan was explained in every way so that the public understood it was a plain case of "you help us grow and you will reduce your own rates." What little it was necessary to say on the economics of the case was presented in a few paragraphs. The first pointed out that the 3-cent tertiary rate was offered so that residence customers could avail themselves of the comfort and convenience of electricity for cooking. Another stated concisely that each electric service customer, in addition to causing the company expense when he uses energy, is a source of investment and service expense. This latter expense, it was pointed out, while it is a large part of the company's total expense, does not increase in proportion to the increase in number of customers, especially where customers are added to existing lines.

The first announcement of this comprehensive, definite and easily understood rate-reduction plan, was, of course, made in the newspapers. A reproduction of the copy used in a 7-in. by 21-in. space is given on page 218. It told practically the whole story. All subsequent copy was intended to emphasize the thought in the latter part of the first announcement. The statement that rates were to be reduced as quickly as 65,000, 70,000 and 75,000 customers were obtained was kept constantly before the public. At the same time the rate of growth in customers was given publicity. Newspaper advertising, bulletins in the company's offices, and printed announcements headed "To the Public," handed out by salesmen, were used for this purpose. The idea was one which was particularly easy to advertise, since it was something that interested nearly everyone and about which nearly everyone could talk. Nevertheless, the effort to maintain public interest was at no time slackened, and particular attention was called to the



RECORD OF KILOWATT HOURS SOLD AND RESIDENCE REVENUE DERIVED 1910 TO 1916, UNION ELECTRIC LIGHT & POWER COMPANY, ST. LOUIS, MO.



NET RECORD OF CUSTOMERS, UNION ELECTRIC LIGHT & POWER COMPANY, ST. LOUIS, 1910-1916

NOTICE OF RATE REDUCTIONS
FOR
"UNION ELECTRIC" SERVICE

EFFECTIVE WITH METER READINGS FROM SEPTEMBER 16th 1915 THE FOLLOWING REDUCTIONS AND CHANGES IN RATE SCHEDULES ARE OFFERED

RESIDENCE RATES

With the development and cheapening of household electrical appliances the residential load is expected to become more and more what can be termed a heating and cooking or power load the most convenient equipment now has the electric iron, toaster, percolator, grills or cooking dishes, heaters, and the electric cooking range is fast finding favor.

To offer the inducement to our residence customers to avail themselves of the comfort and convenience in a more liberal use of electricity in their homes, a third step in the residence schedule is announced, viz:—

3c per Kwh. for all use in excess of 7 Kwh. per month per active room.

COMMERCIAL LIGHTING AND POWER

We shall cancel Maximum Rate Schedule Known as No 1, viz.:

First 200 Kwh. use during month at 10c per Kwh
All over 200 Kwh. use during month at 5c per Kwh

All customers now under the above schedule from and after September 15th, 1915, will be billed under No 6 Schedule, which is as follows:

First 200 Kwh. use during month at 10c per Kwh
Next 200 Kwh. use during month at 8c per Kwh
Next 200 Kwh. use during month at 6c per Kwh
Over 600 Kwh. use during month at 4c per Kwh.

Monthly minimum will be reduced to $1.00 for both light and power. The foregoing rates will be reduced 10c per Kwh. without lamp renewals

We shall cancel Exclusive Power Service Schedule known as No. 2, viz.:

First 100 Kwh. use during month at 8c per Kwh
Next 100 Kwh. use during month at 6c per Kwh
Next 100 Kwh. use during month at 5c per Kwh
Next 300 Kwh. use during month at 4c per Kwh
All over 600 Kwh. use during month at 3c per Kwh

All customers now under the above schedule from and after September, 15th, 1915, will be billed under No. 4 Schedule, which is as follows:

First 200 Kwh. use during month at 6c per Kwh
Next 200 Kwh. use during month at 5c per Kwh.
Next 200 Kwh. use during month at 4c per Kwh.
Over 600 Kwh. use during month at 3c per Kwh

Monthly minimum will be reduced from 75c to 50c per H. P.

ANNOUNCEMENT OF FURTHER REDUCTIONS

The supplying of electricity to the entire population of a city such as St. Louis involves a very large investment and plant, each customer is also an element of not only investment cost, but service expense, in addition to the cost of operation to generate the electricity and its delivery—with the increased use and growth of the business, lower operating costs are made possible.

The total number of residences in the City of St. Louis aggregate approximately 120,000 of which at the present time are 1-3/5, or, in round figures, 40,000 use "UNION ELECTRIC" Service. In addition we have over 20,000 commercial and power customers.

We tabulate below the growth in total number of "Union Electric" patrons beginning with January 1, 1910 up to August 1, 1915.

On January 1st, 1910—24,750 customers
On January 1st, 1911—28,250 customers
On January 1st, 1912—33,750 customers
On January 1st, 1913—38,000 customers
On January 1st, 1914—46,300 customers
On January 1st, 1915—54,500 customers.

ON AUGUST 1st, 1915—60,700 CUSTOMERS.

It is reasonable to expect in December, 1915, a total of 65,000 customers will be reached.

A continued rapid growth will enable the Company to make further reductions in its rates from time to time, and thus share its prosperity with its increasing number of patrons, and as the number of our customers increase we now offer the following further reductions in the primary rate:

When our total number of customers reaches 65,000 reduction to 9c per Kwh.
When our total number of customers reaches 70,000 reduction to 8½c per Kwh.
When our total number of customers reaches 75,000 reduction to 8c per Kwh.

with proportionate rate reductions in the secondary and other steps of our schedule.

The 75,000 Mark Should Be Reached Within the Coming Year.

It is difficult to forecast too far ahead with any degree of certainty, with the rapid advance in the art and improvements and efficiencies that are being constantly developed, to what extent even further reductions may prevail, large additional capital investment is continuously required to maintain a public utility such as the "Union Electric," which must keep abreast of the times to render the best of service at the lowest possible rates.

Many people are still using the older methods of lighting—coal oil—these are obsolete and out of date. With the present high efficiency Tungsten Mazda Lamps, with free renewals, the low rates and monthly minimum of 50c and NO DEPOSIT REQUIRED, electricity offers to the householder an economical luxury with the comfort and convenience which no other domestic service can bring.

If your house is not wired we wire "already built houses" at a low cost, and will divide the payments monthly with your electric light bill.

Call up Main 3220 or Central 3530 our representative will call.

"UNION ELECTRIC"
Light and Power Company
12th and Locust Sts.

A NEWSPAPER ADVERTISEMENT ANNOUNCING THE RATE REDUCTION SCHEDULE

fact each time 5000 customers were added and a reduction made.

The results of establishing this policy are best shown by the curves on page 217. They indicate graphically the company's growth since 1910. In the seven years cited in the curve of customer increase there are two rather abrupt changes in direction. The first of these was attributed largely to the adoption of differential rates and to the installation of policies which made it easy for customers to do business with the company, as explained in the ELECTRICAL WORLD of Feb. 20, 1915. The second break in the curve is attributable to this later policy of enlisting the aid of customers in reducing their own rates. An exterpolation of the curve in the direction of its 1913-1915 trend indicates that the company is about 5000 customers ahead of the record it would have held had it not introduced a new idea. Furthermore, it should be noted that these records for 1915-1916 were made in spite of the fact that the company absolutely discontinued the practice of directly

DATA ON GROWTH OF UNION ELECTRIC LIGHT & POWER COMPANY, ST. LOUIS

Year	Total kw.-Hr. Sold	Net Gain	Kw.-Hr. Sold for Residence Only	Net Gain
1910	52,710,248	.....	4,093,202	.....
1911	59,049,419	6,339,171	4,830,138	736,936
1912	65,773,600	6,724,181	5,933,152	1,103,014
1913	77,000,491	11,226,891	7,465,385	1,532,233
1914	83,011,490	6,010,999	8,864,404	1,399,019
1915	92,216,356	9,204,866	10,354,396	1,489,992
1916	109,150,000*	6,933,644	12,470,000*	2,115,604

	Net Gain per Year	Number of Customers
January 1, 1910	23,750	
January 1, 1911	28,250	4,500
January 1, 1912	33,750	5,500
January 1, 1913	38,000	4,250
January 1, 1914	46,300	8,300
January 1, 1915	54,500	8,200
January 1, 1916	65,191	10,691

RECORD BY MONTHS, 1915-1916

	Number of Customers	Net Gain per Month		Number of Customers	Net Gain per Month
Aug. 1, 1915	60,700	.....	May 1, 1916	68,481	1,622
Oct. 1, 1915	62,898	2,198	June 1, 1916	69,850	1,369
Nov. 1, 1915	63,948	1,050	July 1, 1916	70,790	940
Dec. 1, 1915	64,486	538	Aug. 1, 1916	71,539	769
Jan. 1, 1916	65,191	705	Sept. 1, 1916	72,437	898
Feb. 1, 1916	65,593	404	Oct. 1, 1916	74,001	1,564
March 1, 1916	66,316	721	Dec. 1, 1916	75,000	999
April 1, 1916	66,859	543			

soliciting house-wiring. Its house-wiring solicitors were placed on other work and inducements in the shape of commissions were offered electrical contractors to solicit the business. That the business secured is desirable is evident, since about one-half of the customers secured have been residents of already-built houses.

INCREASE IN ENERGY SOLD

Curves showing the number of kilowatt-hours sold each year also hold evidence that the policy has produced results. The average increase in energy sold per year prior to 1916 was about 7,600,000 kw.-hr. The largest single increase in any one year was about 11,000,000 kw.-hr. But the increase of 1916 over 1915 amounted to about 16,900,000 kw.-hr.; that is, twice the average increase and considerably more than the greatest previous increase. These data, of course, include all energy sold for power purposes. But the records of energy sold for residence service alone reveal the

same trend. The average increase per year of energy sold for this class of service prior to 1916 had been about 1,200,000 kw.-hr. The greatest increase in any one year had been 1,500,000 kw.-hr., but the increase of 1916 over 1915 amounted to about 2,100,000 kw.-hr., which is again nearly twice the increase of the average year. It should also be noted in this connection that while the company's total energy sales have about doubled since 1910, its sales to residence customers have trebled.

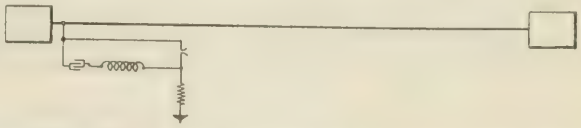
The effect of this policy on the revenue from residential customers is also illustrated in the curves. Since 1910 the average residence rate has decreased from about 11.5 cents per kilowatt-hour to about 6.5 cents per kilowatt-hour. In spite of this fact the gross revenue from residential patrons has increased from about $470,000 to about $810,000 per year. In the two curves which indicate the trend of these factors it is interesting to note that the effect on the gross residential revenue of the more recent reductions has not been so striking as was the reduction in 1911. After the changes in rates the residential revenue curve declined, showing that the gross return from this class of business in 1912 was actually less than in 1911. On the other hand, the effect of three rate reductions in the last eighteen months has been only to check the upward tendency of the residential revenue curve, but not to reverse the trend. The gross for 1916 will be higher than was the gross for 1915. These facts, together with a knowledge of the increasing friendly attitude of the public toward the company, are taken to indicate that the plan has met with popular approval. Business conditions have not been good in St. Louis during the period covered by this review.

In commenting on the policy a few days before his death, A. C. Einstein, who was vice-president and general manager of the company, said: "It is a central station adaptation of a great automobile merchant's idea. He, in his plan, said: 'If we sell 300,000 cars this year everybody who buys one will help us reduce our costs and we will therefore refund to him $40—a part of the saving he helps us make.' We, in our plan, have told our customers that if they will help us get more customers and thereby help us reduce our costs, we in turn will give them a part of our saving in the shape of rate reductions. As a merchandising plan it has been as popular in St. Louis as has been the automobile merchant's plan throughout the nation."

Employing Corona Effects as Protection Against Line Surges

It is well known that considerable energy is dissipated in silent electrical discharges, known as corona, which are effected at very high potentials, and also that high-potential disturbances may be prevented to some extent when a system is working at the so-called "corona voltage." George J. D. Centerwall of Stockholm, Sweden, therefore suggests in patent 1,204,407, employing conductors of relatively small section or of peculiar shapes that are particularly conducive to the formation of corona. By suitably choosing the size of these small protecting conductors or the particular shapes, the formation of corona may be effected at any predetermined voltage, whereby energy is dissipated and excessive and dangerous surges are prevented.

At varying intervals, protecting conductors are inserted in series with the transmission circuit for the purpose of facilitating the formation of corona and thus preventing excessive voltages. These protecting conductors may be of relatively small section in comparison with that of the conductor which constitutes the transmission line or may have shapes that are peculiarly conducive to the production of corona. If the material of which the transmission line is composed is aluminum, a single protecting conductor of copper may be included in series therewith without increasing the normal resistance of the line, by reason of the greater conductivity of the copper conductor.

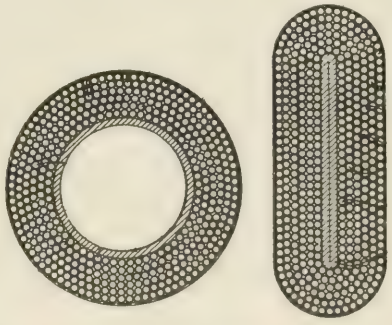


ARRANGEMENT TO PRODUCE CORONA IN SUCH A WAY AS TO PREVENT EXCESSIVE SURGES

Also, in some cases, in order to suppress rapid electrical changes, iron wire, or wire covered with iron or nickel may be employed. In the operation of the system, if the voltage rises above the particular value for which the protecting wires are designed, it is evident that the formation of corona is effected thereon which serves to prevent any surges or momentary line disturbances by absorbing the surplus energy of the surges.

Conductors for Pulsating Currents

That the possibility of eddy current losses in massive copper conductors in electrical machinery is being appreciated, is evidenced in a patent, 1,209,096, issued to R. B. Williamson of Milwaukee, Wis. The original suggestion of M. B. Field based upon the work of Prof. A. B. Field contemplated either splitting the conductor or using a copper braid. With the invention illustrated a tubular core, preferably cylindrical and of copper or other conductive material, is provided. A plurality of wires, insulated one from another, as by oxidation, enameling, etc., are disposed in parallel relation, preferably in contact with each other, on the core and being spirally wound at any desired and suitable pitch. Similar layers of insulated conductors, similarly wound,



FORM OF CONDUCTOR FOR USE IN SLOTTED CORES OF ALTERNATING-CURRENT MACHINES

are disposed with the spires wound in opposite directions, the pitch being preferably the same. The core is of such thickness as to be sufficiently rigid to maintain its cylindrical form during the operation of assembling the conductive elements while being capable of being radially flattened on itself to alter the cross-sectional shape of the assembled structure.

Whereas the epoch making work of A. B. Field was directed to the possibility of an eddy current loss due to self induction alone, it was Prof. A. Press who showed mathematically that considerably greater eddy current copper losses were set up in direct-current and alternating-current rotative machinery due to the main field, even for comparatively low frequencies.



RJUKAN, NORWAY, BEFORE AND AFTER THE ESTABLISHMENT OF NITRATE PLANTS—THE POWER STATION DEVELOPED IN 1912 ABOUT 140,000 HP.

Use Surplus Power in National Preparedness

Frederick Darlington, consulting engineer of the Westinghouse Electric & Manufacturing Company, says in this interview given to the Electrical World that the excess capacity of electric central stations, particularly of hydroelectric systems, is a valuable element in national preparedness. Its utilization will be economy in time and money. It will develop trained workers and assure enormous production of nitrates in time of military emergency.

1917 Series of

"TALKS IN THE INDUSTRY"

By Frederic Nicholas

"THERE has been much discussion on the subject of the production of nitrates for the manufacture of high explosives and for fertilizers and other commercial uses in connection with the development of facilities for nitric acid production to meet military necessities in case emergencies should require output on an enormous scale," said Mr. Darlington. "In general, the opinions of engineers and business men indicate three possible plans of operation:

"1. The saving of by-products in coke ovens and in the so-called 'Mond' gas producers for the recovery of sulphate of ammonia for the manufacture of nitrate fertilizers or nitric acid. This plan was very ably discussed by Thomas C. Clarke in the issue of the New York *Times* for Dec. 24, 1916. The saving of by-products in this manner is an economic movement of great importance and it should be encouraged in every possible way. It promises, however, primarily a steady, economical annual production rather than a method whereby the production of nitric acid could be greatly increased in case of military necessity.

"2. There are advocates of the construction of an enormous hydroelectric plant at government expense and the establishment in connection therewith of a plant for the manufacture of nitric acid, either directly by the so-called 'arc' process or indirectly by the 'cyanamid' process. This idea, which has received much attention in connection with the Muscle Shoals project on the Tennessee River, involves building not only a tremendous hydroelectric plant, whose construction would require upwards of three years, but also a nitric acid plant for turning electric power into nitrates. The proposal is that the big hydroelectric plant would provide power for the manufacture of explosives in case of war, while during times of peace it would manufacture nitrates for commercial purposes, such as fertilizers and explosives and acids for use in industrial manufacturing. From the vital standpoint of military safety, the grave weakness of this plan is that it would concentrate the entire output in one locality. For military reasons that single locality might become vulnerable. Its protection could easily require the massing of military reserves which were sorely needed at other points.

"3. In my judgment a far better plan exists by which it will be possible to supplement coke ovens and gas producers in the production of nitrates for commercial uses and for explosives in case of war.

"According to the report of O. C. Merrill to the Secretary of Agriculture, dealing with water-power development, the number of central stations in the country in 1915 was 6941, controlling a production of 14,871,142 hp., of which 5,346,699 hp. was water power. Later available data show that of a total of 5038 electric central station systems (as distinguished from stations, the unit in the Merrill report), 1509 were hydroelectric in whole or in part.

"In these, and particularly in the hydroelectric plants, a large surplus of power, for which industrial and



ELECTRIC FURNACES IN THE NITRATE PLANTS AT NOTODDEN, NORWAY, WHICH, ACCORDING TO THE LAST AVAILABLE REPORTS, USED IN 1912 ABOUT 60,000 HP.

commercial utilization has not yet been secured, is available continuously or for a large portion of the time. Many of the hydroelectric plants, for instance, have a fixed investment in dams and foundations which includes provision for larger machinery equipments than have yet been installed. In some of these plants the maximum machinery has not been installed because the market for the maximum production is not yet ready, and in others it has not been installed because water is not available at all seasons.

"Surplus power under such circumstances can be regarded as a by-product available in very large blocks because of the great capacity of the electric systems. Considered broadly from the standpoint of the best interests of the country and the conservation of both water powers and invested capital, the natural and logical procedure would be to utilize this enormous volume of surplus power for the manufacture of nitrates. Encouragement at this time would promote results, because many central station men are anxiously inquiring about the electrochemical production of nitrates in the hope that the surplus power of their systems can be utilized in nitrate manufacture.

KNOWLEDGE NOT AVAILABLE

"Of the two distinct systems for the manufacture of nitrates by the use of electrical energy the one known as the 'arc' process is used extensively in Norway and Germany and, while very simple in principle, requires a high degree of special technical knowledge. The second—the 'cyanamid' process—is also in extensive use in Europe, principally in Germany; this system is employed in a plant at Niagara Falls, N. Y. The technical knowledge required for the construction and operation of the plants operated upon both of these systems has been developed by experience in European countries; but, excepting in the case of those particular corporations or individuals that are practically the representatives or agents in America for foreign concerns, this knowledge is not available to Americans.

"As a result of this situation, large American power companies which desire to use their surplus power in the manufacture of nitrates must go to the American representatives of the foreign companies for the necessary technical knowledge. American engineers outside of the representatives of the foreign companies are repeatedly asked by power company officials how much it would cost to construct and operate nitrate plants and what the profit would be, but excepting for very general statements they are unable to answer these questions.

"Having its enormous central power systems in which large quantities of surplus power are available or can easily be made available, and having also a ready market for nitrates for ordinary consumption and a recognized need for an increase in nitric acid plants for military purposes, this country should certainly find some way of putting the knowledge necessary for the manufacture of nitrates into the hands of independent power producers.

"For the attainment of the end which is desired, it is not essential that the government should undertake a tremendous hydroelectric development, such as the one projected for instance at Muscle Shoals, which would involve a serious loss of time to accomplish. At much less expenditure of time and money the government could build the necessary electrochemical plants to start the manufacture of nitrates by both the arc and the cyanamid processes at points where power is already available or can be secured within a relatively short period and where the cost would not be excessive. While these plants were productive for government uses, they could be made, at the same time, schools for the training of engineers and centers for the dissemination of knowledge in nitrate manufacture. It would be feasible to apply the same general methods by which the federal government now fosters knowledge of agriculture, mining, etc.

"If full construction and operating costs and earnings of these government stations were published and engineers were trained for the work, possibly in co-operation with engineering colleges, every proper inducement would then be open to the big central power systems to install and operate nitrate plants.

"This plan has a number of definite advantages over the proposed big government promoted hydroelectric plant, whether at Muscle Shoals or elsewhere. In the first place, the purpose in mind can be carried out in far less time than would be required to develop a big hydroelectric plant, for the electrochemical plants can be built in a relatively short period as compared with the years that would be lost in the construction of a tremendous water power enterprise. Secondly, if the large central stations are induced to go into nitrate manufacture at various points throughout the country, the normal condition will be the production of nitrates from their surplus power on a scale controlled by the law of supply and demand, while in the case of a greatly increased requirement for military purposes the power now going into other channels could be largely diverted to electrochemical uses, the nitrate plants could be rapidly increased in capacity and output, and each plant would have a staff trained and experienced to expand its operations.

MILITARY ADVANTAGES OF DISTRIBUTION

"In the third place, the country would be far safer from military destruction of nitric acid plants if the producing units were scattered over various parts of the nation, instead of located at one or two central hydroelectric centers, which would immediately become the objective of enemy attacks.

"Fourth, the economic soundness of this plan is in the fact that it contemplates building up a profitable industry by using already developed resources on a basis that will be profitable during peace times for ordinary production, and at the same time laying the framework of a series of plants that would easily bear rapid and broad expansion to meet any future military demand.

"The use of hydroelectric plants in the manufacture of nitrates will work in the interest of conservation and further hydroelectric development. It will afford a market to justify such development in conjunction with the ordinary public utility and the factory needs of communities at an earlier date than would be possible if the results of such development were confined to industrial uses alone. It would therefore furnish a stimulus to the utilization of our water-power resources."

A Cooled Nitrogen Filled Lamp

In the more recent types of nitrogen filled lamps, after the lamp has remained lighted for a short period of time the intense heat of the filament is transmitted to the bulb itself, and to the attached shell and socket plug. The intense heating of the socket plug and shell is objectionable, since it will cause a breaking down of the insulation of the lead wires to the socket, resulting in a short-circuit, or else the heated socket may come in contact with some inflammable material, and in each instance the danger of fire is imminent. John H. Dale, of New York, in patent No. 1,204,653 provides a ventilating air conduit arranged in the interior of the sealed bulb to the interior of the shell and socket whence the heated air is permitted to escape through ventilating openings.

Government in Business: A Question of Policy

Although the Problem Is Largely One of Locality or Individual Undertaking, It Involves the Definite Principle of Widely Extended Government Control—Acceptance or Rejection Should Be the Basis for Legislation and Government Action

By Arthur Williams
General Commercial Manager New York Edison Company

TO consider the question of municipal ownership, or government in business, merely from the viewpoint of relative costs would undoubtedly limit the consideration to which it is entitled. It may be admitted, for the sake of argument, that, whether the undertaking is private or public, equal returns will be secured for each dollar invested, without in the slightest degree justifying the attitude that the government enter upon the field of business in this country. Aside from the question of profit or loss, it is a serious thing that there should be a well-defined effort to push the government into business.

At times it has been suggested that the government should operate street railways and supply gas and electricity for public consumption, even when there has been no intimation that the services of these utilities are not sufficient for all of the wants of the people, or that the prices are unfair. Were the service poor or were the prices excessive, the government already possessed the power to improve the one and to lower the other.

What is the real motive of those who would have the government enter upon commercial and industrial enterprises of this nature, using the vast powers of the national government, with its unlimited resources for organization, to secure funds through taxation to crush private resources, which are relatively small and designedly kept so by recent legislation?

A Bad Combination

Theoretically, the combination of government and business is bad; where the government in this country has already entered the domain of business it has usually shown itself inefficient in financial, executive or administrative control. Moreover, in foreign countries where nationalization of great utilities has taken place, nothing can be found which compares either in quality or in relative cost with the corresponding services of this country, privately conducted.

Although the question is largely one of locality or individual undertaking, still it is possible to consider it broadly and lay down some general principles. The following queries suggest such principles:

Is it better that the business of the country should be conducted through agencies of government or, as at present, regulated by government, through the agencies of private initiative and enterprise? Shall we raise the funds required for our industrial and commercial undertakings by assessment, taxation and other forms of involuntary subscription, or shall we continue our present methods of securing funds for these purposes through the investment of private capital? Shall the business of the country be conducted by government employees, who are generally not subject to the usual regulations of employment, or shall we rely upon the present methods, under which employment is economically dependent upon that which is produced by the employee?

Personal Freedom or Despotic Control

Orthodox socialists, I believe, hold that all human activities should be conducted through the agency of government and not through the agency of private enterprise. Many advocating this form of government activity point to the efficiency, or alleged efficiency, of Europe in the conduct of the present war, in her control of food and other necessities of daily life, and in the manufacture of munitions and materials required for war purposes. They say that industry and commerce should be so mobilized in times of peace in order to secure a higher degree of efficiency in production and distribution.

Assuming, simply for the sake of argument, that what is said in regard to this efficiency is true, it must be pointed out that this unified control of production and distribution is in the hands of a despotic power, controlling not only the property and the product, but the liberties and the very lives of the workers. Possibly such concentration of power, for the common good, is essential in times of war; but were it needed to secure a superlative degree of industrial or commercial efficiency in times of peace, I am convinced that, even at the sacrifice of efficiency, our nation would be unanimous in preferring personal freedom of action to subjection to the despotic control of any person or group of persons.

> **The broad principle stated by Mr. Williams is:**
> **"Shall the government go into business, which means all business, or shall we stick to the business of government, through which business shall be regulated?"**

Business or Regulation

The principle is a very broad one, and its acceptance or rejection should be the basis upon which legislation and government action should be conducted. Shall the government go into business, which means all business, or shall we stick to the business of government, through which business shall be regulated?

If the majority is in favor of the government actually conducting the nation's business, then let us first organize the government on broad, comprehensive business principles. The government might begin by taking over the elementary necessities, such as bread, clothing and shelter, affecting the entire public need, and then take over our luxuries and our privileges—and finally the consequences.

If on the contrary the enlightened public opinion of the time is that the reverse course should be followed—that government should continue as government and business as business, regulated by government as may be necessary—then let us adhere to this principle and make no encroachments upon it. In our national conduct let us guard the principle as jealously as we guard any other great principle which we consider necessary to the general welfare.

Energy Earnings and Output for November

Results from Central Station Operation, During First Eleven Months of Past Year Show Earnings of $372,000,000 and Output of 21,000,000,000 Kw.-Hr.

DURING the month of November last the income derived from the sale of energy by central stations reporting to the ELECTRICAL WORLD and which represented 60 per cent of the industry amounted to $21,996,257 and the output sold amounted to 1,234,787,397 kw.-hr., representing an increase over November, 1915, of 14.3 per cent in income and 22.6 per cent in output. From these figures it is therefore estimated that the earnings of the central stations of the United States derived entirely from the sale of electricity for light and power during November last was $36,500,000

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE-MONTH PERIOD

	Percentage of Industry Represented	Income from the Sale of Energy			Kw.-Hr. Output		
		1915	1914	Per Cent Increase	1915	1914	Per Cent Increase
Dec....	64	23,418,774	20,962,264	11.8	1,230,655,404	1,004,108,399	22.5
		1916	1915		1916	1915	
Jan....	65	25,286,336	22,352,721	13.2	1,200,672,452	984,205,683	22.0
Feb....	65	22,133,485	19,175,537	15.3	1,121,452,738	869,537,132	29.1
March...	65	22,027,627	18,722,742	17.8	1,212,363,217	969,888,339	25.2
April....	64	21,206,946	18,375,014	15.5	1,137,602,995	920,464,917	23.1
May....	64	20,345,529	17,559,786	16.0	1,170,143,766	944,681,881	24.0
June....	64	20,254,732	17,551,769	15.4	1,170,679,212	968,724,416	21.0
July....	64	19,760,120	17,301,686	14.2	1,174,374,141	976,704,993	24.4
Aug....	64	20,502,137	17,861,413	15.0	1,262,575,492	1,015,805,383	22.4
Sept....	64	21,432,670	18,600,229	15.2	1,268,339,571	1,037,976,528	21.2
Oct.....	64	22,824,915	20,112,747	13.6	1,345,601,676	1,123,560,198	19.8
Nov.....	60	21,996,257	19,235,300	14.3	1,234,787,397	1,007,834,659	22.6

and that the output was 2,060,000,000 kw.-hr. This brings the totals for the first eleven months of 1916 up to $372,000,000 in earnings from energy sales and 21,000,000,000 kw.-hr. output.

Based on these figures and estimating the figures for December, which are not yet available, the 1916 earnings were in the neighborhood of $415,000,000. This is less than former estimates by about $2,000,000, because some returns which came in too late to be used in previous compilations were smaller than was anticipated. The difference is not great, however, being less than half of 1 per cent. The 1916 output as previously estimated was over 23,000,000,000 kw.-hr. The rate of

TABLE III—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR UNITED STATES—CITIES GROUPED BY SIZE

	Feb	Mch.	April	May	June	July	Aug.	Sept.	Oct.	Nov.
INCOME:										
Group 1.....	14.1	16.0	13.9	14.4	14.9	13.8	13.9	15.0	11.6	13.0
Group 2.....	20.0	18.5	17.0	17.5	17.7	16.8	15.7	20.4	19.2	18.5
Group 3.....	20.7	28.1	24.7	26.2	21.8	19.5	20.9	18.4	18.5	18.5
Group 4.....	15.7	17.3	17.4	15.1	11.0	9.0	9.5	11 3	13.6	15.7
Group 5.....	18.5	26.5	16.1	24.0	15.3	12.2	14.9	13.3	17.2	15.3
OUTPUT:										
Group 1.....	25.4	22.0	20.0	21.3	18.7	18.1	21.4	18.5	16.6	18.6
Group 2.....	40.6	28.1	25.5	18.0	17.5	22.9	33.0	32.9	31.1	29.3
Group 3.....	39.6	39.0	37.7	40.0	21.8	27.8	31.1	19.3	24.0	32.0
Group 4.....	29.7	18.2	22.7	23.0	19.3	16.1	23.0	26.0	22.0	24.5
Group 5.....	22.4	29.9	32.0	33.2	19.0	11.6	16.8	15.3	19.3	30.5

TABLE IV—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR NEW ENGLAND STATES—CITIES GROUPED ACCORDING TO SIZE

	Feb.	Mch.	April	May	June	July	Aug.	Sept.	Oct.	Nov.
INCOME:										
Group 1.....	18 0	21.5	16.0	17.0	16.4	12.6	9.6	16.5	12.1	13.5
Group 2.....	19.9	19.0	21.2	19.5	19.8	20.6	15.1	25.8	21.3	23.0
Group 3.....	29.7	38.7	15 5	24.0	18.2	21.2	15.0	20.5	18.0	19.4
Group 4.....	15.1	18.1	13.2	13.5	7.2	6.2	11.1	10.5	15.4	16.1
Group 5.....	26.3	54.5	27.6	27.0	21.7	14.9	17.5	18.3	18.2	16.3
OUTPUT:										
Group 1.....	38.5	30.9	25.0	28.2	30.0	19.2	31.3	34.0	17.5	18.0
Group 2.....	36.8	27.8	31.4	33.2	26.3	14.1	32.0	37.7	35.0	28.2
Group 3.....	41.6	49.0	38.1	43.0	15.0	31.4	45.5	32 4	42.6	35.9
Group 4.....	23.0	17.4	36.1	30.0	21.0	26 6	39.4	32.9	48.9	44.5
Group 5.....	25.6	58.7	71.8	54.4	31.7	13.5	21.3	27.4	22.0	44.4

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	Percentage of Industry Represented	New England States		Per Cent Increase	Percentage of Industry Represented	Atlantic States		Per Cent Increase	Percentage of Industry Represented	Central States (Illinois Excluded)		Per Cent Increase	Percentage of Industry Represented	Pacific and Mountain States		Per Cent Increase
			1915	1914			1915	1914			1915	1914			1915	1914	
INCOME	December.	66	2,817,557	2,448,813	15.0	67	9,335,396	8,529,866	9.4	57	6,983,909	6,063,349	15.1	88	4,150,045	3,773,810	10.0
			1916	1915			1916	1915			1916	1915			1916	1915	
	January..	66	2,819,144	2,432,177	15.0	67	9,589,347	8,564,488	12.0	57	7,834,831	6,717,799	16.6	88	4,182,114	3,823,156	9.4
	February..	66	2 599,760	2,185,967	18.8	67	8,978,797	7,854,345	14.3	57	6,660,062	5,568,337	19.7	88	3,761,364	3,443,182	9.3
	March....	66	2,595,777	2,122,177	22.0	67	8,998,962	7,660,667	17.5	57	6,470,612	5,394,250	20.1	88	3,787,925	3,388,286	11.9
	April.....	64	2,221,544	1,898,749	17.0	67	8,794,056	7,596,567	15.8	56	6,289,092	5,292,974	19.0	88	3,825,701	3,520,381	8.8
	May.....	65	2,103,585	1,788,219	17.0	67	8,226,231	7,131,063	15.4	56	6,085,407	5,123,132	18.7	88	3,874,270	3,469,871	11.6
	June.....	65	2,208,994	1,906,233	16 0	67	8,045,839	6,905,114	16.5	56	6,007,742	5,143,452	16.9	88	4,017,208	3,539,137	13.5
	July.....	65	2,130,684	1,875,824	13.7	67	7,832,928	6,621,832	16.4	56	5,926,776	5,095,855	16.3	88	3,755,712	3,493,032	7.6
	August....	65	2,203,795	1,935,828	13.7	66	8,000,243	6,875,625	16.4	56	6,195,808	5,266,147	17.7	88	3,883,835	3,582,756	8.4
	Sept.....	65	2,315,514	1,982,050	16.8	66	8,631,725	7,445,243	16.0	56	6,505,593	5,537,868	17.8	88	3,979,838	3,644,058	9 2
	October...	65	2,683,504	2,331,189	15.1	66	8,887,460	7,930,000	12.1	55	6,967,772	5,895,400	18.2	87	4,156,325	3,838,322	8.3
	November.	64	2,751,444	2,371,077	16.0	65	9,312,121	8,132,037	14.7	49	6,305,182	5,351,459	17.8	78	3,501,023	3,274,192	7.0
KW.-HR. OUTPUT	December.	66	99,744,195	80,446,521	24.1	67	447,158,465	373,213,316	20.0	57	363,859,444	293,266,707	24.1	88	311,034,100	249,996,678	24.5
			1916	1915			1916	1915			1916	1915			1916	1915	
	January...	66	97,072,794	77,029,974	26.2	67	431,201,554	356,809,437	20.8	57	362,121,067	284,407,361	27.5	88	301,645,060	258,982,414	16 5
	February..	66	92,855,679	68,982,535	34.8	67	411,715,612	320,924,478	28.1	57	339,326,360	252,816,291	34 1	88	268,653,564	220,662,826	22.1
	March....	66	97,321,924	74,958,898	29.9	67	439,660,902	349,347,454	26.0	57	360,872,072	282,179,673	28.0	88	304,327,753	255,450,143	19.3
	April.....	64	84,769,660	64,816,830	30.8	67	403,223,021	326,574,302	23.4	56	344,866,175	273,367,413	26.4	88	302,386,347	253,778,348	19.2
	May.....	65	84,719,642	64,318,892	31.8	67	409,529,049	333,585,886	22.0	56	345,860,257	275,328,229	25.6	88	328,793,909	266,599,708	23.2
	June.....	65	87,829,797	69,506,884	27.6	67	396,630,887	327,541,507	21.2	56	350,015,166	288,982,024	21.2	88	328,996,553	277,915,476	18.6
	July.....	65	85,317,206	71,160,365	19.8	67	401,179,678	333,771,509	20.3	56	350,708,540	287,407,170	22.2	88	325,647,543	279,285,871	17.4
	August....	65	97,197,131	72,900,805	33.4	66	433,129,067	344,730,909	25.7	56	374,327,105	295,866,692	26.5	88	333,468,777	279,976,391	19.1
	Sept.....	65	98,350,508	73,343,561	34 2	66	446,534,743	369,815,165	20.8	56	387,626,725	307,485,471	26 2	88	335,817,595	288,332,331	16.4
	October...	65	107,756,241	83,705,031	28.8	66	426,151,491	373,704,633	14.2	55	408,363,948	324,509,273	25.9	87	353,711,865	305,697,993	15.7
	November.	64	105,396,833	83,166,374	26.7	65	460,863,679	376,947,077	22.2	49	369,497,511	296,037,254	24.8	78	289,953,815	244,786,833	18.3

TABLE V—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR ATLANTIC STATES—CITIES GROUPED BY SIZE

	Feb.	Mch.	April	May	June	July	Aug.	Sept	Oct.	Nov.
INCOME										
Group 1	13 7	16 7	15 1	14 5	16 4	16 8	16 1	16 2	10 7	14 7
Group 2	18 4	21 2	81 5	21 7	21 9	18 5	21 6	19 0	21 0	22 5
Group 3	14 6	20 5	15 3	17 7	12 0	14 2	15 0	14 0	14 6	13 0
Group 4	19 4	17 9	19 5	14 0	15 4	10 0	14 4	9 8	13 5	15 6
Group 5	15 8	12 2	15 6	13 0	15 2	13 0	19 4	8 9	14 3	16 0
OUTPUT										
Group 1	30 8	29 2	26 1	25 5	13 1	23 4	28 5	23 6	19 2	22 8
Group 2	33 4	25 6	35 6	11 3	31 8	27 4	32 5	26 7	31 0	11 9
Group 3	22 0	16 0	13 7	18 0	13 2	11 5	16 0	24 7	1 5	19 0
Group 4	21 8	20 9	19 0	12 6	19 7	16 3	29 5	18 6	17 5	24 7
Group 5	24 0	13 1	8 9	35 0	11 1	13 5	20 4	1 3	1 5	5 8

growth in 1916 over 1915 was roughly 15 per cent in income and 23 per cent in output.

With the exception of the Pacific and Mountain States the separate sections of the country did about equally well in November. In the Far West it was the cities of more than 50,000 inhabitants that showed the smaller percentages of increase. In the cities having a population between 25,000 and 50,000, however, the increases in per cent over November, 1915, were the largest registered in the country.

Generally speaking, the rate of growth in November last compared with November, 1915, was greatest in cities having a population of from 25,000 to 100,000 in the middle-class cities. Next came the smaller com-

TABLE VI—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR CENTRAL STATES—CITIES GROUPED BY SIZE

	Feb.	Mch.	April	May	June	July	Aug.	Sept	Oct.	Nov.
INCOME:										
Group 1	18.3	19.3	18 2	18 0	16 4	15 8	16.5	16.6	18.0	18.6
Group 2	20.5	19 1	18 0	17.4	17.5	17.3	21.8	21.5	21.0	17.7
Group 3	27 0	23.0	26 7	27.2	20 5	18 6	18 4	13.4	10.9	13.0
Group 4	20.2	22.9	22.8	24.1	17.5	17.5	10 7	20 0	19.7	17.4
Group 5	11.1	14.4	9.4	21.3	12.6	6.1	11.8	11.0	18.4	12.3
OUTPUT:										
Group 1	30.3	25.2	24.7	25 0	23.8	21.0	24.3	22 3	24.9	24.2
Group 2	44 0	32 3	23 9	19.5	12.3	25 7	36 4	40 0	31.7	31.0
Group 3	44 0	40 6	43 5	41.0	31 8	26 0	25.7	20 7	17.3	21.0
Group 4	41 0	31.9	39 2	38.5	34 3	21 1	23.0	33 8	26.1	21.5
Group 5	15.9	19.1	10.1	14.7	4.0	8.6	6.1	13.7	28.2	22.7

munities, and finally the largest cities. The quantity gain, however, was made in the large centers, amounting to about five times that from any one of the population groups named below.

The month of November was marked by a continuance of extreme industrial activity. Factory and mills engaged in practically all lines of manufacture were working at capacity.

During the month, scarcity of coal became a very serious problem and to many isolated plants it presented a gloomy outlook. As this situation became worse, and it became evident that during the winter coal would not only be scarce but high, isolated plants here and there began to abandon their generating plants

TABLE VII—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR PACIFIC AND MOUNTAIN STATES—CITIES GROUPED ACCORDING TO SIZE

	Feb.	Mch	April	May	June	July	Aug.	Sept.	Oct.	Nov.
INCOME:										
Group 1	6 7	8.5	3 9	7.2	7.5	4.7	5.5	6 2	4.2	1 5
Group 2	†	18 7	3 5*	2 3	1 2	0 6*	0 7	4.9	1.3	3 0
Group 3	22 0	28 1	40 0	39 0	39 5	28 3	32.5	28 5	32.4	31 0
Group 4	8 2	17 5	11 7	13 8	3 6	1 0	0 5	11.5	7.2	6 3
Group 5	17.8	26.3	12.0	19.1	12.8	13.2	13.0	11.7	14.4	15.7
OUTPUT:										
Group 1	13 0	22 7	8 0	12 0	8 0	10 0	6 3	7.1	5.2	5.5
Group 2	†	28 3	3 6*	2 2	1 0	2 0	6 5	7 8	9.7	11 4
Group 3	68 8	39 0	89 0	79 0	74 5	56 1	57 5	60 0	63.7	61.3
Group 4	13.8	18 6	10 3	21.8	10 0	4 0	7 5	12 0	*0.7	3 4
Group 5	20.1	30.0	11 7	17.5	16.0	10 8	16 5	7 0	9.8	20.3

*Decrease. †Results omitted owing to insufficient returns.

and to take on central station service. Central stations generally suffered little because of the threatened shortage—especially the larger ones, it is understood. A number of companies, it was reported at different times, wishing to keep up the coal pile were forced to pay higher prices.

The accompanying curves show graphically the per-

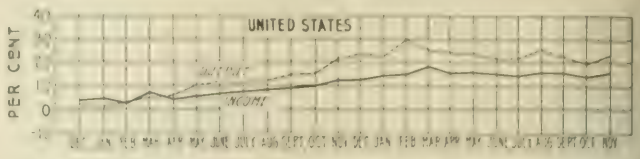
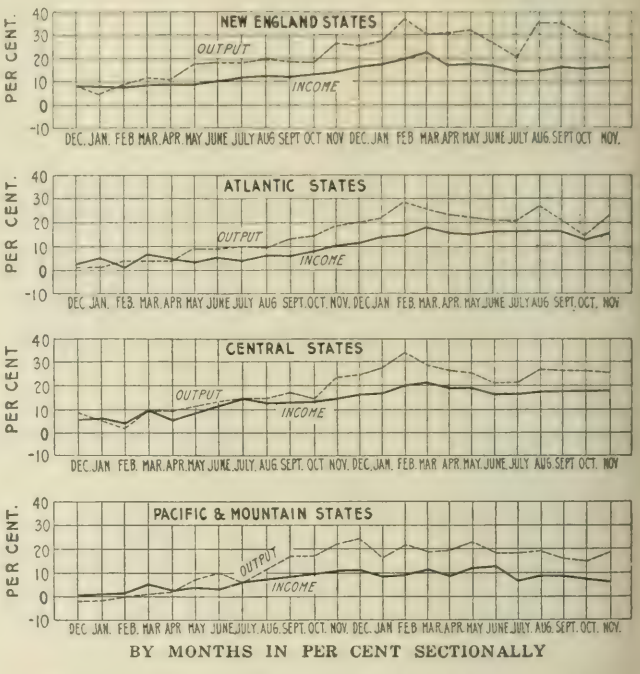


FIG. 1—CENTRAL STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT FOR UNITED STATES

centages of increase in income and output as contained in Tables I and II. The remaining tables show the percentages of increase in income and output for the companies grouped according to the size of the communities served. Group 1 contains those companies operating in cities having a population of more than 100,000 inhab-



BY MONTHS IN PER CENT SECTIONALLY

FIGS. 2 TO 5—CENTRAL STATION INCOME AND OUTPUT GAIN

itants; group 2 contains those companies operating in cities having a population of between 50,000 and 100,000; group 3 those operating in cities between 25,000 and 50,000 inhabitants; group 4, between 10,000 and 23,000, and group 5, between 5000 and 10,000.

Preheating Furnace Air

Preheating furnace air with the heat from flue gases will easily permit 5 per cent fuel saving, according to V. J. Azbe, who presented a paper recently before the A. S. M. E. A simply constructed air preheater could be made with a long sheet-iron compartment through which the air and flue gas might pass separated by a zig-zag partition. In summer the air could be taken from the boiler room and thus maintain the ventilation and keep the temperature down, while in winter it could be taken from outside, thus insuring a comfortably warm boiler room and reduce somewhat the loss by radiation from the boilers and steam piping.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Galvanized-Iron Conduit for High-Tension Bus Serving 1000-Kva., Three-Phase Transformers

Instead of using highly expensive copper tubing for high-tension buses, the Oregon Portland Cement Company has installed in its Oswego (Ore.) plant a 0.5-in. galvanized-iron conduit for 60-cycle 57,000-volt buses. This bus serves two three-phase 1000-kva. transformers. To prevent heating and excessive losses at the joints they were cleaned with gasoline and the couplings sweated to the pipe. Suspension-type insulators are used to support the bus.

On account of the inability to procure solid busbar copper in Portland, Ore., or its vicinity, the expedient of taping together twenty No. 1 solid bare copper wires was employed for the 480-volt buses. At all angles the conductors of each set were soldered together and held securely in red brass castings.

Removing Ice in a Michigan Forebay by Blasting

BY J. G. KOPPEL

The forebay at the hydroelectric plant of the Edison Sault Electric Company at Sault Ste. Marie, Mich., which affords a head of 15 ft., is 900 ft. wide and in the winter time contains water from 6 to 10 ft. deep. Usually this pond freezes over late in the fall and the ice serves as a protector against incoming ice floated down stream from the rapids above.

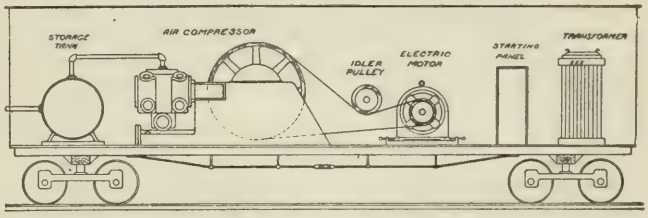
During the present winter, however, a cold spell which formed ice above the falls was followed by a week of mild weather. This broke up the ice and strong winds piled it high in the forebay as shown in the accompanying illustration. The head was reduced to such an extent that it was necessary to take steps to remove the ice. Before this could be done, however, there was a cold spell of four days, with the thermometer registering 19 below zero. This made the piles of ice a solid mass which could not be floated out in the ordinary way and blasting by dynamite was resorted to. Gangs of men were used to bore holes, and these holes filled with dynamite for firing at one time as shown at the right in the illustration.



OPERATORS DRILLING HOLES FOR DYNAMITE AND EXPLOSION IN ICE PILES WHICH CLOGGED FOREBAY

Portable Air Compressor Operated from 11,000-Volt Line

In constructing the barge canal, south of Rochester, N. Y., the Woolstey Construction Company made use of a large portable motor-driven air-compressor plant mounted as shown in the accompanying illustration. The equipment consisted of a 11,000/2300-volt transformer, a 200-hp., 2300-volt 25-cycle motor, a 1200 cu. ft. two-stage air compressor, a storage tank and all starting and controlling equipment. To secure as compact an arrangement as possible the motor was set close to the compressor and an idler pulley employed to increase the arc of belt contact. For light loads only one cylinder of the compressor was used, thereby reducing the load considerably. Direct bracing between the tracks and car platform was found necessary when the outfit was in operation, since blocking the wheels did not prevent vibration due to the car springs.



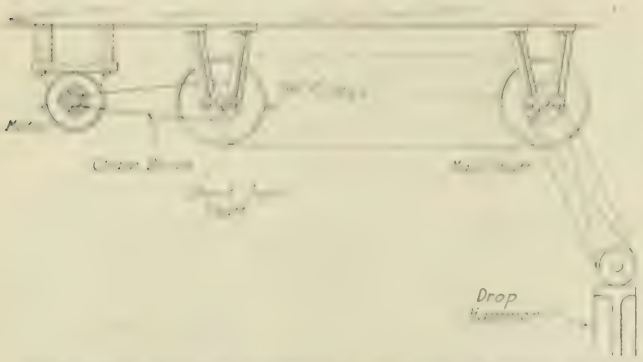
ARRANGEMENT OF AIR-COMPRESSOR EQUIPMENT ON COVERED RAILROAD FLAT CAR

A Method of Utilizing Motor Overload Capacity

BY SYDNEY FISHER

Since a squirrel-cage motor will develop 200 to 250 per cent of its rated torque and will carry a corresponding overload for periods of maximum demand such as occur in industrial operations it is particularly adapted to driving drop hammers, rolling mills and punch presses. Utilization of these valuable characteristics is seriously limited, however, by the pulleys which are usually supplied with them. While the pulleys will transmit the rated output of the motors to which they are attached and will even carry 25 per cent overload if it is applied gradually, heavy intermittent overloads, such as are encountered in the service being considered, will cause excessive belt slippage. This is due partly to the small arc of contact and also to stretching of the belt which is a result of excessive belt tension. Both of these causes of slip are obviously due to small pulley dimensions, the former to small diameter and the latter to limited width of face. Usually this slip is temporarily reduced by belt tightening, the inevitable result of which is a seized bearing and shut down.

On a large drop hammer installation, the full utilization of motor overload capacity, and the prevention of numerous shut downs was accomplished in one case by installing a combined chain and belt main drive as shown in the accompaning sketch. Obviously, the large driving pulley positively connected through the auxiliary jack shaft and chain drive becomes an integral



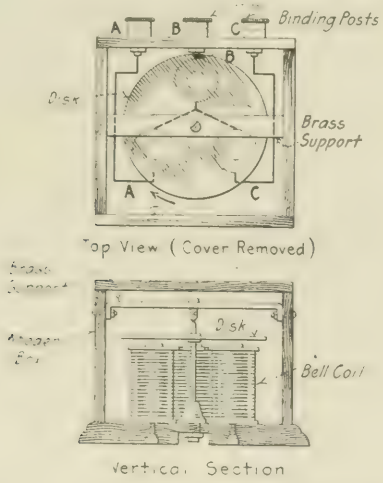
CHAIN AND BELT TRANSMISSION FOR DROP HAMMER DRIVE

part of the motor, and it can be designed as regards diameter and width of face to transmit the maximum overload output of the motor. Direct connection of the motor to the main shaft by means of a chain drive might appear to be a simpler solution of the problem. However, when the shock-absorbing main driving belt is eliminated, sheared keys, broken couplings and broken chains are more liable to occur.

Phase-Rotation Meter Easily Made

When a three-phase generator is to be connected to a live system its phase rotation must be the same as that of the system. For determining this phase rotation the following easily-made instrument was devised under the direction of E. P. Peck, superintendent of department of tests and repairs, Georgia Railway & Power Company, Atlanta, Ga.

The moving element of a watt-hour meter having an aluminum disk was mounted in its regular bearings and



CONSTRUCTION OF A HOME-MADE PHASE-ROTATION METER

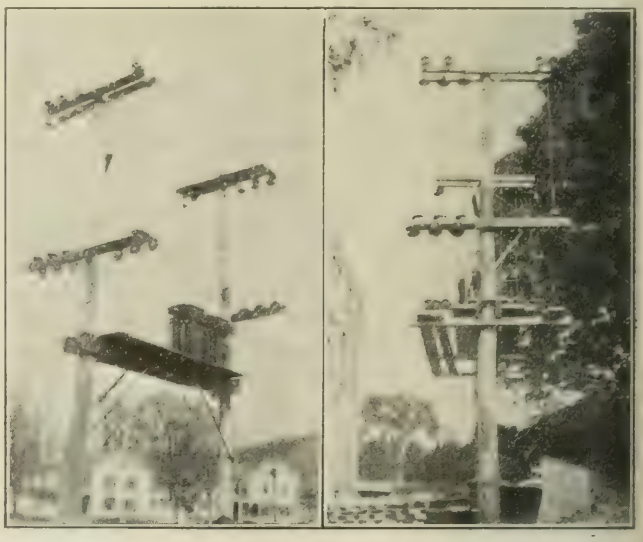
three 1250-ohm telephone bell coils were fastened under the disk at points about 1 in. from the shaft and equidistant from each other as shown in the diagram. They were connected in Y and the three leads *A*, *B* and *C* were brought to binding posts on the outside of the case. This case was the box used for holding a telephone bell. In its top was placed a small window, about 2 in. by 1 in. over the edge of the disk. On the disk an arrow was painted to indicate the direction of rotation.

When the posts *A*, *B* and *C* are connected to the three legs of a system, the disk revolves either forward or backward. It is advisable in practice to have it always going forward so as to avoid confusion. It may be reversed by interchanging any two legs. Let us say the disk runs forward on connection to the system. Then the leads of the instrument are connected to the corresponding legs of the cable coming from the generator which it is desired to tie to the system. If the meter again runs forward the phase rotations are the same. If it runs backward any two legs of the cable should be interchanged. The meter is intended for use on 110-volt circuits but by employing potential transformers it may be used on higher voltages.

Outdoor Transformer Installation to Serve Industrial Plant

BY N. M. LONGBOTHUM

Illustrated herewith is an industrial plant transformer installation which was made by the Housatonic division of Connecticut Power Company to serve the Seth Thomas Clock Company of Thomaston, Conn. In addition to supporting the step-down transformers required, this structure serves to dead-end the primary



FIGS. 1 AND 2—BROADSIDE AND END VIEWS OF SMALL OUTDOOR TRANSFORMER INSTALLATION

and secondary feeders and carries the corresponding transformer bus conductors. The transformer tower consists of two poles connected by two cross timbers, on which are laid planks that serve as a transformer platform. Both cross timbers are braced at each end by angle irons. While only two 50-kva. 2200/575-volt Westinghouse transformers are installed at present, space is provided for four more.

At the tops of both poles are double crossarms, one set dead-ending the incoming primary feeders and the other supporting secondary lines running to the factory. Single-disk insulators are used for this purpose as well as to support the transformer bus conductors, and the risers connecting them with the primary and secondary feeders. The bus conductors are strung horizontally between two crossarms several feet below the upper crossarms, three wires being strung on each side of the pole. Attached to the casings of the transformers on the side nearest the primary bus is a board on which are mounted primary plug cutouts. Westing-

house type CR multi-gap single-pole lightning arresters for the primary circuit are inserted in the loops under the bus crossarm. Home-made fuse-type line switches are provided in the primary circuit on the pole adjoining the tower.

So that the dead-end strains of the primary and secondary feeders will be suitably cared for, the double crossarms are connected by three tie wires containing ordinary guy insulators of the interlocking type, and head guys attached to each pole. Since the strain insulator bolts dead-ending the feeders pass through only one arm of each double arm, additional bolts are run through both arms several inches from each end to divide the stress between the arms of each set. The tie wires connecting the double arms are not attached to these bolts, but to others several inches from them, thus interposing considerable resistance between the primary and secondary strain insulator bolts in case a primary insulator breaks down.

As further protection interlocking type insulators have been installed in the head guys several feet from the top attachments and far enough above the anchorage so that persons on the ground cannot be shocked by faulty insulation on the crossarms and so that linemen working on the transformer platform will not be brought dangerously near ground connections. Furthermore, permanent steps have been omitted from the poles so unauthorized access to the transformer platform is impeded. Attached to one pole of the tower, however, are sockets in which temporary pole steps may be inserted. To facilitate hoisting or lowering transformers, angles are permanently attached to one pole of the tower so a jib crane can be hinged thereto and guyed from the pole top. All crossarms, platforms, timbers, floor-boards and pole butts are treated with carbolineum.

Small Electric Annealing Furnaces That Operate at 100 Per Cent Power Factor

To save time and secure a more uniform product in tempering and annealing tool steel, the Minneapolis Steel & Machinery has installed six small electric furnaces in its tool shops. These units, which comprise the first installation of the kind in the Minneapolis district, were supplied by The Hoskins Manufacturing Company of Detroit, Mich. The furnaces are rated as follows:

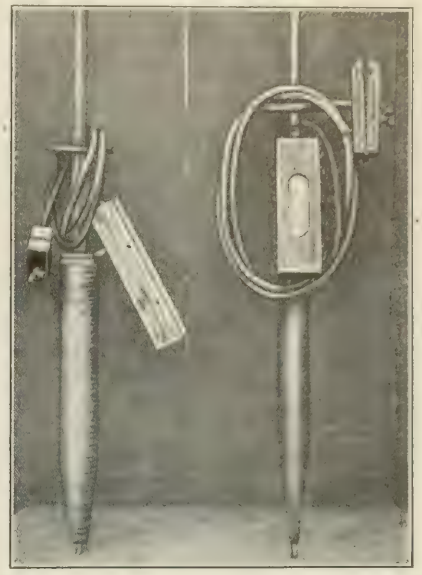
Number	Type	Maximum Kilowatt Rating	Inside Dimensions in Feet
2	F.C. 204	15 kw. each	5 x 6.5 x 12
3	F.B. 206	12 kw. each	12 x 8 x 19
1	F.C. 206	25 kw. each	8 x 12 x 18

The four furnaces of the F. C. type have a maximum operating temperature of 2500 deg. Fahr., while the two type F. B. furnaces reach temperatures of 3000 deg. Fahr. It requires approximately one and one-half hours to bring a furnace to its maximum temperature under operating conditions, and tests show that the energy required to heat treat the steel varies from 0.091 kw.-hr. to 0.15 kw.-hr., depending upon the temperature that is required to produce the grade of steel desired.

All of the furnaces are served from the lines of the Minneapolis (Minn.) General Electric Company, energy being stepped down to 27 volts at the furnaces. Since the furnaces are of the carbon-resistance and wire-resistance types, they will operate at practically 100 per cent power factor at all times. The furnace installation is but a small part of the steel company's 2382 hp. connected load. It is estimated that the central station will receive an annual revenue from their operation amounting to about $600.

Geissler-Tube Cable Testing Device

To determine when high-tension conductors are energized the Buffalo (N. Y.) General Electric Company makes use of a cable tester which depends for its action on static charge and not direct contact. The device consists of a Geissler tube in series with a condenser.



TWO VIEWS OF DEVICE FOR INDICATING ENERGIZED CABLE

Both are attached to a wooden rod with a metal tip and are connected with a grounding clamp by a flexible cable. When the metallic tip is applied to the sheath of a high-tension cable which is energized the tube will glow brightly. A similar device is being developed by the Rochester (N. Y.) Railway & Light Company.

Pulling Three Cables Simultaneously

By arranging three cable reels behind each other, as shown in an accompanying illustration and wrapping



THREE CABLES PULLED AT ONE TIME BY ELECTRIC TRUCK

their pull-in lines around a winch drum installed on an electric truck, the Commonwealth Edison Company has been able to install two 500,000 circ. mil. cables and one No. 4/0 much quicker than could have been done by pulling them singly. The reels were supported on jacks, as is usually done, and the truck doing the pulling equipped similar to that described on page 666 of the Sept. 30, 1916, issue of the ELECTRICAL WORLD.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

Customer Growth and Service-Extension Policies of Abington (Mass.) Company

The Abington & Rockland (Mass.) Electric Light Company, one of the Stone & Webster properties, recently celebrated its twenty-fifth anniversary by issuing a booklet of nearly fifty pages describing the departments of the company and their work, reviewing the history of electric service in the territory and presenting information of interest regarding meter readings, power sales, cost of lighting, office facilities and other features.

Although the booklet was issued before the recent order of the Massachusetts Gas and Electric Light Commission relative to management contracts, it contains certain data as to the growth of this company under centralized management which are of particular interest.

Power Demand Nearly Doubled

The plant passed under Stone & Webster management in 1906. Prior to that the equipment of the plant was not used during the daytime, the small day load being carried by generating equipment in a local factory. In order to use the plant as many hours a day as possible, power to operate factories was solicited. It was found necessary to almost immediately double the electrical capacity of the station, and a 300-kw. generator was added in 1907. In that year the service was extended into Hanover. In 1908, the capacity of the plant having been outgrown, and on account of the scarcity of water for condensing purposes, it was decided to purchase energy from the East Bridgewater turbine station of the Edison Electric Illuminating Company of Brockton, Mass., another Stone & Webster property. In 1909 the Cohasset Electric Company was purchased, and in 1910 the local plant of this concern was shut down and used as a distributing substation. Service was immediately extended to the town of Scituate. The growth of the company since 1906 has resulted in a gross income and number of customers five or six times those under local management, with a present output in kilowatt-hours more than twenty times as great. House lighting rates have been reduced 25 per cent. The number of customers increased from about 500 in 1906 to more than 3000 in 1916. The same superintendent, Mr. F. N. Sanderson, has been in local charge of the property since 1892.

Increases in Taxes and Capital

Since 1906 the average increase in the amount of taxes paid per year has been over $600 a year, or several times more than the total increase in the previous ten years. For the ten years before 1906 the stock had not increased because the business had not increased in service to new customers or extensions to new communities. Since the new management began it has been found necessary to increase the capital stock several times under the jurisdiction and approval of the Massachusetts Gas and Electric Light Commission. This capital stock is now $283,500 and bonds $25,000. This stock is widely scattered in ownership, being largely held in Massachusetts. Stone & Webster do not hold over 5 per cent of the stock and the management can be changed by vote of the stockholders.

The booklet outlines the protection to the public secured by the steps necessary to obtain an increase of capital stock. The cost of new construction has first to be carried by means of borrowed money secured by notes. When it is desired to pay these notes by the issuing of stock, the company petitions the commission for authority to make the increase. The commission then has published a notice of a public hearing upon this petition, at which time the company is obliged to show in minute detail, submitted in writing, the total expenditure for construction since the last stock issue. If the commission, after examination of the written and oral statements of the company and the statement of others who may be present, reports favorably, the stock is issued at a price determined upon. (The directors fix this price, but if the commission finds it not to be in the public interest the board may name the price.—Eds.) It is thus practically impossible under the laws of Massachusetts for a company to issue more stock than it has property, which safeguards the community against paying dividends on investments which are not actually represented by property. Any stock premium must be invested in the property of the company. The rate of interest obtained by the stockholders of this company on the money invested in the stock of the company is between 5 and 6 per cent. "Thus it can be seen," the booklet reads, "that the public in the State of Massachusetts is protected against over-capitalization by an electric light company and is protected against paying a high rate of interest on the money which the stockholders have invested. It also gives greater value and stability to stock issued under such conditions—a mutual advantage to both the corporation and the public."

The Relation Between Density of Business and Cost of Service

In his address at the Indiana Engineering Society's thirty-seventh convention, held at Purdue University, LaFayette, Ind., Jan. 18 to 20, Peter Junkersfeld, of the Commonwealth Edison Company, Chicago, spoke of the effect of density of business upon the costs and income of public utilities.

"In general, the larger the capital invested in proportion to the annual revenue," said Mr. Junkersfeld, "the more important the matter of density. For instance, the capital invested in many public utilities is turned over about once in from four to six years. The capital in most manufacturing is turned over perhaps once a year; that in merchandising perhaps two or three times a year. The slower the turnover the more important it is to make every dollar invested serve as many customers as possible in order to prevent the turnover from being still slower.

"As a definite example of the effect of density on public utility service I will point out some differences in cost to supply electric service under different conditions in Chicago, which differences also apply in a greater or lesser degree to smaller cities.

"In the table, column A shows approximately the relative investment required to supply electrical energy untransformed at a large substation; column B that to render complete electric service to one of five residence

customers in a block, and column C that to render the same service to one of fifty residence customers in a block.

	A Per Cent	B Per Cent	C Per Cent
Generating station	12.3	12.3	12.3
Transmission system	3.2	3.2	3.2
Substations		4.4	4.4
Distribution to block in which home is located		9.3	9.3
Distribution within such block		58.6	12.0
Meters		9.0	9.0
Lamps		3.2	3.2
	15.5	100	53.4

"If for simplicity of illustration we assume, first, that the electric utility has only two classes of customers and, second, that the yearly load factor of each customer in the two classes is the same, and, third, that the same yearly fixed charge could be applied to the entire investment used for each customer, then the investment charge for the consumer of untransformed energy would be only 15.5 per cent of that for the residence customer who is one of five customers in a block.

"In column B are shown the relative investment costs of the man who is one of only five small residence customers in a block. If there are fifty similar small customers in a block, as in the case of large flat buildings, the total investment charges as shown in column C are reduced almost one-half.

"The reason for this large reduction is, that for mechanical reasons the poles, the primary wires and the secondary wires necessary for five customers to the block are also sufficient to supply fifty customers to the block. The only addition in investment for fifty customers instead of five customers in a block is the larger transformer and the additional number of service drops. If every block in a city or in an area served for fifty or more customers, there would be a considerable reduction also in the items of transmission or substations, and of distribution of energy to the boundary of the block.

Large Relative Investment for Small Customer

"The above, together with the table, illustrates the very great influence of density of investment required to render electric service to homes. It also shows that the investment per unit of demand is six or seven times as great for the small customer in column B as for the large customer in column A. The interest and other fixed charges in this investment must be paid from month to month and year to year. The interest and other fixed charges go on and on and must be paid when the customer uses the service only five minutes per day as well as when he uses it five hours per day. This is one of the reasons why a minimum bill each month is equitable and fair.

"Again, the cost to supply electric service depends on local conditions and habits. If every householder in a block takes electric service instead of only a few in the block the cost will be less and hence finally the rate will be less and all share the benefit.

Relative Expenses Other Than Investment Charges

"All of the expenses per kilowatt-hour (other than fixed charges on investment) incurred in supplying electrical energy untransformed are only about 6 or 7 per cent of those incurred in rendering electric service to a very small customer (five customers to the block). The reason for this is that in case of untransformed energy in bulk the only large expenses are those in operating and maintaining the generating station and the transmission lines. All of the other expenses such as the cost of reading and maintaining meters and rendering and collecting of bills for such large customers are relatively small items.

"In the case of the very small customer that we are considering, the operating and maintenance expenses in connection with the substation and complete distribution system, meters and lamps and often free repairs for customers are a very large item. The general expense incurred in reading, testing and maintaining meters, rendering and collecting bills and keeping and carrying the account is just as great for the smallest customer as for a moderate-sized customer. Here, then, is another reason why a proper minimum bill is necessary to prevent injustice and it therefore is equitable."

Terms of Electrical Ordinance Prepared by Co-operating Electrical Interests of Salt Lake City

The Utah Electric Club has approved the draft of an ordinance prepared by the various local electrical interests co-operating with the electrical department of the Bureau of Inspection of Salt Lake City, urging the adoption of this ordinance by the city commission.

The ordinance provides that a permit from the municipal inspection bureau shall be secured for the installation of all new wiring and appliances and for the addition to or alteration of any existing electrical installation. The fees are required to be paid in advance. As soon as practicable, when the ordinance becomes effective, the bureau is also required to inspect all existing installations and to require the correction of defects which are dangerous, likely to cause fire, or otherwise hazardous to life or property. No fee is required for such inspection unless it is made at the request of the owner or user of the installation.

The first inspection of new installations is required to be made as soon as practicable after the contractor notifies the bureau that the job is ready for inspection, but jobs will not be considered as ready until all inclosed plumbing, heating and gas fittings are in place. When the final inspection is made, an approval label is attached to the service wires, and a certificate issued to the person taking out the permit. All persons are prohibited from lathing or otherwise concealing the electrical wiring until first inspection tag for the roughing in has been placed on the job.

If the bureau is unable to make the final inspection within twenty-four hours after application for the same, authority is given to grant a temporary permit for the current to be turned on pending inspection. The bureau is given authority to disconnect all wiring of appliances installed not in accordance with the provisions of the ordinance, or which may have become dangerous to life or property.

Permits to Licensed Contractors Only

The ordinance provides that permits for electrical wiring shall be issued only to licensed electrical contractors. All electrical installations are required to be installed in accordance with the latest issue of the rules and requirements of the National Electrical Code, and all fittings and material must be approved in the latest list issued by the National Board of Fire Underwriters. Several requirements which are supplementary to the National Electrical Code are included in the ordinance. Service switches, cut-outs and meters must not be located in bathroms, and all switches, sockets, or other electrical fixtures in bathrooms must be located so that they cannot be reached by one standing in the bathtub.

All wires in damp places, basements, or cellars, unless concealed, must be run in conduit, and no metal-covered sockets or switches will be allowed in these places.

Drop cords must be of "reinforced cord."

A separate service must be provided for each flat or dwelling place in an apartment house unless the cut-outs or meters are located in a cabinet or closet opening into a public hall so as to be readily accessible at all times. Underground service must enter the building at some convenient location on the ground floor readily accessible to the police or fire department officials and main cutoff switches as few in number as possible, must be provided at this location so that all electricity for light, heat or power purposes can be cut off from the building in case of necessity.

Fuses Required Outside Buildings Where Service Wires Exceed 30 Ft.

A decidedly new departure is contained in the provision that for all buildings hereafter erected where the service wires are to be more than 30 ft. long, a fused condulet must be placed on the outside of the building for overhead feeders and at the entrance feed on underground feeders.

Circuits running from the main cabinet to the attic must be lined in conduit. Bell circuits are required to be not smaller than No. 19 twisted-pair or No. 18 copper fixture wire.

Within the commercial, wholesale and manufacturing section of the city, all wiring shall be placed in conduit. The same rule also applies to all wiring hereafter erected, to be used for public purposes, including churches, stores, halls, school buildings, garages, manufacturing establishments, warehouses, and apartment houses.

Representatives of some of the electrical contractors urged that the ordinance be extended so as to require that the wiring for all buildings hereafter to be erected, be done in conduit. This was opposed principally for the reason that it would increase the cost of wiring from 50 per cent to 75 per cent, and that the effect of this increased cost would be that many residences would not be wired, and that, since any form of illumination which might be substituted for electricity would increase the hazard. The number of outlets for residence wiring is limited to eight on one circuit.

Specifications for Electric Signs

All signs hereafter erected which extend more than 2 ft. beyond the property line must be constructed of metal or other non-combustible material, and must be self-illuminated with at least 4 cp. per square foot of exposed surface. No piece of glass having an area of more than 1 sq. ft. is permitted to be used on any projecting sign.

All projecting signs now installed must be self-illuminated or taken down, the signs to be kept lighted not less than fifteen hours per week of each week in the year. Illuminated signs are specified to include signs having all or any part of the letters outlined in incandescent lamps; signs with painted flush or raised letters and lighted by electric lamps, and transparent glass signs whether lighted by electricity or other illuminant.

Fees for Inspection

The fees specified for inspection of electric wiring and signs are as follows:

For electric wiring, $1 for the first two outlets and 5 cents for each additional outlet; the word outlet being interpreted as including a switch outlet and switch, or lighting outlet and the fixtures attached thereto.

For arc lamps and light outlets requiring 400 watts or more, $1 for the first two lamps or outlets, and 25 cents for each additional outlet.

For projecting signs which must be illuminated, $3. An annual inspection fee, thereafter, is provided at the rate of 10 cents per square foot for the first 30 sq. ft., 8 cents per square foot for the next 30 sq. ft., and 5 cents per square foot for all over 6 sq. ft.

For roof signs the fee is 1 cent per square foot for permit to erect. Minimum charge, $2.

For each motor:	
1 to 5 hp	$1 25
5 to 15 hp	2 00
15 to 40 hp	4 00
Over 40 hp	7.00
For each generator:	
3 kilowatts or less	$1 00
3 to 15 kilowatts	2 50
15 to 40 kilowatts	4 00
More than 40 kilowatts	7.00

Special circuits for heating devices requiring more than 600 watts, 50 cents per circuit, provided that no permit for installing meter or special circuit shall be issued for less than $1.

For special wiring for equipment not otherwise specified, a charge of $1.50 for the first hour and at the rate of 75 cents per hour for additional time if the minimum fee of 50 cents is provided.

Prizes for Safety Appliances Proposed by Employees

The Plymouth (Mass.) Electric Light Company has offered three prizes to be awarded during the year 1917 for the employees who suggest the best and largest number of safety devices to prevent accidents among the employees of the Plymouth company.

The prizes are $25, $15 and $10 respectively. Suggestions are to be made to the manager, E. P. Rowell, and are to be reviewed by the board of directors.

Motor Drive of Rock-Crushing Plant

The rock-crushing plant shown in the illustration is driven by a 30-hp. induction motor, and the Paterson, N. J., contracting firm which operates the plant is well satisfied with its performance.

Service is supplied by high-voltage overhead lines, and is transformed by the equipment illustrated. The motor is located in the low building directly behind the transformer poles. A belt transmits the power from the motor to the crushing and conveying mechanism, and a winch with clutch attachment to the motor is provided for hauling the cars of rock up the incline.

An inclosed starting compensator is used with the motor.

During the regular 8-hr. day about 50 cu. yd. of rock are crushed into sizes suitable for building macadam roads. The owners are well satisfied with the equipment and consider that they are making a substantial saving through its use.



A 30-HP. MOTOR DRIVES THIS ROCK-CRUSHING PLANT WHICH TURNS OUT 50 CU. YD. OF CRUSHED ROCK PER DAY

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

TRACTIVE RESISTANCES OF ROADS AND PAVEMENTS

A Summary of Recent Research Work in the Department of Electrical Engineering at the Massachusetts Institute of Technology

TRACTIVE resistance may be defined as the horizontal force necessary for overcoming the road, tire, and still-air resistances, when the vehicle is running at constant speed on a level surface in the absence of wind. It is, therefore, in the case of an electric truck, the force which, at this speed, gives the power obtained by deducting from the total battery output the axle frictions and all internal power transmission mechanism losses.

EQUIVALENT PER CENT GRADE OF TRACTIVE RESISTANCE BY VARIOUS WRITERS

Note: In making comparisons based on this table, it must be borne in mind that some of the results presented include various amounts of wheel-bearing frictions and internal vehicle losses wheels and tires also vary.

Type of Road	Condition	A. Morin, 1842, Stage Coach or Carriage	M. Bixio, 1880, Four-Wheeled Cab	Beaumont, 1900, Iron-Tired Wheels at Low Speed	McCormick, 1912	Hall and Hargrave, Solid Rubber Tires, 1912	A. Churchward, 1912: Speed, 10 m.p.h.		F. E. Whitney, 1913		I. O. Baker, 1913, Summary of Various Tests	Kennelly and Schurig, 1915, Solid Rubber Tires Speed 10 m.p.h.
							3-in. Tires, Solid Rubber	4.5-in. Pneumatic Tires	Solid Rubber Tires	Pneumatic Tires		
Asphalt	*	.....	1.9	1.1–1.4	1.9	1.5	.....	.....	0.9–2.0	0.75–1.75	1.5–3.5	.....
Asphalt	Good	.....	.....	1.1	.....	.....	.....	.....	0.9	0.75	.....	0.9
Wood block	Good	.....	.....	.....	.....	1.6	.....	.....	.....	.....	.....	1.1
Wood block	*	.....	.....	1.1–1.9	1.65–2.1	.....	.....	.....	.....	.....	1.5–2.5	.....
Brick block	.....	.....	.....	.....	2.8	2.0	.....	.....	.....	.....	0.8–2.0	1.1[3]
Granite block	*	.....	2.2–2.5	.....	.....	2.9	.....	.....	.....	.....	.....	1.8[3]
Granite block	Grouted joints	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.2[3]
Cobblestones	.....	.....	.....	.....	2.7	.....	.....	.....	.....	.....	2.5–5.0	.....
Stone block	*	1.3–4.3	.....	.....	.....	.....	.....	.....	.....	.....	1.5–4.0	.....
Macadam	Good	1.7	.....	2.0	1.9	.....	1.0	1.2	.....	.....	.....	1.1
Macadam	*	.....	2.1–3.0	2.0–5.3	.....	1.7	.....	.....	.....	.....	1.0–5.0	1.1–2.4
Macadam	Very bad 4-in. ruts	10.1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Cinder	Good	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.25
Gravel	Good	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.4
Gravel	Loose	.....	.....	6	7	.....	.....	.....	.....	.....	5.	.....
Sand	Average	.....	.....	.....	.....	.....	.....	.....	.....	.....	5.	.....
Sand	Loose	.....	.....	.....	16.	.....	.....	.....	.....	.....	7.5	.....
Earth	.....	3.5	.....	.....	5.0–9.5	.....	.....	.....	.....	.....	2.5–10	.....
Snow	Fairly hard	.....	.....	.....	.....	2.5[1], 2.9[2]	.....	.....	.....	.....	.....	.....
Snow	Fairly soft	.....	.....	.....	.....	3.1	.....	.....	.....	.....	.....	.....

*Results stated cover range or average of tractive resistances obtained on both good and bad pavements.
[1]Without tire grips. [2]With tire grips. [3]Road in good condition.

In the accompanying table are given the results on tractive resistance obtained by various experimenters. Though most of the figures given have been derived from published results dating as far back as 1842, the comparative table presented is believed to be new, and is here published for the first time. It will be observed that the figures are given in "equivalent per cent grade" of tractive resistance. A 1 per cent equivalent grade of tractive resistance means that on a level road a horizontal force of 20 lb. would be required to pull at constant speed a 2000-lb. vehicle having no axle friction or other internal mechanism losses. This force would obviously serve to propel the same vehicle up a frictionless grade of 1 per cent in the absence of tire, roadbed, still-air and internal frictions.

The results given in the last column of the table are in strict accordance with the definition of tractive resistance stated in the first paragraph, while some of the other figures include various amounts of wheel-bearing frictions and internal losses. This fact, together with the fact that speed, wheels and tires also vary, must be considered in the use of the table. It is seen, however, that the results of several recent investigations are in fair agreement. The table also shows in a general quantitative way the reduction of tractive resistance brought about by both the introduction of modern pavements and improvements in the construction of vehicles. The great importance of constructing and maintaining smooth, hard and clean pavements, particularly for economical motor-truck operation, is also indicated by the results, as has already been pointed out by other observers. Low tractive resistance means small gasoline consumption for gasoline trucks, and a reduced electricity expense, or greater daily mileage on a single battery charge with electric trucks. It is seen that the difference between the figures for the tractive resistances of good and bad pavements of the same type may be 100 per cent or more of the value for the same road in good condition. This increased resistance with increasing pavement wear obviously produces a corresponding though not necessarily proportionate increase in the motive power of a motor vehicle or a reduction of speed, or both. Bad pavements are, therefore, in a great many cases, a direct impediment to the economic use of motor vehicles.

The results of the last column in the table were obtained in an experimental investigation carried on in the Research Division of the Electrical Engineering Department at the Massachusetts Institute of Technology, with the aid of a 1000-lb. (450 kg.) electric truck with solid rubber tires. The complete report on this research was published in the *Proceedings* of the American Institute of Electrical Engineers, June, 1916, Vol. XXXV, pages 1011-1039, under the title of "Tractive Resistances to a Motor Delivery Wagon on Different Roads and at Different Speeds," by A. E. Kennelly and O. R.

Schurig. An abstract prepared by the same authors, and entitled "Recent Investigations of Tractive Resistance to Motor Trucks on Roads and Pavements," was presented on Dec. 28, 1916, at the Highway Engineering Session of the American Association for the Advancement of Science in New York.

The investigation involved test runs over definite lengths of road at constant speed to determine the battery output, and laboratory tests to determine the losses to be deducted. The results obtained are (1) over-all efficiency of truck mechanism; (2) tractive resistances of a number of urban roads, and (3) an analysis of tractive resistance into its components. The following urban pavements, when in good condition, are enumerated in the order of their desirability for vehicle operation from the point of view of tractive resistance at 20 km. (12.4 miles) per hour, as found in this investigation: (1) Asphalt; (2) wood block; (3) hard smooth macadam; (4) brick block; (5) granite block with cement-filled joints; (6) cinder; (7) gravel; (8) granite block with sand-filled joints. The results for equivalent grade of tractive resistance obtained in this investigation range from 0.9 per cent on the best asphalt road, at a speed of 10 miles (16 km.) per hour, to 2.7 per cent on a very poor macadam pavement, at a speed of about 12 miles (19.3 km.) per hour.

This investigation should stimulate additional researches in the same field on subjects such as: (*a*) Tractive resistances on country roads; (*b*) tractive resistances to vehicles with different tires; (*c*) tractive resistances of urban roads at speeds below 10 miles (16 km.) per hour; (*d*) tractive resistances at speeds in excess of 15 miles (24 km.) per hour; (*e*) tractive resistances for heavy-duty trucks.

Generators, Motors and Transformers

French and American Standardization Rules.—A. S. MILHOUD.—The author outlines the tests prescribed by the standardization rules of the American Institute of Electrical Engineers and compares them with those of the Union des Syndicats de l'Électricité and of the Associations des Propriétaires d'Appareils à Vapeur. He concludes that the American tests are better adapted to meet the conditions of operation of the different machines.—*La Lumière Elec.*, Dec. 23, 1916.

Influence of Temperature on the Friction Losses and Efficiency of Dynamos.—W. PEUKERT.—The method of allowing a machine to lose speed gradually and come to rest is frequently used for determining the losses in the machine. In this way the amount of the total losses can be ascertained and the various losses can be separated. The friction losses can be divided into those due to air friction and bearing friction, on the one hand, and those due to brush friction on the other. This is done by carrying out two similar tests, in one of which the machine is allowed to come to rest with the brushes resting on the commutator and the magnets unexcited, and in the other case the brushes are lifted. No really successful method has yet been indicated for separating the losses due to air friction and bearing friction. The difficulty lies in the fact that both depend on the temperature, but vary according to different laws. The relation of air friction to temperature has not been properly ascertained, so that no calculations are possible. Brush friction also varies with temperature. The object of the author's tests was to investigate the effects of a change of temperature on the friction losses. An ordinary shunt motor was used, which at full load took 26 amp. at 440 volts and ran at 1100 r.p.m. The normal exciting current was 0.554 amp. The room in which the motor ran could be artificially heated to any desired temperature. The experiments were carried out very slowly and carefully to make sure that the machine was at the exact temperature. In Fig. 1 the total friction losses for the different temperatures, which were kept constant, are shown in relation to the speed. These curves show very clearly the decrease of the friction losses with temperature. Fig. 2 shows the change of the no-load losses with temperature; these also decrease with an increase of temperature. Fig. 3 gives the curve of the friction losses for a constant normal speed of 1100 revolutions as function of the temperature. The friction loss at constant speed decreases with an increase of temperature. The second curve gives the efficiency of the motor and shows the rise

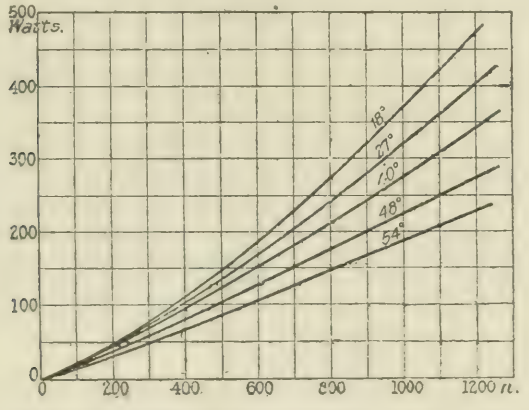


FIG. 1—RELATION BETWEEN THE FRICTION LOSSES, SPEED AND TEMPERATURE

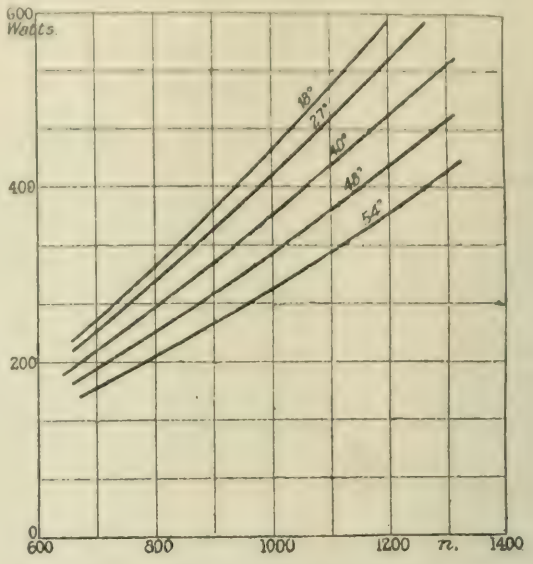


FIG. 2—RELATION BETWEEN THE NO-LOAD LOSSES AND THE SPEED AT DIFFERENT TEMPERATURES

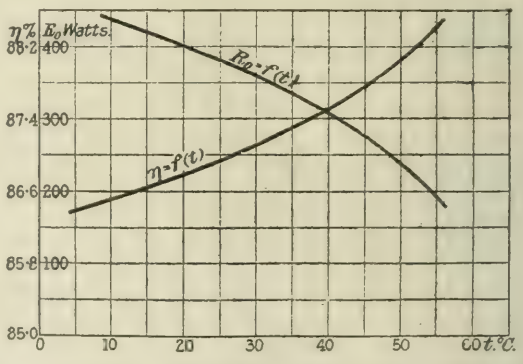


FIG. 3—RELATION BETWEEN THE FRICTION LOSSES, THE EFFICIENCY AND THE TEMPERATURE

from 86.68 per cent at 18 deg. C. to 88.35 per cent at 54 deg. C.—From *Elek. Zeit.*, Nov. 17, 1916, translated in abstract in London *Electrician*, Dec. 22, 1916.

Lamps and Lighting

Lighting Conditions in England.—L. GASTER.—A paper read before the British Illuminating Engineering Society dealing with the present light conditions in England. The author discusses the effects of the Daylight Saving Act and the problems of economy in artificial light. The Committee on the Health of Munition Workers has been carrying out many detailed investigations into the effect on output in munition factories of changing hours of work, and it is suggested that while detailed investigations into other variations in conditions affecting the health and efficiency of munition workers are being made, the influence of changing conditions of lighting could also be studied. The present lighting conditions in the streets of London are also discussed.—London *Electrician*, Dec. 22, 1916.

Generation, Transmission and Distribution

Heat Transmission Through Boiler Tubes.—E. A. FESSENDEN and J. W. HANEY.—An account of an experimental investigation carried out at the University of Missouri. The authors sum up the theories of heat transference and discuss the inadequacy of the formulæ in current use. They then give a detailed account of their tests, the object of which was to determine the law of decrease in temperature of the gases passing over the boiler heating surface. The results are given in numerous tables and diagrams. The coefficient of heat transmission is defined as the number of heat units (B.t.u.) transmitted per hour per square foot of heating surface (measured on the inside of the tube) per degree temperature difference between the boiler water and the hot gases. From the authors' experiments as well as from extended Babcock & Wilcox tests it is concluded that the rate at which the heat is transferred from gases to water is not directly proportional to the temperature difference, but that the rate itself depends on the temperature difference.—*University of Missouri Bulletin*, Vol. 17, No. 26, October, 1916.

Utilization of Water Power in Ireland.—At a recent lecture before the Belfast Association of Engineers, A. W. Brown suggested the transmission of power generated from the tidal rise and fall of the water at Strangford Lough and Lough Neagh to Belfast. Thus, at Strangford Lough there are 20 square miles of water available; the spring tides have a rise of 14.5 ft. and the neap tides a rise of 11.5 ft., with a range of 7.5 ft. About 20,000 hp. could be developed for a period of two and one-half hours, the power available varying from maximum to minimum every six hours. Large storage batteries would be needed, or extra water storage at Strangford Estuary and Magee Island could be designed. The ordinary navigation of the lough would not be interfered with.—London *Electrician*, Jan. 5, 1917.

Wires, Wiring and Conduits

Investigation of Cartridge-Inclosed Fuses.—The full report of the Bureau of Standards in the case of Economy Fuse & Manufacturing Company versus Underwriters' Laboratories (Inc.) concerning the fire and accident hazard of the Economy refillable fuse as compared with approved fuses. The report covers more than 200 pages. The board of referees consisted of E. B. Rosa, H. B. Brooks, Burton McCollum, W. J. Canada and F. W. Glading. The Bureau's investigation shows that the Economy fuse when new and properly filled or refilled operates satisfactorily under the most common working conditions of overload and moderate short-circuits when in circuits with low inductance, and possesses some marked advantages over the approved fuses with which it has been compared. The Bureau's finding recommends that Economy fuses be not approved at present for general use on the same basis as fuses at present listed as standard by Underwriters' Laboratories (Inc.), but that their use be permitted by municipal and underwriters' inspection departments under conditions where their performance can be observed by each inspection department until sufficient experience regarding their performance under service conditions can be obtained to justify an unqualified approval or refusal to approve.—*Technologic Paper, Bureau of Standards*, No. 74, Dec. 1, 1916.

Electrophysics and Magnetism

Collisions of Electrons with Gas Molecules.—K. T. COMPTON and J. M. BENADE.—An account of a study of the collisions between electrons and gas molecules undertaken to find information regarding molecular and atomic structures. The general plan of the experiments was to project electrons with a definite velocity through a hole in a plate so that they moved toward a second parallel plate against a retarding field which was insufficient to prevent their reaching the plate unless they collided on the way. From the relative numbers reaching the second plate at various distances from the first plate the average number of collisions per centimeter path by each electron could be easily calculated. From the results obtained in the experiments the following conclusions are drawn: An electron is not always stopped whenever it strikes the spherical region which we sometimes call the molecule; whence it is concluded that the molecule, or its field of force, does not possess radial symmetry. The energy lost by an electron in striking or passing a molecule is a function of the least distance between their paths and is shown to vary inversely as the tenth power of the distance in the case of nitrogen. It is also shown theoretically that this loss of energy should be greatest in the case of heavy complex molecules, less in the case of light simple molecules and very small in the case of monatomic molecules—thus accounting for the phenomena of elastic and inelastic impacts. From the experimental data, assisted by theoretical considerations, the authors are able to calculate the natural frequency of a nitrogen atom with a fair degree of accuracy. There is no such thing as a definite collision between an electron and a gas molecule; the phenomena which have been thus accounted for must be explained as the results of deflections and losses of energy in amounts which depend on the distance between the electron and a molecule at their nearest approach.—*Phys. Rev.*, November, 1916.

Telegraphy, Telephony and Signals

Audion.—MARIUS LATOUR.—A brief theoretical discussion of the audion in which the author deduces the general characteristic equations of the audion operating as amplifier, without giving specific numerical constants.—London *Electrician*, Dec. 1, 1916.

Miscellaneous

Combination of Two French Electrical Journals.—Beginning with January, 1917, *La Lumière Electrique* and *La Revue Electrique* will be combined as one publication with the title *Revue Generale de l'Électricité.* It will be the official organ of the French Association of Central States (Union des Syndicats de l'Électricité). The program of the new journal will be outlined in the first issue by André Blondel. The two editors-in-chief will be J. Blondin and J. de Soncy. There shall be four sections—a scientific and technical section, an industrial section, an economic and financial section, and a legal section.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

LITTLE PROGRESS ON WATER-POWER LEGISLATION

Senator Walsh Announces That He Will Keep Bill Before Senate at Least One Day—Prospect Bill Will Pass Senate

Senator Walsh, who is in charge of the water-power bill in the Senate, has refrained from standing on his rights in regard to the bill, in order to serve the general public interests as to appropriation bills, and has not insisted that the bill be kept before the Senate the past week or so, as he has had the right to do under the rule which made the bill the so-called "unfinished business" of the Senate. Hence, there has been little done in regard to the bill, excepting the perfecting of amendments by Senators in their own offices, ready to offer when the time for amending the bill comes.

Senator Walsh, however, announced to a representative of the ELECTRICAL WORLD in Washington that he would keep the bill before the Senate at least one day, and would insist upon a night session for its discussion.

"There is a prospect that the bill will pass the Senate at this session," Senator Walsh said, "although I would not care to say how good that prospect is. The Senate committee, I understand, is preparing some amendments to the substitute bill which the Senate committee reported, and it is still impossible to say what the House will do with the bill even if the Senate finishes it at this session."

UNITED STATES CHAMBER OF COMMERCE CONVENTION

Department of Commerce Urged to Find Out Cost of Doing Business—Daylight Saving Action by Congress Recommended

The fifth annual convention of the Chamber of Commerce of the United States was held in Washington on Jan. 31, Feb. 1 and 2, with a program of especial interest to business men concerning conditions after the war. President Wilson and former President Taft both spoke at the banquet which concluded the convention.

Congressional action to set all the clocks of the country one hour ahead of the present standard time was recommended by the chamber's committee on "daylight saving." The committee on railroads urged action by the present session of Congress to prevent strikes and lockouts on interstate railroads. The committee on commerce urged that the Department of Commerce "find out what it costs to do business in the United States," and should deduce from the figures obtained what percentage business concerns spend of their total incomes on specific items, such as deliveries. The commerce committee also urged that the Department circulate more information regarding the highly efficient concerns of the country and should work out for the betterment of business generally still better methods than it finds in use in any actual business.

The committee on vocational education reported that "the vocational education bill now before Congress will have failed of its ideal if it does not stimulate the States to undertakings in vocational education far in excess of the amounts appropriated for this purpose by the federal government."

The committee on statistics and standards urged the creation of a federal commission for the survey of all census statistics.

CENTRAL STATION MEN TO MOBILIZE AT PROVIDENCE

New England Section of the N.E.L.A. Will Make a Tour of the Narragansett Company's System and Hold Session in Rhode Island Capital

Under the auspices of the New England Section of the National Electric Light Association, a visit of central station and other electrical men will be made on Feb. 15 to the headquarters of the Narragansett Electric Lighting Company at Providence, R. I. Special cars will be attached to the 10.05 a. m. train from the South station, Boston, for Providence, and upon arriving, the party will visit the departments of chief interest to them in the Narragansett organization, starting in the company's electric shop at the Turks Head Building. At 12.45 p. m. luncheon will be served in Association Hall, 360 Eddy Street, and at 1.30 p. m. ten-minute talks will be given by the following representatives of the Narragansett company: E. R. Davenport, on "Sales;" J. E. Gray, on "Power;" A. H. Allcott, on "Appliances;" and F. A. Gallagher, Jr., on "Lighting." The film, "The King of the Rails," will be shown at this meeting and the return to Boston will be made at 4 p. m. Miss O. A. Bursiel, secretary of the New England Section, 149 Tremont Street, Boston, Mass., is receiving notifications from members and others proposing to attend. M. R. Griffeth, 84 State Street, Boston, is chairman of the excursion committee.

TERMINAL ENGINEERS' CLUB

New Society Formed to Encourage Study of Freight Problems

The Society of Terminal Engineers has just been chartered to promote the study of terminal engineering and mechanical freight handling as a specialty.

The organization has three grades of membership—members, associate and junior. The member grade is open to professors of civil and mechanical engineering and engineers specializing in terminal work. Associate membership applies to officers and others connected with concerns manufacturing freight-handling appliances and terminal equipment, and those whose work and interests enable them to co-operate in the aims of the society. Junior members comprise recent graduates who will specialize in terminal engineering and young engineers.

The partial organization so far effected is: President, H. McL. Harding, New York; vice-presidents, Gen. W. H. Bixby, U. S. A., Washington, and John Meigs, Philadelphia; treasurer, W. J. Barney, New York; secretary, J. Leonard, 1133 Broadway, New York.

FURTHER CURTAILMENT OF NIAGARA POWER FROM CANADA

The Ontario Hydro-Electric Commission Demands an Additional Block of 50,000 Hp., Delivery to Commence by April 1

An additional block of 50,000 hp. has been demanded from the Canadian Niagara power companies by the Ontario Hydro-Electric Commission not later than April 1. This means further curtailment of power that is now being sent across the Niagara frontier into New York State. The Canadian Niagara Power Company, the Ontario Power Company and the Electrical Development Company are arranging for the delivery of the power so that the entire responsibility will not rest upon any individual generating company.

Announcement of this new demand by the Hydro-Electric Commission came as a complete surprise to the power companies and industries along the American Niagara frontier which are dependent upon Canadian power to keep their plants in operation. The Canadian Niagara power companies recently allowed the commission a block of 50,000 hp., and it was the belief at that time that no other demands would be made until after the Canadian government had reached a decision on the hearings held before the Minister of Inland Revenue.

Although the additional 4400 cu. ft. of water per second which is now being diverted from the Niagara River by American generating companies under authority of the Niagara water-power legislation approved by Congress and the President has tended to relieve the power situation in western New York, the cutting off of a block of 50,000 hp. from Canada will have the same effect upon the power situation as before the enactment of temporary power legislation by Congress. The 4400 cu. ft. per second generates 50,000 hp. which is divided up between the Hydraulic Power Company and the Niagara Falls Power Company. The former is allowed to divert an additional 2400 cu. ft. and the latter is allowed an additional 2000 cu. ft. per second. The war department announced that this allotment is subject to change if consumers feel they are not being treated fairly by the power-generating companies.

This temporary permit expires on July 1, and unless there is an extension of time granted by the war department or permanent legislation is enacted by Congress, there will be a serious shortage of power in western New York after that date. With practically no power being imported from Canada, many industries either will be forced into temporary idleness or else take up residence in Canada.

ST. PAUL ELECTRIFICATION TO BE EXTENDED TO COAST

Surveys of 400 Miles of Additional Trackage Now Being Made Preparatory to Extending Electrification from Avery, Idaho, to Western Terminus

Electrification of the Chicago, Milwaukee & St. Paul Railway already completed through the Rocky and Belt Mountains and nearly finished through the Bitter Root range, is to be extended to the Pacific Coast. Announcement of the plans for this project has been made by C. A. Goodnow, assistant to the president of the St. Paul system.

On the railroad's Puget Sound line a stretch of 416 miles is now being operated electrically and the work on 24 miles from East Portal to Avery, Idaho, is to be finished in February. The completion of this section of the work will finish the original electrification program of 440 miles. While it has not been definitely decided how soon the electrification through the Cascade Mountains to the Coast will be undertaken, it has been announced that the surveys for this work are now under way. In financial circles it is reported that a portion of the $25,000,000 4.5 per cent general and refunding mortgage bonds recently sold to a syndicate headed by Kuhn, Loeb & Company and the National City Bank of New York, will be used for this additional electrification.

PROGRAM FOR A.I.E.E. MIDWINTER CONVENTION

In Addition to Five Technical Sessions, Arrangements Have Been Made for a Number of Inspection Trips

Arrangements have been completed for the fifth annual midwinter convention of the American Institute of Electrical Engineers to be held at the Engineering Societies Building, New York City, on Feb. 14, 15 and 16. In addition to five technical sessions, plans have been made for a number of interesting inspection trips, an informal reception and a dinner dance.

Each of the three days is devoted to some particular phase of electrical engineering. The papers for Wednesday's sessions refer to the heating and temperature of generators, and the protective devices. Thursday is devoted to electrophysics, three papers under this heading being scheduled for the morning session, and a lecture in the evening by Prof. R. A. Millikan on "Modern Physics." Members of the American Physical Society have been invited to participate in both of these sessions. The two sessions on Friday are to be devoted to the subjects of direct-current and alternating-current motor control.

In addition to a dinner-dance to be held at the Hotel Astor on Friday evening, Feb. 16, the entertainment committee has provided for an informal reception to be held at the close of Professor Millikan's lecture on Thursday evening. This reception will be held in the institute headquarters.

The following companies have offered an opportunity to those in attendance at the convention to inspect their power houses and substations with particular reference to those enumerated below. Thursday afternoon has been selected for these visits: Edison Electric Illuminating Company of Brooklyn, Gold Street power station; Interborough Rapid Transit Company, Fifty-ninth Street and Seventy-fourth Street stations; New York Central & Hudson River Railroad Company, Port Morris power house, substations, Grand Central Terminal; the New York Edison Company, Waterside station, Thirty-eighth Street and First Avenue; the New York Telephone Company, Walker Street building; Public Service Electric Company, Newark, N. J., Essex power house.

The following technical program has been arranged:

Wednesday morning—Opening address by President H. W. Buck. Standards Session. "Internal Temperatures of Alternating-Current Generators," by Ralph Kelly. Wednesday afternoon—Protective Devices Session. "Reactors in Hydroelectric Stations," by J. Allen Johnson; "The Effect of Current-Limiting Reactors in Steam Turbine Stations Under Short-Circuit Conditions," by Paul B. Juhnke; "Protection of Transformer Neutrals Against Destructive Transient Disturbances," by Max H. Collbohm. Wednesday evening—Board of directors' dinner, University Club.

Thursday morning—Electrophysics Session. "Corona and Rectification in Hydrogen," by J. W. Davis and C. S. Breese; "The Electric Strength of Air-VII," by J. B. Whitehead and W. S. Brown; "Oscillating Current Circuits by the Method of Generalized Angular Veloci-

ties," by V. Bush. Thursday afternoon—Inspection trips; electrophysics committee meeting; standards committee meeting; board of directors' meeting; other committee meetings will be held as specified in notices to committee members. Thursday evening—"Modern Physics," by R. A. Millikan.

Friday morning—Direct-Current Motor Control Session. "Industrial Controllers with Particular References to the Control of Direct-Current Motors," by H. D. James; "Analysis of Starting Characteristics of Motors," by K. L. Hansen. Friday afternoon—Alternating-Current Motor Control Session. "Transient Conditions in Asynchronous Induction Machines and Their Relation to Control," by R. E. Hellmund; "Performance of Polyphase Induction Motor Under Unbalanced Secondary Conditions," by A. A. Gazda.

COAL SHORTAGE SERIOUSLY HANDICAPS CENTRAL STATIONS

Many Companies Forced to Buy Coal in the Open Market at Greatly Increased Cost Because of Railroad Embargoes and Car Shortage

As has been reported in these columns from time to time many central stations in the Eastern sections of the country have been seriously handicapped by the failure of the railroads to make deliveries of coal in transit. In a number of cases large companies have had to buy coal wherever it could be found at prices two and three times normal in order to avoid shutdown. In other cases the companies have had to draw on and use up their reserve supplies, causing very much uneasiness to the management.

The case of the Detroit Edison Company is not unlike that of many other large companies and reflects present conditions admirably. In his annual report Alex. Dow, president and general manager of the Detroit Edison Company, comments on the coal situation as follows:

"In comparing the ratio of operating expenses to gross earnings with the figures for 1915, there should be added to the stated $5,489,092.83 the special deduction from 1916 income $98,296.39 made for the purpose of charging back to the year its fair share of the extraordinary mid-winter expense for fuel. The prices of all materials and supplies and the rates of wages, hourly and weekly, have risen steadily during 1916, reaching figures even greater than we anticipated a year ago. The operating ratio did not show a proportionate increase from month to month because our plants have been operating at high load factor; because, naturally, the increase in gross earnings has not carried with it an immediate increase of general expense, and particularly because until October we were supplied with sufficient coal under contracts holding over from 1915, or made at fair prices during the first half of 1916. In October, however, shortage of cars and congestion of railroads compelled us to draw unreasonably upon our coal stocks, and by the end of November there was serious interference with our fuel supply. The interference ranged from 25 per cent curtailment of shipments from mines on one coal railroad, because of car shortage, all the way to absolute stoppages for days at a time (for weeks, in one case) of shipments from other roads. Notwithstanding that our fuel contracts were for ample quantities and were made with twenty-two mines on four different coal railroads, it was necessary to begin buying extra coal in November wherever we could find it on wheels and to continue buying at high prices up to the present time.

"The deepest cause of the present unsatisfactory condition is that the railroads have neither cars nor motive power to move the limited amount of bituminous coal being mined. There is a market, at home and for export, for more coal than can be got out this winter. Mining operations are now limited by lack of transportation and can be increased more rapidly than the railroad deficiency can be remedied. In our own case we expect delayed delivery of contract coal to be followed by higher mine prices and that it will be months before the coal market will be normal."

CHAIRMAN WEED ADVOCATES FRANK AND OPEN POLICY

Secret Influence or Questionable Methods, He Maintains, Are Unworthy of Any Legitimate Enterprise, and Especially of a Public Utility

An important declaration of policy for public utility companies was given by Chairman A. R. Weed of the Massachusetts Gas and Electric Light Commission at a Boston Edison street lighting rate arbitration hearing on Jan. 22. The legal expenditures of the Edison company have been attacked by the city of Boston at considerable length during the past fortnight, and on behalf of the city much criticism has been leveled at the company for its alleged inability to itemize these expenditures sufficiently to satisfy the city as to their propriety. J. Otis Wardwell, of Burdett, Wardwell & Ives, counsel for the company, was on the stand under examination as to funds disbursed by him, when Chairman Weed said, after a conference of the commission:

"I think there is something that should be said for the board while you are here, Mr. Wardwell. Of course the issues that have been raised by some of the matters that have been disclosed here are certainly much broader than this case, and raise a fundamental issue which this case can't decide, whatever our decision may be. And the board after the hearing of last Wednesday had concluded that such inquiry as it should make should be made independently of this case. Of course it is perfectly true, I think, that an issue which raises really the fundamental question of what character of relations should be established between public service corporations and the properly constituted public authorities is one of the very highest importance.

"I want to make it perfectly clear, so far as I am personally concerned, that I do not feel any objects, however legitimate they may be, that a corporation feels it must have or should promote or should defend, are worth promoting or defending or urging, if that must be done through secret influences or by unacknowledged agents. I think that I share with everyone that is interested in the development of the electrical industry in this State, a feeling of appreciation of the tremendous possible usefulness which this particular company has, with its opportunity and property, and I think it must be and should be a satisfaction for anybody who can aid in that development. But if the development must come through any methods which will challenge any serious question as to their propriety, the development had better stop rather than be brought about in that way.

"I don't believe it is necessary. I think the old methods have passed away or are passing, and they will pass with far more promptness if every man that is in a responsible position in the public service corporations shall say, and shall say it resolutely, that notwithstanding any disappointment which any management might suffer in its legitimate aims, notwithstanding any hardship which may ensue to the public, that arrested physical development is far to be preferred to any form of deformed or stunted civic or

political life and that, come what may, he will stand resolutely on that proposition. I believe the time will come, I hope it may come promptly, when these men will stand on that platform and on no other."

Closing, Chairman Weed said that the matters which have appeared are of sufficient gravity so that any further inquiry which it is the duty of the board to make will be conducted independently of the present case.

In the course of his examination, Mr. Wardwell stated that part of the funds disbursed by him were expended in compensating a field agent who investigated the locations granted the then Connecticut River Transmission Company in the central part of Massachusetts and that another representative of his handled all permits desired by the Edison company at the Boston City Hall. The witness vigorously denied that any improper expenditures had been made.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS

Committee Reports and Interesting Discussions on National Electrical Code, Rubber-Covered Wire, Concentric Wiring, and Inspectors' Problems—Emil Anderson of Minneapolis Elected President

The last two days of the convention of the Western Association of Electrical Inspectors held at Toledo, Jan. 23 to 25, were given over to discussion of reports of standing committees and to inspection trips in the city. The main recommendation of the committee on the National Electrical Code was for the insertion of a third paragraph under Rule 12, Section F, to read as follows: Metal conduit containing service wires must be insulated from the metal conduit, metal molding or armored cable system within the building, and all metal work on or in this building and isolated by position or elevation of at least 8 ft. to be beyond the reach of persons, or they must have the metal of the conduit permanently and effectively grounded to water piping, gas piping, or other suitable ground, provided that when connections are made to gas piping, they must be on the street side of the meter. Ground connection to the metal conduit containing service wires must be independent of and in addition to any other ground wire of metal conduit, metal molding, or armored cable systems within the building. This was adopted by the convention.

The report of the committee on outside wiring dealt largely with roof-top construction for miscellaneous signal circuits. As this report covered a class of wiring which exists only in the larger cities in the East it received little discussion. It was considered, however, that the requirements are necessary where construction of this type exists. A concise report from the committee on theater wiring and show equipment told of an experiment which had been made to demonstrate that the use of slow-burning wire is not objectionable, as was previously stated.

The report of the committee on rubber-covered wire represented the completion of the efforts of the association to stamp out the use of what was termed "old code" wire. It was considered that this work is completed, since the wire and cable section of the Associated Manufacturers of Electrical Supplies recently took official action in compliance with the inspectors' association's earlier report tending to abolish the manufacture of old code wire.

The report of the committee on gas-filled lamps reviewed the entire lamp situation, and the discussion indicated the belief that the tendency is toward still higher lamp temperatures, as is indicated by the advent of the blue-glass lamp. The committee on concentric wiring concluded with the statement that so far as inspection is concerned no further action on this topic is necessary; sufficient evidence has not been presented to show that the material was either safe, desirable or economical.

Interpretation of code rules, the practice of running service wires over buildings, the fusing of the neutral wire in three-wire mains having a smaller neutral wire than the three outside wires, the preparation of wiring tables for alternating-current motors, and the collection of data on demand factors, were the principal topics discussed at the meeting left open for a presentation of the inspector's problems. In connection with the discussion on demand factors a motion was passed creating a committee to supervise the gathering of this information so that a complete and accurate report may be made at the next meeting.

The following officers were elected for the ensuing year: President, Emil Anderson, Minneapolis; first vice-president, F. L. Lucas, Toledo; second vice-president, C. K. Cregier, Chicago; secretary and treasurer, William S. Boyd, Chicago; executive committee—W. E. Flickinger, Detroit; Ralph Knox, Louisville; C. L. Reasoner, Colorado Springs; E. C. Horton, Buffalo; C. J. Wagner, Joliet; H. R. Markel, Columbus. The next meeting of the association will be held at Memphis, Tenn.

RATE REDUCTION FOR NEW YORK & QUEENS COMPANY

Voluntary Offer to Public Service Commission Includes Provision for Monthly Service Charge in Lieu of Minimum Bill

A voluntary offer of reduced rates by the New York & Queens Electric Light & Power Company is under consideration by the New York Public Service Commission of the First District. It is proposed that the present monthly charge of $1 to consumers paying the maximum retail rate shall be eliminated, and in lieu thereof a monthly service charge of 60 cents shall be made; and after April 1, 1917, the maximum rate shall be reduced from 12 cents to 9 cents per kilowatt-hour, with the proviso that no customer shall have his bill increased under the operation of the new rate. Free renewals of tungsten lamps of 50 watts and larger sizes would be continued. The proposition, which was presented on Jan. 24 by C. G. M. Thomas, chairman of the board of directors, was taken under consideration by the commission.

Mr. Thomas stated that numerous conferences had been held between the executives of the company and the members of the company touching upon the question of whether the company was prepared to reduce rates voluntarily and to what extent. The suggestion of the commission was received in good faith, and, after consultation, the commission was informed that the company was willing to confer with the representatives of the commission upon the advisability of reducing the maximum rate. The members of the commission were invited to visit the company's territory and plants so that they could personally understand the situation in Queens Borough.

In order that every customer might have an actual reduction in his bill, Mr. Thomas said, the schedule would provide that no one should pay more under the new rate than he would have paid if the maximum rate, with the monthly minimum charge, had been reduced from 12 cents to 11 cents per kilowatt-hour. The company has considered savings that would be affected to

the company as well as to the State in avoiding the necessity for a long proceeding before the commission and possibly the courts. Prevailing rates and hours of labor, the enormously increased price of coal and other supplies and appropriations for extra compensation to employees for faithful and efficient service, together with material increases in real estate and special franchise taxes, would indicate that this reduction is about $100,000 in net income and is hardly justified; and the company reserves the right to appeal to the commission if experience, with the increased costs indicated, makes it impossible to meet obligations.

Provided the conditions on Jan. 1, 1918, should warrant, the maximum rate on that date would be reduced further from 9 cents to 8.5 cents with the same service charge.

Commissioner Hayward expressed the opinion that a service charge is fair, just and logical.

FOREIGN TRADE CONVENTION CALLS FOR CO-OPERATION

Webb Bill Needed if Our Industries Are to Meet European Competition on Equal Grounds— Helps for the Small Manufacturer and Merchant

Co-operation was the dominant note of the Fourth National Foreign Trade Convention which met in Pittsburgh last week. It was crystallized in the report of the National Foreign Trade Council on the Webb bill, where it was pointed out that the nations of Europe have developed their foreign trade co-operatively, and are planning still more extensive and intensive co-operation after the war. Only in the United States are individual companies left to stand alone in the development of foreign trade.

Of the group sessions—covering foreign credits, co-operation in foreign trade, banking and investment, education for foreign trade, function of the export commission house and the problems of the smaller manufacturer and merchant—the last was the most popular.

The scope of the group sessions devoted to the small manufacturer and merchant can best be sensed from the report of the group rendered to the final session. The report emphasized, in the first place, that the circular containing a series of questions and answers helpful for the small manufacturer and merchant should be given wide circulation. It then set forth:

1. That the Department of Commerce be urged to report statistics of foreign trade in greater detail.

2. That larger appropriations be granted to the proper bureaus so that more consular agents and commercial attachés can be engaged.

3. That in the selection of consular agents and commercial attachés, emphasis be placed upon the business rather than academic qualifications of the candidates.

4. That every influence be brought to bear to secure the passage of a measure (the Webb bill) which would permit co-operation abroad of companies and individuals who compete here.

5. That all things considered, foreign trade can be promoted best by direct representation, and that next to direct representation the best plan for the small merchant and manufacturer is to make use of export commission houses.

6. That preliminary to a foreign-trade campaign a careful survey of the country it is proposed to enter be made if possible.

7. That salesmen should be well trained, and developed, preferably, from the prospective exporter's own staff. They must know the language of the country where they are to work and must know the exporter's line.

8. That co-operative schemes are likely to succeed provided the lines are well selected and the salesmen competent.

9. That exclusive contracts should not be made with export commission houses unless the right of cancellation be retained.

10. That where an export commission house is engaged the manufacturer must do his share, by providing an attractive display of samples, suitable catalogs and literature.

11. That translations should be correct and full.

12. That the use of the metric system be adopted more widely here and, of course, used exclusively in quotations for foreign sale (except in England and the British colonies).

13. That with ordinary commercial safeguards it is as safe to grant credits abroad as here.

14. That merchants acquire a knowledge of the use of trade acceptances and arrange with their banks for their collection.

15. That quick returns should not be expected.

16. That the exporter be liberal with expense allowances and do all in his power to help his men and his agents.

17. That no one should go into export trade unless he intends to stick.

18. That efforts be made to win and to keep the confidence of the foreign buyer by giving him goods fully up to specifications and fair and courteous treatment.

WATER POWER DEVELOPMENT IN NATIONAL FORESTS

Report of Forester to Secretary of Agriculture Indicates Increase in Power Projects and Transmission Line Permits

In his report to the Department of Agriculture covering the fiscal year ending June 30, 1916, the chief forester, Henry S. Graves, gives the outstanding features of the year in the administration of the national forests. Early this year the so-called Merrill report on the ownership and control of waterpower sites in the United States was issued in response to the Senate resolution of Feb. 13, 1915, and the work of compiling the report having been assigned to the forest service, reference to it naturally occurs in the annual report.

Referring to the use of the forests for water-power development the forester reports twenty new power projects which began operations as against twelve in 1915. The estimated average output capacity at minimum discharge for the plants in operation decreased from 2420 hp. to 2070 hp. Development of relatively small projects is particularly in evidence in the Rocky Mountain States. A decrease of 356,603 hp. in the estimated capacity of all projects under permit was due mainly to the elimination from the Dixie National Forest of the land upon which is located a project of very large capacity, and in lesser measure to revised estimates of capacity and to the revocation of some permits for failure to comply with the conditions prescribed.

An apparent decrease of 76,183 hp. in the capacity of plants in operation was due to a change in classification of a permit covering four projects, of which two are in operation, one is under construction, and one is not yet started. These four projects are in this statement placed each in its proper class, but in the 1915 statement were counted as one.

In the amount of power under permit and in operation, California still leads.

Of transmission-line permits the number in effect at the end of the year was an increase of thirteen over the number one year previously.

Forty applications for power-project permits as received during the year included eight from Alaska—a notable evidence of increased local interest in power development on the National Forest lands there.

WATER POWER DEVELOPMENT IN NATIONAL FORESTS UNDER PERMIT FISCAL YEAR 1916

Classes of Permits	Transmission Lines Only			Power Projects (Reservoirs, Conduits, Power Houses)		Total Number of Permits
	Number of Permits	Length in Miles		Number of Permits	Estimated Average Output at Minimum Discharge	
		Within Forest Boundaries	On National Forest Land			
Permits in force at close fiscal year:						
Rental permits—						
Preliminary	0	0	0	21	66,974	21
Final	111	794.4	589.5	88	770,058	199
Free permits	10	132.0	105.0	80	67,925	90
Total	121	926.4	694.5	189	904,957	310
Construction completed at close fiscal year:						
Rental permits	104	729.4	545.8	68	258,396	172
Free permits	9	108 0	90.0	60	6,697	69
Total	113	837.4	635.8	128	265,093	241
Construction incomplete at close fiscal year:						
Rental permits	4	22.5	16.4	8	131,999	12
Free permits	0	0	0	7	1,275	7
Total	4	22.5	16.4	15	133,274	19
Construction not started:						
Rental permits	3	42.5	27.3	33	446,637	36
Free permits	1	24.0	15.0	13	59,953	14
Total	4	66.5	42.3	46	506,590	50

Permits are classified according to the character of the works covered. Permits for transmission lines only are designated "transmission-line permits," while those which cover reservoirs, conduits, or power houses, irrespective of whether or not a transmission line is involved, are designated "power-project permits." The accompanying table shows the amount of development authorized under both classes.

ILLINOIS CONTRACTORS ADVISED BY OUTSIDERS

Midwinter Meeting of Illinois Contractors Addressed by Central Station Men, Jobbers and Manufacturers, Who Offer Constructive Criticisms

The speakers at the mid-winter meeting of the Electrical Contractors' Association of Illinois on Jan. 25 and 26 were almost entirely men who were not directly connected with the electrical contracting business. John F. Gilchrist, vice-president of the Commonwealth Edison Company, delivered an address which, to the Chicago contractors, indicated a more keen desire on the part of the Commonwealth Edison Company to co-operate with the local contractors than has been evidenced heretofore. H. L. Grant of the Western Electric Company, Chicago, speaking on "How to Sell at a Profit," declared that the contractor must know his costs, must have confidence in the uprightness and fairness of his competitor, and must add a fair profit in order to be a real merchant. Mr. Grant defined a fair profit as a return above all salaries, which is higher than a banking rate. He said a fair profit should be at least 10 per cent.

E. H. Cameron of the National X-Ray Reflector Company, Chicago, said he believed contractors would profit by entirely eliminating from their vocabulary the term "estimate." He said a contractor should submit a proposal, not an estimate; what the contractor really submits is an engineering proposal, since the men who prepare it are in reality engineers.

He recounted a conversation with a contractor who was congratulating himself on the fact that he was getting 7 per cent of the jobs upon which he bid. Proceeding on such a basis he argued it cannot be profitable. The contractor should watch his work and see what class of jobs his organization is best fitted to do. He should then specialize on that kind of work, educating the architects and other large buyers to the fact that he is really an electrical specialist, who desires to compete for jobs on the ideas he may add and not on price.

Mr. Durgin delivered an illustrated lecture entitled, "Applied Illumination."

ALLIANCE BETWEEN INDUSTRY AND SCIENTIFIC SCHOOLS

If Trade Is to Increase, Scientific Method and Spirit Must Pervade All Industrial Operations and Scientific Weapons Must Be Employed

Facing the international trade conflict coming after the war, a closer alliance between American industries and scientific schools becomes imperative, stated President R. C. Maclaurin of the Massachusetts Institute of Technology at a banquet of the Eastern Connecticut Chamber of Commerce on Jan. 22. However much this country may keep out of entangling alliances, it cannot escape from the net of international trade. Present prosperity encourages, rather than checks our national habit of extravagance and wastefulness, and this will be enormously against us in the strenuous times ahead. We shall have to compete with peoples who have gone through the stern but effective discipline of hardship which has already produced in Europe more changes in two years than might otherwise have come about in a century. "Think of the industrial changes that are demonstrated by the fact that France produces more to-day than it did before the war, although nearly a third of its richest territory is in the hands of the enemy," said the speaker, "and nearly all its vigorous men are at war." England's production is 15 or 20 per cent larger to-day than before the war.

"Broadly speaking," said Dr. Maclaurin, "our only hope of success is to devise means whereby what is known as the scientific method and the scientific spirit pervades all the industrial operations of the country. All the old methods of intuition and 'rule of thumb' must be scrapped. "Everything must be done in the spirit of scientific advancement. Far-sighted patriotic business men must bestir themselves and see that the fountains of science in this country are well tended and flow freely. The bonds between industry and the schools must be more firmly welded and every effort made to see to it that scientific schools make the most of their opportunities, so that there may be an adequate supply of young men trained to apply the methods of science to the industrial development of the land. Referring to the new $7,000,000 plant of the Institute of Technology at Cambridge, President Maclaurin said that by a proper combination and organization of all its laboratories with due regard to the all-important question of manning them properly, there is scarcely a practical problem which such an institution would not be in a position to cope with, without detriment to its fundamental usefulness in the instruction of students.

The demand for men to work in the research labora-

tories of modern industrial concerns will soon outgrow the supply. These laboratories are costly affairs and many of the smaller concerns will soon find themselves in a difficult position. They will not be able to afford research laboratories and will go under in competition with others unless through research they can improve their processes and overcome their difficulties. The salvation of these smaller concerns will often come from such institutions as the Massachusetts Institute of Technology; the difficulties here are almost wholly financial, and could easily be overcome by a little wise planning and adequate support from the industries concerned. In the industrial warfare of the future science will surely be in the saddle and no nation, however well placed, can survive the struggle without scientific weapons.

MERCHANDISING OF APPLIANCES BY ELECTRICAL CONTRACTORS

Missouri Association in Annual Convention Consider Ways of Making Its Members Better Merchants and Business Men

The relation of Jovianism to electrical contractors, the proposed Missouri compensation law, merchandising of electrical goods, and the National Electrical Safety Code, were the subjects which were discussed at the seventeenth annual meeting of the Electrical Contractors' Association of the state of Missouri at the Sexton Hotel, Kansas City, Jan. 20.

It seemed to be the opinion of the contractors that an equitable compensation law is desirable in Missouri, because it will take away the uncertainty which now exists as to the amount which can be charged against an employer in damage suits brought for trivial accidents. It will eliminate the unscrupulous lawyer who takes advantage of the opportunity presented by trivial accidents to work up a damage suit and create strained relations between the employer and his men. It was also believed that a compensation law should be compulsory rather than elective.

Following the paper entitled "Is a Retail Department Profitable to the Electrical Contractor," by Charles A. Pierson, which urged that more attention be given to merchandising of electrical goods, a communication from George H. Duffield, secretary of the National Electrical Contractors' Association, was read. Mr. Duffield outlined a plan which a prominent electrical manufacturer is perfecting by means of which the manufacturer hopes to smooth out all friction between contractors and central stations which has arisen through price cutting in the resale of electrical appliances. Mr. Duffield expressed the belief that this plan, when it is carried into effect, will make the opportunity for the electrical contractor to become a real merchant much better than it has been in the past. Contractors who took part in the discussion expressed the hope that this plan could be carried out and evinced a desire to take whatever steps are necessary on their part to become better retail merchants.

In speaking on the National Electrical Safety Code, F. B. Adams of St. Louis, urged the contractors to secure copies of this code as it has been issued in trial form, to study its requirements, and as far as possible to carry out its suggestions for safer construction. He pointed out that contractors who follow the suggestions of this code will stand in a much better light before customers and before courts if questions concerning the safety of their work are raised.

The following officers were re-elected to serve the association during 1917: President, F. B. Adams, St. Louis; first vice-president, W. A. Koenemann, St. Louis; second vice-president, Robert Baker, Kansas City; secretary, A. J. Burns, Kansas City; treasurer, E. H. Heath, Kansas City; sergeant-at-arms, L. E. Reid, St. Joseph, and director, A. P. Denton, Kansas City.

ANALYSIS OF CALIFORNIA'S VARIOUS WATER PROBLEMS

Data on Use and Administration of Water Rights Collected by Water Problems Conference—Recommendations of the Conference

After spending a year investigating the subjects under its jurisdiction the State Water Problems Conference of California has published a 125-page report which presents an exhaustive analysis of present conditions and recommends a policy and procedure to the 1917 Legislature. The conference automatically dissolved upon the completion of its work, but the various interests concerned with irrigation, reclamation and power development in the State are taking the report as a basis upon which to make urgent demands for action upon the Legislature now in session.

The conference was created by a legislative act in 1915 with the Lieutenant-Governor as chairman and sixteen other members, including the chairman of all State commissions involved and six representatives at large appointed by the Governor. Instructions to the conference were to "recommend a unified policy with reference to irrigation, reclamation, water storage, flood control, municipalities and drainage, with due regard to the needs of water power, mining and navigation."

It is recommended that the State assume full control over the construction and maintenance of dams with full power to prevent their use unless declared safe.

To reduce materially the great expense and delay involved in water litigation it is recommended:

"1. That the findings of the three State water commissions be final as to all matters of fact;

"2. That expert witnesses be no longer allowed to testify as such in behalf of either side; that a court expert be appointed when necessary, by agreement between the parties to the suit, or, if they cannot agree, then by the court; and that each side may cross-examine the expert as to matters concerning which he testifies;

"3. That a superior judge be selected by the Governor to try all water cases, in accordance with the principle already established in connection with trial of reclamation cases. Such a plan would greatly reduce the number and expense of Superior Court trials as necessitated by the present system, and would tend to free them from local influence and prejudice;

"4. That procedure in the exercise of the right of eminent domain by a State agency be so changed as to avoid delays. * * * It is proposed to adopt the plan successfully followed in Mississippi and Arkansas, under which possession of the property is secured at once by payment of its valuation as fixed by the court. Subsequent proceedings are had to determine finally the value, and the necessary adjustment is made by payment of more money, or by return of a portion already paid, as the case may be."

It is recommended that in order to unify State policies the Legislature submit to the three water commissions all bills pertaining to the use or control of water rights and that the commissions be required to promptly report same back to the Legislature. The conference believes unwise the policy which allows a municipality to tie up indefinitely unlimited quantities of water to meet anticipated needs of a remote future. It recommends instead that the State Water Commission be authorized to make reasonable provision for future development of municipalities.

IMPORTANCE OF PURE RESEARCH TO ENGINEERS

Dr. W. R. Whitney Points Out That Progress in Engineering Has Been Possible Through Experiments of Scientifically Trained Men

In an address before the alumni of the Massachusetts Institute of Technology at Boston on Jan. 6, 1917, Dr. W. R. Whitney, director of the research laboratory of the General Electric Company, discussed in an interesting way the significance of research in engineering work and modern life. Dr. Whitney spoke in part as follows:

"Most of the foundations of the world's great advances in knowledge have been laid by men who were set apart and supported by the government, or by some more or less public institution where, for very long periods (usually for life) they were encouraged to delve into the unknown. Think of Davy and Faraday in the Royal Institution; of Graham, Ramsay, Rayleigh, Thomson, Kelvin, in English institutions; of Pasteur in the Sorbonne and Pasteur Institute; of the Curies, of Dumas and Berthelot and others of France; of Helmholtz, Bunson, Hertz, Wohler, Hofmann, Ostwald, Haber and others, in German universities; of Berzelius, Vant Hoff, Mendelijeff, Arrhenius, and a score of men from the universities of other countries. Most of these are professors of physics or chemistry of our time. How many such cases can we cite for America? In a few colleges, one or two men are permitted to carry on a little research, when it does not interfere with routine teaching. It was not long ago that research, if done at all in some of our colleges, had to be done surreptitiously. At this same time, other countries were paying their best scientists to continue research, and schools of research were being maintained in almost every large German and French city.

"It is not realized how generally the world's greatest discoveries were disclosed in their first stages by men who were highly trained and skilled in experimenting. The trying of new things which made the telephone possible was done by Faraday when he studied the effect of one electric current on another and disclosed the general laws of magnetic induction. His was no *untrained* mind suddenly awakened by a gracious Nature with a useful discovery in her outstretched hands. Taught to experiment by a Davy, and retained in a position in the Royal Institution, he was in command of his own time and adequate apparatus for scientific research for forty years. This cost the Royal Institution of Great Britain yearly not over $2,500.

"The work of Langley in the field of aeronautics, was for a time supported by the government, but this support was withdrawn at the critical period when a successful aeroplane, as we now realize, was apparently actually at hand. For only a part of his work on other matters such as the extension of the invisible solar spectrum or the bolometer, we ought to have rewarded him by aiding him to develop those other subjects, like aeronautics, in which he excelled. Now we appropriate at once $11,000,000 for flying machines to keep abreast of our putative enemies who are using the principles disclosed by Langley.

"A Swedish professor in a lecture once noticed that a wire carrying electricity made a magnetic needle move when brought near it. He studied this little thing because he liked it. Another professor, in France, quickly went on with this little phenomenon, finding out how in general electricity and magnets were related. Then a couple of Germans used the principle for communication at a distance and we soon had magneto-electro telegraphy. In addition, such men as our own Prof. Joseph Henry contributed to the study of the electromagnet. Is it an accident that all these men, Oersted, Ampere, Gauss, Weber and Henry, were in educational institutions; that they were mature and highly educated men? We must get out of the way of thinking that great advances by original thought and work emanate usually from the young and untrained mind, or are accidents of time and environment. Prior to the studies of Ampere no one proposed using current in wires acting on magnets as a scheme for communication. No one knew telegraphy as a *want* at all. The use followed after the discovery when it was studied by scientists, who later steered it into useful directions and engineers made it commercial.

"Most Americans imagine the great ultities now depending on the use of steam as traceable to the discovery of a lad who observed the steam pressure exerted in a kettle at the home fireside and who, with a little tinkering, set up the steam engine. Hero of Alexandria apparently made the first steam engine. He was one of the greatest scientists, students, teachers and writers of his day, and his results were the work of the most advanced and careful experimentation. We find in the researches which led to the engine becoming the combination of a cylinder, piston and condenser the work of Professors Papon and Hooke leading up to that of Newcomen, who developed a pumping engine, and then came Watt. With the aid of college professors, Black and Robinson, Watt experimented on steam eight years before he made the advance of adding the vacuum principle to the earlier engines. It was not a flash of thought, but a long study.

"The earliest work on the action of electric arcs in producing combination between the gases of the air was the observations of Professors Priestly and Cavendish, each a lifelong experimenter in chemistry and physics. They showed that nitrous oxides were produced. The refinements of technical development were due to the experiments of Bradley and Lovejoy in America, of Birkeland and Eyde in Norway, and of Schoenberg and Paulding in Germany and America. Another of the fixation processes, the cyanimid, is traceable to the discoveries of Moissan, an experienced chemist and professor in Paris, and Willson in America, who described the production of calcium carbide in the electric arc.

"The last contribution to our economics in artificial lighting was made, possibly, by the scientific researches of Rayleigh and Ramsay, other than whom no scientists were better trained. Their discovery of argon later permitted its use in incandescent lamps to improve the quality of the best we then had.

"The monumental work of such men of science as Helmholtz, Newton, Maxwell, Liebig, Bunsen, Kelvin and scores of others, could scarcely be briefly treated, but in all of them the value of long-continued application in new fields of physical knowledge is plain. They were all given time, opportunity and support.

"The results of scientific research now form a large portion of our human inventory, and we ask: Are other such additions possible? The answer is certainly, Yes, and by the same method. These disclosures are portions of infinite nature. They seem insignificant until some strenuous and highly studious efforts are expended upon them, and then it slowly becomes apparent that they fit perfectly into our needs. Just as we could not have foreseen them, so we cannot foresee their followers, but with the extensions of knowledge the possibilities continually increase. The limitations are in us and our vision. We will get ahead in proportion to our training for extending the realms of natural knowledge, and we will grow in proportion to our applications of modern methods used at the advancing boundary between known and unknown."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Brooklyn Edison New Business.—The increase in new business of the Brooklyn Edison company, according to T. I. Jones, general sales agent of the company, since 1912 is over 175 per cent.

Electric Meter Inspector.—Examination will be held on Feb. 24 for the position of electric meter inspector in the employ of the New York Public Service Commission. The salary ranges from $900 to $1,200.

Examination for City Electrician for Cleveland. — Civil service examination will be held on Feb. 8, at Cleveland, Ohio, for the position of city electrician division of buildings, department of public safety. The salary is $1,800.

New Jersey Public Utility Tax Compromise.—As a compromise for the direct 5 per cent tax on gross receipts for all public utilities operating in the State advocated by State officials elected last November, a bill has been introduced in the New Jersey Assembly covering a graded tax on such utilities. The bill provides for an initial tax of 3 per cent of gross receipts, to be increased by 1 per cent a year until the maximum of 5 per cent is reached.

City Gives Up Light Plant After Fifteen Years' Operation.—Another example of a small town finding private utility service more desirable than municipal service is furnished by Holgate, Ohio. After fifteen years of municipal operation of a lighting and water-works plant the city has granted a franchise and entered into a contract for lighting service with the Northwestern Ohio Light Company. A transmission line will be constructed from Leipsic.

Advantages of Privately Over Municipally Generated Energy. — In his annual report, A. W. Lee, manager of the municipal light plant of Concord, Mass., states that instead of going ahead with needed plant extensions and betterments "it is possible a much better and simpler solution of the entire problem would be to contract with the Edison Electric Illuminating Company (of Boston) for a portion or all the current required by our plant." He pointed out the following advantages consequent upon signing the contract: (1) A certain amount of capital now invested in the generating plant will be released and may be utilized for outside construction or used to reduce the debt of the plant; (2) lower cost per kilowatt-hour for energy on the switchboard; (3) no money tied up in fuel for months at a time and the prospect for higher fuel prices eliminated; (4) no large supplies of materials and repairs for steam plant and oil and waste and the further saving because such material is constantly advancing in price.

Public Utility Bonds Held by Insurance Companies.—An analysis of the investments of American life insurance companies, made by the Association of Life Insurance Presidents, shows that 116 companies, representing 97.9 per cent of the total admitted assets of all American companies, had invested $185,848,360 or 3.84 per cent of their total assets as of Dec. 31, 1914, in public utility bonds as compared with $111,209,859 or 4.47 per cent as of Dec. 31, 1904. The gain in the ten years was $74,638,500 or 67.11 per cent. In comparison, however, with the total assets, which in the ten years had increased by 94.05 per cent, the relative amount of public utility investments in per cent held by insurance companies had fallen off during the ten-year period by 0.63 per cent.

Measurements of Streams in the South Atlantic and Eastern Gulf States.—A report that will be useful to engineers and others who are interested in the utilization of the streams of the South Atlantic and Eastern Gulf States has just been issued by the United States Geological Survey, Department of the Interior, as Water-Supply Paper 402. This report is one of a series of fourteen that present the results of stream-flow measurements made in the United States during the year ending Sept. 30, 1915. The records include descriptions of the stations at which the measurements were made and tables of daily and monthly discharge. An appendix gives a list of gaging stations maintained on the principal streams that discharge into the Atlantic Ocean south of York River, Va., and into the Gulf of Mexico east of the mouth of the Mississippi, and also a list of publications relating to the water resources of the area.

Bill to Provide Texas with Utility Commission.—Senator O. S. Lattimore of Fort Worth has introduced a bill in the Texas Legislature providing for the creating of a State Public Utilities Commission. The measure provides for the creation of a board of five members at an annual salary of $6,000 and a secretary at an annual salary of $3,000. The bill provides that the commission shall have control of all public utilities, including telegraph, telephone, heat, light and power companies, water for irrigation or other purposes, street car service, toll bridges, pipe line or other transportation of freight and passengers, except railroad companies now under the control of the Railroad Commission, including plant, equipment and property of such corporations. It also includes any utilities belonging to any municipality, to the extent that appeal can be made to the board by citizens when in their opinion the municipally-owned utility is not being operated in a reasonable manner. The charges made by all utilities for public service shall be arranged by the board. All issues of stocks and bonds of public utilities shall be under the supervision of the board. The board is given the right to make a valuation of all utilities in the State, provide for examination and audit of all accounts and records.

Associations and Societies

The Directory of Electrical Associations, which is regularly printed in the first issue of each month, appears on page 255 of this number.

New York Jovian Meeting.—The February meeting of the New York Jovian League will be held at Stewart's Restaurant on Feb. 7. A brief business meeting and movies will follow the luncheon.

Some Economic Aspects of the High Cost of Living.—The St. Louis Jovian League on Jan. 16 had for its speaker William F. Gephart, professor of economics, Washington University, whose subject was "Some Economic Aspects of the High Cost of Living."

Schenectady Section of Institute Hears Address on Navy.—On Jan. 19 Prof. William L. Cathcart of Philadelphia, Pa., gave an illustrated address on "The Development of Our Fleet and Naval Stations" before the Schenectady section of the American Institute of Electrical Engineers.

Radio Club of America.—A meeting of the club was held on Jan. 19 at Columbia University, New York City. Prof. J. H. Morecroft, Columbia University, lectured on "Inductance and Capacity Phenomena." Following the lecture there was a specially arranged exhibition of amplified radio-telephone reception.

American Institute of Consulting Engineers.—At the annual meeting of this institute, on Jan. 15, the following members were elected to the council: Gardner S. Williams, to serve until January, 1919, and A. M. Hunt, Lewis B. Stillwell and William J. Wilgus to serve until January, 1920. F. A. Molitis, 35 Nassau Street, New York City, is secretary.

Lecture on Pattern Making.—At the meeting of the Lynn section of the American Institute of Electrical Engineers on Jan. 24 John Pemberton, superintendent of the pattern shop of the Lynn works of the General Electric Company, spoke on "Pattern Making and Foundry Work." The lecture was illustrated with lantern slides. On Saturday afternoon, Jan. 27, members of the section visited the plant of the Lynn Gas & Electric Company.

Telephone Evening with Cleveland Section of Institute.—The American Institute of Electrical Engineers, Cleveland Section, held its regular monthly meeting on Jan. 15 in the Electrical League rooms at the Hotel Statler. The session was a telephone evening, and Norman Anderson, traffic superintendent of the Cleveland Telephone Company, discussed the construction and operation of the Bell system. About sixty members of the Cleveland Section were in attendance and an interesting discussion followed the address.

Commission Rulings

Important Decisions of Various State Bodies Involving or Affecting Electric Light and Power Utility Operation and Practice.

Lighting Plant of Brewery Selling Energy a Public Utility.—The Public Service Commission of Missouri has directed M. C. Danciger & Company of Weston to restore the electric light and power service taken from W. H. Roach and others, following the local option election there last April. Danciger & Company operate a light and power company in connection with their brewery. Roach publishes a newspaper which warmly advocated local option. After the election he and other patrons of the light company who led in fighting the saloons, suddenly were cut off from electric current. The brewery contended the lighting plant was not a public service corporation, as it was not chartered and was a part of the brewery and had the right to cut off customers at any time.

"An electric light plant," says the ruling of the commission, "as defined by our laws, includes all property used in connection with the generation of electricity for light, heat and power for sale. This clearly includes the plant of the defendant."

The company is directed to restore the old service at the old rate by Feb. 1.

Rates Based Upon Value of Service.—In a final order entered by the State Public Utilities Commission of Illinois in a water rate case in the village of Ardmore, population 400, the commission denied a theoretical rate of 75 cents service charge plus 48 cents per 1000 gal. consumption charge, based upon a valuation of the utility property, including an analysis of the operating expenses and the required depreciation annuity. The commission fixed a rate of 35 cents per 1000 gal., and based its conclusions upon the value of the service rendered to the public.

After citing a long line of court and commission decisions in support of the value of utility service, including Smyth vs. Ames (169 U. S., 466) and the Minnesota Rate Cases (230 U. S., 452) the commission concludes:

"In rate-making practice, although it be not so scientific as a theoretical rate built upon a valuation and expense analysis of a utility's property, a comparison of similar rates for similar service is a legitimate line of inquiry, and such comparison may be made herein. The commission is of the belief that the meter rates which have been heretofore established by the petitioner are all that the water service (as rendered in the village of Ardmore at the time of the filing of the said meter rates) is reasonably worth. The commission, moreover, is of the opinion that the said water service, as heretofore rendered, is reasonably worth to the public of Ardmore the rates which the petitioner filed for metered water service. Unless unforeseen circumstances develop, such rates will yield to the petitioner sufficient revenue to pay all reasonable operating expenses, inclusive of taxes, and will also yield some moderate return on the value of the property and upon the moneys actually invested therein. Although the petitioner herein has prayed that this commission fix water rates for the village of Ardmore based upon a valuation of its properties, such rates obviously would exceed the value of the service; and this commission cannot find such rates to be reasonable in this particular case."

In this case the commission also required the utility to install meters on all services at its own expense; but the commission allowed an increase in rates, over former rates, of 1.5 cents per 1000 gal., which is sufficient to compensate the utility for all fixed and operating expenses of additional meters. Regarding the use of meters, in general, the commission says:

"During the process of the investigation herein, the commission has required the petitioner to install and maintain water meters on all consumers' services. It has been the general practice of this commission, in many instances, to require utilities to meter their services, and gradually the commission is requiring the supersession, where practicable, of flat rates by meter rates for utility services. Flat rates are now growing to be obsolete among progressive utilities, and properly so, for without doubt such a style of rates is susceptible to the very greatest and most unfair discriminations. A consumer on a flat rate, if he so wills, may permit his water to run mercilessly and unrestrictedly night and day, but the utility product thus wasted must be compensated for by averaging its cost among the more economical and more deserving (though worse faring) consumers. In order to prevent the unrestricted waste of utility products prevalent with flat rates, the general use of meters is very conducive to the conservation of the available supply, and to promote such conservation this commission generally requires meters to be installed at the cost of the utility. In this particular case the commission finds that the cost of installing meters on all water services in the village of Ardmore should be borne by the utility.

"The petitioner, however, has been required to make additional investment for many meters, and will be required to make additional expenditures for maintaining and repairing the said meters, and in keeping the same in the efficient operating condition that is required by this commission's published rules and regulations. Such fixed and operating expenses are to be defrayed in rates to be paid hereafter by the consumers of water service in the village of Ardmore; and the commission in its second supplemental order herein stated that it would fix the differential in rates which would compensate for the additional metered service."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public-utility companies.

Employees Right to Service Letter.—Any employee of a public service corporation doing business in the State of Oklahoma, upon his discharge or the voluntary termination of his service, is entitled, by law and upon his request therefor, to have issued to him a service letter, it was held by the Supreme Court of Oklahoma (159 P. 851). Before a public service corporation will be guilty of any breach of duty in failing to issue a service letter, the request for such service letter must be made by such employee, either orally or in writing, served personally or by mail, upon the superintendent, manager or contractor of such corporation.

Legality of Methods Employed in Making Public Improvements.—Laws providing that, on petition signed by the owners of two-thirds of the linear frontage and two-thirds of the area of the improvement district, a city may order the construction of a street-lighting system, together with the cost of furnishing electrical energy thereto, and levy and collect special assessments, to pay the whole or any part of the cost thereof, does not violate the articles of the constitution providing that the Legislature may vest the corporate authorities of cities with power to make local improvements by special assessments, on the ground that the furnishing of electrical energy for the system is not a local improvement, since the lampposts, conduits, wires, and lamps, are of themselves no benefit to abutting owners without the electric current necessary to operate the system, and since a "local improvement," to be chargeable upon private property, while required to be such as a municipality would be justified in constructing and maintaining by general taxation, and such as to confer a special benefit upon the property sought to be specially charged with its creation and maintenance, need not possess the element of permanency, it was held by the Supreme Court of Washington (159 p. 806). Under such statute, the character of the lighting plant which may be installed rested largely in the discretion of the municipal officers, and was not abused by a system of underground conduits carrying wires to the several lampposts since the posts, though designed for ornament, did not so far depart from ordinary construction as to warrant the court in saying as a matter of law that the proportional part of the cost which the city assessed for the property benefited was in excess of its legitimate powers. The remedy for the Council's abuse of its discretion by attempting to levy special assessments would be to allow assessments only to the value of a system.



N. W. STORER

Men of the Industry

Changes in Personnel and Position
Biographical Notes

Norman W. Storer, general engineer of the Westinghouse Electric & Manufacturing Company, was elected president of the Veteran Employees' Association of that company at the annual banquet of the association on Jan. 20. Mr. Storer, who is widely known in connection with his railway electrification work, was graduated from Ohio State University in 1891. Entering the Westinghouse organization, he directed for several years engineering work in connection with direct-current motors and generators, and subsequently became head of the railway engineering division. At present, Mr. Storer is devoting his entire time to railway electrification work. He is a past manager and vice-president of the American Institute of Electrical Engineers.

R. D. Jones has been appointed claim agent for the Reading (Pa.) Transit & Light Company, succeeding Rex D. Billings, recently resigned.

Willis L. Adams, consulting engineer, of Buffalo, N. Y., has been elected president of the Niagara section of the National Electric Light Association.

Ross Aver, formerly of Grass Valley, Cal., has been appointed local manager of the Pacific Gas & Electric Company's interests in Colusa, to succeed L. H. Hartsock, recently resigned.

P. R. Chambers, formerly manager of the Manatee Electric Company of Bradentown, Fla., has been appointed superintendent of the Ithaca (N. Y.) Gas & Electric Company, to succeed William O'Neil, recently resigned.

M. W. Holman, formerly treasurer and manager of the Princeton (Ky.) Light & Power Company, has been appointed superintendent of the municipal water and light plant at Paris, Tenn., to succeed M. W. Younkin, who recently resigned to accept the position as manager of the Johnson-Porter Clay Company of Paris, Ky. Mr. Holman is a graduate of the Georgia School of Technology at Atlanta. In 1905 he leased from the town of Huntington, Tenn., its electric light and water plant, and operated this as a private enterprise until 1910, when he purchased the plant at Princeton, Ky.

J. D. A. Cross, who was district heating specialist for the General Electric Company at Chicago, has been appointed manager of heating device sales with headquarters at Pittsfield, Mass.

Nathan Hayward of Philadelphia, Pa., who has been engineer for the Bell Telephone Company of Pennsylvania and associated companies, has been elected president of the American Dredging Company.

F. S. Nicholson, vice-president and general manager of the Sayre (Pa.) Electric Company, has been appointed vice-president and general manager of the Rutland (Vt.) Railway, Light & Power Company.

William O'Neil, for the past eight years superintendent of the Norwich (N. Y.) Gas & Electric Company, has taken up his duties as superintendent of the Ithaca (N. Y.) Gas & Electric Corporation, succeeding J. W. Murdock.

James H. Porter, assistant superintendent of the Oskaloosa (Iowa) Traction & Light Company, has been appointed superintendent of the company, succeeding A. H. R. Jackson, resigned. Mr. Porter has been associated with the company five years.

L. H. Hartsock, who for the past five years has had charge of the Colusa district of the Pacific Gas & Electric Company of San Francisco, Cal., has been promoted to the managership of the Grass Valley District with headquarters in Grass Valley, Cal.

Halbert P. Hill has become associated with Fred Ophuls and J. Harold McCreery, and under the firm name of Ophuls, Hill & McCreery the organization has opened an office for consulting engineering work in electrical, mechanical and refrigeration equipment at 112 West Forty-second Street, New York City.

H. C. Deffenbaugh, cost engineer for the Rochester (N. Y.) Railway & Light Company, has resigned to accept the position of assistant secretary of the Empire Gas and Electric Association, with headquarters in New York City. He is a graduate of Cornell University and became associated with the Rochester company in 1906.

H. B. Bixler, who was formerly superintendent of light and power for the Northern Ohio Traction & Light Company, has resigned to enter the industrial engineering field, with headquarters in the Second National Bank Building, Akron, Ohio. Mr. Bixler has gained wide experience at Akron in the electrification and operation of rubber working plants and will devote a large part of his time to work of this nature. He plans also to engage in general industrial plant engineering.



EMIL ANDERSON

Emil Anderson, president-elect of the Western Association of Electrical Inspectors, is electrical inspector for the Minneapolis (Minn.) Underwriters' Inspection Office, now a branch office of the General Inspection Company. Mr. Anderson is a graduate of the University of Minnesota, class of 1905. He is also a member of the American Institute of Electrical Engineers and during the year 1914-1915 served as secretary for the Minnesota Section. He has taken an active part in all electrical organization affairs in Minneapolis and served for a time as president of the Minneapolis Electric Club. In Jovian affairs he holds the commission of Second Tribune for his home district. In the Western Association of Electrical Inspectors he has been very active, and as member of its executive committee, as vice-president, as chairman of its committee on electric signs and as chairman on its committee of concentric wiring Mr. Anderson has had an unusual opportunity to study the needs of this organization.

G. L. F. Phillips, technical director of Phillips Lamp Works, Eindhoven, Holland, has been nominated *doctor honore causa* by the senate of the Technical University of Delft, Holland.

Obituary

Capt. William Brophy, consulting electrical engineer, Boston, Mass., died on Jan. 24 at his home in Jamaica Plain, at the age of seventy-eight. He was born in Ireland, but joined the Worcester (Mass.) fire department when a young man, served as city electrician of Worcester, and later settled in Boston as a consulting engineer. From 1894 to 1900 he was chief electrician of the Boston wire department. Captain Brophy had a very large acquaintance in the central station field and in a quiet, unassuming way performed much valuable work for various electrical interests. He was particularly interested in fire prevention, and was a welcome speaker at some of the later conventions of the New England section of the N. E. L. A., of which he was a member.

Clifford A. Bront has been elected chairman of the board of directors and president of the Toms River (N. J.) Electric Company.

Daniel P. Tierney, for the past eight years assistant superintendent of the Sayre (Pa.) Electric Company, has been appointed general manager to succeed Frank S. Nicholson, recently resigned.

Charles F. Thompson has resigned from the engineering department of the General Electric Company in order to take up commercial engineering work with the Research Corporation at 63 Wall Street, New York City.

J. W. Murdock has resigned as manager of the Ithaca (N. Y.) Gas & Electric Company to accept the position of general superintendent of the Associated Gas & Electric Company's properties in that part of New York State.

Albert S. Hall, manager of the Hood River Gas & Electric Company, and of the Hydro Electric Company of Hood River, Ore., has resigned to become district manager for the Pacific Power & Light Company at Pasco and Kennewick, Wash.

P. A. Staples, vice-president and general manager of the Binghamton (N. Y.) Light, Heat & Power Company, has been appointed general manager of the Sayre Electric Company, which position he will fill in connection with his duties at Binghamton.

William R. Bell, chief load dispatcher of the New England Power Company, with headquarters at Millbury, Mass., has been transferred to the engineering department of the company, with offices at Worcester, Mass. Mr. Everett Collins has been appointed chief load dispatcher of the company.

Edward Pryor of Philadelphia, Pa., who has been connected with the American Railways Company, in charge of the plant of the Consolidated Light, Heat & Power Company at Huntingdon, W. Va., has been appointed superintendent of the Home Electric Light & Steam Heating Company of Tyrone, Pa., a subsidiary of the American Railways Company.

Gardner Rogers, who for the past seven years has been president of the Houghton (Mich.) County Electric Company and the Houghton Traction Company, has been appointed general manager of the Blockstone Valley Gas & Electric Company at Woonsocket, R. I., to succeed Alfred T. Townsend, who left Woonsocket some time ago to take charge of the Stone & Webster Company's properties in Texas, with headquarters in Beaumont.

T. A. Panter has been appointed to the position of operating engineer in the reorganization of the Los Angeles Aqueduct Power Bureau, which has been effected in anticipation of increased activities attendant upon taking over the distributing systems of two Los Angeles companies. H. C. Gardett has been made general construction engineer and C. A. Heinze distributing construction engineer. The appointments were made by E. F. Scattergood, chief electrical engineer.

C. E. Torrey, formerly assistant manager of the Central Power Company, Canton, Ohio, has been appointed manager of the East Liverpool district of the Ohio River Power Company, a subsidiary of the American Gas & Electric Company.

Judge Oliver H. Hughes has been appointed a member of the Ohio Public Utilities Commission by Gov. James M. Cox. The appointment of Louis M. Day as a member of the commission last year by Gov. Frank P. Willis was withdrawn, as it had not been approved by the Senate. Judge Hughes was a member of the commission for eleven years preceding the administration of Governor Willis, having been appointed by Governor Harris.

F. W. Bacon, who has been vice-president and general manager of the Kentucky Traction & Terminal Company and of the Lexington Utilities Company at Lexington, Ky., for the last six years, has transferred his headquarters to Philadelphia, where he will continue



F. W. BACON

in executive charge of various Chandler & Company properties, including the Lexington company, of which he will continue to be vice-president. Mr. Bacon has been connected with the Kentucky properties since 1911, when he first became vice-president of the Lexington & Interurban Railways.

S. G. Hibben, formerly head of the illuminating engineering department of the Macbeth-Evans Glass Company of Pittsburgh, Pa., has become identified with the Westinghouse Lamp Company as illuminating engineer. Mr. Hibben's new work will consist of the furnishing of expert lighting advice to customers of the company, and he will have his headquarters in Pittsburgh.

O. E. Clemens, cost accountant for the bureau of power and light, city of Los Angeles, recently tendered his resignation to become effective Jan. 1. Instead of accepting the resignation, the Public Service Commission decided, as a mark of the esteem in which Mr. Clemens was held, to accord him a year's leave of absence. Mr. Clemens has accepted a position in San Francisco with the Spring Valley Water Company.

Jay B. Franke of Perth Amboy, N. J., has been appointed city electrician of Perth Amboy for a period of three years.

H. H. Wood has been made assistant to the general superintendent of the Central Illinois Public Service Company, at Mattoon, Ill.

I. Maxwell Stover, manager of the Key West Electric Company, has been appointed manager of the Baton Rouge (La.) Electric Company.

Lewis Smith of the Rumford Falls Light & Power Company of Rumford, Me., has been appointed superintendent of the light and power department.

C. M. Hansen has been appointed chairman of the committee for accident prevention and workmen's compensation of the National Association of Manufacturers.

C. F. Crowley has been appointed general manager for the Wm. A. Corrao Electric Company, which is one of the leading electrical contracting firms in St. Louis.

Harry T. Hughes has been elected treasurer of the Denver Gas & Electric Light Company, operated by Henry L. Doherty & Company. Mr. Hughes formerly held the position of auditor.

Arthur H. Robbins, who has been prevocational instructor in electricity in the Boston, Mass., public schools, has resigned that position to become electrical engineer with the Electric Light & Power Company at North Abington, Mass.

Frank S. Sawyer, who for the past few years has been connected with the engineering force of the Turners Falls (Mass.) Power & Electric Company, is planning to go shortly to South America, where he will engage in engineering work in Peru.

Hermon E. Eddy, who had been associated for several years with the late Clarke C. Fitts, vice-president of the Connecticut River Power Company of Barcelona, Spain, where he has been vice-president of the company to succeed Mr. Fitts.

William C. Chappel has been appointed chief assistant engineer to the Government of Tasmania at Hobart, Tasmania. Mr. Chappel was formerly an electrical engineer with Siemens Brothers Dynamo Works at London, England.

Cyprus P. Eaton, vice-president of the Rumford Falls Light & Power Company of Rumford, Me., will soon retire on account of his health and advancing age. Mr. Eaton has been connected with the company since its organization nearly twenty-five years ago.

Roy M. Taylor of Taunton, Mass., recently employed as purchasing agent of the United States Cartridge Company of Lowell, Mass., has accepted a position as assistant to the general manager of the Thompson Electric Welding Machine Company, with full charge of its Lynn factories. Mr. Taylor was employed by the Stone & Webster Corporation of Boston, Mass., for a number of years at the Cell Drier Machine Company in Taunton.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

ELECTRICAL EXPORTS TO SOUTH AMERICA IN 1916

Value of the Goods Estimated at $5,825,000—Brazil Was Largest Customer, Followed by Argentina and Chile

Exports of electrical goods to South America during 1916, it is estimated, amounted to $5,825,000. This estimate is based on the compilations made by the foreign trade department of the National City Bank of New York, showing the detailed exports to South America from the port of New York, about 85 per cent of goods for South America leaving from this port.

The monthly totals leaving the port of New York to the South American republics are shown in the accompanying table. On the basis that 85 per cent of the exports destined for South America leave this port, the 1916 totals for the separate countries have been estimated as follows: Argentina, $1,365,000; Brazil, $1,880,000; Chile, $1,030,000; Colombia, $594,000; Peru, $308,000; Uruguay, $176,500; Venezuela, $298,000; all others, $157,000. Brazil, according to these figures, continues to be the leading South American market for American electrical goods. Compared, however, with the value of electrical products of American manufacture absorbed by Brazil prior to the European war the relative importance of the Brazilian market is becoming less. In the twelve months from July 1, 1912, to June, 30, 1913, Brazil imported American electrical goods valued at $2,930,000. Notwithstanding the fact that prices in 1916 were considerably higher than in 1912 and 1913, the exports to Brazil were less in 1916 by more than $1,000,000, or over 30 per cent. Should a comparison be made of volumes it would probably be seen that the exports to Brazil had been cut in two. The only other republic to show a falling off was Peru; but the difference was not great.

Since the beginning of the war the exports to Argentina, Chile, Colombia, Uruguay and Venezuela have increased greatly. Compared with the twelve months from July 1, 1912, to June 30, 1913, the 1916 exports to Argentina were greater by a little less than 140 per cent; to Chile by more than 140 per cent; to Colombia by 286 per cent; to Uruguay by 117 per cent, and to Venezuela by 157 per cent. These comparisons, however, have been made with values only and no consideration has been taken of the fact that prices in 1916 were much higher than were quoted prior to the war in Europe.

While complete figures for the United States are not available, it is practically certain that the 1916 electrical exports will come very close to $40,000,000. It is therefore evident that but a small part is going to South America, in fact, but 14.55 per cent. The South American trade in 1916 represented about 1 per cent of the total production in this country.

EXPORTS OF ELECTRICAL GOODS TO SOUTH AMERICA FROM THE PORT OF NEW YORK DURING 1916

	Argentina	Brazil	Chile	Colombia	Peru	Uruguay	Venezuela	All Others	Total
*January	$74,000	$120,000	$17,000	$34,000	$17,000	$10,000	$20,000	$8,000	$300,000
February	58,777	133,679	17,745	39,661	12,619	17,400	3,787	4,751	288,419
March	82,465	79,788	10,609	24,131	13,670	7,018	47,923	21,236	286,840
April	52,073	69,919	9,832	53,320	15,168	8,207	38,843	6,256	253,618
May	72,000	62,494	14,061	71,077	13,131	7,250	10,556	6,877	257,446
June	46,492	160,413	33,951	34,847	18,735	5,578	18,144	12,979	341,139
July	211,294	134,911	51,056	13,362	19,782	6,122	37,832	15,655	490,014
August	145,294	128,883	168,116	106,441	16,873	18,986	21,994	4,634	611,224
September	93,046	122,707	73,601	13,836	23,328	11,808	17,908	10,172	366,406
October	82,409	102,792	257,657	74,896	25,288	14,894	16,046	17,963	591,945
November	109,696	233,616	17,273	21,100	50,471	15,186	7,076	12,670	467,088
December	133,676	249,884	203,686	18,423	36,300	27,803	13,503	12,493	695,768
	$1,161,222	$1,599,086	$874,587	$505,097	$262,365	$150,252	$253,612	$133,686	$4,949,907

*Estimated.

MARKET FOR MOTORS STILL ABOVE NORMAL

Fractional Horsepower Sizes in Greatest Demand, Due to Tremendous Sale of Small Motor-Driven Appliances

Motor manufacturers are still swamped with orders. In the small fractional horsepower sizes for use in fans, vacuum cleaners, washing-machines and other small motor-driven appliances, the supply has proved inadequate to meet the demand for some months, and in some cases only old customers are now being served. Even in these cases immediate delivery cannot be had. Practically none of the appliance manufacturers specializing in motor-driven appliances manufacture their own motors. The sale of these appliances has grown tremendously during the past year and consequently the motor manufacturers have been deluged with orders.

For the larger sizes of motors the demand, while still large, is not so insistent. Books are filled with orders and buyers are becoming accustomed to nine months delivery and have made their arrangements accordingly. The buying is gradually slowing up, but it will be many months, at the present rate, before anything near the normal condition is reached. Even then production will continue at capacity for some time in order to clean up the books.

ADVANTAGES OF TRADE ACCEPTANCE SYSTEM

Thirteen Reasons for the Adoption of the System Cited by Those in Favor of the Wider Use of Acceptances

Trade acceptances are being used more and more by American manufacturers, but the system is still in its infancy in this country. In the electrical trade but few houses use this method of extending credit. Where acceptances are used, however, there is no complaint expressed about the system—only satisfaction.

The advantages claimed for the system are numerous. The following have been given by those in favor of acceptances:

1. That open book accounts, i.e. dead capital, will be transferred into trade acceptances, which is live capital, i. e., self-liquidating commercial credit paper available for the payment of debts, and when discounted, like promissory notes, becomes a basis for issue of currency and bank reserves under the Federal Reserve Act.

2. That they show on their faces that they arise out of a bona fide commercial transaction.

3. That acceptances, being two-name drafts, are safer, more liquid for bankers to hold, and more likely to be paid at maturity than single-name promissory notes.

4. That banks would have better knowledge of a borrower's financial position through trade drafts instead of direct notes.

5. That the trade acceptance system would practically eliminate the overdue accounts which, according to the records submitted from jobbers and manufacturers herewith, amount to about 30 per cent of the sales, and if legal proceedings are necessary, a trade acceptance is much better to have than an open book account, because the seller has an acknowledgment in writing of the account.

6. That the use of the trade acceptance would remove the necessity for the manufacturer or jobber, with somewhat limited capital, borrowing so heavily in order to act as banker in supplying credit to customers.

7. That the trade acceptance would reduce loss by bad debts by effecting prompt payments, and would save the interest on overdue accounts.

8. That trade acceptances would tend to educate the retailer not to overbuy, thus tying up too much of his capital, or to extend too long credits to his own customers.

9. That trade acceptances will tend to eliminate the abuse of the extension of credit to those retailers who, having but little real capital themselves invested, learn to conduct their business principally on the credit extended to them by rival jobbers or manufacturers.

10. That those who settle by trade acceptances will put themselves into the class of preferred buyers, the same as those who discount for cash.

11. That the trade acceptance system, even with small retailers, would work a great improvement on our whole merchandising system, and tend to make the untrained and unsystematic tradesman of less menace to his competitor.

12. That trade acceptances would curtail or end the bad practice of taking unearned or unauthorized discounts, would curb the unfair practice of returning merchandise after shipment has been made, would tend to stop the pernicious habit of assigning or hypothecating book accounts to secure working capital, and would operate to reduce the overhead costs of doing business and enable both manufacturer and jobber to sell at lower prices.

13. That the Federal Reserve Board, recognizing the advantages of the "trade acceptance," has authorized special rates of discount for this class of paper, and that all Federal Reserve Banks in establishing rates have made a rate generally one-half of 1 per cent lower for trade acceptances than the rate for promissory notes.

PEACE UNCERTAINTIES GIVE RISE TO PROBLEMS

Large Stocks of Merchandise May Cause Embarrassment to Trade When Prices Begin to Be Revised Downward

Many problems have arisen in the industrial world within the past two months as a result of the possibilities of peace. To electrical manufacturers these problems are of grave importance. The raw material entering into his goods, it is felt, will be the first to feel the effects of peace. In practically every quarter it is expected that prices will fall off, slowly perhaps but certainly. In a large number of cases the price of the finished product fluctuates with the market for raw materials.

The question of customers' stocks and credit terms for this reason are of more than passing importance right now. Deliveries are not yet so improved that jobbers no longer have to stock up months ahead. For the most part the jobbers are buying with caution. On the other hand, they are also buying so as to be protected over the time it now takes for delivery.

Late in 1916 there was a considerable amount of stock ordered in anticipation of a rise with the advent of the new year, but in these lines it is doubtful if a fall in prices will come for some time after the raw materials market begins to recede.

Should prices fall while there is so much unsold stock in the hands of distributers the manufacturer will have to bear his share of the burden. Just how large this share will be is what is worrying him. The stocks were sold on credit and the jobber has a certain time after delivery. The manufacturer has protected himself to a certain extent by accepting orders with the provision that they be accepted when delivered. No cancellations will be allowed unless the manufacturer can readily dispose of the goods. The buyers therefore face the market both on goods in hand and in the process of manufacture.

When the market begins to slump off jobbers will find it inconvenient frequently to meet their obligations promptly or fully. The manufacturers will therefore find their assets in a much less liquid state.

It is not anticipated that such conditions will bring about any widespread state of bankruptcy, for it is highly doubtful if the downward price revision will be sudden or steep. It will, however, involve the tying up of large quantities of now liquid capital for an uncertain time.

COPPER MARKET STILL DULL

Quotations a Little Higher, but No Evidence of Any Buying Activity

No change is shown in the copper market at this writing over the past week. The dull and listless tone which has prevailed since the middle of January continues. For technical reasons the market advanced slightly during the week, but there was no evidence of any volume of buying. Even inquiries are scarce. Buyers are watching the market closely, but show no disposition to make any purchasers.

It is evident that, although the producers are sold out for some months, but little copper is held for speculation. Consumers have bought heavily, but only for actual needs. Nor is there any doubt that consumers are well covered for the early months of 1917.

It is doubtful, however, that consumers are supplied with second-half copper. Producers still have considerable second-half production unsold. Still there is no evidence of any large buying for summer and fall metal. In fact, it is the general impression that buyers of copper are disinclined to commit themselves long in advance. There is no desire to take any large loss in a declining market. This situation is borne out by statements from manufacturers that every effort will be made to minimize the loss that is bound to come.

On the other hand, should the nations of Europe again enter the market for large tonnages it is practically certain that American buyers will again place orders months in advance.

The prices quoted in New York on Tuesday of this week were from a quarter to a half cent higher than a week previous. Quotations were as follows: January delivery, 33 cents; February delivery, 32.75 cents; March delivery, 32 cents; second quarter, 30.5 cents; third quarter, 28.5 cents; fourth quarter, 27 cents.

NEW YORK METAL MARKET PRICES

	Jan. 23 Selling Prices Bid	Jan. 23 Selling Prices Asked	Jan. 30 Selling Prices Bid	Jan. 30 Selling Prices Asked
Copper	£ s d		£ s d	
London, standard spot	130 0 0		132 0 0	
Prime Lake	31.00	to 31.50†	31.75	to 32.25†
Electrolytic	32.00	to 33.00†	32.50	to 33.50†
Casting	28.50	to 29.00†	29.25	to 29.75†
Copper wire base	38.00†		39.00†	
Lead	7.50		8.00	
Nickel	50.00		50.00	
Sheet zinc, f.o.b. smelter	21.00		21.00	
Spelter, spot	9.92½	to 10.00†	10.67½	to 10.92½†
Tin, straits	45.50†		45.75†	
Aluminum, 98 to 99 per cent	50.00	to 54.00†	52.00	to 54.00†

OLD METALS

Heavy copper and wire	23.00	to 24.00†	25.00	to 25.50†
Brass, heavy	13.50	to 14.00†	14.50	to 15.50†
Brass, light	11.00	to 11.50†	11.00	to 11.50†
Lead, heavy	6.85	to 7.00†	7.00	to 7.12†
Zinc, scrap	7.00	to 7.25†	7.25	to 7.75†

COPPER EXPORTS

Total tons to Jan. 30	23,511

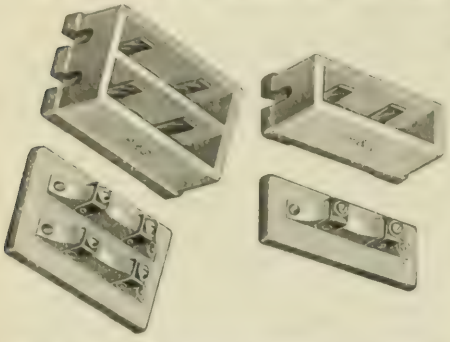
†Nominal

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Wiring Devices for Foreign Trade

Two fuse blocks made exclusively for foreign trade are shown in the accompanying illustration as manufactured by Pass & Seymour of Solvay,

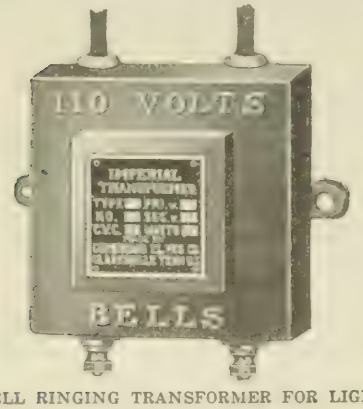


TWO FUSE BLOCKS FOR FOREIGN MARKETS

N. Y. These fuse blocks are used to a large extent throughout Europe and South America. The block shown on the right is a single pole fuse block or fuse carrier and the other is a double pole type.

Bell Ringing Transformers for Light Signal Work

Bell ringing transformers which are suitable for light signal work, such as residences and apartment houses have been developed by the Cumberland Electric Manufacturing Company of Clarksville, Tenn. One type of transformer measures 2.25 in. by 3.25 in. by 3.25 in., weighs about 2.5 lb., has a



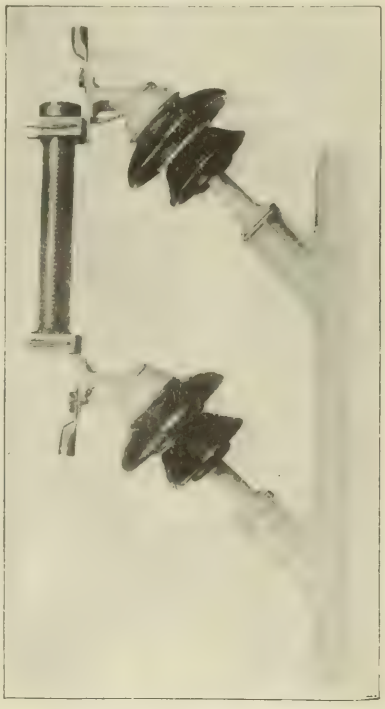
BELL RINGING TRANSFORMER FOR LIGHT SIGNAL WORK

capacity of about 20 watts, and may be used on any current up to 133 cycles. The primary voltage range is from 110 to 130 volts, and the secondary is rated for 8 volts.

Another type that is offered has the same weight and measurements except that it furnishes three secondary voltages, 6-9-15. Its rating is about 25 watts on 60 to 133 cycle circuits. A third type for heavy work is rated at 75 watts furnishing three secondary voltages 6-14-20, for use on 60 to 133 cycle circuits. This transformer is designed for factories and large buildings where there are a large number of bells.

Outdoor High-Tension Fuse Equipment

A unit type outdoor fuse mounting has been designed by the Delta-Star Electric Company of Chicago, Ill., which it is claimed will clear short-



UNIT TYPE OUTDOOR FUSE MOUNTING FOR 13,200 VOLTS

circuits instantly. The equipment shown here is rated for 13,200 volts, but actually employs 22,000-volt carbon-tetrachloride fuses and 27,000-volt insulators with a flash-over value of 100,000 volts. This, it is pointed out, gives a high factor of safety and immunity from puncture between the insulator cap and pin. The insulator element is interchangeable so that in case of accidental breakage a new self-contained insulator, pin and cap can be easily replaced. Cementing in the field is unnecessary, insuring minimum expense, trouble and time required for repairs. This equipment is supplied in all voltages up to 66,000.

Electric Warming Pad with Safety Device

The Scientific Products Company of Steubenville, Ohio, has developed and placed on the market the electric warming pad shown in the accompanying illustrations. The heating element is



FIG. 1—EXTERIOR OF ELECTRIC WARMING PAD

wound on India mica with asbestos paper firmly cemented over it, and then incased in a metal covering. It is claimed that there is no stress or strain on the heating element wire as all pulling twisting and bending comes on a braided copper cable composed of 72 No. 36 gage wires.

Attention is also called to a safety link placed inside the pad in circuit with the thermostat. This device



FIG. 2 — DETAILS OF CONSTRUCTION OF HEATING PAD SHOWING SAFETY DEVICE

keeps the circuit closed through a little spring held in place by a fusible alloy which melts and allows the circuit to open in case the temperature of the pad rises to an unsafe degree. A three-heat control switch in the cord is easily operated with one hand. This switch is made of vulcanized fiber. The attachment plug is a standard separable type made of black composition. The pad is 10.5 by 12.5 in., covered in two styles,

eiderdown and cretonne, and is lined with asbestos cloth. Details of the construction of the heating pad and the location of the safety device are shown in Fig. 2.

Conduit Fittings for Push-Button Switches

Three new conduit fittings are shown in the accompanying illustrations particularly adapted to Cutler-Hammer snap switches. In Fig. 1 a surface switch is shown on a rectangular Crouse-Hinds fitting and in Fig. 3 a

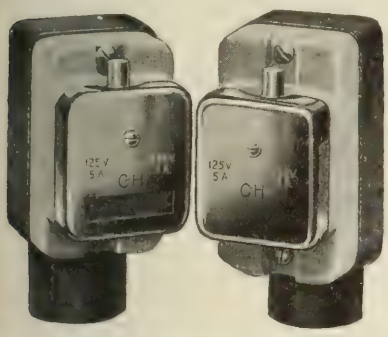


FIG. 1—LEFT—SURFACE SWITCH ON A RECTANGULAR FITTING—FIG. 2—RIGHT—SWITCH WITH SPECIAL BASE INSTALLED ON A STANDARD TAPLET

round base switch installed on a standard round conduit fitting. Fig. 2 shows a switch with special base installed on a standard Paiste taplet. The conduit fittings referred to may be used with any metal conduit of corresponding diameter and thread. The fittings are small, with a japanned or galvanized finish to match the finish of the conduit.

The switches have the character-

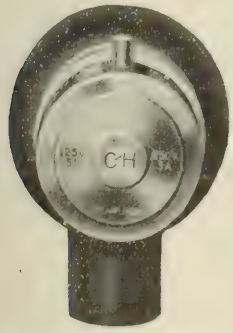


FIG. 3—ROUND BASE SWITCH INSTALLED ON A ROUND CONDUIT FITTING

istic Cutler-Hammer push-button operation with a light button for closing the circuit and a dark button to open the circuit.

In addition to being used on conduit systems it is pointed out that the switches may also be used on practically all kinds of wiring systems—wooden and metal molding, open wiring and concealed wiring. These switches are rated at 5 amp., 125 volts and 3 amp., 250 volts, National Electrical Code Standard and made by The Cutler-Hammer Manufacturing Company of Milwaukee.

Inclosed Overhead-Trolley for Indoor Use

An inclosed overhead trolley for use in rooms or places where film plays are staged that permits rapid arrangement and transfer of lighting units has been developed by Frank Detering, chief electrician of the Rolfe-Metro Studios, 3 West Sixty-first Street, New York City. The trolley casing or housing may extend over a large area and the trolley and the bank may be shifted from one end to the other. The conducting means within the trolley housing may be continuous throughout, or, for specific purposes it may be constructed in sections and mounted at certain intervals for individual contacts. In the top central portion of the trolley housing a trolley guide is formed, the trolley being slotted in the top so that it may slide along a guide provided on the trolley housing. The feed cables run through a small cable housing provided on the top of the trolley housing.

In Fig. 1 is shown a horizontal track in which one of two rollers slide. The roller is secured to a frame which extends vertically down and forms a horizontal portion. Between the angular portion of the frame there is a strengthening web. The horizontal portion of the frame carries the bank of light which acts as a support. The trolley housing is mounted parallel to the track and may be secured to the ceiling. A cable housing is mounted on the top of the trolley housing. Within the trol-

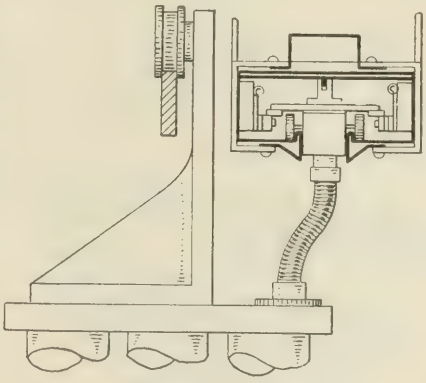


FIG. 1—TROLLEY HOUSING

ley housing there is the trolley which runs on wheels and in the center of the trolley there is a bearing for the wheel shafts. Centrally within the bearing a tube extends downwardly in which a cable is secured. When the sources of light are shifted so as to get the proper illumination of a scene the cable secured to the bank pulls the trolley along and thus secures the supply of current at any desired location. Centrally within the top horizontal portion of the trolley housing a ridge is formed which acts as a trolley guide. The vertical side walls of the trolley housing carry inside slate bars. To the inner surfaces of the slate bars conductive lugs are mounted which connect below each with a busbar. Thus the current is allowed to pass from the feed cables into the busbars. The top part of the trolley is mounted upon a slate bar which carries the bearing for the shafts of the trolley wheels. The contact shoes of the trolley are secured to the slate bar, which comprises a contact bar

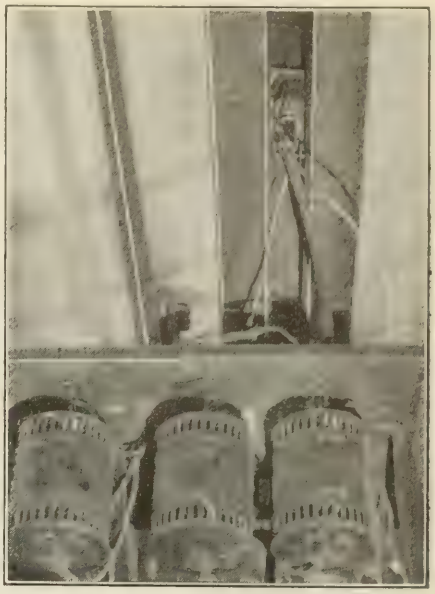


FIG. 2—VIEW SHOWING TROLLEY, HOUSING AND SECTION OF LAMP BANK

which is slightly curved at the ends. A spring-actuated contact shoe insures perfect contact with the busbars.

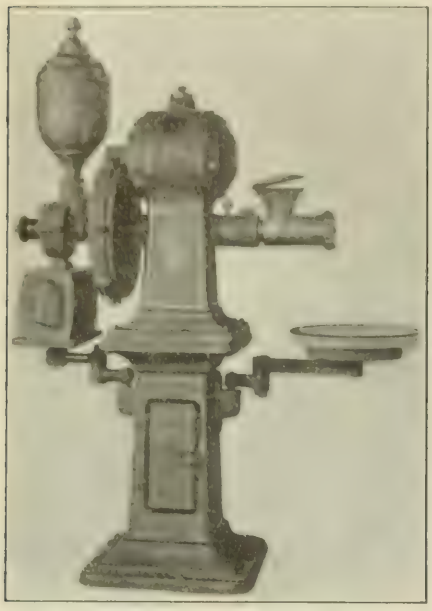
Electric Coffee Mill and Meat Grinder

The combination mill and meat grinder shown in the accompanying illustration is one of several new models that have been placed on the market by the Coles Manufacturing Company of Philadelphia, Pa. The small mill will granulate a pound of coffee in forty seconds, it is claimed, and can be connected to the ordinary electric light socket. It is operated by a 0.25 hp. Westinghouse motor. This mill has obstruction release to clear grinders; an indicating regulator which provides for six grades of coffee; a detachable hand crank for hand operation of the mill should current fail, and a self-cleaner and dust-proof pan. It occupies a counter space of 12 by 17 in., and is 27 in. high.

The double mill will granulate 5 lb. of coffee per minute, or pulverize 1 lb. per minute. It is operated by a 0.75-hp. Westinghouse motor. The motor operates both grinders at the same time. This mill has an automatic releasing and resetting device, self-cleaning heads, dustproof pans, indicating regulator which provides for twenty grades of coffee, and 6-lb. nickel hoppers. It is furnished for mounting on the counter or with pedestal base for floor mounting.

The combination coffee mill and meat chopper has a capacity of 8 lb. of beef per minute, or will granulate 2 lb. of coffee per minute. It is operated by a 0.75-hp. Westinghouse motor. All parts, including the bowl, are removable. The regular equipment consists of four

sets of knives and plates, one sausage stuffing attachment, meat pusher, spanner wrench for chopper ring. Bone grinder, pulley or tool grinder also furnished when desired. It is furnished for mounting on the counter or with pedestal base for floor mounting, and occupies a space 20 by 32 in. and is 36 in. high.



COMBINATION ELECTRIC COFFEE MILL AND MEAT GRINDER

3-lb. Electric Iron

The Westinghouse Electric & Manufacturing Company of Pittsburgh, Pa., has developed a 3-lb. electric iron for travelers and for light pressing work, for which several features are claimed. The handle is not removable as in the former model, thus avoiding the danger of losing or misplacing it, with the space required for packing no greater. The cord is permanently attached and a hole in the stand provides a receptacle for heating a curling iron.

All of the desirable features of the larger 6-lb. irons are found in the smaller size, including simple construction, guaranteed heating element, and no heat radiation from the upper surface. All heat is given off at the ironing face, which permits an even temperature to be maintained, with no part hotter than another. A heat storage plate absorbs all heat not needed to keep the ironing face hot.

Electric Drill with Special Control

A special control which is designed to prevent the breakage of small drills when operating the close corner electric drill, is shown in the accompanying illustration. The operating scheme is similar to that of an automatic pistol, one finger doing the work. The grip need not be released to turn the switch or push in or pull out the handle at the moment the drill breaks through. The housings are cast from an aluminum alloy having a high tensile strength and resistance to distortion. The chuck is strong and rigid in design. The motor is of special design, and made by the Robbins & Meyers Company of Springfield, Ohio.

The commutator and brushes are readily accessible by removing four screws, which enables the top cover to be slipped off. This cover does not carry the armature shaft bearing. This bearing and brushes are carried by an inner spider, which is protected from external injury or strains, tending to bind the bearing. Furthermore, this construction allows the drill to be run while the cover is removed for inspection of the brushes and commutator, which is a great practical advantage in the upkeep of the tool. This outfit is a product of the Black & Decker Manufacturing Company of Baltimore, Md.



DRILLING MACHINE THAT PROTECTS SMALL DRILLS

Insulated Pliers

The Rubber Insulated Metals Corporation, Plainfield, N. J., is now making pliers of tool steel, insulated with rubber compound that it is claimed will withstand high-voltage test and give definite practical service to the user. One of the features pointed out for this tool is that it bears the stamp of approval of the Electrical Testing Laboratories, Inc., of New York City, which stamp on each individual plier shows that it has been tested and passed for 10,000 volts. Attention is called to the fact that the bond of the rubber to the metal is of such a character that there can be no chance of its wearing loose. On the contrary, it is said, it is so firmly held to the metal that repeated experiments of a severe nature have failed to show any "breakdown," when once the rubber has been applied to the handles.



PLIERS INSULATED FOR 10,000 VOLTS

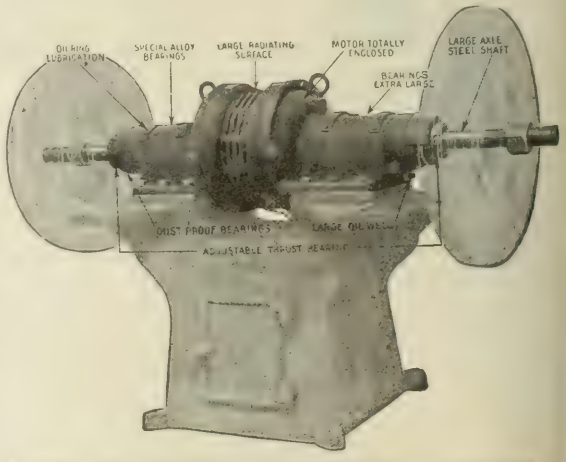
Alternating-Current Grinder Motor

The grinder motor shown in the accompanying illustration has been placed on the market by the Westinghouse Electric and Manufacturing Company of East Pittsburgh, Pa. It is designed for use on two-and three-phase, 60-cycle, alternating-current circuits, and has been constructed especially to meet the severe conditions to which such motors are subjected in grinding and polishing work. This grinder motor is obtainable in three sizes, having capacities of 5 hp., 7.5 hp., and 10 hp. respectively. The 7.5 and 10 hp. two-phase motors are supplied with auto starters. For the 5 hp. two- and three-phase motors an ordinary knife switch is employed, and a special starting switch for the 7.5 two- and three-phase motors. Pedestal bases, grinding wheels, and tool rests for the machines are furnished by the tool manufacturer.

To protect parts against wear and injury from grit and metallic dust, the bearings are made dustproof, and the motor is wholly inclosed. However, provision has been made for large radiating surface.

The end brackets are solid and cast integral with the feet, which are extra heavy and arranged so that they can be bolted rigidly to the pedestal. The shaft is made of axle steel, is of extra large diameter, and is extended at both ends to receive the grinding wheels. The bearings have large bearing surfaces. The end thrust is taken up by adjustable collars. Two oil rings lubricate the bearings.

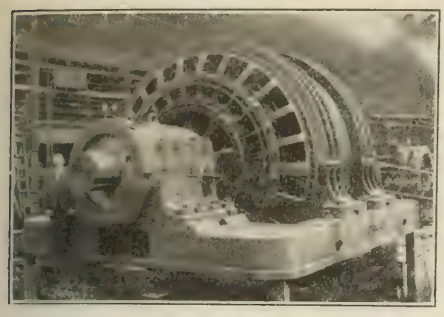
The rotor of the motor, which is of the squirrel-cage form, has no moving contacts. The rotor bars are firmly fastened in the iron core and are short-circuited by end rings. No bolts or screws are used, and there is nothing about the rotor, it is claimed, that can work loose, even under the most severe service, or that will deteriorate under heat. The stator winding is thoroughly treated with an oil and moisture-resisting varnish. In motors larger than 5 hp. the winding consists of coils wound on forms and completely insulated, then laid in the open stator slots and securely held in place by some means of wedges.



MOTOR FOR GRINDING AND POLISHING MACHINES

Largest Electric Motor Yet Built

The Westinghouse reversing motor shown in the accompanying illustration is designed for driving a two-high, 35-in. reversing blooming mill, which reverses for every pass; that is, every

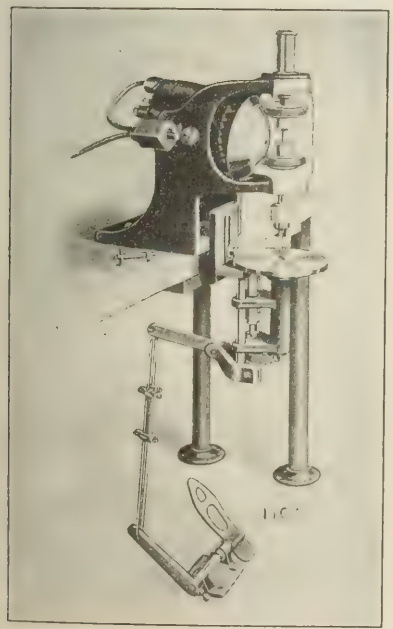


A 15,000-HP. MOTOR FOR DRIVING STEEL BLOOMING MILL

time metal goes through the rolls. Reversals can be made from full speed to full speed in about two seconds, and in regular work nineteen or twenty passes are made in two minutes. This motor has a rating of 15,000 hp. The complete motor weighs more than 250 tons, the rotating part about 100 tons. It is 20 ft. high, and the shaft is over 2 ft. in diameter. The man standing alongside the motor is 6 ft. tall.

Motor-Driven Tapping Machine

A motor-driven tapping machine has recently been developed by The Anderson Die Machine Company of Bridge-



TAPPING MACHINE DRIVEN BY A 1/6-HP. MOTOR

port, Conn., in which the power is transmitted from the motor to the spindle through a friction driving disk, and two spindle friction wheels, one for driving the taps forward into the work and the other for reverse. The friction driving disk is mounted direct on the shaft of a Robbins & Meyers motor which has a rating of 1/6 hp. at 1750 r.p.m. The motor is pivoted in the frame of the machine on a line with the center of the shaft which carries the friction driving disk. Various cutting and return speeds are obtained by tilting the motor. If the speed is reduced in one direction it will be increased in the other. In this way a quick return speed is obtained to compensate for a slow cutting speed, or if a quick cutting speed is used, the return speed will be slower. The sum of the cutting and return speeds is always 2000. The spindle is mounted in S. K. F. radial ball bearings with a spring provided at the upper end which can be adjusted so as to balance the weight of the spindle and various parts related to it.

Lighting Fixture that is Easily Cleaned

A lighting fixture designed for the lighting of stores, show windows, public halls, factories, and all places re-



FIG. 1—SUSPENSION FIXTURE

quiring a maximum amount of light at a minimum cost is being offered to the trade by the Perfectlite Company of Seattle, Wash. This fixture, it is declared, by using a nitrogen lamp in connection with its reflector, and a glass bowl which absorbs little light, produces a soft, white light equally distributed. It is also said that a uniform diffusion of light is obtained, making it agreeable to the eyes. The fixture is of simple and neat design, and can be placed in any office or room in a residence and be in harmony with the surroundings. Attention is called to the fact that the lamp is entirely concealed from view, thereby leaving nothing to detract from the lines of the



FIG. 2—CONSTRUCTION FEATURES OF LIGHTING FIXTURE

complete units. The fixture is easily cleaned, for by removing one thumb screw, which holds the bowl, easy access is had to the reflector and lamp. The construction of this lighting fixture is clearly shown in Fig. 2 and one style of suspension fixture is shown in Fig. 1.

Electric Table Stove with Special Plug

The Standard Stamping Company of Marysville, Ohio, has placed on the market a table stove in which the heating element is made in two sections, one above the other, with 1.5-in. space between them. In the space between the two sections of the heating element a wire toaster drawer is located, so that both sides of the bread are exposed to the heat and are toasted at the same time. This arrangement of the heating element also allows two additional cooking operations to be carried on above and below the two outer surfaces of the heating element, since toasting does not in any way interfere with other cooking operations. An egg-poaching attachment with four egg cups for use in the deep vessel is included in the regular equipment. The deep vessel is also provided with a removable grid for use when broiling.

Another feature of this table stove, to which attention is called, is the attachment plug with which it is equipped. This plug operates by a tilting motion instead of a straight push-in or pull-

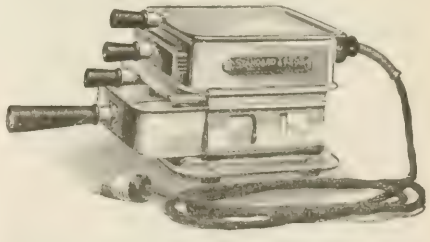


TABLE STOVE THAT PERMITS OF THREE COOKING OPERATIONS AT ONCE

out. The manufacturer claims that the use of this plug will eliminate much of the plug and cord trouble experienced with domestic appliances.

Trade Notes

THOMAS A. EDISON, INC., West Orange, N. J., has purchased a tract of about 10 acres of land on the meadows, Kearney fronting on the Hackensack River to be used for future factories for the manufacture of storage batteries, talking machines, etc.

SHEPARD ELECTRIC CRANE & HOIST COMPANY, Montour Falls, N. Y., is making extensions to its plant consisting of two bays along its present building having a width of 15 ft. and a length of 210 ft. each, one to be used as a punching and shearing shop and the other as a machine shop and for miscellaneous uses.

L. S. SHAW announces the establishing of the firm of L. S. Shaw & Company with offices in the Dime Bank Building, Detroit, Mich. The company will deal in power plant equipment, specializing in high-grade apparatus. Mr. Shaw for the last five years has been manager of the power departments of the Westinghouse companies at Indianapolis, Chicago and Detroit.

H. E. FREEMAN, formerly vice-president of The American Trust & Savings Bank of Springfield, Ohio, has been appointed treasurer of the Robbins & Myers Company. W. J. Myers, who in addition to his duties as vice-president of The Robbins & Myers Company has previously acted as treasurer, will now be relieved of the duties in connection with the latter position so he can give his entire time to his duties as vice-president.

CENTURY ELECTRIC COMPANY, St. Louis, Mo., has made the following changes and additions to its organization. G. Y. Watt, formerly in charge of the Rochester sales office of the Century Electric Company, has now been transferred to the new sales office opened at 10 High Street, Boston, Mass. He will be assisted by J. F. Elliott and H. P. Westervelt. G. H. Lindsey, formerly connected with the St. Louis office, has been placed in charge of the Rochester sales office. The sales organization at St. Louis has been increased by the addition of E. S. Moore, who will have charge of the fan department. In order definitely to handle the large amount of raw material necessary in the manufacture and production of its apparatus, the Century Electric Company has let a contract for the erection of a reinforced concrete warehouse containing some 15,000 sq. ft. of floor space with terminal facilities and designed with special reference to handling sheet steel, shaft stock and other raw material.

WESTINGHOUSE VETERANS HOLD ANNUAL BANQUET.—The Veteran Employees' Association of the Westinghouse Electric & Manufacturing Company, consisting of those who have been with the company more than twenty years, held its fourth annual banquet at the William Penn Hotel, Pittsburgh, on Jan. 20, at which time the election of N. W. Storer, general engineer of the company, as president for the ensuing year was announced. The association now numbers more than 500 members, of which five are women. President E. M. Herr of the company announced the granting of two weeks' vacation with full pay to every member of the association. Guy E. Tripp, chairman of the board of directors of the company, delivered an address dealing with trade conditions after the war, in which he predicted that this country would meet a united Europe and that an industrial war would undoubtedly ensue from which we should draw a lesson of thinking, talking and acting preparedness.

WINNERS OF NATIONAL MAZDA LAMP WINDOW DISPLAY CONTEST.—The winners of the 1916 contest, which opened Oct. 1 and closed Dec. 15, were announced on Jan. 27. Sixty awards were offered and there were many contestants for each. The displays of exceptional value entered were so numerous that a list of twenty-one entries, deserving of honorable mention and a special award was added to the winners of the sixty original awards. Human interest was the main feature in the first six winning displays.

The first prize was awarded to W. D. McSpadden, Bristol (Va.) Gas & Electric Company; the second prize to L. J. Sewell, Lehigh Valley Light & Power Company, Allentown, Pa.; the third to L. E. Ragan, Rome (N. Y.) Gas, Electric Light & Power Company; fourth to F. P. Safford, Denver (Colo.) Gas & Electric Company. The contest was operated under the direction of N. H. Boynton, advertising manager of National Lamp Works. F. M. Feiker, ELECTRICAL WORLD; A. A. Gray, *Electrical Review and Western Electrician*, and N. A. Boynton composed the board of judges.

HARALD AND KARLOS KARLSEN of Christiania, Norway, are visiting America for the purpose of purchasing electrical goods for export to Norway, where the Karlsen brothers are in business as wholesale merchants and importers. Their temporary address in New York City is 100 Cathedral Parkway, Apartment 516.

New Incorporations

THE B. T. MOWRY COMPANY of Taunton, Mass., has been incorporated with a capital stock of $10,000 to manufacture and deal in electrical appliances and supplies. The incorporators are: Berton T. Mowry of Raynham, G. Morton Leach of Raynham, and Everett S. White of Taunton, Mass.

THE R. V. PETTINGELL ELECTRIC SUPPLY COMPANY of Boston, Mass., has been chartered with a capital stock of $75,000. The directors are: Roger V. Pettingell, 28 Lowell Road, Winthrop, Mass., president and treasurer; D. T. O'Connell and F. P. McCartin.

THE ELECTRIC CONTRACTING COMPANY of Wilmington, Del., has filed articles of incorporation under the laws of the State of Delaware, with a capital stock of $25,000 for the purpose of doing a general contracting business. The incorporators are: John W. Moore, John A. Spahn and George G. Steigler of Wilmington, Del.

THE TELLER-PROTECTOR COMPANY of Richmond, Va., has been incorporated by G. W. Lancaster, C. W. Rex and S. Wilson, all of Richmond, Va. The company is capitalized at $500,000 and proposes to manufacture electrical devices for communication between tellers and bookeepers and other officers.

THE AMERICAN JOBBERS SUPPLY COMPANY has been incorporated with a capital stock of $50,000 to manufacture and deal in electrical machinery and appliances, etc. The principal New Jersey office will be in Wallington, R. F. D. Passaic, N. J. The incorporators are: William M. Carpenter, M. L. Joslyn and Ernest S. Hough.

L. L. FLEIG & COMPANY of Chicago, Ill., has been chartered with a capital stock of $30,000 by Thompson, Tyrrell & Chambers, 25 North Dearborn Street, Chicago, Ill. The company proposes to manufacture and deal in electrical supplies, etc.

I. P. FRINK, INC., of New York, N. Y., has filed articles of incorporation with a capital stock of $30,000 to manufacture and deal in reflectors, chandeliers, lighting fixtures, etc. The incorporators are: G. F. Spencer of Montclair, N. J.; W. H. Spencer, 468 West Twenty-fourth Street, New York City, and F. T. Ward, East Orange, N. J.

THE AUTOMOBILE LIGHTING, IGNITION & REPAIR COMPANY of St. Louis, Mo., has been incorporated with a capital stock of $11,500 by Henry C. Thompson, Henry C. Thompson, Jr., John G. Landis and others.

THE DUNCAN ELECTRIC COMPANY of Montreal, Que., Can., has been chartered with a capital stock of $150,000, to manufacture electrical machinery. The incorporators are: John H. Meager, Henry C. Chauvin of Montreal, and others.

THE ELECTRIC CAR & LOCOMOTIVE CORPORATION of New York, N. Y., has been incorporated by A. H. Dirk of Bloomfield, N. J.; W. V. Wightman and others. The company is capitalized at $1,000,000 and proposes to manufacture railway, passenger, street and freight cars and electrical devices.

THE NATIONAL CARBON COMPANY of Queens, N. Y., has been incorporated with a capital stock of $1,000,000 to manufacture carbon and specialties, batteries, electrical appliances, etc. The incorporators are: H. K. Wood, H. O. Coughlan and S. B. Howard, 65 Cedar Street, New York City.

THE JOHN M. HOLLER CONSTRUCTION CORPORATION of Albany, N. Y., has been chartered with a capital stock of $50,000 for the purpose of doing a general contracting and construction business and also electrical work. The incorporators are: J. M. Holler, 513 Western Avenue; O. Holland, 6 Catalpa Drive, and H. B. Woolard, 196 Elm Street, Albany, N. Y.

THE SHORT ELECTRICAL MANUFACTURING CORPORATION of Penn Yan, N. Y., has been incorporated by H. M. Short, W. T. Morris of Penn Yan, and E. O. McDowell, 154 Nassau Street, New York, N. Y. The company is capitalized at $40,000 and proposes to manufacture electrical supplies and appliances, etc.

CONSUMERS LIGHT & POWER COMPANY of Ardmore, Okla., has been incorporated, with a capital stock of $1,000,000, by Paul E. Ekern, W. D. Potter and P. C. Kings, all of Ardmore, Okla.

THE SCHOHARIE VALLEY LIGHT & POWER COMPANY of Esperance, N. Y., has been incorporated with a capital stock of $100,000 to generate and distribute electricity for lamps and motors and for transportation purposes. The incorporators are: F. M. Landers, E. C. and B. Grantier of Esperance, N. Y.

Trade Publications

DISCOUNTS.—"Decimal Net of Compound Discounts" is the title of a booklet prepared by the American Screw Company of Providence, R. I. This book should be of help to everyone interested in this subject.

SOCKETS.—P. & S. chain-pull candle-fixture sockets are described in a leaflet issued by Pass & Seymour of Solvay, N. Y.

SWITCHES, ETC.—Harvey Hubbell, Inc., of Bridgeport, Conn., has prepared bulletin No. 15-21, containing prices on porcelain sockets, receptacles and pull switches.

UNIFLOW ENGINES—The Nordberg Manufacturing Company of Milwaukee, Wis., is distributing a mailing folder describing and illustrating achievements in engine building.

RECTIFIER.—The Stahl Rectifier Company, 536 South Clark Street, Chicago, has prepared a folder descriptive of its commutator rectifier.

ELECTRIC DRILLS.—The Black & Decker Manufacturing Company, Baltimore, Md., has prepared a leaflet descriptive of its Type A, close corner electric drill.

DYNAMOMETERS.—Electric Absorption Dynamometers are described and illustrated in bulletin No. 508 now being distributed by the Diehl Manufacturing Company of Elizabeth, N. J.

APPLIANCES.—Julius Andrae & Sons Company of Milwaukee, Wis., is mailing to the trade a revised price list on electrical appliances.

FANS.—Bulletin No. 4001 is being distributed by the Emerson Electric Manufacturing Company of St. Louis, Mo., descriptive of its Emerson fan motors for alternating and direct current. Bulletin No. 4002 descriptive of Northwind electric fan motors for the season of 1917 is also being distributed by this company.

ELECTRICAL APPLIANCES. — The Hamilton Beach Manufacturing Company of Racine, Wis., has prepared a booklet descriptive of its electric labor-saving devices.

GASCO PROTECTOR.—The Gasco Protector Company, 1103 North Avenue, Waukegan, Ill., has prepared a bulletin descriptive of its improved aluminum Gasco protector.

LIGHTING FIXTURES.—The Perfeclite Company of Seattle, Wash., has prepared an illustrated catalog descriptive of its Perfeclite fixture.

ROWBOAT MOTOR.—Bulletin No. 300 has been issued by the Jewel Electric Company, 112 North Fifth Avenue, Chicago, Ill., descriptive of its Jewel rowboat motor.

WIRING DEVICES.—The Detroit Closed Bushing Company, Inc., 901 Kresge Building, Detroit, Mich., has prepared a mailing folder descriptive of its closed bushings.

PLATE VALVES.—The Mesta Machine Company of Pittsburgh, Pa., has prepared bulletin D descriptive of its automatic plate valves.

OIL.—The Vacuum Oil Company of Rochester, N. Y., has prepared two catalogs concerning lubrication for large, small and medium-sized horizontal gas engines. These bulletins show much care in make-up and are well illustrated. They should be of interest to every man in gas-engine work.

HEATERS.—The uses of open heaters in connection with the heating, metering and softening of water for boiler and other purposes are exhaustively treated in a 100-page book (Publication No. 710) lately issued by the Harrison Safety Boiler Works, 3159 North Seventeenth Street, Philadelphia, Pa. This book covers in a very complete manner the important matters of handling feed water and exhaust steam, and should be of value to those who design, manage or operate steam power plants.

New England

BOOTHBAY HARBOR, ME.—Plans are being considered for the construction of an electric railway to connect with the Lincoln and Knox County division of the Maine Central Railroad. The cost is estimated at about $150,000. Luther Mattocks of Boothbay Harbor is interested in the project.

ROCKLAND, ME.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Feb. 19, for a new conduit and wiring, gas piping, lighting fixtures, etc., in the United States custom house and post office at Rockland, Me. For details see proposal columns.

MANSFIELD, MASS.—The Union Light & Power Company of Franklin is contemplating the erection of a 13,000-volt transmission line from Mansfield to North Attleboro in the near future.

NEW MILFORD, CONN.—Condemnation proceedings have been brought against several land owners along the Housatonic River in the town of New Milford and Brookfield, Mass., by John H. Lancaster of Litchfield, Conn., and others, preparatory to the construction of a large dam across the Housatonic River in connection with the establishment of a large hydroelectric power plant to transmit and distribute electricity over a large area. The cost of the dam is estimated at $1,000,000.

Middle Atlantic

NEW YORK, N. Y.—Plans are being prepared for the construction of a substation for the Interborough Rapid Transit Company at 150 West Sixteenth Street, to cost about $40,000. George H. Pegram is engineer.

NEW YORK, N. Y.—Bids will be received by Burdette G. Lewis, commissioner of correction, Municipal Building, New York City, until Feb. 5 for furnishing material and construction of drug hospital to be erected on Riker's Island as follows: (A) General construction work; (B) plumbing work; (C) steam heating; (D) electrical work. Blank forms and further information may be obtained and plans and specifications may be seen at the office of the Department of Correction, Municipal Building.

NEW YORK, N. Y.—Bids will be received by the Department of Public Charities, Tenth Floor, Municipal Building, New York City, until Feb. 19, for construction and completion of cottage dormitories Nos. 7, 10, 12, 14, 48 and 49, and infirmary No. 16, at Randall's Island as follows: (1) General construction and electrical work (exclusive of plumbing, heating and ventilating work); (2) plumbing and drainage work; (3) heating and ventilating work. Blank forms and further information may be obtained at the office of Donn Barber, architect, 101 Park Avenue, where plans and specifications may be seen.

UNADILLA, N. Y.—The Public Service Commission has approved the proposed extensions and new connections for the transmission lines of Standard Light, Heat & Power Company of Unadilla in Delaware and Otsego Counties. The company is authorized to extend the lines from its power plant in Sidney through the town of Sidney, except to East Sidney and Sidney, where the Delaware & Otsego Light & Power Company is established. Other franchises approved are for the town of Butternuts and the village of Gilbertsville, Otsego County.

ALLEGHENY, PA.—Bids will be received at the office of the sunervising architect, Treasury Department, Washington, D. C., until Feb. 16 for a conduit and wiring system, lighting fixtures, etc., in the United States post office at Allegheny. For details see proposal columns.

CATASAUQUA, PA.—A petition signed by several hundred people of this borough has been sent to the Public Service Commission protesting against the establishment of a municipal electric-light plant in Catasauqua, as voted at a special election.

PHILADELPHIA, PA.—The power plant and foundry of the Willis Adams Foundry Company, North Ninth Street, was partly destroyed by fire on Jan. 21, causing a loss of about $20,000.

PHILADELPHIA, PA.—The Colonial Knitting Mills, Inc., is contemplating the construction of a power plant at its proposed new mill at Twenty-fifth Street and Hunting Park Avenue. J. P. Quinlan is vice-president.

SOUTH BETHLEHEM, PA.—The Bethlehem Steel Company is planning to install a one-story power plant, 40 ft. by 75 ft. at its stone quarries at McAfee, N. J.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

FLORENCE, N. J.—Negotiations are under way with the Public Service Electric Company for the installation of a street-lighting service, also to furnish electricity for domestic and commercial purposes.

FREEHOLD, N. J.—Bids will be received by the Board of Chosen Freeholders of the County of Monmouth, County Court House, Freehold, N. J., until Feb 7 for furnishing gas and electric-light fixtures in the Court House at Freehold. Drawings and specifications may be obtained of Warren H. Conover, architect, 114 Liberty Street, New York, N. Y., or Freehold, N. J., or can be seen at the office of the county collector, Freehold.

UNION, N. J.—The installation of additional street lamps is under consideration by the Union Township Committee.

WOODBURY, N. J.—Extensions and improvements to the street-lighting system is under consideration by the City Council.

MILFORD, DEL.—Extensions are contemplated to the municipal light and water plant to meet the increasing demand for electrical service. J. F. Anderson is secretary of board of light and water commissioners.

ELKTON, MD.—The Home Manufacturing Light & Power Company will install a 100-kw. synchronizing motor to run idle on the line to correct the low power factor.

LOGAN, W. VA.—Plans and specifications have been prepared for extensions and improvements to the plant of the Logan County Light & Power Company, which will include addition to power station (103 ft. by 50 ft.) steel and concrete construction: contract to be let. Contract has been awarded for 5000-kva. turbines, four 500-hp. boilers with superheaters, condensing equipment, four stokers and a 200 ft. by 10½ ft. concrete brick-lined chimney. Coal-handling equipment will be installed (contract not yet awarded) and 25 miles of 44,000-volt transmission lines will be erected this year. Francis R. Weller, Hibbs Building, Washington, D. C., is consulting engineer; M. A. Maxwell of Logan is general manager.

WEST POINT, VA.—The Peoples' Light, Heat & Power Company is contemplating the installation of two additional engines and generators in its plant. C. L. Maskey is president.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Feb. 16 for furnishing and installing lighting fixtures in the United States post offices at Aurora, Neb.; Charles City, Iowa; Charlotte, N. C.; Falls City, Neb.; Hackensack, N. J.; Hornell, N. Y.; Opelika, Ala.; Seymour, Conn.; Shelby, N. C.; Taylorville, Ill.; Titusville, Pa., and Waynesville, N. C. For details see proposal columns.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations the following supplies: Brooklyn, N. Y., Schedule 650—14 steam indicators; Schedule 657—1908 composition unions; Schedule 655—3800 lb. annealed black iron wire, 6300 lb. galvanized iron wire; Schedule 656—35 portable ventilating sets, 45,000 ft. twin conductor wire; Schedule 652—75,000 ft. lighting and power wire. Philadelphia, Pa., Schedule 643—miscellaneous fuel oil feed pumps, etc. Mare Island, Cal., Schedule 660—800 lb. copper wire, 150 lb. phosphor bronze wire. Norfolk, Va., Schedule 642—11 starter panels; Schedule 651—one electrically-driven winding machine. Washington, D. C., Schedule 640—one No. 2 screw wire feed machine. Applications for proposal blanks should designate the schedule desired by number.

North Central

CHEBOYGAN, MICH.—Extensive improvements are contemplated by the Cheboygan Electric Light & Power Company to its Black River power house, dam and substation as soon as the weather permits. The new power house will be of reinforced concrete and designed for the installation of vertical turbines which will be directly connected to umbrella type generators. Gardner S. Williams, hydraulic engineer, Ann Arbor, Mich., and Chicago, Ill., has been engaged to prepare plans for power house and other equipment

MARQUETTE, MICH.—Plans have been prepared for the construction of the power plant for the new factory of the Piqua Handle Company in Marquette. B. Hogan is construction engineer.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, until Feb. 13 for paper-insulated, lead-covered cable for the department of public utilities, division of light and heat. Specifications may be obtained at the office of the division of light and heat, room 204, City Hall.

DAYTON, OHIO.—Application has been made to the County Commissioners to grant the Dayton Power & Light Company authority to erect an electric transmission line on the Smithville and Marshall Roads in Van Buren Township.

NEWARK, OHIO.—The Ohio Light & Power Company is contemplating extending its transmission lines to Pleasantville, Baltimore and Basil this spring.

PIQUA, OHIO.—The Dayton Power & Light Company contemplates the installation of an ornamental lighting system in Piqua, to cost about $25,000.

CLINTWOOD, KY.—Plans are under way by the Appalachian Light & Power Company of Bluefield, W. Va., to establish an electric plant in Clintwood. The construction of a water-works system is also under way. J. M. Stevens is interested in the project.

McKEE, KY.—At an election to be held in April the proposal to issue $60,000 in bonds for the installation of an electric-light plant and waterworks system will be submitted to the voters.

WHITESBURG, KY.—The Consolidation Coal Company, it is reported, contemplates extending its electric transmission lines from the central power station in Jenkins to supply electricity in Whitesburg, Kona and other central points. Further information may be obtained from W. Burdine of Whitesburg.

HOPE, IND.—Pulse & Porter, owners of the local electric-light plant, are changing the street-lighting system. The 20 arc lamps now in use are to be removed and four 400-watt, Mazda type C, gas-filled incandescent lamps and forty-one 100-watt Mazda lamps will be installed.

INDIANAPOLIS, IND.—The Interstate Public Service Company, Board of Trade Building, which operates electric plants in Bedford, Crown Point, Fowler, Monticello and a number of other places in Indiana, it is reported, contemplates the construction of a hydroelectric power plant on the Blue River at White Cloud, near Corydon.

NEW ALBANY, IND.—The Middle West Utilities Company, which controls the United Gas & Electric Company of New Albany, it is reported, contemplates the construction of a hydroelectric power plant on Blue River, 8 miles west of Corydon. The plans provide for a dam 100 ft. high, which, it is said, would supply power for Jeffersonville, New Albany and Louisville, Ky. Surveys, it is understood, are under way.

BONDVILLE, ILL.—The Bondville Electric Light Company is considering improvements to its plant. Jay C. Flowers is superintendent.

CARROLLTON, ILL.—The Council considering the question of issuing $25,000 in bonds for the installation of a municipal electric-light plant.

CHICAGO, ILL.—Steps have been taken by the Electric Development Company of the Sanitary District of Chicago toward the construction of a hydroelectric plant on Brandon Road, 4 miles below Joliet, to develop about 28,000 hp.

CHICAGO, ILL.—Work will soon be started by the Chicago, Milwaukee & St. Paul Railroad Company to equip 220 miles of its railroad in the State of Washington for electrical operation. The cost of the work is estimated at $25,000,000. Surveys have already been made.

LOUISVILLE, ILL.—Owing to the advance in the price of coal the management of the Louisville electric-light and water plant contemplates installing a fuel oil engine to replace the steam engine. G. N. Sanford is manager.

MARION, ILL.—The Southern Illinois & St. Louis Railway Company, recently organized to construct an electric railway to connect Harrisburg, Pittsburgh, Marion, Johnson City, West Frankfort, Benton and Herrin, it is understood, will begin work in the spring as soon as the weather will permit. The plans provide for about 60 miles of track. Frank Payne, of Marion, Ill., is general superintendent and chief engineer.

QUINCY, ILL.—The city of Quincy is asking for bids for a new street-lighting contract and will probably award contract on Feb. 5. The Quincy Gas, Electric & Heating Company holds the present con-

tract for street lighting. H. O. Channon is manager of the company.

SAVANNA, ILL.—The People's Gas & Electric Company contemplate the erection of an electric transmission line to Mount Carroll and the installation of a 500 kw. steam turbine. T. P. Bowen is manager.

CUMBERLAND, WIS.—The Clear Lake Electric Company is reported to have been granted a franchise to furnish electricity in Cumberland.

LAKE MILLS, WIS.—A movement has been started by local business men for the installation of a cluster-lighting system on the main streets.

NEENAH, WIS.—The City Council, it is understood, will grant the Wisconsin Traction, Light, Heat & Power Company a new franchise for extending its lines in Neenah.

WEST ALLIS, WIS.—Bids, it is reported, are being received by the Kempsmith Manufacturing Company of West Allis, through Vaughn & Meyer, consulting engineers, Majestic Building, Milwaukee, for an electric generating unit, consisting of a 200-kw. generator, engine and switchboard. Paul Thomas is general manager.

EVELETH, MINN. — The Minnesota Utilities Company, recently incorporated with a capital stock of $1,000,000, has taken over the property of the Home Electric & Heating Company of Eveleth, the Chisholm (Minn.) Electric Company, and the Western Mesaba Electric Company of Colerain. R. M. Haskett of Chisholm is secretary and treasurer.

OWATONNA, MINN.—Bids will be received at the office of the auditor of Steele County, Court House, Owatonna, until Feb. 13, for construction of County Home at Owatonna. Separate bids to be submitted for general contract, heating, plumbing and electrical work. Plans and specifications may be obtained at the office of Alden & Harris, architects, Commerce Building, St. Paul, Minn.

ZIMMERMAN, MINN.—The Elk River Power and Light Company is reported to have been granted a franchise to supply electricity in Zimmerman. F. D. Waterman is in charge.

ALGONA, IOWA.—Bids will be received at the office of S. W. Crowell, city clerk, Algona, until Feb. 25, for fur furnishing one 225 or 250-hp. Diesel engine, directly connected to a 160-kw., three-phase, 60-cycle generator. Plans and specifications may be obtained from W. C. Buck, 4821 Fremont Avenue South, Minneapolis, Minn., upon deposit of $10.

CENTERVILLE, IOWA.—The Centerville Light & Traction Company will install this season one 2500-kw. turbine and condenser, one cooling pond, two 500-hp. boilers and build one stack, and also to erect 30 miles of 33,000-volt transmission line. Frank S. Payne is president and manager.

DUNLAP, IOWA.—The local electric plant of the Iowa Gas & Electric Company, it is reported, was recently destroyed by fire.

MANILLA, IOWA.—Bonds have been voted for the installation of an additional oil engine, generator and switchboard in the municipal electric-light plant. It is proposed to duplicate the present equipment. E. C. Brooks is general superintendent.

OSAGE, IOWA.—The Osage Electric Light, Heat & Power Company expects to install an ornamental lighting system, consisting of 40 standards carrying single lamps of either 100-cp. or 250-cp. lamps. Thomas Ferris is manager.

SIOUX CITY, IOWA.—Bids will be received until Feb. 26 for elevator equipment for St. Vincent's Hospital, Sioux City, Iowa, consisting of two travel dumb waiters, 2 ft., 8 in. by 2 ft., 8 in., driven by 220-volt direct-current motors, automatic control, Eggler guide lubricators; one duplex geared-drum elevator, driven by a 220-volt, direct-current motor, equipped with push button control, speed governor, automatic engine stop, hatchway limit switches, Bostwick collapsing gate, automatic door selective unlocking devices, etc. William L. Steele, 502 United Bank Building, Sioux City, is architect.

SPIRIT LAKE, IOWA.—The Northern Iowa Gas & Electric Company, 1412 South La Salle Street, Chicago, Ill., will install a 250-kw. turbine and 300-hp. in boilers this spring. James H. Ehret is manager.

WEBSTER CITY, IOWA.—The City Council is contemplating extensions to the municipal electric-light and water plant, including the installation of one 600-kw. steam turbine, one 350-hp. water tube boiler, one mechanical stoker and jet condenser. G. J. Long is superintendent.

DE KALB, MO.—Preliminary work has started by the De Kalb Light & Power Company, recently incorporated, on the erection of a service tranmission line from the Hammond Packing plant to the top of Croy Hill and from there along the rock road to De Kalb. Electricity will also be supplied to farm houses along the line for lamps and motors.

JOPLIN, MO.—The contract for electrical work in the new high school has been awarded to the W. J. Nelson Electric Company of Joplin. The cost of the school is estimated at $200,000.

ST. JOSEPH, MO.—Plans are being prepared by Robert M. McCandlish Engineering Company, 723 Railway Exchange Building, Kansas City, Mo., for the construction of a plant to manufacture "Cakoal", which will include a one story building, 100 ft. by 200 ft., and a 300-hp. steam power plant. James R. Page, 908 Gloyd Building, Kansas City, Mo., is interested in the project.

ST. LOUIS, MO.—The Cupples Station Light, Heat & Power Company has been granted permission to lay underground conduits in Wharf Street from Popular to Biddle Street.

ALTOONA, KAN.—An election will soon be called to submit to the voters the proposal to issue $20,000 in bonds for improvements to the electric-lighting system and waterworks. Riley & Hardman of Parsons are engineers.

BRONSON, KAN.—W. B. Rollins & Company, Railway Exchange Building, Kansas City, Mo., have been engaged to prepare preliminary plans for the installation of an electric-light plant in Bronson. An election will be called later on to vote on a bond issue to provide funds for an electric plant.

BUNKER HILL, KAN.—Preliminary plans are being prepared by W. B. Rollins & Company, Railway Exchange Building, Kansas City, Mo., for the installation of an electric-light plant and water-works system in Bunker Hill. The proposal to issue bonds for same will be submitted to the voters later on.

LIBERTY, KAN.—The Liberty Roller Mill Company contemplate changing from flat rate to meters and will be in the market for meters very soon. The company has recently installed a Fairbanks-Morse fuel oil engine to replace steam power. L. W. Cundiff is general superintendent.

McPHERSON, KAN.—The City of McPherson will call for bids in the spring for 200 or 300-hp. water tube boilers; concrete or brick stack and a feed water treating plant. A well, 12 in. by 160 ft., is now under construction to deliver 300 gal. per minute, motor driven pumps, remote control will be installed. Arthur Groesbeck is manager.

OLATHE, KAN.—The Olathe Electric Light & Power Company is planning to install additional generating equipment some time before next winter. During the spring the company will install an ornamental street-lighting system, consisting of 50 lamp standards mounted with a single lamp, to be operated from its series lighting system. S. M. Brockway is president and manager.

Southern States

ASHEVILLE, N. C.—The contract for electrical work in connection with the new high school has been awarded by Longest & Tessier of Greensboro, general contractor, to the Edwin McKay Electric Company of Asheville. The cost of the school is estimated at $200,000.

SAVANNAH, GA.—Bids will be received by the Auditorium Commission, Savannah, until Feb. 8, for furnishing and installing electric lighting fixtures in the Municipal Auditorium Building. Plans and specifications are on file in the office of Henrik Wallin, architect, 23 Abercorn Street, Savannah, where copies may be obtained upon deposit of $10, of which $5 will be refunded upon return of plans.

CUMBERLAND SPRINGS, TENN.—The installation of an electric-light plant in Cumberland Springs is under consideration. L. Motion, who has purchased the Cumberland Springs Hotel, is reported interested.

MASCOT, TENN.—The local substation of the Tennessee Power Company, Hamilton National Bank Building, Chattanooga, was recently destroyed by fire, causing a loss of about $25,000.

NASHVILLE, TENN.—The City Council is reported to be considering an issue of $50,000 in bonds to purchase new boilers for the municipal electric-light plant.

CLARKESDALE, MISS.—Bids will be received by the Commissioners of the city of Clarkesdale until Feb. 6 for furnshing transformers, meters, lamps and other electric supplies and machine oils for the water and light department. Further information may be obtained upon application to W. W. Painter superintendent of water and light department.

FORT SMITH, ARK.—The Fort Smith Light & Traction Company contemplates extensions to its electrical transmission system.

DONALDSVILLE, LA.—The Municipal Light & Water Commission is considering the installation of an ornamental street-lighting system on about four blocks (1200 ft.) in the near future. It is proposed to add to it each year. E. A. Thibodeaux is manager.

LA GRANGE, LA.—Bids will be received by the city of La Grange until Feb. 4 for the construction of an electric-lighting system, including about 12 miles of power transmission line, substation, arc lamps and distribution system. B. O. Austin of Charlotte (also Box 4, La Grange) is consulting electrical engineer; Anderson Christie of Charlotte are consulting city engineers.

KAW CITY, OKLA.—Plans are being considered for the construction of an electric-light plant to develop about 75 hp., for which $10,000 in bonds were recently voted. Bids, it is understood, will be asked for the work. The Benham Engineering Company of Oklahoma City will have charge of the engineering work.

OKLAHOMA CITY, OKLA.—Estimates prepared by Max L. Cunningham, state highway engineer, place the cost of a power plant for the State Capitol Building at $187,000. The plans provide for the installation of five 250-hp. boilers.

GALVESTON, TEX.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until March 2 for furnishing telephone connections between the United States quarantine station at Galveston and the city of Galveston. For details see proposal columns.

GATESVILLE, TEX.—The electric plant of the Gatesville Power & Light Company was recently destroyed by fire, causing a loss of about $75,000. The plant, it is understood, will be rebuilt. J. R. Raby is president.

Pacific States

GRASS VALLEY, CAL.—The Board of Supervisors has granted the Empire Mines Company to construct an electric railway to connect the Empire and Pennsylvania mines.

OXNARD, CAL.—The Ventura County Power Company has begun work on the reconstruction of its transmission lines. The cost is estimated at $20,000.

SAN BUENAVENTURA, CAL.—Application has been filed by Clarence L. Chrisman with the State Railroad Commission for a preliminary approval of his intention to secure from the city of San Buenaventura a franchise to build an operate an electric plant here.

SANTA BARBARA, CAL.—The Santa Barbara Gas & Electric Company contemplates building an addition to its power station on Quarantina Street, and installing a new generating unit.

SAN LEANDRO, CAL.—Bids will be received by the city clerk until Feb. 19 for the installation of an electrolier lighting system on East Fourteenth Street.

Canada

TRANSCONA, MAN.—Application will be made at the next session of the Legislative Assembly of the province of Manitoba for an act to incorporate the Transcona Electric Railway Company, with power to construct, operate and equip electric railways, and also to carry on an electric light, power and gas business.

BRANTFORD, ONT.—Steps have been taken by the Township Council to secure hydroelectric power for the township.

TORONTO, ONT.—The construction of a civic car line on Dufferin Street from the city limits to the Exhibition Grounds is under consideration.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer of the Panama Canal, Washington, D. C., until Feb. 19 for furnishing steel, chain, pipe, electric cable and wire, electrical attachments and fittings, transformers, etc. Blank forms and general information relating to this circular (No. 1119) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

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ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General Secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill. Semi-annual meeting Hot Springs, Va., May 22-24.

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Printed in the First Issue of Each Month

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WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, 1410 First National Bank Building, Milwaukee, Wis. Annual meeting Milwaukee, Wis., March 15-16.

1,213,150. Method of Producing Magnetic Sound-Records for Talking Motion Picture Films. Henry C. Bullis, Redwood Falls, Minn. App. filed Dec. 13, 1911. Sound-controlled light.

1,213,181. Railway Signaling System. Albert V. T. Day, New Rochelle, N. Y. App. filed Aug. 12, 1908. Block signal systems adapted for operation in connection with electric railroads.

1,213,182. Traffic-Controlling System for Railways. Albert V. T. Day, New Rochelle, N. Y. App. filed Oct. 29, 1908. Improved arrangements of apparatus by which the same line wires may be used to transmit both signal-controlling currents and relay-energizing currents.

1,213,163. Electric Sterilizing-Oven. Nicholas Dedrick, Manitowoc, Wis. App. filed Feb. 5, 1916. Electric heating.

1,213,166. Electric Self-Playing Grand Piano. Charles W. Derricott, Philadelphia, Pa. App. filed July 3, 1912. By aid of electro-magnets.

1,213,174. Electric Welding-Machine; Peter Faszler, Berlin-Friedenau, Germany. Arrangement of the transformer.

1,213,175. Portable Electric Battery; Isidor Fertman, New York, N. Y. App. filed Dec. 16, 1915. Produce a low resistance series connection between the cells with the utmost expedition, and without recourse to soldering or spring connections.

1,213,176. Apparatus for Phonograph-Kinetoscopes; Reginald A. Fessenden, Brookline, Mass. App. filed June 27, 1916. Large audiences.

1,213,180. Recovery of Zinc; Charles H. Fulton, Cleveland, Ohio. App. filed July 17, 1916. Improvements.

1,213,182. Storage Battery; William Gardiner, Chicago, Ill. App. filed May 22, 1915. Improvements in the electrolyte.

1,213,208. Kassette; John Robert Kelley, Covington, Ky. App. filed July 26, 1915. Holder for photographic plates to be used in connection with X-ray apparatus.

1,213,211. Current-Distributing Apparatus; Laurence M. Klauber and Ray C. Cavell, San Diego, Cal. App. filed March 10, 1916. Enabling the electrical connection of any conductor to be altered without necessitating its disconnection from the mechanical support for the conductor.

1,213,250. Means for Receiving Intelligence Communicated by Electric Waves; Greenleaf Whittier Pickard, Amesbury, Mass. App. filed Nov. 8, 1906. Exclusively by the energy of the oscillatory current generated by the receipt of the waves.

1,213,254. Liquid-Heater; Fred Poole, Jewell, Kan. App. filed Feb. 2, 1915. Instantaneous.

1,213,282. Vehicle Signal Apparatus; Edgar S. Shaw, Minerva, Ohio. App. filed May 20, 1916. A simple means for giving proper signals.

1,213,287. Terminal Box; Elda G. Smith, Syracuse, N. Y. App. filed Jan. 9, 1914. Novel features of construction.

1,213,298. Telephonic Relay; Frank E. Summers, Memphis, Mo. App. filed July 11, 1916. Provision of an amplifying relay of the microphonic type in which a diaphragm is provided.

1,213,309. Railway Signaling; Herbert A. Wallace, New York, N. Y. App. filed Jan. 23, 1914. Signaling for stretches of single track over which traffic moves in both directions.

1,213,310. Railway Signaling; Herbert A. Wallace, New York, N. Y. App. filed June 23, 1914. Relays adapted for use in railway signaling systems.

1,213,317. Trucking System; Robert Carleton Weller, Chicago, Ill., Philip Daniel Naugle and Stanley Taber Hyde, Bremerton, Wash. App. filed Nov. 4, 1912. Electrically propelled truck.

1,213,323. Conveying Apparatus; Charles S. Williamson, Chicago, Ill. App. filed Dec. 1, 1915. Method of arrangement and construction of the driving mechanism for the trucks or wheels upon which the legs of a bridge or crane for conveying coal or the like, are supported.

1,213,345. Electric Time-Stamp; Charles S. Ellis, Chicago, Ill. App. filed March 10, 1911. Simplify the magnetically actuated mechanism for operating the time-marking elements.

1,213,353. Electrical Incubator; John David Graves, Colton, Cal. App. filed June 30, 1916. Heat is uniformly distributed over the top of the eggs and the temperature is under perfect control.

1,213,356. Recorder; Ray E. Hall, Ann Arbor, Mich. App. filed July 31, 1915. Type of recorders which produce a continuous line record.

Record of Electrical Patents

Notes on United States Patents issued on Jan. 23, 1917.

1,213,360. Spring Take-Up for Trolley-Wires; Demetrius H. Hart, Birmingham, Ala. App. filed June 1, 1916. Automatically taking up slack.

1,213,364. Socket for Electric Lamps; William Herskovitz, Chicago, Ill. App. filed Jan. 17, 1914. Minimize the number and simplify the construction of hangers.

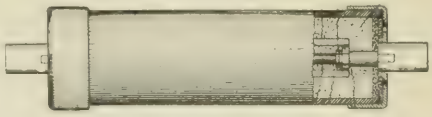
1,213,365. Protecting Means for Electric Circuits; Alfred Herz, Chicago, Ill. App. filed Oct. 2, 1915. Improved potential surge protector for transmission lines and the like.

1,213,393. Connector for Electric Conductors; Hosea F. Maxim, Norfolk, Va. App. filed Feb. 10, 1912. Spring clip.

1,213,406. Indicator; Hubert Peters, Edmonton, Alberta, Canada. App. filed June 11, 1914. Automatically display on a curtain or the like the name of each consecutive street or stopping place as it is about to be reached.

1,213,422. Process of Electrically Welding Tubes; Johann Sacek, Charlottenburg, Germany. App. filed Dec. 13, 1916. Placing strips of the same material as that of the tube along the welding seam inside and outside of said tube, said strip overlapping the seam, and passing an electric current through said strips.

1,213,456. Signaling Device for Automobiles; James K. Burleigh and Lauren V. White, Kalamazoo, Mich. App. filed July 8, 1915. Improvements.



1,213,777. Inclosed Fuse Element

1,213,467. Electric Accumulator; Constantin de Sedneff, Paris, France. App. filed July 28, 1913. Provision of electrodes having a very large active surface per unit weight combined with high rigidity and permeability toward the electrolyte.

1,213,495. Ignition-Timer; Edward B. Jacobson, Pittsfield, Mass. App. filed Dec. 18, 1915. Internal combustion engines.

1,213,507. Electric Heater; James awrence of New York, N. Y. App filed May 29, 1916. Heating element comprises an electric resistance member.

1,213,528. Apparatus for Displaying Advertisements, Signaling and the Like; James Priestnall Naylor, Dulwich, London, England. App. filed Sept. 15, 1913. New and useful improvement.

1,213 535. Galvanic Battery; John Edward Preston, London England. App. filed Aug. 31, 1914. More tightly binding the component clamping parts together to put pressure upon the opposite faces of the disk.

1,213,595. Electric Stove; George Deal, Omaha, Neb. App. filed Oct. 23, 1915. Improvements.

1,213,610. Dynamo-Electric Machinery; Reginald A. Fessenden, Brookline, Mass. App. filed Oct. 4, 1915. Increased efficiency.

1,213,611. Dynamo-Electric Machinery; Reginald A. Fessenden, Brookline, Mass. App. filed Oct. 4, 1915. Production and detection of compressional waves, and still more particularly to submarine signaling.

1,213,616. Means for Producing, Controlling and Utilizing Electric Currents; Charles Edgar Fritts, deceased, late of Oneonta, N. Y. App. filed June 22, 1912. Application of photography and electricity for recording and reproducing such variations or pulsations.

1,213,617. Alternating-Current Motor; Valere Alfred Fynn, St. Louis, Mo. App. filed April 12, 1915. Good starting characteristics and particularly, one which will readily attain the higher speeds for which it is designed.

1,213,618. Alternating-Current Motor; Valere Alfred Fynn, St. Louis, Mo. App. filed April 12, 1915. Start with a powerful torque, operate at one or more speeds while making full use of the rotor copper.

1,213,632. Electrical Connector; William P. Hammond, Passaic, N. J. App. filed March 3, 1916. Detachable connection between wires and the binding posts.

1,213,642. Rain and Wind Signal; Martin Geo Hoeft, Minonk, Ill. App. filed March 1, 1916. Mounted in a window or other opening and which will notify the occupants of the dwelling house or other structure in the event of rain or wind so that the window or other opening may be closed.

1,213,654. Thermostatic Fire-Signal; Archibald B. Jones, San Francisco, Cal. App. filed March 30, 1914. Provision of a device which will operate to signal automatically by the heat given forth from a starting conflagration.

1,213,689. Inductance-Coil; David R. Price, Winthrop, Mass. App. filed April 24, 1914. Tuning circuits, for example, space telegraph circuits, and for loading telephone or other lines.

1,213,702. Governor for Electric-Lighting Generators for Motor Cars; Herbert Charles Humphrey Smyth, London, England. App. filed Oct. 26, 1915. Centrifugal governor.

1,213,705. Electric Cut-Off Mechanism; Minot M. Stevens and Thomas J. Newcome, Hastings, Pa. App. filed Dec. 14, 1915. Improvements.

1,213,709. Signal for Automobiles; Ralph W. Thibodeau, Quincy, Mass. App. filed Dec. 8, 1915. A signal, a lamp circuit connecting the signal with the steering mechanism.

1,213,714. Electrically-Indicating Weather-Vane; Frank L. Washburne, Westfield, N. J., and George E. Kimmerle, Brooklyn, N. Y. App. filed March 13, 1915. Indicate at a distance, the exact direction of the wind.

1,213,723. Indicator System; Adolph Zeisel, Bel Air, Md. App. filed June 24, 1916. Any vertical or other movement may be indicated at any distance whatever, and the amount of the movement is noted.

1,213,726. Impregnated Coil and Method of Making the Same; Leo H. Baekeland, Yonkers, N. Y. App. filed Dec. 4, 1907. Windings are embedded in and supported by an infusible and insoluble organic body.

1,213,738. Rail-Bond; George H. Burge, Huntsville, Mo. App. filed Sept. 23, 1914. Improvements.

1,213,751. Electric Switch; James S. Crossley, Solvay, N. Y. App. filed Oct. 29, 1914. Quick make and break switch.

1,213,754. Flash-Light Lamp; Friedrich David, Brooklyn, N. Y. App. filed Sept. 13, 1916. Manually operative electric switch forming part of a removable cap for a casing.

1,213,777. Inclosed-Fuse Element; Edward E. Roberts, Hartford, Conn. App filed May 8, 1916. Improvement.

1,213,789. Ignition Apparatus; Ellis D. Allensworth, Waukegan, Ill. App. filed Aug. 30, 1915. Render the parts accessible for observation, adjustment and repair.

1,213,790. Igniting and Spark-Distributing Device; Ellis D. Allensworth, Waukegan, Ill. App. filed Jan. 3, 1916. For plural cylinder internal combustion engines.

1,213,798. Incubator-Alarm; Perry S Martin, Broadway, Va. App. filed Feb 25, 1913. Circuit closure.

1,213,799. Electric-Circuit-Breaking Device; Frederic S. Perrin, Brooklyn, N. Y. App. filed April 18, 1916. For use in ignition systems of internal combustion engines using primary or storage batteries.

1,213,803. Art of and Apparatus for Generating and Distributing Music Electrically; Thaddeus Cahill, Holyoke Mass. Renewed Dec. 14, 1916. Improvements.

1,213,804. Art of and Apparatus for Generating and Distributing Music Electrically; Thaddeus Cahill, New York N. Y. This application filed April 27 1915. Improve the character or quality of music that is produced electrically.

1,213,809. Electrical Compression Resistance Unit; Paul J. Ray, Lakewood Ohio. App. filed Jan. 10, 1914. Maximum radiating surface and to be contained in a minimum space.

Electrical World

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ational Engineering Standardization

HE first steps in the direction of machinery standardization, from the engineering rather than e manufacturing viewpoint, were taken by the Amer- an Institute of Electrical Engineers in 1898, and the rst set of A.I.E.E. standardization rules appeared in 899. The success of the movement led to its exten- on, both in this country and abroad. All of the lead- g countries in the world now have national electrical ngineering standardization rules, which define the tings, qualities and performances of plant and appa- tus, without necessarily specifying dimensions or odes of construction. As the work advanced, it was und that standardization could not be effected in ectrical engineering without extending into the fields other branches of engineering, so that it became ecessary to form national engineering standardizing mmittees, with representatives from the principal gineering societies. In Great Britain, for example, e Engineering Standards Committee has representa- ves from a number of engineering bodies, and it for- ulates standardizing rules for engineering at large.

It is hoped shortly to complete, in the United States, organization similar to that which exists in Eng- nd for general engineering standards. The influence such an organization, with representatives from all the engineering bodies, would be very great. It ould not only serve to weld and inter-connect the rious engineering societies in America, but it should so lend a dignity and prestige to American engineer- g which, except by collective effort, can never be won. o movement could be more welcome at the present ne to the advancement of national engineering and of ternational progress than one which united American gineering associations into a single standardizing dy properly representing all branches.

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etting At Trade Fundamentals

TRADE relations between manufacturer, jobber, central station, dealer and contractor have few termining lines of policy to-day. The industry is vake to the need of better merchandising methods, t the policies which underlie methods have not been scussed enough by the leaders of the industries. A able trade in electrical merchandise, in our opinion, ll never be developed until each party in the chain tween the manufacturer and final customer realizes at each must have a chance to make his legitimate ofit for the service he renders. It must pay each man the chain to be in the electrical business or he can- t last.

The dealer who competes locally with the central station that cuts prices indiscriminately can never be a merchant. The jobber who takes the credit risk and assumes the stock-carrying charges as a middleman must get his profit. The manufacturer who has to adjust his prices to meet the demands of a jobber who is also a retailer is at a disadvantage. These questions exist in other industries. In the electrical business there is an unusual opportunity to establish real trade-building policies. We have contractors' and dealers' organizations, central stations, jobbers' and manufacturers' associations. But the real trade discussion between the leaders in these organizations seldom takes place. The ELECTRICAL WORLD believes that each of these associations is working too much by itself on detail situations, all good, but with few connecting threads of policy that tie the whole industry together. Representative jobbers should discuss trade and commercial relations at central station conventions, contractors should be heard in manufacturers' meetings, central stations should be heard in contractors' meetings. The trade and merchandising methods are being discussed in detail by detail men, but the trade and merchandising policies which underlie methods need the thought of the leaders in every group.

Graphical Presentation of Wire Properties

ELECTRICAL men are much interested in wires and their properties. Even so-called "wireless" men use wires extensively in their radio constructions. Wires possess mechanical, electrical and thermal properties. These properties need to be expressed in units of some kind. In the world at large there are two kinds of units, namely, scientific or civilized units, and unscientific or uncivilized units. The scientific units are the international metric units. The unscientific units are the British, American, Turkish, Arabic and other varieties. Sooner or later all of the world will adopt the international metric system.

For the inter-comparison of the properties of wires in metric and in non-metric units, tables or charts are desirable. Among comparison tables are the wire tables of the U. S. Bureau of Standards and the tables of H. M. Hobart. The article by Andres Ham, which we print this week, offers a convenient chart for presenting the same comparison graphically. For American wire gage the lines on such a chart have the advantage of being simple, straight lines. A chart of this kind is useful for reference, even when there is no need to transfer from metric to non-metric units or vice versa.

A Dummy Antenna for Testing Radio Units

WHEN electrical engineers test a dynamo machine they are not likely to disturb engineering operations in other buildings, or even in other parts of the same building. When, however, they test a radio plant of considerable power they are likely to disturb the ether for hundreds of kilometers in all directions. A need arises, therefore, for a dummy antenna, or a radio load for testing radio generators, which shall not seriously stir up and vex the ether in the vicinity. The problem is to load the generator but to suppress the output beyond a short range. This is a problem in radio inefficiency, and is just the reverse of the ordinary problem of the radio engineer, which is to load his generator as efficiently as possible, so that the effects may be manifested at a great range.

The article on page 278 describes a dummy antenna at Palo Alto, constructed by the Federal Telegraph Company. It consists evidently of a bed of horizontal galvanized iron wires in five layers, so arranged as to be capable of forming an air condenser of adjustably variable capacitance up to about one-thirtieth of a microfarad. With such a capacitance carrying 250 amp. at 20,000 cycles per second, the voltage, neglecting all losses, would approximate 64,000. Sixty-four kilovolts driving 250 amp. in quadrature would develop 16 megawatts of reactive power. An active power rating of 200 kw. would thus only demand a little more than 1 per cent of dissipation factor. It is evident that this dummy has large dissipation possibilities.

Uniflow Engine Economics

THE article in this issue by E. Hagenlocher on the use of the uniflow engine in electric plants gives our readers a welcome idea of the present state of development of this particular type of reciprocating engine. The principle of the machine is well known, the fundamental purpose being to lessen the temperature variations which produce condensation in the steam cylinder by causing the steam flow to maintain a uniform direction with respect to the cylinder walls instead of alternating high and low temperatures. The steam enters the cylinder at the heads and is exhausted in the middle, producing an economy equivalent to that obtained from multi-cylinder engines of moderate rating, but in a far simpler and less costly form. It would be interesting to know, although difficult actually to measure, the cylinder wall temperatures and the lowered condensation secured by this design, since it seems, in the engines here described, to have been worked out in an efficient and scientific manner. The use of the poppet valve, for instance, is a step toward efficiency, particularly if superheated steam is to be used, and a large area of exhaust port also tends to improve the thermodynamic conditions. The results which Mr. Hagenlocher quotes certainly speak well for the designing skill that has obtained from a small and comparatively simple engine, results which would be creditable to ordinary compound engines of considerably greater output. The performance, too, may well challenge comparison with that of turbines of similar size, and if run non-condensing the difference would be still more noticeable. As indicated by the figures before us, the uniflow design seems to give specially favorable results at low and moderate loads, a particular point of excellence for which the steam turbine has earned a reputation. There seems to be no doubt that the great use of the turbine has been a very valuable stimulant in producing improvement in the design and performance of reciprocating engines, so that the latter, especially in the smaller sizes, seem to have taken a new lease of life. Data like those presented are a good indication that progress is still possible along this and other lines to improve fuel economy, which is the goal of modern steam engineering. The saving in coal shown in the example given by Mr. Hagenlocher is particularly striking, since the comparison is between a modern high-efficiency uniflow engine and those of more common type, all operated non-condensing. Such conditions represent a type of plant which in no small number of instances has to be used owing to local conditions. It is the small plant operated under variable load which is notorious for high steam consumption, and the present improvement, directed to remedying that condition, is therefore all the more important in practice.

Naval High-Powered Radio Stations

THE opening of the new naval radio station, located just outside of San Diego, Cal., marks the latest step toward the completion of the ambitious plans formulating for some years past. It will be remembered that when the Arlington, Va., naval radio plant was put into service four years ago it was not only the strongest wireless station in the world, but the first of a projected series of powerful installations. It was intended for direct trans-oceanic and trans-continental naval radio service, and, with the distant stations to be erected at various outlying points, was to provide instantaneous communication from Washington to any of our war vessels on the Atlantic or Pacific. Arlington's range has, in fact, extended from Panama to Nova Scotia, and from Gibraltar to the Pacific Coast. Until the San Diego plant was put in commission a few weeks ago, however, there was no naval radio station on the West coast which had sufficient power to work reliably across the continent to Arlington.

The San Diego transmitter is one of a group of five new high-powered sustained-wave plants using arc generators, and is rated at 150 kw. This is nearly as large as the great Sayville station which has been used to communicate with Germany. Not long ago it was thought impossible to build arc oscillators of such large input power, and even yet the efficiency of these enormous gas-discharge converters is held by some authorities to be necessarily low. Neverthelss, American commercial radio-engineering development has produced still larger arc generators, whose rated input power runs as high as 350 kw. Record-breaking apparatus of this sort is to be used in the naval radio station now building at Cavite, P. I., for direct communication with the North American continent.

When the projected plants in Hawaii, Guam and Alaska are opened and placed in wireless connection with Cavite, Panama, San Diego and Arlington, our Navy Department will be well started on its world-embracing communication scheme. The next step will be to build up, demonstrate and maintain reliability of service, for unless messages can be sent through under practically all conditions the system will not have that dependability which is so necessary in commercial and proper military operations. On the opening day, San Diego is reported to have communicated with Panama, Alaska, Arlington and Australia, over distances up to 6000 miles. This argues well for the station's effectiveness; continued ability to communicate over such vast spans of land and sea must not only be hoped for but secured, if the expense of the stations is to be justified.

Daylight Saving

DAYLIGHT saving possibilities have now passed from interesting suggestions to strong probabilities. The convention just closed has made it evident that there is throughout the country, and especially from boards of trade and chambers of commerce, a considerable demand for at least trying out the plan as quickly as possible, and that there will be vigorous pressure for the passage of the Borland Bill before the end of the present session. Whether it can be pushed through in the short time now remaining is another matter. The interesting feature of the discussion is that so far no organized opposition has shown itself, and in default of this there is no brake upon legislative action. The present sentiment seems to be a spontaneous manifestation, and the only objectors so far have been a small conservative body of astronomers whose influence in legislative matters is negligible, and a certain section of the lighting supply companies whose opposition is viewed with suspicion by the man on the street.

Looking at the proposition in perfectly cold blood its effect on the lighting industry does not seem likely to be great except perhaps in some strictly local manifestations. If the plan should be put through to take effect, for example, from May 1 to Oct. 1, it is dealing with a part of the year in which the lighting load of central stations is relatively small, and of this load only a portion is likely to be affected. The results would be chiefly manifest in a diminution of the residence lighting, itself rarely in a considerable percentage of the output, and even here the load would probably be cut by only a very modest amount, the loss of which ought to be easily recouped by additions to the appliance and miscellaneous service.

A striking feature of the discussion was the fact that the questions raised were not regarding the desirability of the movement, but chiefly with the particular way in which it should be applied. Some early rising enthusiasts were anxious to have the change carried throughout the year. Obviously a very little experience with going to work while the street lights were still burning of necessity would affect an automatic cure of this perfervid desire for early rising. Our country extends over so wide an area north and south that any change of clocks must be made rather cautiously to avoid overdoing it along the northern border. The soundest argument advanced was the extra time given for recreation by the artificially lengthened day, which probably accounts for the active co-operation on behalf of some of the labor interests. Another argument advanced based on the probable lessening of eyestrain by the change seems quite unwarranted by the facts, since within the months in which daylight saving could be carried out without losing as much at one end of the day as one could gain at the other, the amount of work done by artificial light is very small, and the only period within which the use of the eyes would be greatly reduced either in business or pleasure would be after the clocks were put back to their normal place.

It will be difficult in a country governed as is our own to get a consensus of opinion to enforce the change. After the present time-belt system was formally adopted, largely by the influence of the railroads, it took some years to make the change of the clocks anything like universal, and indeed some places even now rejoice themselves in two or three kinds of time after the lapse of more than thirty years. Of course, legislation for the change in all matters with which the United States government has to do, including interstate railways, would practically push the system into use if backed up, as seems to be the case, by local enthusiasm. Yet it might be a long time before it became universal. It must be borne in mind that the conditions in this country are quite different from those in the European countries which initiated the change, and that conclusions drawn from its effects noted during the last summer are disturbed by the entrance of many factors which have nothing to do with the case. That the clocks can be set forward and backward without any particular difficulty as regards public convenience seems, however, to be well demonstrated.

Coming Issues

IN the next issue of the ELECTRICAL WORLD a leading article by Prof. Alfred Still will take up the technical and engineering problems involved in the design of high-tension terminals and bushings to meet operating conditions of transmission systems. Other articles will discuss other engineering problems from technical and scientific viewpoints. The issue dated Feb. 24 will, as usual, contain articles dealing particularly with the commercial side of engineering problems. One article will take up a plan for graphic analysis of load factor improvement. In the first issue for next month, dated March 3, matters of public policy and the broader phases of problems in the management of public service properties will be discussed. The next issue of ELECTRICAL MERCHANDISING will be issued on the 15th of this month and will present selling suggestions worked out especially for spring house-wiring campaigns, together with a new department on store equipment for the electrical dealer.

Characteristics of Uniflow Engine Generating Units

Features of Construction and Performance Characteristics of Uniflow Engines, and Fields of Application in Which They Show High Operating Economy

By E. Hagenlocher
Member Engineering Staff J. G. White Engineering Corporation

THE economy effected by the use of the uniflow engine in power stations of moderate size is far greater than the average engineer will imagine unless he has kept constantly in touch with the most recent developments. For this reason the writer has assembled in what follows here the main features of uniflow engine applications, designs and operating characteristics, together with test data. By the uniflow engine is meant that construction which makes use of the uniflow or central flow of steam through a cylinder. That is, steam is admitted at the ends of a cylinder, expanded and discharged through ports midway between the cylinder heads. The ports are uncovered by the movement of the cylinder piston as an exhaust valve during its travel. The construction is shown in Figs. 2, 3, 4 and 5. Since the steam is exhausted at the middle of the cylinder, the cylinder heads are always maintained at the temperature of the live steam entering and the central part at the temperature of the exhaust steam.

The main reason for the uneconomical performance of the simple one valve engine is found in the large amount of steam condensed during each stroke. This design has therefore been best adapted to low pressures and temperatures. The condensation is due in part to the excessive clearance spaces and surfaces in the steam passages, and to the total range in temperature alternately heating and cooling the cylinder walls. Further limitations of the slide valve are that the advantages incident to the use of superheat can not be obtained on account of troubles due to warping, lubrication and leakage due to dryness of high-temperature superheated steam.

The design of the four valve engine shortened up the steam passages and thus reduced the condensation by a certain amount. The Corliss type of valve is suitable only for slow speeds, while the poppet valve type is now the nearest single cylinder competitor to the uniflow design on account of the high pressures and temperatures which can be used.

The multiple expansion engine obtains its high efficiency by the reduction in the range in temperature to which the walls of each cylinder are subjected.

The uniflow engine reduces condensation by not allowing the low temperature exhaust steam to cool the portion of the cylinder walls and clearance spaces which come in contact with live steam. This action is more fully described later. Steam passages are also reduced to a minimum and valves are used which will permit the use of high temperature and high pressure steam. On account of the uniflow or central flow principle of operation, the temperatures of the cylinder heads and clearance surfaces in this design are high on account of the heat of compression raising the normal temperature. These two factors are the principal ones which contribute to the economy of the engine, and make possible results which are better than those obtained with four valve engines and comparable with those obtained from compound and multiple-expansion engines.

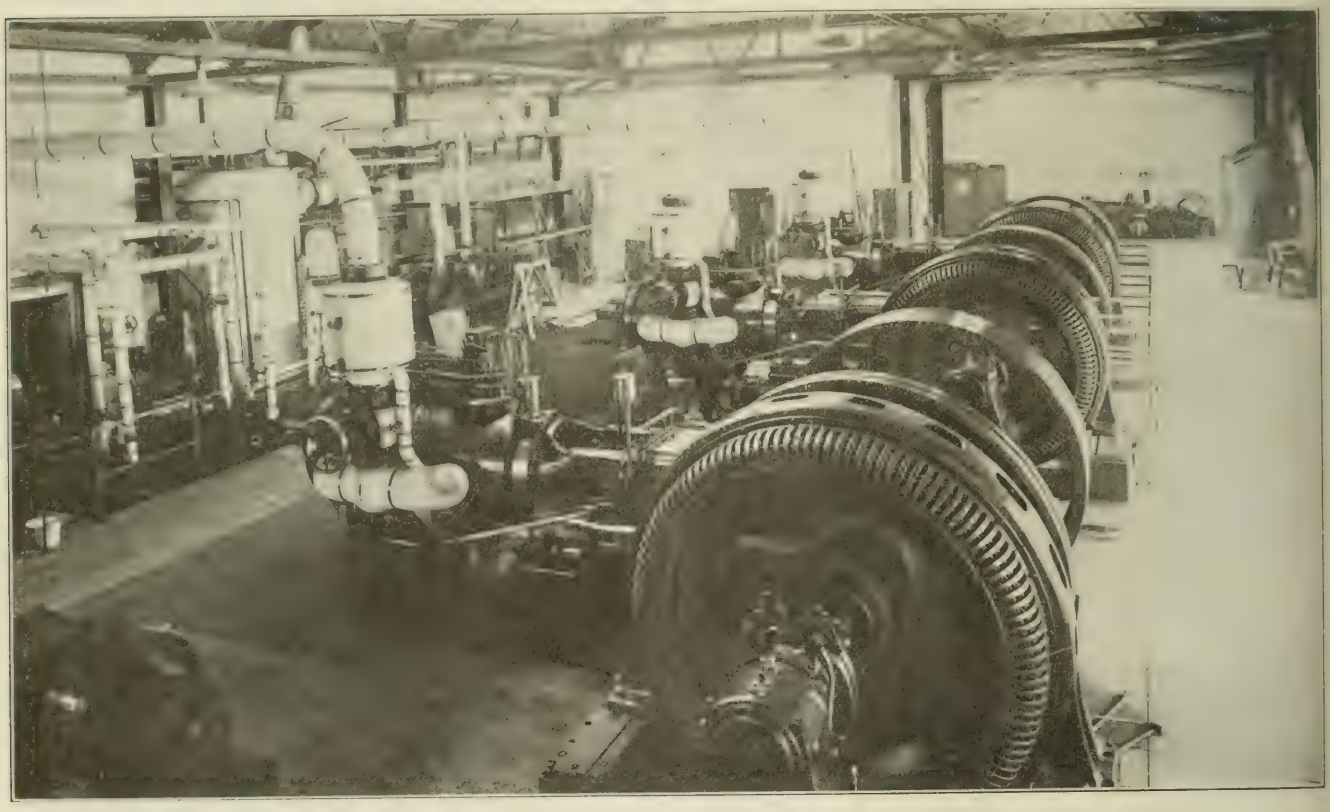
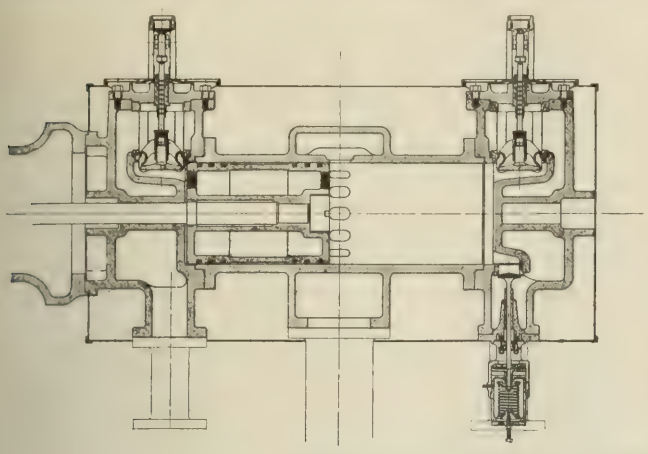


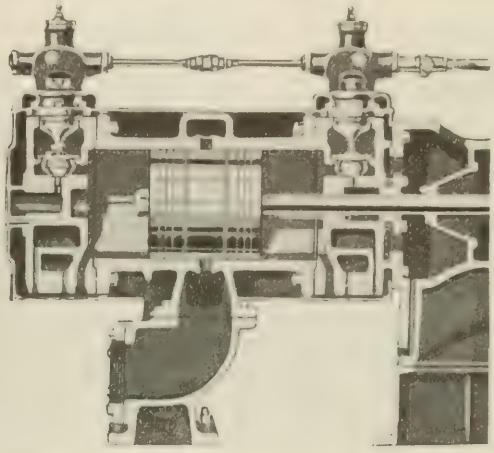
FIG. 1—THREE 21 BY 22-IN. UNIFLOW ENGINES OPERATING CONDENSING AND NON-CONDENSING IN WOODHAVEN (L. I.) MANUFACTURING PLANT

Jacketing of Uniflow Engines

The heads and ends of the cylinder up to the point of cutoff are usually jacketed with live steam when operated on steam having little or no superheat. For

higher pressures and superheat less steam jacketing is necessary. The greatest amount of condensation takes place at the piston surface, which in most cases is not steam jacketed. Any steam that may have become wet by coming in contact with the piston is necessarily near the exhaust ports and is therefore expelled with each stroke of the engine. The steam trapped for the compression part of the stroke is comparatively dry and receives heat from the jackets and from compression. Jackets need to be thoroughly drained to prevent accumulation of condensation in them.





FIGS. 2 AND 3—SECTIONS OF NORDBERG AND AMES UNIFLOW ENGINES

Uniflow engines are governed by changing the lift of the poppet valves, which is accomplished by increasing the throw of eccentrics. Some governors are mounted in the flywheels while others are on the lay shaft, alongside the cylinder, which drives the eccentrics. It is of great advantage to have governors which are adjustable while running, where several engines, connected to alternators, are to be synchronized and paralleled.

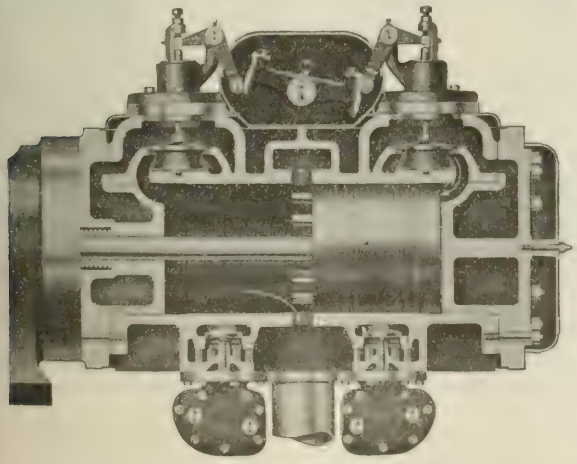
Inlet Valves of Uniflow Designs

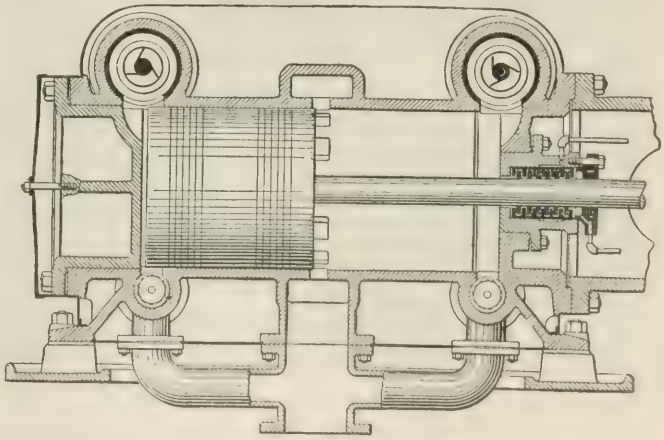
The main differences in the uniflow engines on the market to-day appear to be in the arrangement of valves, valve gear and methods of adapting the engines to condensing and non-condensing conditions. The inlet valves may be of any type—that is, poppet, Corliss, piston, slide, etc.—but are more commonly poppet type on account of the quick opening and closing features and adaptability to high temperatures. The poppet valves are usually of the balanced type, designed with the view of having them tight under all conditions of temperature and load. This requires that they be made either with the seats expanding at the same rate as the valve body or made in such a way that the parts of the valves are separate and self-adjusting. It is very necessary that the inlet valves remain tight as in the uniflow engine compression extends over a large part of the stroke, about 90 per cent, and any leakage will tend to increase the pressure to a higher point than desired, in addition to requiring more power for compression. When poppet valves are used they are operated either by cams connected through bell cranks or straight rods to the eccentric on the main shaft or directly by cams mounted on auxiliary shafts parallel to the piston travel.

It is essential that there should be as little lost motion as possible in the valve gear, as even the maximum opening of the poppet valve is quite small and at very light loads the motion of the valve stem can hardly be detected. Therefore it would seem that the most direct motion is the most desirable from the standpoint of keeping its regulation and economy maintained after years of service.

Exhaust Valves for Uniflow Construction

As already mentioned, the exhaust is usually taken through ports extending around the middle of the cylinder, with the piston acting as the exhaust valve. The use of a ring of exhaust ports around the middle of the cylinder allows the area of the exhaust ports to be several times that obtained by using other forms of valves. This aids greatly in quickly bringing the cylinder pressure down to that of the exhaust, and is quite necessary because the duration of the exhaust is less than in the counterflow engine.





FIGS. 4 AND 5—SECTIONS OF SKINNER AND YORK POPPET-VALVE UNIFLOW ENGINES

Auxiliary exhaust valves are sometimes provided to reduce the amount of steam being compressed when running non-condensing. One type of engine changes the amount of steam compressed from condensing to non-

condensing operation, when the vacuum fails, by the automatic operation of these valves with additional valve gear, which delays the point at which compression starts. Another accomplishes a similar result with self-acting valves, which increase the clearance spaces for the latter condition.

The auxiliary exhaust valves which are operated by

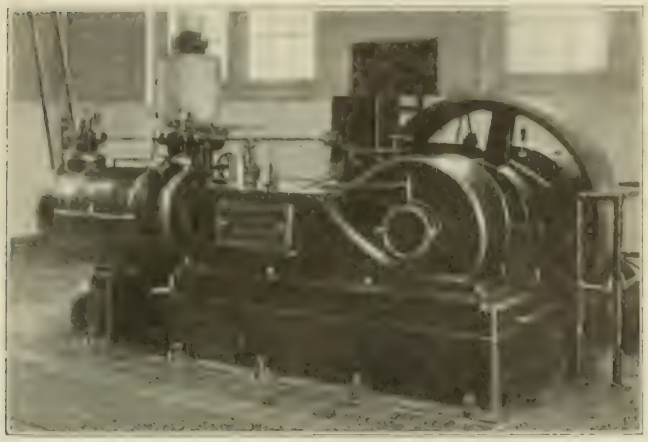
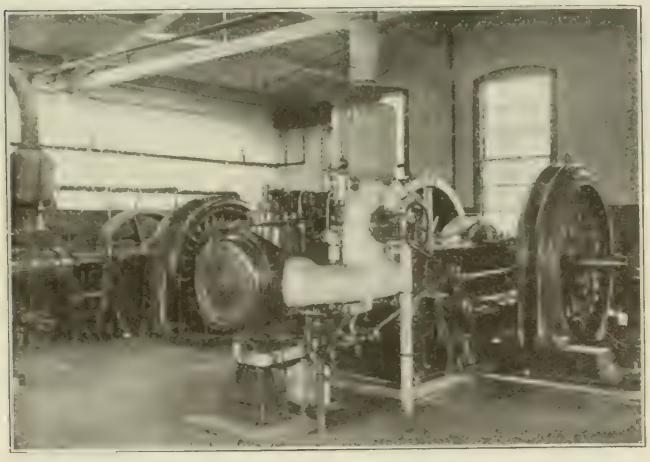


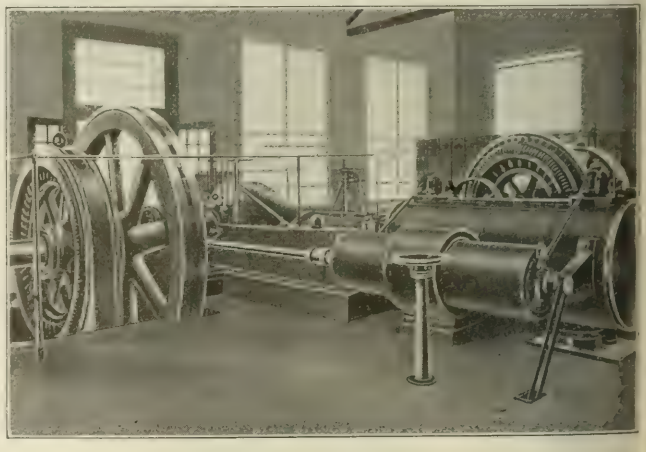
FIG. 6—NON-CONDENSING 17 BY 20-IN. UNIFLOW-ENGINE INSTALLATION

valve gear are also poppet type, but they do not need to be balanced as they are opened only when the pressures on the two sides are equal. At light loads and at starting there is a tendency for these to create noise due to the expansion of the steam being so great that the pressure is less inside the cylinder than outside, allowing these valves to lift. Those types of auxiliary valves which act without valve gear increase the clearance volume or eject the steam in case the compression becomes too high.

Location of Inlet Valves

One of the important differences in designs of uniflow engines now on the market is the manner in which the inlet valves are placed relative to the cylinder. In one design the valve casings are a part of the cylinder, in another a part of the heads, and in still others they are





FIGS. 7 AND 8—A 17 BY 20-IN. UNIFLOW ENGINE RUNNING NON-CONDENSING IN A BAYONNE (N. J.) COTTON-WEAVING MILL; AND A CENTRAL-STATION UNIFLOW-ENGINE INSTALLATION AT BARSTOW, FLA.

removable, and located either in the ends of the cylinder or in the heads. The valves are placed either with the stems vertical or horizontal, and usually at right angles to the piston rod.

Condensing and Non-condensing Operation

Low boiler pressure or high back pressure requires greater clearance in uniflow engines, and this tends to reduce the economy. In order to get compression equal to the initial steam pressure, a less volume of steam is required while running non-condensing than for condensing, because of the greater density of the latter. This means that a non-condensing engine must have more clearance or the amount of steam for compression must be reduced. For an engine with a fixed low clearance auxiliary valves are necessary to delay the point at which compression starts. Where clearance pockets are provided the additional steam can be compressed in these to prevent excessive pressure. A higher economy is probably obtained by the former method at an expense of additional valve gear. In the latter the conditions reduce the economy about in proportion to the clearance pockets. Engines built for non-condensing service are usually fitted with pistons of a special pattern, such as concave face, which give more clearance without the necessity of changing the cylinder.

Speed Regulation of Engines and Parallel Operation

The regulation of a uniflow engine is usually much better than a counterflow. There are engines on the market that will easily regulate within one revolution in 200 from one-quarter load to full load. At very light loads the speed is likely to be somewhat variable, but if there is a constant dead load, such as friction and windage of a direct-connected generator, this trouble will not be noticeable unless the generators are of the alternating current type, in which case there may be difficulty in synchronizing.

At very light loads, especially if the machines are running in connection with condensing equipment, there is an unstable condition presented where the speed is liable to change, which makes it difficult to synchronize. Difficulties have been encountered with three engines working together under equal loads. They may continue to operate satisfactorily for an hour or so, then when a slightly heavier load is required they will take it very unequally, perhaps to such an extent that two of the machines may throw the third one out. It has been found necessary in one installation where flywheel governors were used to put motors in the flywheels so that the speeds could be changed with the engines running.

Parallel operation of uniflow engines with older types of steam engines has been accomplished without any difficulties in many installations that have been made.

Maintenance of Equipment

Due to the newness and undeveloped state of this type of engine, statements as to present maintenance should not be considered too seriously, as the troubles that are now arising are being rapidly overcome. It may be

expected that the higher the superheat the greater the maintenance on account of difficulties incident to lubrication and packing. Most of the engines which have come to the writer's attention have operated for a year without any maintenance. On others there have been troubles consisting of governor adjustments for synchronizing and load division troubles, need for eliminating noise at light and heavy loads, piston rod packing, cylinder replacements, and need for increased strength of valve gear.

It should always be recognized that for the best operation the additional cost of having a good engineer in charge will usually be more than returned by savings in maintenance and fuel, as the poppet valve gear must be kept in adjustment to maintain uniform economy.

Essential Points When Testing

Temperature due to a preceding load is a very important factor affecting economy, as considerable time, compared with the period of testing, is required to obtain the proper constant temperatures for a load. This is a point usually undervalued, as test runs are often made as rapidly as possible, and since accurate tests for a certain load condition can be made in less than five minutes if the equipment is adequate. Drainage water from steam jackets should be considered as adding to water rate of engine. Quality and pressure of steam must be kept constant and at the proper value. Adjustment of valves should be made as equal as possible. Indicators should be used to check the pressure gages in the steam and exhaust lines.

If tested with an alternating-current generator and water box load care should be taken to calculate efficiencies of the generator at 100 per cent power factor and correct the results of pounds of steam per kilowatt-hour obtained for 80 per cent power factor efficiencies if the guarantees are made on the latter basis.

Variations from Standard Conditions (Corrections)

The guarantees of some manufacturers give the following corrections for variations in steam conditions:

For each pound of back pressure in the exhaust additional to that of the atmosphere, the steam consumption should be increased about 0.6 lb. per indicated horsepower-hour for pressures of about 125 lb. per square inch and 0.5 lb. for pressures around 140 lb. per square inch.

If superheated steam is used instead of saturated, reduce the consumption at all loads, both for condensing and non-condensing operation about as follows:

50 deg. superheat	1.75 lb. per indicated horsepower-hour
75 deg. superheat	2.25 lb. per indicated horsepower-hour
100 deg. superheat	2.50 lb. per indicated horsepower-hour
150 deg. superheat	3.00 lb. per indicated horsepower-hour
200 deg. superheat	3.25 lb. per indicated horsepower-hour

Corrections for Pressure Variations

The increase in economy due to an increase of pressure is greater at lower pressure than at higher. This increase is not so great with condensing as with non-condensing operation. The following approximate figures will illustrate these points, which refer to average loads for one make and size of uniflow engine:

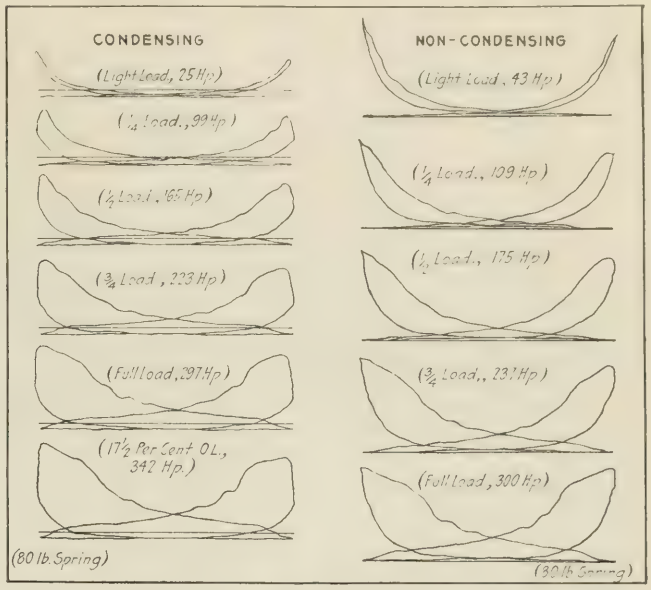


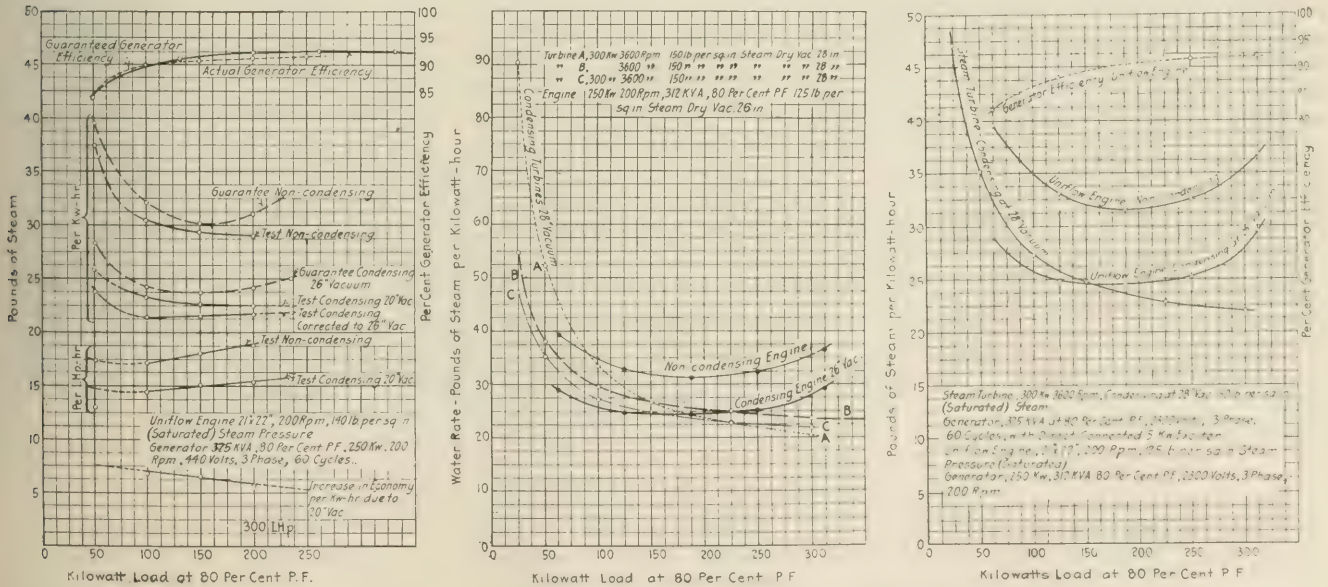
FIG. 9—INDICATOR CARDS TAKEN DURING TESTS OF 21 BY 22-IN. UNIFLOW ENGINE, THE PERFORMANCE OF WHICH IS SHOWN IN FIG. 10

Pounds of Steam per Indicated Horsepower-Hour

Pounds per Square Inch	Non-condensing	Condensing
100	21.5	15.5
125	19.5	14
140	18.5	13.5

Corrections for Vacuum Variation

The following corrections were made for the engine whose curves are shown in Fig. 10. Although these corrections may not be absolutely accurate, they are the best that could be applied at the time and are more



FIGS. 10, 11 AND 12—ECONOMIES OF TURBINES AND UNIFLOW ENGINES

Guarantee and test performances of 21-in. by 22-in. uniflow engine; comparisons of uniflow engine with three competitive turbines; and guarantees of units for a plant, the performance of which is given on page 264. The water rate for the turbine in Fig. 12 includes excitation.

likely to be insufficient rather than too great. The values of economy obtained in condensing tests at 20 in. vacuum were subtracted from those obtained in tests made at the same time with exhaust at atmospheric pressure. The differences were plotted and form the curves shown at the bottom of Fig. 10. This shows the benefit derived from 20 in. vacuum, and other pressures were considered to be in proportion. An average value for each inch of mercury is about 0.3 lb. per kilowatt-hour.

Field of Application

The uniflow engine at present competes for all positions in the entire field of the steam engine in sizes up to approximately 500 hp., and is approached in economy only by multiple expansion engines and recent types of four-valve engines. It is capable of quite high overloads without a great increase in steam consumption, and is therefore suitable for service where the loads are subject to wide fluctuation, such as electric power for both lighting and traction, rolling mill service and general power. Also for load conditions such as occur in refrigeration, where the unit would be so small that a multiple expansion engine would not be considered on account of its high initial cost. For mixed service—that is, condensing and non-condensing operation—the uniflow engine is preferable to the turbine, and for condensing operation it is a close competitor.

In places where economy is not of prime importance there is no particular advantage to be gained by this type, as there is no doubt that more development is needed to make it as universally applicable and inattention proof as the counterflow with its more rugged mechanism.

If exhaust steam is used at all times there will be less additional benefit derived from the uniflow design over others. In a great many cases exhaust steam is used for heating during cold weather only, and here the advisability of using a uniflow engine would depend upon the particular installation. Some engines are equipped with a device which will automatically accommodate the engine to the required conditions of exhaust. This device is of great help in maintaining good economy in a plant which runs under such varied conditions as condensing in the daytime and non-condensing at night. When engines are run condensing during certain seasons only it will pay to change pistons if the engines do not change over automatically.

If the plant is to be run condensing, however, it will be found that the uniflow has great advantages, because the equipment can be smaller as a result of its economy with a consequent saving in fuel, reduction in upkeep and smaller boiler room. If non-condensing and the exhaust is not to be used, there will be a saving in boiler room, equipment, fuel and water.

The space taken up by the uniflow is not materially different from that of the single cylinder counterflow engine, while the smaller space taken up by the turbine will be of advantage in some cases. In the case of the installation referred to later, the engine could be included in a space 15 ft. by 20 ft. approximately, while the turbine required but 5 ft. by 16 ft. The additional length of the cylinder is the principal change in the dimensions of a uniflow compared with a single cylinder engine of the counterflow type.

Load Conditions

Since the low steam consumption per horsepower-hour at light loads (one-quarter load) is practically the same as at full load, this engine is eminently suitable for use in plants that run a considerable length of time at low loads, and it is in this field that the engine has become most popular. In steel mills the load factor is very low and an engine of this type is desirable.

Many central stations and isolated plants have a low-load factor, whereas manufacturing plants usually have a steady load. It would appear, therefore, that in the latter case the advantage of the uniflow would not show to such a great extent. However, in these plants it often happens that one engine is kept running at night to supply a very light load, and it will be economical to use one of the large uniflow units for the light loads, because the necessity for having a small auxiliary machine is eliminated.

Analysis for Determining Exhaust Conditions

To decide between non-condensing and condensing operation requires the same analysis that is used for other types of engines, as shown in the tabulation below:

Relative Advantages and Disadvantages of Condensing Operation Over Non-condensing

First cost	Higher
Life in years	Shorter
Interest on amortization fund	Higher
Interest on capital	Higher
Taxes	Higher
Yearly cost of operation	Lower
Yearly cost of maintenance	Higher

Analysis of Economies and Operating Results

When considering results of operation or test, the following points should be looked into very thoroughly:

Kind of coal being used.
Exhaust conditions (back pressure or vacuum).
Steam conditions (quality and pressure).
Distribution of load between units of various sizes and types.
Periods of light and heavy loads.
If economy is expressed in pounds per kilowatt-hour, the efficiency of generator, including excitation and rheostat losses, friction and windage of generator (if direct connected), should be charged to the engine.

Since most operating figures are given in terms of the coal used they will depend greatly upon (in addition to the above) the method of firing and condition of boilers, efficiency of auxiliary apparatus, etc.

The results which follow were obtained in an electric light plant, which, in 1915, operated the following equipment:

Unit No. 1—150-kw. simple non-condensing engine, direct connected to a 2300-volt generator.
Unit No. 2—70-kw. simple non-condensing engine, direct connected to a 2300-volt generator.
125-hp. boiler H.R.T. 125 lb. per square inch.
254-hp. boiler W. T. 125 lb. per square inch.

These units were used practically all the time in 1915.

Unit No. 3, a 250-kw. uniflow engine, was installed in 1916 for non-condensing operation. Slight changes were made in the boiler room consisting of the installation of a balanced draft system, blower, soot blower and increasing the combustion chamber by lowering the grates. Unit No. 3 carried practically all the load during this period, with No. 2 helping a few hours each day on the peak.

OPERATING RESULTS FOR THE PLANT CONSIDERED

	Month of October		Ten-Month Period	
	1916	1915	1916	1915
Total kilowatt-hours generated	75,830	49,900	538,870	404,134
Peak kilowatts (see note)	318	197	318	209
Load factor—hourly average in per cent.	32	34	22.8	26.7
Pounds coal per kilowatt-hour	5.49	13.7	6.64	12.5
Total coal burned (tons—2000 lb.)	212.3	342.6	1760.3	2537.3
Cost of fuel	$595.34	$993.79	$4,732.21	$7,621.55
Generating cost per kilowatt-hour	$0.0163	$0.0285	$0.0192	$0.0300

Note: Coal used was Susquehanna bituminous at $2.818 per ton.
Peak kilowatt—average of difference between watt-hour readings for one hour.

From the above it will be seen that, for the same ten-month period, the coal saved in 1916 over that used in 1915 amounted to $2,880, or $3,460 per year. This is at a rate which will pay for the engine and its installation in less than two years' operation.

Iron-Wire Line Built to Serve Small Communities

Details for the Construction of an Iron-Wire Steel Pole Transmission Line 30 Miles Long, Operated at 22,000 Volts, Together with Material and Labor Costs

BY M. D. LESLIE

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RELATIVELY inexpensive forms of transmission-line construction have had to be developed lately in the Middle West, as an economic expedient, to serve small communities which are located far from central stations. One line which fulfills operating conditions has recently been built between Dodge City and Bucklin, Kan. The line, which is about 30 miles long, extends in a southeasterly direction, following a road parallel to the Arkansas River and passing through the town of Ford. Bucklin has a population of about 800. Ford has a population of about 300 persons, and had never had electric service. In order to make service available the city built a distribution system which it leased to the company operating the transmission line as soon as the latter was completed. The territory served is not thickly populated, nor are there any other towns of importance within convenient reach of the line. The principal business obtainable is the commercial lighting and power in the two towns, and power for a few grain elevators. The line was designed on the basis of a present peak of 50 kw., with a future capacity of 75 kw. Owing to the length of the line and the small amount of business obtainable, it was necessary that the construction be inexpensive and the upkeep low for the fifteen years of the lease.

The line as constructed operates at 22,000 volts, three-phase, 60-cycle, and consists of three No. 6 EBB galvanized-iron wires mounted horizontally 4 ft. apart on steel arms. Thirty-foot 4-in. Bates expanded steel poles are employed, being set in concrete 300 ft. apart. Every



FIG. 1—RAISING 35-FT. EXPANDED-STEEL POLE

half-mile one pole is head-guyed both ways in the direction of the line. Corner poles and railroad crossings are double-armed, 35-ft. poles being used at crossings.

The general conditions were favorable to the use of iron wire, as the market prices were such as to make the cost of a copper line almost prohibitive, even considering the possibility of using a lower voltage. Since iron wire had been used quite successfully on short lines in other parts of the State, the length of this line was the only factor that caused any misgivings regarding the successful use of iron wire in this case. At the time this line was designed, no information could be located concerning the electrical characteristics of iron wire. EBB wire was chosen on account of its low resistance,

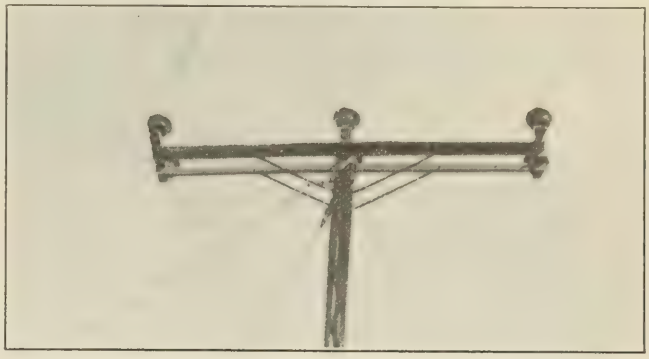


FIG. 2—DOUBLE ARM CONSTRUCTION USED AT CROSSINGS

and the fact that the current would not be more than 3 amp. per phase. The government report on iron wire for transmission purposes (*Bulletin No.* 252) indicated that No. 6 EBB wire would have a lower effective resistance than the other grades for currents up to about 3 amp. Beyond this value the better magnetic properties of the harder wires give them the preference. More recent information indicates that the line loss will be greater than originally estimated, but it will not be sufficient to make any considerable difference for some time to come. In a short time instruments will be available at both ends of the line for conducting adequate tests to determine its characteristics. Curves taken at the end of the line show the voltage excessive at times, but seldom does it drop below normal.

Unexpected difficulties were experienced in calculating the sag, as no tables or curves for this class of work were available. The high modulus of elasticity and low coefficient of expansion of iron makes the use of standard formulas very difficult. This line was designed to withstand a 0.5-in. coating of ice and a 30-mile wind pressure, or a loading of 0.7 lb. per foot. The stress allowed with a maximum sag of 6 ft. at zero deg. Fahr. the temperature of maximum loading, is 75 per cent of the ultimate strength of the wire. Close examination of the problem shows that the unstressed length of the conductor even at 60 deg. Fahr. is less than the span length. No results in the way of a sag curve were obtained until formulas by K. L. Wilkinson, published in the ELECTRICAL WORLD of Feb. 6, 1915, page 336, were located. These permitted a rapid and comparatively simple solution of a difficult problem. The assumptions made for this line were based on the records of the local branch of the U. S. Weather Bureau, which indicate that the loading is more than sufficient. Tests on the wire show it to be somewhat stronger than the values given by the manufacturers.

The original plans for the line called for 30-ft. 7-in. top treated wooden poles set 250 ft. apart, with a triangular arrangement of conductors. After consideration

of life, maintenance and interest charges, steel poles were purchased instead, one of the principal considerations being the destruction of wooden poles by fire and lightning. The steel poles make an attractive line and impress the public with their reliability and permanency. Comparative tests showed that the 4 in. steel poles will fail with a pull of about 1200 lb. at the top, while a 6-in. top 30-ft. wood pole will withstand over 2000 lb. pull without any damage. The wood pole which was tested was one that had been in service for about five years, and had decayed about 1 in. deep from the ground line to the butt. In testing the steel poles, the first was erected in frozen ground and failed by the collapse of the braces below the ground line.



FIG. 3—CLIMBERS USED BY LINEMEN

The second pole was set in concrete and failed by twisting about 5 ft. above the ground. In the construction of the line, two poles failed. One, which was a double-armed pole, failed to drop to the bottom of the hole when being erected and toppled over, bending the pole edgewise about 8 ft. from the bottom. The second pole was pulled over by a wire joint which caught on the arm while pulling in slack. Without relieving the stress on the wire, one of the linemen climbed to the top of the pole, and his weight, with the tension in the wire, caused the pole to fall to the ground. All of the poles which failed, however, were straightened and reset in the line.

Experiments were carried on to determine the most satisfactory way of setting the poles in concrete. The manufacturers of the poles supply H-shaped forms, which require about 2 ft. of concrete. The form itself requires a hole about 17 in. in diameter, but the ordinary hole digger cannot be depended upon to center the hole exactly, so it is necessary to dig a much larger hole in order to "line up" the poles properly. It was also found difficult to place concrete in such a small form at the bottom of a hole. Old-fashioned posthole diggers were then tried. Two holes were dug side by side and joined, thus giving a hole about 6 in. by 12 in. in cross-section. This method of construction was satisfactory in some soils, but was abandoned in favor of digging with ordinary tools, which were trimmed down on the sides so that a small rectangular hole could be made. These holes were easily dug, and required from 5 to 6 cu. ft. of concrete to the pole.

Crossarms were distributed with the poles, and a definite quantity of sand left at each pole. The cement was stored along the way, a day's supply being carried by the pole-raising gang. From two to five diggers were employed, according to the nature of the ground. The assemblers were accompanied by a wagon, in which was carried all the necessary material, including insulators.

At the time the line was built is was very difficult to get labor of any kind. Consequently it was necessary to work part of the time with a "short" crew, and to leave the wire stringing for the return trip. A cook shack was maintained for feeding the men and tents provided for them to sleep in. The camp was moved along as the work progressed.

A full raising crew consisted of a driver, two concrete mixers, a "jinney" man, four "pikers" and a foreman. The outfit which was used consisted of one team, a water tank and a sled. The cement was carried on the tank and the sled served to carry the tools from pole to pole and as a mixing box for the concrete. The concrete was usually mixed by the time the pole was set. The poles were raised by ordinary methods, plumbed with a level and tamped in. Poles tamped in with the concrete were stable enough to be left at once. An oval form, 4 in. deep, was made to shape the base above top of the ground. While the majority of the gang moved up along the line to the next pole site, one man stayed behind to trowel off the top of the base and remove the form for use on the next pole. The best day's work by the raising gang was to set thirty-four poles in eleven hours.

The guying and stringing was done on the return trip. Two men dug the slug holes and set the concrete slugs. Two men with a single-horse wagon installed the guys. Four linemen and a teamster did the stringing and tying in. Three coils of wire were distributed every 1/3 mile and picked up by the stringing gang. All three wires were strung at one time from reels mounted on a wagon. The wire was pulled at intervals of about 1 mile, using permanently guyed poles. The usual high-tension tie of No. 8 iron wire was employed on this line.

Five-inch neck-soldered Western Union splices were used, soldering being done with a pot and ladle. Sample splices made by different linemen gave the following results under test:

Sample No.	Maximum Strength (lbs.)	Cause of Failure
1	1850	Splice slipped
2	1870	Wire broke, splice held
3	1810	Wire broke, splice held

The line has been in satisfactory operation for about three months with five interruptions, caused by an insulator being shot off in one case, a wire thrown onto the line in two others, and broken wires, due to defects in the wire itself, in the remaining cases.

The item of engineering given in the accompanying table includes considerable of the writer's time and expenses as well as those of the surveyor. The item of total labor includes all labor of all classes, including the foreman on the job, with the exception of some of the teamsters who were hired at a flat rate per day with their teams and wagons. The item of camp expenses is the net cost after deducting the amount charged the men for meals. Laborers were paid 25 cents per hour

DISTRIBUTION OF TRANSMISSION LINE COSTS
(Distance Dodge City to Bucklin, Kan., approximately 31 miles).

	Total.	Per Mile.
Engineering and survey	$828.50	$26 73
Pole rights	238.30	7.69
Total labor	2,619.59	84.50
Camp expenses and meals	592.54	19.11
Teaming	717.49	23.15
River sand, gravel and cement	356.81	11.51
Insulators	840.03	27.10
Pins	469.30	15.13
Wire (95 miles No. 6 EBB)	3,368.93	108.67
Steel poles (total, 557, including twenty-three guy stubs)	7,856.31	253.43
Guying material	380.31	12.27
Wood poles and line material	287.90	9.28
Transformers, switches and arresters	2,739.63	88.37
Substation material	193.11	6.23
General expense	107.25	3.46
Total	$21,596.00	$696.64

DISTRIBUTION OF LABOR.

Rebuilding of wood-pole line in town to accommodate high-tension line from city limits to plant	$391.30
All work connected with setting 539 steel poles ready for wire	1,133.95
Stringing wire, setting anchors and attaching guys to above poles (about 29 miles of line)	470.64
Building towers and finishing up last mile of steel line	623.30
Total	$2,619.59

and linemen 40 cents per hour, and all were charged 20 cents per meal, which amount covered less than half the cost. The item of teaming includes all expense of teams for hauling various materials and carrying on the work, a charge being made for the use of company teams, as well as those hired.

Labor expenses are distributed in the lower part of the table, so that the actual cost of pole setting is shown. This line, like most others, had special features which made it expensive. One of these was the rebuilding of about 1 mile of wood pole line in order to provide a connection with the power house where the transformers are located. The other condition that affected the installation cost was the finishing up of the last mile on the Bucklin end at a later time with a small crew. This was made necessary by a lack of necessary material, and the expense was entirely out of proportion to the work done. Some of the men on this section of the line also built towers, so it is not possible to give an accurate division of this labor.

The expense given for setting 539 steel line poles and the necessary guy stubs includes all labor connected with such work as digging holes, assembling arms, pins and insulators, setting poles and concreting their bases, as well as the foreman's time and other labor that was paid for.

Formation of Clinkers in Boiler Furnaces

An Analysis of Combustion Conditions in Different Types of Boiler Furnaces and Suggestions to Reduce Clinkering Troubles

BY ALBERT A. CARY
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DURING many years' experience in designing, testing, improving and operating furnaces, used for many purposes, no branch of this subject has been found that requires more consideration than the troublesome formation of clinkers in the furnace and the formation and growth of clinkers on furnace linings. In a great majority of cases this trouble can be either greatly reduced or avoided, for clinkers are formed by the fusion of the ash and refuse which remains after the combustion of the coal in the furnace. Ash is really a very useful material in the furnace, when it is properly taken care of there, since, with a proper thickness of ash covering the top surface of the grate, the burning and warping of the bars is prevented.

Where properly designed shaking bars are used, the thickness of the ash bed on the top surface of the bars can be easily regulated, and it is very necessary that this be properly accomplished with this type of bar, as most of the shaking grates are designed with thin, delicate edges which are easily burned or warped when brought in prolonged contact with a hot fire bed. It is quite essential that the thickness of the ash bed should always be reduced before any attempt is made to break up the fire bed above, otherwise the ash will be thrown up into the bed of fuel and fused into clinker.

The shaking grate improperly used may be productive of more clinker in the furnace than would occur with the plain stationary grate in use. The thickness and conditions of the fire bed have much to do with this grate and clinker trouble, however. The density of the fuel bed is really of more importance than its thickness. A comparatively thin fire bed that is dense and compact will hold the ash within its hot body, instead of allowing it to precipitate to the grate bars, just as much as a thicker bed, when it is more open and porous.

When any fire bed is more or less solid, or compact, the air for its combustion will not pass uniformly throughout its mass, but, on the contrary, this air will search out its easiest paths of passage and flow through the irregularly scattered openings formed by cracks or holes in the fire bed, and, with the ash held up in this densely packed bed, the air, rushing through these selected positions, will cause intense combustion to occur at such places, which rapidly fuses the surrounding ash into clinker and at the same time causes the soft, pasty mass to attach to itself a considerable amount of the solid combustible fuel.

Too thin fires, carried on the grates, should be avoided, especially with shaking grates, as every fire bed should be of sufficient thickness to allow a proper depth of ash to be carried on the bars to protect them from the intense heat of the burning fuel above them. Excepting these very thin fire-beds, it may be said that the intensity of draft required to operate a furnace is, generally speaking, a measure of its clinker-making properties, which is another way of saying that the intensity of the draft required is a measure of the density of the fire bed. With a properly constructed hand-fired mechanical grate, the writer has been able to carry a bituminous coal fire continuously (using Eastern bituminous coal) with a fire-bed thickness of from 12 to 18 in., with no troublesome formation of clinkers, and this was done with a coal consumption of between 20 and 30 lb. of fuel per square foot of grate per hour. The whole secret of this performance was due to the fact that the accumulation of ash at the bottom of the bed could be easily kept reduced to a desirable thickness by use of the shaking bars, while the crust or cake forming over the top of the fire bed was broken up, when necessary (as well as the packing of fuel in the interior of the bed), by very slowly moving the lifting part of the grate up into the bed of fuel without disturbing the ash.

This kept the whole fire bed thoroughly broken up and so open and porous that less than 1-in. draft pressure measured by a U tube at the flue outlet (natural, chimney draft) was sufficient to keep the fuel bed (averaging fully 15 in. in thickness) in a highly incandescent state. Under these conditions there was no troublesome formation of clinker that would not go through the shaking bars, and this avoidance of such trouble was emphasized by the fact that no hand cleaning tool was used in the furnace from the beginning to the end of the week. This performance has been repeated in several plants and with a variety of Eastern bituminous coals, with the same non-clinkering results, which proves conclusively that the density of the fire bed has more to do with clinkering trouble than its mere thickness.

CLINKERING IN UNDERFEED STOKERS

The underfeed type of stoker, in its method of working, simply defies all theories for the reduction of clinker troubles. With this type of stoker the coal is fed by plungers or screws, into U-shaped troughs, with the top open surface of these retorts dropped to the upper level of the grate bars. When the troughs (or retorts) are filled, further feeding of coal, by the plungers or screws, will cause the coal to rise above the

level of the grate bars, and above this surface is found an incandescent bed of burning fuel into which fire bed the fresh coal from the retort is forced. As the fresh bituminous coal passes upward into the "zone of combustion" its gaseous matter is first liberated by the heat and mixing with the air from the tuyeres (placed at the grate level) it burns as it seeks out its passages of escape through the hot fuel bed above. As fresh coal continues to be forced into the retort below, it shoves the coke above (which remains after the gaseous matter has been driven out of the preceding charge of coal) so that this burning coke becomes the upper incandescent fire bed. This coke continues to be forced upward, burning rapidly until only the ash is left which has been produced in the hot burning mass of coke and forced to the top of the fuel bed.

Very few grades of coal produce ash which will not become fused into more or less of a clinker under such conditions of treatment, and it therefore becomes necessary, where this type of stoker is used, to select a coal which does not run too high in its percentage of ash, and the ash must have the highest fusing temperature possible. By the method of feeding used by this type of stoker, it will be noted that the coal is compactly forced into a more or less condensed mass of burning fuel, which demands the use of heavy forced blast fans, and, in order to reduce the amount of clinkering which occurs, the operator must use every possible means to keep his fuel bed open and porous, otherwise the air for combustion will seek every easy passage for escape, and work its way through cracks and holes in the fuel bed, instead of being more uniformly distributed throughout the mass of hot fuel.

This form of stoker has permitted the feeding of more coal per unit of grate area than its predecessors, and this valuable feature largely offsets its clinkering troubles, as the demand of to-day is for a stoker that will burn coal, and lots of it when required, to carry the plant over its troublesome peak loads.

Side walls with this type of stoker should be kept free from accumulations of ash or clinker at very frequent intervals and before the clinker is allowed to cool and harden to prolong the life of these walls. By a careful selection of the coal and refractory lining for the furnace the worst effects of clinker trouble can be considerably reduced.

Clinkering on Furnace Walls

There is a most troublesome result following the fusion of ash in contact with the side walls and bridge walls of furnaces, which frequently causes expensive repairs and necessitates untimely stoppage in the operation of the boiler, and this occurs in hand-fired furnaces as well as in those equipped with mechanical stokers, although, of course, to a lesser extent.

The selection of refractory material for lining furnaces is a matter which has received altogether too little attention by power-plant owners, who are too often influenced by the most persuasive salesman who calls upon them, or else they leave the matter to their masons, who are in many cases pretty certain to buy the cheapest firebrick or else buy at the place where their commissions are the highest. The common practice of using the same quality of firebrick for all parts of the furnace is certainly a mistake. The side-wall lining of a furnace should be selected with the use to which it is subjected kept in mind. It is true that these side walls are subjected to the effect of high temperatures, but if we use the most refractory bricks we can buy for this position, we will find that they will not stand the severe abrasion to which they are subjected, such as received with the use of the poker, the clinker bar, etc., to free them from the adhering clinker, and it is most important to consider the fluxing effect on these bricks from the ash produced from the particular kind of coal used.

An altogether different kind of service is called for in the refractory arches used over the fire bed, which needs a different quality of brick, and still further consideration should be given in the selection of refractories for use in special-shaped blocks and tiles used in other parts of the furnace. The fire-clay brick is the one used in nearly all boiler settings, and it is probably the best brick adapted to sudden changes of temperatures, due to its more or less porous structure. The fine-ground, hard-burned brick usually gives the best linings for side walls, while the coarser and more open (or porous) bricks are better adapted for fire arches. Accumulation of ash or any incipient formation of clinkers on the side walls or bridge walls of furnace must be promptly removed without allowing them to build up if destruction of the walls is to be avoided.

With the overfeed type of stoker, with inclined grates as has been previously explained, the ash formation out of the fuel does not begin until after the burning coal has descended a certain distance upon the inclined grates. In that class of inclined grate stokers which receive coal at the front end of the furnace and pass the burning fuel slowly downward along sloped grate bars to the rest grate at the rear of the furnace; unless this fuel is constantly being agitated with a shearing motion, next to the side walls, there is a tendency for the ash to fuse and adhere to the side wall at the lower part of the furnace. Convenient poke holes are usually provided through which the fireman can slice the fire next to both side walls and thus reduce the tendency to build up clinker at these positions.

In the other class of inclined grate stokers, which have their fuel fed from coal magazines placed in each side wall, feeding their fuel from these positions down sloped grates to the lower center of the furnace, we find a reduced surface of furnace wall presented to the fire bed, at the rear and front of the furnace. At the bottom of the V, formed where the two sets of inclined grates (from each side wall) come together, there is provided a set of clinker bars which are supposed to remove the ash and clinker automatically as soon as they reach this position, but there is always an accumulation of incandescent ash, clinker and some small amount of fuel at the bottom of this trough, which builds up, especially in the presence of large clinkers formed in the fire bed and where this lower part of the fuel bed comes in contact with the end walls, there is a tendency to build up clinker or erode.

With the chain-grate type of stokers, there is a very slowly moving bed of fuel, each side of which is in contact with the side walls. With a very slow motion of the burning fuel on these grates, there is a tendency, with certain coals, for fusion of the ash to take place, and when this comes in contact with the side walls, due to the slow rate of travel, and clinkering often occurs there. Such trouble is increased when the movement of the grate is stopped for considerable periods of time. Efforts have been made to reduce the destructive action to side walls in furnaces, where this type of stoker was used, by substituting metal faces in the furnace walls to replace the fire-brick lining, back of which faces a water circulation was maintained. Besides the clinker or erosive troubles in stokers of this type, there is added the abrasion caused by the constant rubbing of the fuel bed against the side walls. Notwithstanding the occurrence of such troubles in certain plants using this type of stoker, there are many hundreds in use where fire-brick linings are used in their furnaces, and it is claimed that the cost of repairs for these linings is not excessive, and that it is no higher than in other stokers doing similar service.

Chart for Determining Copper Wire Properties in Metric and English Units

Devised by ANDRES HAM
Guadalajara, Jal., Mexico

Supplement to ELECTRICAL WORLD, *Feb.* 10, 1917. (*For description see page* 269.)

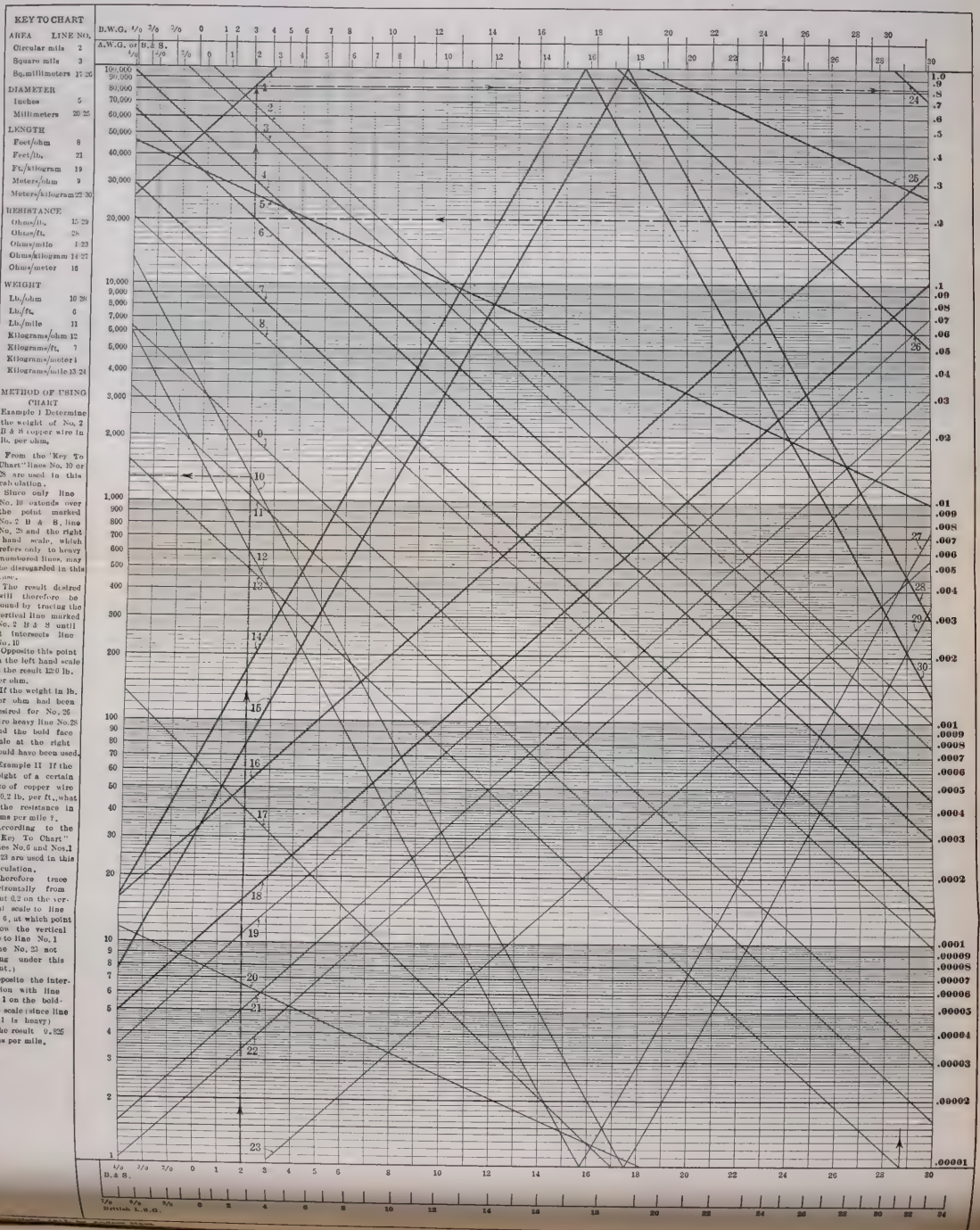
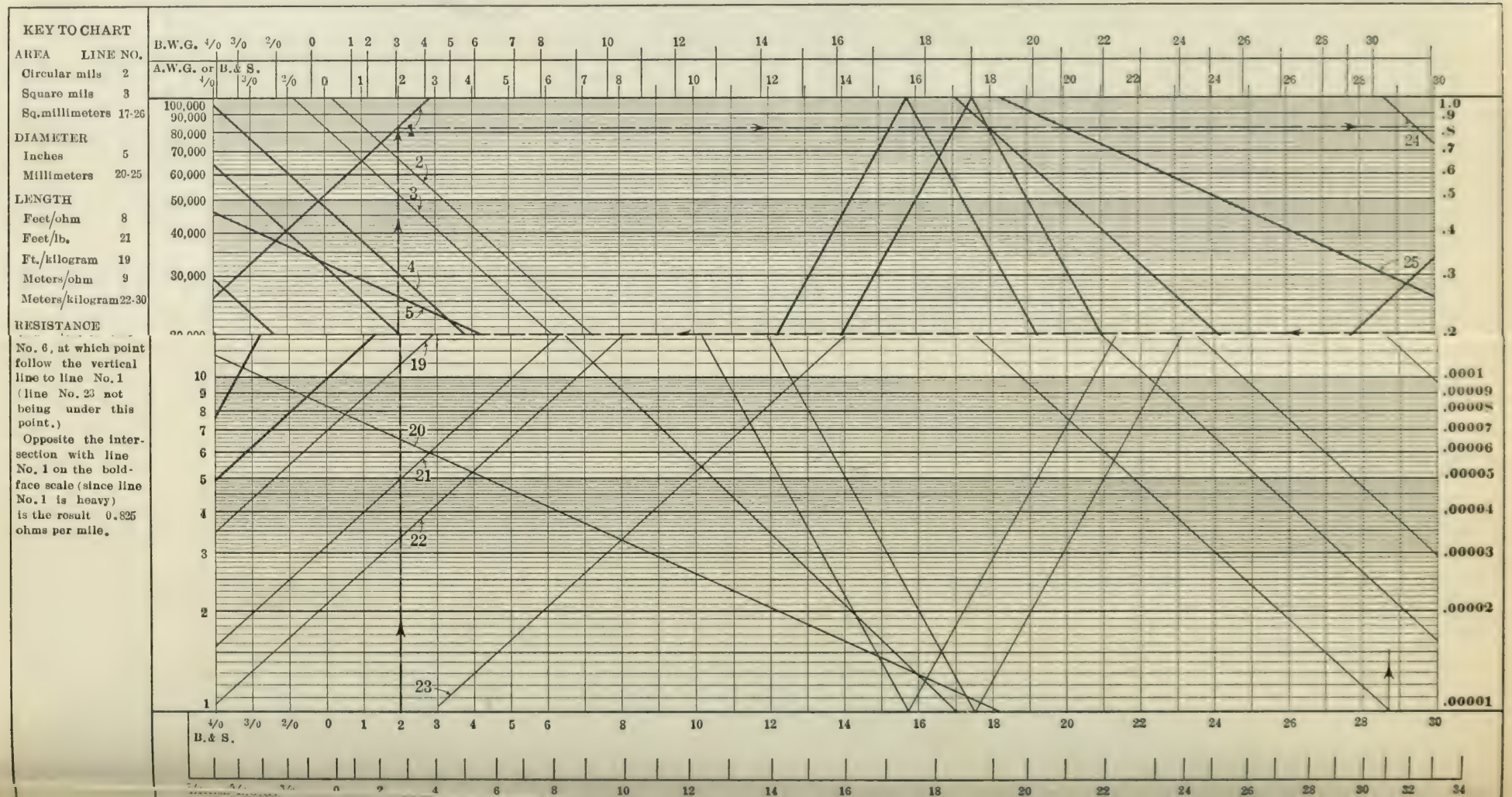


Chart for Determining Copper Wire Properties in Metric and English Units

Devised by ANDRES HAM

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Graphical Presentation of Conductor Properties

Description of a Wire Chart, with an Outline of the Method of Using It, Basis for Construction and Method of Plotting Lines

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BY means of the accompanying chart areas, diameters, lengths, resistances and weights of different sizes of copper conductors can be obtained directly, expressed in twenty-two different units. In the writer's opinion, while it is especially useful in Latin American countries, where the metric system is employed, and where considerable business is carried on with companies employing the English system, it will likewise be found most useful by any engineer who has occasion to frequently use wire tables. For instance, if wire is specified in metric terms the corresponding specifications in English terms can be readily determined and vice versa. Furthermore, it permits obtaining any of the previously mentioned properties of a copper wire if one of the properties of the same size copper wire is known. While the chart applies only to copper wire sizes from No. 4/0 to No. 30, the principle used in its construction may be extended to include larger or smaller sizes and other metals, such as aluminum, galvanized iron and steel wire, resistance and fuse wires.

METHOD OF USING CHART (SEE SUPPLEMENT)

To find the area, diameter, length, resistance or weight of any copper wires (size No. 4/0 to 30) in either English units, metric units or combinations thereof, obtain from the "Key to Chart" the number of the line corresponding to the particular units in which the property desired is expressed. From the point where the vertical line through the size of wire intersects the numbered line, follow the horizontal line to the heavy (boldface) or light scale, depending on whether the heavy or light numbered line is intersected. The result is obtained directly. When the property of a conductor is known the size of the wire can be determined by following the reverse operations. Concrete problems are solved on the chart (see Example I).

If it is desired to determine any property of a conductor when another is known, the procedure is as follows: As before, determine the numbers of the lines corresponding to the unit known and the unit desired. Then from the value of the unit known on the vertical scale follow the horizontal line to the numbered line corresponding to the unit known. From this point trace along the vertical line to the other numbered line and opposite the intersection on the lightface or boldface vertical scale, depending on whether the last line is light or heavy, will be found the desired result. The solution of a concrete problem of this type is also given on the chart (see Example II).

BASIS FOR CONSTRUCTION OF CHART

The chart is based on the fact that the diameters and areas of conductors numbered in the B & S or A. W. gage are in geometrical progression. For instance, the area of the larger of two consecutive numbers is $(a\sqrt[3]{2})$, where a is the cross-sectional area of the smaller wire. Thus taking a_o as the area of No. 0 wire and a_n as the area of any other wire (size n) $a_o = a_n(\sqrt[3]{2})^n$, or $a_n = \dfrac{a_o}{(\sqrt[3]{2})^n}$ Since the diameter of wires varies as the square root of the area, then $d_n = \dfrac{d_o}{(\sqrt{2})^n}$.

Taking logarithms of both members of the last two equations,

$$\log a_n = \log a_o - \frac{n}{3} \log \sqrt{2}$$

and

$$\log d_n = \log d_o - \frac{n}{6} \log \sqrt{2}$$

TABLE I—DATA FOR PLOTTING AND EXTENDING WIRE CHART
COPPER WIRE

	Numbers of B. & S. Wire Gage			
	No. 4/0	No. 6	No. 16	No. 40
Diameter—Inches	0.460	....	0.05082	0.00314
Mils	460.	....	50.82	3.145
Millimeters	11.684	....	1.291	0.0799
Area—(Cross sectional)—circ mils	211,600.	....	2,583.	9.888
(Cross sectional)—square mils	166,190.	....	2,029.	7.77
(Cross sectional)—square millimeters	107.22	....	1.309	0.00501
Weight—Pounds per foot	0.6405	....	0.007818	0.00002993
Pounds per 1000 ft	640.5	....	7.818	0.02993
Pounds per mile	3,382.	....	41.28	0.1581
Pounds per meter	2.1	0.2602	0.02561	0.0000982
Pounds per kilometer	2,100.	....	25.61	0.0982
Pounds per ohm 68° F.	13,090.	....	1,950.	0.00002858
Pounds per ohm 122° F.	11,720.	....	1,746.	0.00002559
Pounds per ohm 176° F.	10,570.	....	1,575.	0.00002309
Kilograms per foot	0.2902	....	0.003541	0.00001358
Kilograms per 1000 ft	290.2	....	3.541	0.01358
Kilograms per mile	1,537.00	....	18.70	0.07175
Kilograms per meter	0.953	....	0.01161	0.0000445
Kilograms per kilometer	953.	....	11.61	0.0445
Kilograms per ohm. 68° F	5,939	....	885.	0.00001296
Kilograms per ohm. 122° F	5,317.00	....	792.	0.00001160
Kilograms per ohm. 176° F	4,794.	....	715.	0.00001046
Length—Feet per pound	1.561	....	127.9	33,410.
Feet per kilogram	3.444	....	282.	73,700.
Feet per cwt. (of 100 lb.)	156.1	....	12,790.	.....
Feet per cwt. (of 112 lb.)	174.9	....	14,330.	.....
Feet per ton (of 2000 lb.)	3,122.	....	255,800.	.....
Feet per ton (of 2240 lb.)	3,500.	....	286,400.	.....
Feet per metric ton (1000 kg.)	3,444.	....	282,700.	.....
Feet per ohm 68° F.	20,440.	....	249.4	0.955
Feet per ohm 122° F.	18,290.	....	223.3	0.8548
Feet per ohm 176° F.	16,510.	....	201.5	0.7718
Meters per pound	0.4764	....	39.0	10,200.
Meters per kilogram	1.050	3.837	86.	22,520.
Meters per cwt. (of 100 lb.)	47.64	....	3,900.	.....
Meters per cwt. (of 112 lb.)	53.4	....	4,370	.....
Meters per ton of 2000 lb.	952.8	....	78,000.	.....
Meters per (of 2240 lb.)	1,067.	....	87,300.	.....
Meters per metric ton (1000 kg.)	1,050.	....	86,000.	.....
Meters per ohm 68° F.	6,240.	....	76.1	0.2912
Meters per ohm 122° F.	5,580.	....	68.2	0.2607
Meters per ohm 176° F.	5,040.00	....	61.5	0.2352
Resistance—Ohms per foot 68° F.	0.00004893	....	0.004009	1.047
Ohms per foot 122° F.	0.00005467	....	0.004479	1.170
Ohms per foot 176° F.	0.00006058	....	0.004964	1.296
Ohms per meter 68° F.	0.0001604	....	0.01314	3.432
Ohms per meter 122° F.	0.0001792	....	0.01468	3.840
Ohms per meter 176° F.	0.0001985	....	0.01628	4.252
Ohms per mile 68° F.	0.2583	2.081	21.168	5,530.
Ohms per pound 68° F.	0.00007639	....	0.5128	34,980.
Ohms per kilo 68° F.	0.0001684	....	1.130	77,100
Breaking stress hard drawn pounds	8 310 00	....	133	
Annealed pounds	5.650		69	
Hard drawn kilograms	3.770 00		60.3	
Annealed kilograms	2.561 00		31.3	

The logs of a_n, d_n and $\sqrt{2}$ are constants, however, so log a_n is proportional to n 3 and log d_n is proportional to n 6.

Thus if a_n or d_n are plotted on logarithmic scales they will be directly proportional to the size of the wire in B & S or A. W. gage, and can therefore be plotted as straight lines. As shown by the equations of the lines, the slope of the lines showing variation in area will be twice that of those showing the variation in diameter with size of wire. Since all properties to which this chart applies are proportional to the diameter, area or powers thereof, they, too, can be plotted as straight lines, their slopes depending on the ratio of the quantity to the diameter or area.

As values from 0.00001 up to 100,000 have to be plotted on this chart, this range of values is split in half and 0.00001 to 1 plotted on the right-hand scale and 1 to 100,000 on the left-hand scale. This arrangement reduces the size of the chart and permits reading all values to the same degree of accuracy.

TABLE II—DATA FOR ALUMINUM AND NICHROME WIRE SIMILAR TO THAT IN TABLE I

ALUMINUM WIRE	No. 4/0	No. 6	No. 16	No. 40
Resistance—Ohms per 1000 ft	0790	0 637	6 475	1,691 1
Ohms per mile	4173	3 36	34 19	8,930
Ohms per kilometer	2594	2 089	21 22	5,550
Ohms per lb	00941	0 0266	2 7505	18,770
Length—Feet per ohm	12,652		154 4	0 59
Feet per pound	5 13		420 8	
Feet per kilogram	11 30		928	
Meters per kilogram	3 45		238	
Meters per ohm	3,865		47 1	0 18
Meters per pound	1 562		128 4	
Miles per ohm	2 398	0 2992	0 02945	
Weight—Pounds per 1000 ft	195		2 375	
Pounds per mile	1,029		12 55	
Pounds per kilometer	640		7 79	
Kilograms per 1000 ft	88 45		1 077	
Kilograms per mile	466 5		5 69	
Kilograms per kilometer	290		3 53	
NICHROME WIRE				
Resistance—Ohms per 1000 ft. 68° F	2 81		230	66,700
Ohms per meter	0 00922		0 7545	218 7
Ohms per 1000 ft. 1000° F	3 48		286	82,800
Ohms per meter 1000° F	0 0116		0 937	271
Ohms per pound	0 00471	0 3001	31	2,333,000
Ohms per kilogram	0 1038	0 662	68 4	5,145,000
Weight—Pounds per 1000 ft	583		7 2	0 025
Pounds per ohm	212 3	3 3334	.0323	
Kilograms per ohm	96 3	1 510	.01462	

TABLE III—DATA FOR GALVANIZED IRON AND STEEL WIRE IN DIFFERENT UNITS

GALVANIZED IRON & STEEL WIRE	No. 4/0	No. 6	No. 16	No. 40
Weight—Pounds per 1000 ft	556		6 78	
Pounds per mile	2,937		25 50	
Pounds per kilometer	1,822		22 22	
Kilograms per 1000 ft	252		3 07	
Kilograms per mile	1,333		11 56	
Kilograms per kilometer	827		10 07	
Resistance—Ohms per mile "EBB"	1 603		131	
Ohms per mile "BB"	1 87		153 1	
Ohms per mile steel	2 215		181 2	
Ohms per 1000 ft. "EBB"	0 3034	2 44	24 80	
Ohms per 1000 ft. "BB"	0 3543	2 85	29 00	
Ohms per 1000 ft. steel	0 4194	3 38	34 35	
Ohms per kilometer "EBB"	0 998	8 00	81 50	
Ohms per kilometer "BB"	1 163		95 20	
Ohms per kilometer, steel	1 378		112 80	
Breaking stress iron pound	8,820		106 50	
Steel, pound	16,600		203 50	
Iron kilograms	4,000		48 30	
Steel kilograms	7,525		92 30	

TABLE IV—RESISTANCE OF DIFFERENT METALS AT 68° F. (20° C.)

	No. 0000 B. & S. Ohms per		No. 16 B. & S. Ohms per		No. 40 B. & S. Ohms per		Relative Resistance (Copper =1)	Per Cent Increase of R. for 1° C. at 20° C.
	Km.	1000 Ft.	Km.	1000 Ft.	Km.	1000 Ft.		
Copper annealed	0 1603	0 0489	13.14	4.009	3,430	1,047	1.000	0.388
Copper hard drawn	0.1640	0 0500	13.45	4.099	3,510	1,070	1.022	0.388
Silver annealed	0 1476	0 0450	12.08	3.688	3,160	964	.920	0 377
Silver hard drawn	0.1605	0.0490	13.15	4.012	3,435	1,048	1.001	0.377
Gold annealed	0 2105	0 0642	17.27	5.262	4,510	1,373	1.312	0.365
Gold hard drawn	0.2143	0 0654	17.58	5.360	4,685	1,398	1.337	0.365
Aluminum annealed	0.2930	0 08945	21.23	6.475	5,550	1,691	1.828	0.365
Zinc pressed	0.5665	0.1727	46.41	14.15	12,130	3,700	3.530	0.365
Platinum annealed	0.911	0.2778	74.65	22.76	19,500	5,950	5.682	0.365
Nickel annealed	1.254	0 3827	102.70	31.32	26,800	8,180	7.82	0.365
Tin pressed	1.332	0 4062	109.20	33.27	28,500	8,690	8.31	0 365
Lead pressed	1.940	0 5920	159.0	48.53	41,500	12,670	12.09	0 387
Antimony pressed	3.590	1 094	294.0	89.70	76,700	23,400	22.37	0.389
Bismuth	13.18	4.020	1079.5	329.2	282,200	86,050	82.2	0.354
Mercury column	8.97	2 733	734.0	223.8	191,800	58,500	55.9	0.072
2 Ag+1 Pt	2.30	0 702	188.5	57.5	49,300	15,020	14.35	0.031
"German silver"	1.982	0 6045	162.2	49.52	42,400	12,920	12.36	0.044
2 Au+1 Ag	1.033	0.315	77.7	23.70	20,300	6,194	6.447	0 065

Method of Plotting Lines

Since, as previously explained, all properties of wires expressed in terms of area, diameter, lengths, resistance or weight are straight-line functions when plotted on this chart, it is only necessary to know two points on each line to draw them. For convenience, the properties of No. 4/0, No. 6, No. 16 or No. 40 are used, as many of the functions have to be represented by two separate lines, each of which requires two points for location. These values are given in the accompanying table. If it is desired to represent properties that are not indicated on the chart, it is only necessary to plot the values given and connect corresponding values by straight lines.

Vacuous Arc Lamp

An arc lamp operating in a vacuum chamber in which the electrodes are fixed and non-disintegrating constitutes patent No. 1,208,597 issued to George M. J. Mackay of Schenectady, N. Y. The essential condition of operation appears to be that one electrode be incandescent and for this reason two conductors are led into the top of the envelope, whereas only one lead is provided for the anode. The device comprises an envelope consisting of glass, such as low expansion or sodium-magnesium boro-silicate glass. The cathode consists of highly refractory material having a melting point exceeding at least about 2000 deg. C., such, for example, as tungsten, tantalum, carbon or the like. The anode consists of conductive material, for example, tungsten, carbon or other solids, but in some cases a liquid such as mercury may be used.

The globe is first evacuated and then filled with a suitable gas at considerable pressure. Monatomic gases of the argon group, also nitrogen, and carbon monoxide, may be used. The gaseous pressure will more usually approach atmospheric pressure in order of magnitude. In a device used for rectifying alternating current at low voltages, argon at a pressure of about 5 to 12 c.m. of mercury is found suitable. With an envelope containing a filling of nitrogen, phosphorous pentoxide is preferred for absorbing water vapor and other gaseous impurities. In devices filled with a monatomic gas, such as argon, neon, krypton, xenon, or helium, calcium magnesium or one of the related metals is preferable. By the use of a gas-absorbing chemical agent, the potential drop or loss is reduced to one-half, or even less.

To give specific illustrations, an incandescent cathode arc carrying about 6 amp. when filled with argon purified by ordinary methods has an arc drop of about 30 to 40 volts. When the envelope contains a small quantity of phosphorous pentoxide, as above described, the arc drop is reduced to about 10 volts. Similarly a 6-amp. neon tube containing, at a pressure of about half an atmosphere, neon gas purified by the usual methods, has an arc drop of about 50 volts. The same tube when provided with metallic calcium acting to purify the gas *in situ* in the manner above described has an arc drop of about 20 volts.

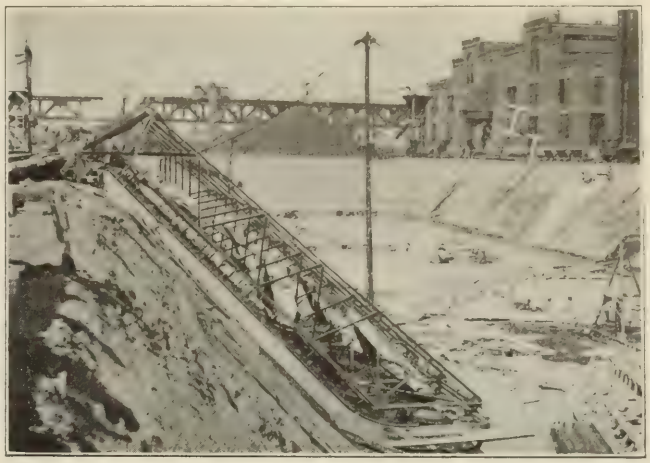
UNDER-WATER COAL STORAGE

Provisions Made by the Duquesne Light Company for Submerging 100,000 Tons of Coal

To prevent spontaneous combustion in the large amounts of coal that must be kept on hand for consumption in the Brunots Island generating station, the Duquesne Light Company, Pittsburgh, is just completing a huge concrete basin in which 100,000 tons of coal may be submerged in water. While it has been realized for some time that spontaneous fires are liable to start in coal piled to a greater depth than 15 or 20 ft., the building of this reservoir was really prompted by the loss sustained over a year ago when hundreds of tons of coal were destroyed before the smoldering fire could be extinguished.

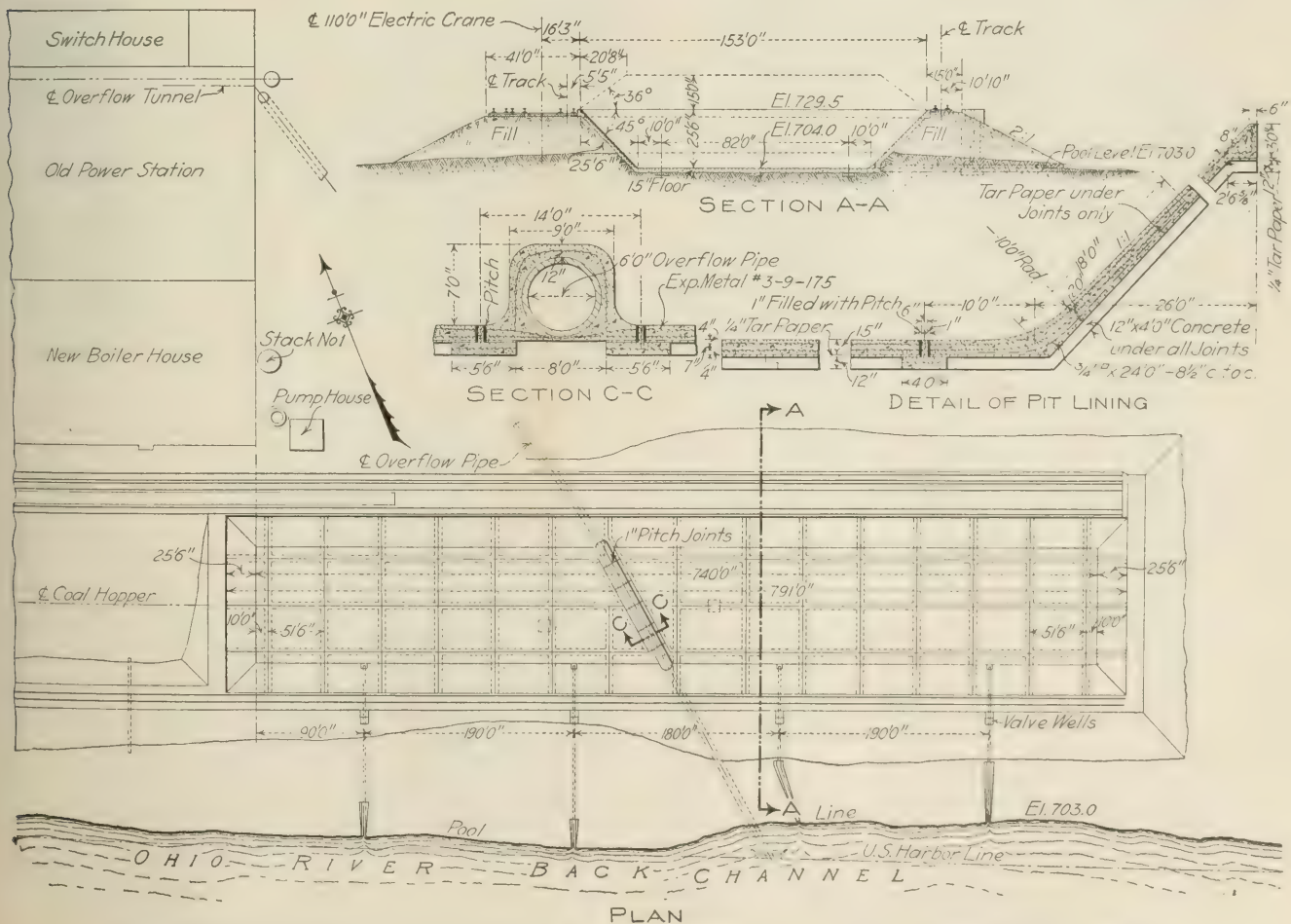
The basin is about 25.5 ft. deep by 791 ft. long by 153 ft. wide, and is made of 40 by 50-ft. reinforced concrete slabs laid so as to permit expansion and contraction. The inside walls have a 1:1 slope, while the outside embankments have a 2:1 incline. A rip-rap wall of double stone is provided over this embankment to prevent erosion during high water. Cranes will be provided for handling the coal. Since the basin has so much displacement automatic valves have been provided to flood the reservoir in case of high water so it will not float. This was done by equipping the discharge system with check valves which permit water to rise inside the pit as the river elevation rises during flood season. The discharge system which consists of four 18-in. pipe lines are located as shown in the accompanying diagram. Across the bottom and sides of the pit every 51.5 ft. longitudinally and lengthwise of the bottom 41 ft. apart are expansion joints. These are made waterproof with pitch and tar paper and are supported on 12-in. concrete bases.

Water for submerging the coal is pumped into the reservoir through a 14-in. cast-iron pipe leading from the power house to four 12-in. cast-iron outlet pipes placed 160 ft. apart in plan and about 6 ft. below the top of the reservoir. The 6-ft. concrete overflow pipe shown on the plan is not connected in any way with the water system of the coal storage tank, but was already in place when the construction of the reservoir was started. The special covering shown had to be provided to protect it from mechanical injury.



INTERIOR VIEW OF STORAGE PIT DURING CONSTRUCTION

The pit is being constructed by the Duquesne Contracting Company of Pittsburgh. The design was made and the construction was supervised by F. Uhlenhaut, Jr., chief engineer of the Duquesne Light Company, Pittsburgh, Pa.



CONSTRUCTION DETAILS OF A COAL-STORAGE RESERVOIR BEING BUILT BY THE DUQUESNE LIGHT COMPANY

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

How Ice on Transmission Line Was Held to Safe Limits During Sleet Storm

BY STUART VAN BUREN

During a recent severe sleet storm the writer successfully prevented ice forming in dangerous quantities on the conductors of a transmission line by using the heating effect of the current. This line is of double-circuit construction connecting a large power house with a substation 50 miles away. Under normal conditions the two circuits were operated in parallel at 60,000 volts. As the storm occurred during light load operation, the line current was not sufficient to produce the desired heating effect. It was therefore decided to use wattless current.

In order to do this the two lines were first separated at the power house with one generator on each line, but were left in parallel at the substation end. Next, the field excitation was raised to the limit on one machine and was lowered as much as possible on the other. This set up a heavy wattless current between machines which was forced to flow over the transmission lines through the substation loop. This scheme proved effective in keeping the ice on wires within safe limits.

Auxiliary Oil Burners for Carrying Emergency Loads

Four auxiliary oil burners have been provided for each of the boilers installed at the Dutch Point station of the Hartford Electric Light Company to carry unexpected peaks such as might occur if any boilers or coal-handling apparatus become incapacitated. As shown by the accompanying drawings the burners are installed on the side walls of the furnaces in such a manner that they may be inserted in rectangular openings and the flames directed across the furnace. Being connected with the oil and steam supply lines by swivel

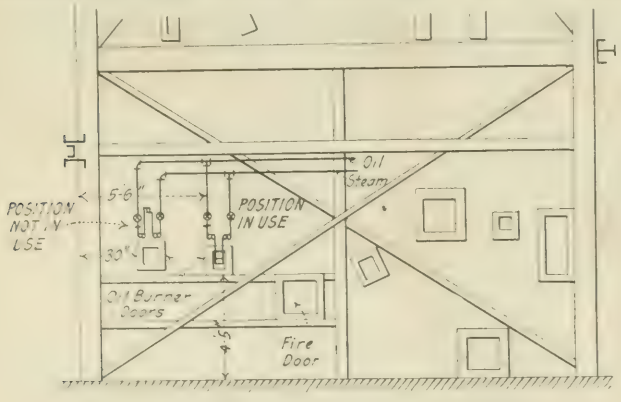


FIG. 1—POSITION OF BURNERS ON BOILERS

joints the burners can be folded up against the furnace wall when not in use and the wall openings closed by doors hinged along the top. The openings are about 4.5 ft. above the floor level and 3 ft. apart, the one nearest the stoker being 30 in. from the front wall. Sufficient space is provided around each burner to admit the air required for combustion.

The oil and steam supply pipes approach the openings vertically and terminate in swivel joints about 14 in. above the center lines of the furnace-wall openings. At these joints they are connected with pipes that hold the burner-nozzle tip almost even with the inside wall of the furnace when in position for operation. The pipes are bent and connected in such a manner that the noz-

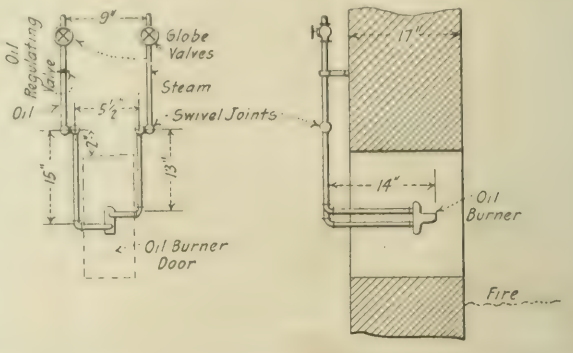


FIG. 2—NOZZLE CONNECTIONS TO STEAM AND OIL PIPES

zle and pipes connecting with it may turn about an axis through the two swivel joints. Globe valves are provided in both pipes leading to the burner, but the oil flow is regulated by an additional valve installed below the globe valve. Since no auxiliary equipment, such as baffles to protect the grates, is required with the equipment, it does not hinder normal operation when the underfeed stokers are used. In one case a brick checker work was built over the grate, however, to ascertain its effect on oil-burner operation. With this temporary addition the oil burners were able to carry 200 per cent of boiler rating according to F. M. Wilbraham, a superintendent of the Hartford company.

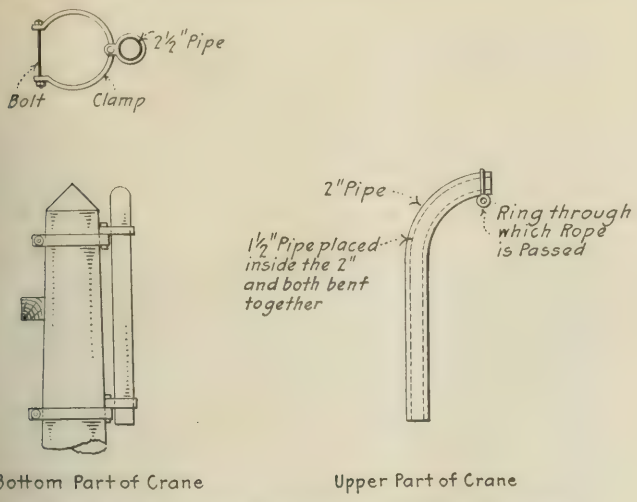
The boilers installed at this plant are 1250-hp. Bigelow-Hornsby units. Three are equipped with Riley underfeed stokers and the remainder with Taylor stokers. W. N. Best oil burners are used in the installation described.

Construction of a Convenient Pole-Top Crane

A convenient pole-top crane constructed as shown in the accompanying illustration has been devised by Mr. Henry Manztel, superintendent of Overhead Construction, Galveston (Tex.) Electric Company. It consists of two pieces of pipe and two adjustable clamps to hold it on the pole. The upper part of the crane consists of a 1.5-in. pipe placed inside of a 2-in. pipe, and both curved together. The diameter of the upper clamp is from 7 in. to 9 in. and the lower clamp 8 in. to 10 in. The pipe fitted to the clamps is 2.5 in. in diameter.

To use this device, the lineman hoists up the section of 2.5 in. pipe to which the two adjustable clamps are fitted. Since the bolt in the lower clamp may be swung free, the upper clamp is slipped over the pole top, the lower clamp bolt swung into place and the two bolts tightened up. When the upper section of the crane is dropped inside the first section the crane is ready.

This crane has been found especially useful where a transformer must be removed from a defective crossarm and a new crossarm installed. In such a case a rope is passed through the ring of the crane and fastened to the transformer, which is then swung free. Since the lineman can rotate the upper part of the crane through any angle, the transformer may be easily

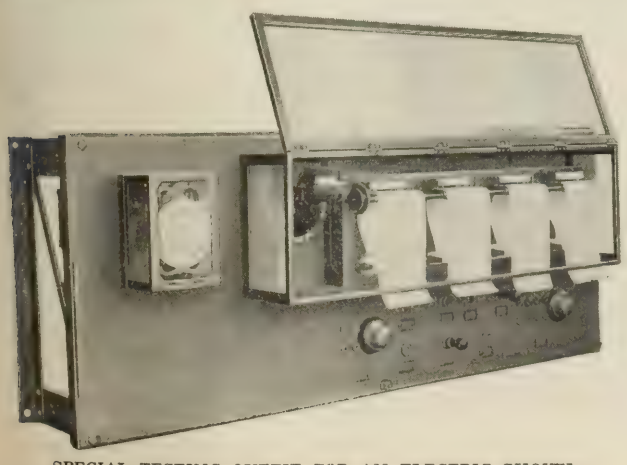


TOP AND BOTTOM SECTIONS OF POLE-TOP CRANE

swung out of the way, around to the other side of the pole, a new crossarm put up, and the transformer put back in place. The crane may be made whatever length desired. The one described has an over-all length when set up of about 5.5 ft., the bottom portion being about 3 ft. long. This device was made in the shops of the Galveston Electric Company, at a total cost for time and material of about $12.

Testing Unit for Investigating the Operation of an Electric Shovel

An outfit consisting of four graphic recording meters and an integrating wattmeter, all connected on a slate panel has been recently developed by the Chile (S. A.) Exploration Company to investigate the operation of an electric shovel at its copper mines. This testing outfit is provided with necessary transformers, wiring, and jacks to enable any test to be made rapidly and without changing connections. The graphic meter equipment consists of a polyphase wattmeter, single-phase ammeter, voltmeter and a speed recorder. The arrangement of jacks as shown under the meters in the accompanying illustration, enables the operator to connect any one of the graphic meters with either the hoisting, thrust or turning motor, or if it is desired the wattmeter and the ammeter can be connected to record the total load being taken by the shovel. The speed recorder is arranged for connection to either of the three motors. The charts of the graphic meters are all coupled to run together at any speed from 3 in. to 9 in. per minute; the speed of the chart being varied according to the conditions of the test. The chart is driven by a small motor which can be seen at one end of the drive roll. The watt-hour meter is connected permanently to measure the total load taken by the shovel. This outfit has been made for the Chile Exploration Company by the Esterline Company of Indianapolis, Ind.



SPECIAL TESTING OUTFIT FOR AN ELECTRIC SHOVEL

Impressing Employees with the Value of Supplies to Prevent Waste

By handling small articles like repair parts, insulators, brushes, tape, etc., day after day employees are very liable to forget their aggregate value and be careless with them. Since a considerable part of the total expense of a production and transmission department is made up of just such items, however, it is important that companies take steps to prevent any waste due to this cause.

One method that has been employed by the Consumers Power Company, Jackson, Mich., has been to print cards impressing employees with the value of supplies that pass through their hands. On these cars the following information is printed:

MATERIAL MEANS MONEY

Every Piece of Material Should Earn Its Cost, just as Should Every Hour of Labor. Did you Ever See Any Material Wasted? Did You Ever Waste Any Material Yourself?

DID YOU EVER STOP TO THINK OF ITS COST?

For your own information consult this list and see if you have ever been guilty of throwing away or

ABANDONING DOLLARS

Anchors and rods	$1.00	each
Batteries (dry cells)	.30	each
Bolts, machine, ⅜x4½	8.40	per M.
Brooms	.40	each
Brushes, 2½x1¼x¾	.43¾	each
Brushes, 2¼x1¼x1½	.34	each
Brushes, metite	1.69	each
Crossarms, 8 inch	.60	each
Crossarms, 5 inch	.40	each
Electrolyte KD	.75	per gal
Fire extinguisher (container)	6.50	
Fire extinguisher (Pyrene)	4.00	per gal.
Gasoline	.10	per gal.
Grease (transmission)	.50	per lb.
Hose, garden, ¾ inch	.18	per ft.
Insulating compound (G. E. 178)	.75	per gal.
Insulators, 17,000 V	.19	each
Insulators, 40,000 V	.90	each
Insulators, 70,000 V	2.00	each
Insulators, suspension type	.85	each
Lamps, 25-watt Mazda	.27	each
Lamps, 40-watt Mazda	.27	each
Lamps, 50-watt Mazda	.36	each
Lamps, 100-watt Mazda	.65	each
Motor bearings, 5 hp	2.08	per set
Motor bearings, 15 hp	4.50	per set
Oil—engine	.22	per gal.
Oil—cylinder	.48	per gal.
Oil—transil	.30	per gal.
Paint (floor enamel)	2.00	per gal.
Packing	.90	per lb.
Rectifier tubes	25.00	each
Relay contacts (Terrill Reg.)	2.75	per set
Rings—A. C. Collec. 900 r.p.m	50.00	per set
Rings—A. C. Collec. 1200 r.p.m	40.00	per set
Screws, ½x5 in. lag	.0157	each
Solder—wire	.30	per lb.
Solder—bar	.30	per lb.
Soldering paste	.10	box
Switch bars—K-12 oil	3.75	each
Switch fingers—K-12 oil	.30	each
Tape (friction) 2 rolls to pound	.35	lb.
Waste (white)	.08	lb.
Waste (wiping rags)	.16½	lb.
Wire, No. 10 B. & S. R. C	.043	per ft.
Wire, No. 12 B. & S. R. C	.034	per ft.
Wire, No. 14 B. & S. R. C	.027	per ft.
Wire, Band, .072 Steel	1.50	per lb.
Wire, 1/16-in., stranded (5000)	.0157	each
Scrap copper	.16	lb.

AN EFFECTIVE CARD IN ACQUAINTING EMPLOYEES WITH VALUE OF MATERIAL USED

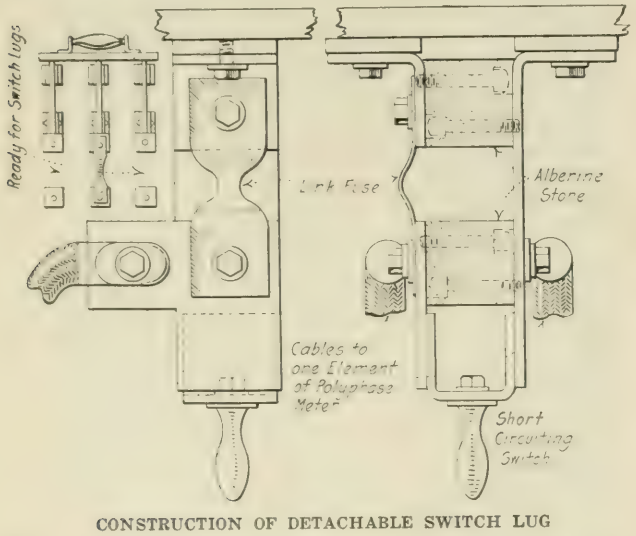
W. J. McCullough, general storekeeper of the Southern California Edison Company, has also expressed the opinion that the ease with which an employee is able to obtain material has a great deal to do with the value of the material in his mind. For this reason it is necessary that the workmen should be required to exert some effort before letting them have the material wanted. In other words, if a workman can come up to the counter and call for a coil of copper wire, a dozen connectors, etc., whenever he chooses, he is not so impressed with the value of the material as when he is obliged to go to the foreman and get a regular order and sign a receipt for the material before taking it from the store. Providing stock material will answer the purpose, it should be used rather than to leave it on the shelves and buy new, even at a lower figure, for the reason that in many cases surplus stock would in this way be eliminated. On the other hand, if a purchase is made, the old stock is not disposed of and additional money is invested.

Proper care of material does not necessarily require elaborate storerooms. It does mean, however, that rubber goods, rubber insulating materials, etc., should be kept in moist rooms; that pipes, conduits, etc., which must sometimes be stored outside, should be kept painted, threaded ends should be greased, or similarly protected to avoid rust; that lumber, poles, crossarms, etc., should be kept off from the ground on skids to avoid rot; that material moving slowly should be so reported; that the man in charge should know the location of and be able to produce any material in his charge immediately when called upon for it, so that it will be ready for use.

Arrangement for Studying Loads Without Breaking Circuit

BY SIDNEY FISHER

When load variations in different circuits have to be determined with one set of apparatus and little time is afforded between tests for changing apparatus connections, detachable switch lugs like the one shown herewith may be found serviceable. This particular design was developed for use in a large Connecticut industrial



CONSTRUCTION OF DETACHABLE SWITCH LUG

plant where load tests had to be made in different circuits during three successive shifts. Only twenty minutes was allowed for changing connections from one circuit to another. As shown each device is constructed so that it may be bolted to the fuse lugs of any branch-circuit switch in place of the fuses. To permit leaving each circuit intact while adjusting the instrument and transformer connections a short-circuiting switch was provided in the head of each detachable lug. If time permits, the fuses that are removed to give place to the lugs may be attached to the latter, but considerable time is saved by having each detachable lug equipped with fuses in advance. Provision is made for link fuses.

One Way of Solving a Difficult Wiring Problem

In a New England plant supplying numerous factories with hydroelectric service the handling of the outgoing circuits was rendered unusually difficult on account of the location of the building across a narrow gorge and directly over a river. The interior arrangement of the station necessitated carrying the outgoing lines out from the down-stream side above the tail-race. The main difficulty was the location of the lightning arrester connections and horn-gaps. The problem was solved by erecting a structural steel platform along the entire length of the station, providing a wooden walkway on the dead side of the arrester leads and mounting the horn-gaps over an opening between the walkway and an outside channel iron which ties the bracing together. Through this opening the rods governing the rotation of the horn-gaps are carried vertically to the bottom of the frame and then connected with the station interior by horizontal runs. The live lines are dead-ended on strain insulators in the usual fashion at the top of the station wall, taps being carried through bushings from the high-tension buses to the outgoing lines. Other bushings in concrete panels lower down provide space for the entering arrester leads, the outer halves of the horn-gaps being reached by diagonal taps from the main lines above. This arrangement makes the wiring accessible at the horn-gaps without carrying the latter into the building, and while not to be recommended as a promenade, furnishes a means of access when necessary far superior to the usual temporary staging or boatswain's chair.



LIGHTNING ARRESTER CONNECTIONS AND HORN-GAPS INSTALLED ON STEEL PLATFORM ON SIDE OF STATION

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

University Building Flood-Lighted as Demonstration for Students

During the meeting of the Indiana Engineering Society at Purdue University, Jan. 18 to 20, Eliza Fowler Hall, one of the university buildings, was flood-lighted to demonstrate the possibilities of flood-lighting to the



ELIZA FOWLER HALL AT PURDUE UNIVERSITY REFLECTING 5-KW. OF LIGHT

convention delegates and to the engineering undergraduates at the school. To light the building, the front of which measured 100 ft. by 125 ft., two batteries of projectors, each containing five 1000-watt lamps, were placed in front and somewhat to the sides of the building at a distance of 125 ft. from its corners. The accompanying illustration shows the building as it appeared under the illumination. The lighting units were furnished by the American Lighting Company.

FIFTY RANGES IN TOWN OF 3500

The Experiences of the Municipal Plant at Lake City, Minn., in Selling and Serving Electric Ranges

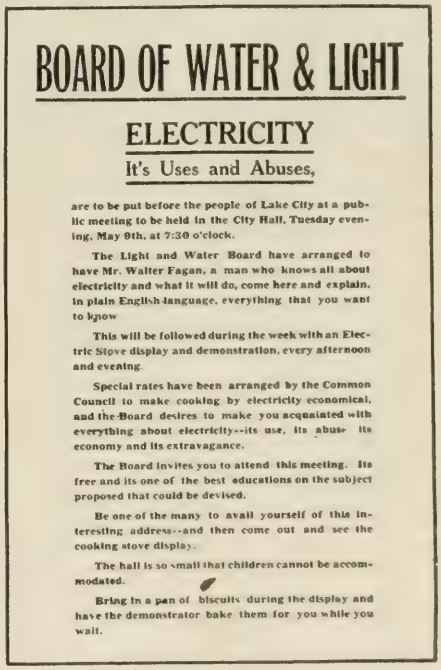
Lake City, Minn., which has a population of 3500, owns its electric light plant, purchasing energy from the Wisconsin-Minnesota Light & Power Company. The local plant has just passed through its first season's experience at selling electric ranges. The electrical affairs of the city are handled by a board of water and light commissioners, of which J. Cole Doughty is chairman. In the following Mr. Doughty tells how fifty ranges were sold at Lake City:

"First we applied to several different electric range manufacturers in an endeavor to get them together for a joint exhibition of their wares. We were not successful in this, as we found they insisted on the whole field or none. We finally secured the co-operation of the present company. We then fitted up the auditorium of our city hall for an exhibition room. We advertised in the local papers that an exhibition of electrical cooking would be given at the hall, extending through four days, covering Wednesday, Thursday, Friday and Saturday.

"The manufacturer sent his demonstrators and they gave a talk to our citizens in general assembly on the use of electricity as applied to cooking and heating. Assisted by a member of the board, they also took orders from persons desiring the appliances. In addition, they made demonstrations in cooking every day, showing what could be accomplished. They brought with them a young lady who thoroughly understood her business, and who was not only a good cook, but was also a good canvasser. They put in the week here canvassing every prospect.

"In the meantime we had prepared circulars which we distributed very freely among the users of electricity. These attracted considerable attention and brought inquiries that enabled us to reach many people whom we probably should not have reached in any other way.

"A member of the water and light commission was in attendance at each meeting taking orders and assisting in a general way. This we regard as having added considerably to our success, as it gave the project the indorsement and backing of our board. Our room was equipped with hot plates, ranges, cabinet ranges, electrical washing machines, sad irons, electric fans, and such appliances as would naturally come into play under our special rate.



BOARD OF WATER & LIGHT

ELECTRICITY

It's Uses and Abuses,

are to be put before the people of Lake City at a public meeting to be held in the City Hall, Tuesday evening, May 9th, at 7:30 o'clock.

The Light and Water Board have arranged to have Mr. Walter Fagan, a man who knows all about electricity and what it will do, come here and explain, in plain English language, everything that you want to know

This will be followed during the week with an Electric Stove display and demonstration, every afternoon and evening.

Special rates have been arranged by the Common Council to make cooking by electricity economical, and the Board desires to make you acquainted with everything about electricity--its use, its abuse its economy and its extravagance.

The Board invites you to attend this meeting. Its free and its one of the best educations on the subject proposed that could be devised.

Be one of the many to avail yourself of this interesting address--and then come out and see the cooking stove display.

The hall is so small that children cannot be accommodated.

Bring in a pan of biscuits during the display and have the demonstrator bake them for you while you wait.

"BRING IN A PAN OF BISCUITS AND HAVE THE DEMONSTRATOR BAKE THEM FOR YOU WHILE YOU WAIT," WAS THE FRIENDLY INVITATION FEATURED IN THIS NEWSPAPER ADVERTISEMENT BY THE LAKE CITY LIGHTING BOARD

"In addition to this we made a summer rate of 2.5 cents per kilowatt (to be used with a separate meter) and to extend from the April 20 reading to and including the November reading. The rate for the winter

service was established at 3.5 cents, all conditioned upon a measurement of electrical current through the separate meter. We found, however, that the great 'bug a boo' we had constantly to contend with was the matter of installation. Consequently, we took this feature in our own hands, installing the stoves ready for operation at the list price. This enabled us to make a definite price to start with, so that people knew exactly what their investment would amount to. The customers own their meters. The stoves are guaranteed as to the 'elements' for a period of one year. Contrary to our expectations, all ranges averaged a greater price than we anticipated.

"As is usual among people starting something new, we made some errors, among which was placing our cooking rate too low. We should have demanded 3 cents per kilowatt during the summer months and 4 cents as a winter rate. With that change this would have been very desirable business.

"We anticipate a considerable dropping off in the use of electrical ranges during the winter months owing to the fact that, in this climate, so many residences are equipped with wood and coal ranges, which are used in heating kitchens and will frequently shut out the use of electric stoves. For summer, we have no doubt they will be in constant use to the exclusion of any other form of cooking."

Data on Motor Drives in a Massachusetts Printing-Shop

The ratings of motors and methods of connecting them with different machines in the plant of the Davis Press, Worcester, Mass., are given in the accompanying table. With this connected load of about 20.7 hp. the average monthly energy consumption is 1450 kw.-hr., which with the rate of 4 cents obtained makes the bill $58 a month. Many of the motors are variable speed Kimble units, the remainder being General Electric and Peerless motors. Flywheels are employed with most of the motors to absorb peak loads. Friction drive is used with three presses. The energy is supplied by the Worcester Electric Light Company.

Machine Driven	Size, In.	Motor, Hp.	Motor Speed, R.p.m.	Pulley Diameters, In.		Face or Belt Width In.	Remarks¶
				Motor	Machine		
Whitlock premier press	41x52	5.0	1300–1800	4.25	20	6	*700-1900 impressions per hour
Whitlock pony press	25x38	2.5	1800	4.00	26	4	*800-2200 impressions per hour
Miehle No. 3 press	33x46	3.0	1800	4.00	18	4.75	*700-2100 impressions per hour
Golding job press	12x18	0.5	Approx. 3 to 1	4.00	42	1.75	*†
Golding job press	12x18	0.5	Approx. 3 to 1				
Chandler & Price press	10x15	0.5	Approx. 3 to 1	4.00	40	1.625	*†
Golding-Pearl press	9x11	0.16	Approx. 3 to 1	2.5	28.5	1.25	*†Hand and pedal control
Standard automatic press	13x19	1.5	1800	2.5	16	2.25	*
Oswego cutter press	38	3.0	1160	4.5	20	3.5	*
Colt's armory press	13x19	1.0	1160	3.75	26	3.00	*
Cleveland folding machine	19x24	0.5	1700	2.25	17	2.00	General Electric motor
Embossing oven	12	0.05					Peerless motor three-part pulley
Miller saw trimmer		0.5	1800	3.75	2	1.75	General Electric motor
Monotype machine		0.5	1200 max.	2.5	14	1.375	
Monotype machine		0.5	1200 max.				
Air pump		1.0	1160	2.5	36	4.00	

*Has flywheel. †Friction drive. ¶All motors except those whose makes are indicated are Kimble units.

Additions to Commonwealth Edison Company System Load During Year 1916

The men in charge of the various divisions of the contract department of the Commonwealth Edison Company, Chicago, recently prepared a statement showing the extent of business handled during the last year. Abstracts of these statements, which were published in full in the Edison *Round Table*, are given herewith:

George H. Jones, power sales agent, reported during the year contracts which have been taken for motor service, exclusive of street-railway loads, amounting to more than twice the volume secured during the year of 1915. The net total was 52,300 hp. To secure this load the department closed 3122 contracts, among which were some thirty contracts covering the replacement of large isolated plants.

Oliver R. Hogue, head lighting agent said that the lighting business obtained by the company increased 47 per cent over 1915. This represents a net increase of over 1,000,000 50-watt equivalents during that period. To give an accurate idea of the work of his department in developing and putting into service new industrial heating devices, Mr. Hogue cited the following list of devices which have been developed and put into service during the year 1916: Putty warmers, wax compound heaters, cattle prodders, new type of gluing machines, enameling ovens, drying rooms, electric heaters for oil cars, sand heaters, cloth steamer, seed germinator, heating sprinkler valves, lumber treaters, pyrographic machines, pearl shell heating, printing press ink heaters, bake ovens, fur dryers and optical furnace.

Reporting for the estimating division, W. P. Lyon said that during 1916 the division had handled 3852 contracts amounting to $619,403. This is an increase of 51 per cent in contracts and 88 per cent in the amount of contracts as compared with 1915. In this total were included 3142 house-wiring contracts amounting to $406,908.

A Small Central Station's Safety Code for Its Public

In a handy booklet of electric service information issued by the Wapsic Power & Light Company of Mount Vernon, Iowa, to its customers the following pointers to safety are listed:

"Do not touch any wire that is down on the ground, or hanging from a pole, with hand or foot or any part of the body, no matter whether it is an electric, telephone or guy wire.

"If you find a wire down on the ground, have some person guard it, and notify the electric company at once.

"In an emergency a wire may be moved by using a rake, pitchfork or similar tool with long dry wooden handle, keeping the full length of the handle between yourself and the wire.

"Inside house wiring should be arranged so that it is not possible to stand in the bathtub or be in contact with a water or steam pipe at the time one is touching any electric light socket, switch, or any portion of an electric circuit. Even low voltages have been known to give a shock if received by persons in a bathtub.

"Do not leave your electric flatiron turned on while you answer the telephone or go to the door. It may scorch some valuable cloth.

"Do not have stand lamps, telephones or any other electric devices where they may be placed on radiators or where persons handling same may come in contact with radiators, sinks or pipes.

"In case of trouble with your motor, call a competent electrician or notify the lighting company."

SECURING AND OPERATING SMALL TOWN STREET LIGHTING

Ideas on Tree Trimming Which the Manager of a System of Interconnected Towns Found Valuable in Dealing with Town Boards

BY SAM B. MOTT

Manager Noblesville (Ind.) Heat, Light & Power Company

From the central station viewpoint the subject of street lighting is very important. It assumes prominence, not so much on account of the revenue to be gained, although that is important, but more from the fact that the public judges the electric company by the character of the street lighting service it gives.

In tackling the street lighting problem in a small town the first thing to do is to secure a street lighting contract. This is equally important to the town to be served and to the central station furnishing the service, and should be handled with perfect frankness by both sides. In the making of such a contract the question will arise as to whether the system is to be operated on an all-night or moonlight schedule. This feature alone is worthy of a great deal of consideration. In lighting five small towns on the moonlight schedule, we found that there was more or less dissatisfaction because many of the citizens of the towns thought the lights should be burning regardless of whether the moon was shining or not. For this reason alone, it seems to me that all street lighting contracts should specify all-night operation. The additional cost should not be more than 20 per cent greater and the increased satisfaction obtained would more than pay for the additional expenditure.

Another important consideration in making a street-lighting contract is the location of lamps and the distance between them. It is much better, I believe, to use close spacing and smaller units than long spacing and higher candle-powers. It has been our experience that a 50 cp. or 60 cp. tungsten lamp at each street intersection in the thickly-settled residential sections, and spaced at two-block intervals in the thinly settled portions, gives perfect satisfaction. In the business district it is much better to use 80 cp. or 100 cp. units and a spacing of one-half block. This arrangement will give satisfaction in towns which cannot afford ornamental post lighting.

Another important feature of a street lighting contract is the method of suspending the lighting units. A great many cities use the bracket type of suspension regardless of surrounding conditions. This practice is all right in localities where there are no trees, but in the shaded portions of a town the lamps should be suspended in the center of the street in perfect alignment. There is nothing more pleasing to the eye of the small-town resident than a row of street lamps perfectly in line and all the same distance from the ground.

From 18 ft. to 20 ft. is about the best height to use for such lamps. This of course must depend on the conditions of the trees surrounding the location of the lamp. It has been the custom in the past for town boards to pass tree-trimming ordinances, requiring trees to be trimmed to at least 8 ft. above the sidewalk. Such an ordinance seemed to suit most of the people who had trees to trim. They would trim them to this height from beneath, then hire a tree butcher to cut the top out. While such tree trimming would make a tree unsightly, it was satisfactory in the old days of the kerosene or gas lamp that stood on a post about 7 ft. high.

Modern street lighting with electricity has made it necessary to change ideas on tree trimming. The up-to-date method is to trim trees from beneath to a height of 20 ft. if the size of the tree will permit it and to leave the top without trimming. The result of such trimming is a tree that will let the artificial light shine through and will also allow sunlight to reach the grass and make it grow. A tree so trimmed will afford better all-around conditions and will itself be more nearly what Nature intended it to be.

WHO TO SECURE AS THE LOCAL OPERATOR

The operation of a street lighting system in a small town also presents a problem. The first consideration is the location of switching and regulating apparatus. It has been found that the most practical place for this apparatus is in the town's fire department building or in one corner of the town jail. The last-named place is very practical, for since the open saloon is passing there is no need for a jail of large capacity and there is nearly always enough room to partition off space for the installing of the apparatus.

The next consideration is the arranging for a man to care for the system. His principal duties will be renewing burnt-out lamps and winding and setting the time switch. Even an inexperienced man can do such work. There are two ways to settle this question, one is for the central station to furnish the man and in consequence thereof to charge a higher price for their service, and the other is for the town to furnish the man and as a result to get the service at a lower cost. If the central station furnishes the man, the local telephone lineman is usually selected because in addition to operating the street lighting system, he can install meters and run the service wires for the lighting customers. If the town furnishes the man, the town marshal seems to be the most practical fellow, as he can do the work without interfering with his other duties. The town clerk does this work in one town served by our company and the president of the village board does it in another.

By following plans such as are set forth above I believe it is possible for the average small town or village to have street lighting service that will be as good as city service.

Sales Force Devotes the Month to Bettering Public Relations

During the month of January the outside salesmen of a small Ohio central station were set to work calling on every customer of the company to ask whether or not service had been good during 1916. Each customer was asked the direct question, "Have you any complaint?" The salesmen found that the great majority were entirely satisfied. But where there was complaint everything that is possible was done to remove the cause for it. As many as five calls were made on the same customer to clear away satisfactorily certain misunderstandings.

January was selected as the proper month for the campaign of education because it is a month in which no campaign is conducted on any special device. Furthermore, January is the month in which customers receive high bills and there is an advantage in explaining why these increases occur in the winter, before the customer talks about the higher cost with her neighbor.

It was discovered as the result of this campaign that 80 per cent. of the company's customers were normally "neutral"; they were neither for nor against the company. Of the remaining 20 per cent. one-half were boosters for the company and one-half were complaining. It is believed that the educational campaign changed those who were complaining to neutrals and spurred the boosters to redouble their praises of the company.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

A DUMMY ANTENNA FOR TESTING RADIO UNITS

Installation at Factory in Palo Alto, Cal., Has a Capacity of 0.031 Microfarads

IN the manufacture of radio units of larger capacity than have heretofore been attempted, the Federal Telegraph Company found it necessary to provide for its factory in Palo Alto, Cal., a dummy antenna which could be used for testing Federal-Poulsen arc converters of various sizes. Because of the large units contemplated, and since interference with nearby commercial stations had to be avoided, the type of construction shown in the accompanying illustrations was developed. This afforded capacities up to 0.031 microfarad, and by being of such construction as to have a low effective height caused a minimum of interference.

The antenna consists of five parallel layers of wires spaced 5 ft. apart vertically. The wires in each layer are 2 ft. apart horizontally and there is a 10 ft. clearance between the ground and the lowest point in the bottom layer. The bottom layer, which is grounded, is 136.5 ft. wide with a maximum length of 262.5 ft. The other layers, insulated from ground are 20 ft. shorter and 41 ft. narrower. The insulated layers have fifty-one wires each and the grounded layer sixty-six wires.

The two outer wires on each side of the four top layers are size No. 2, because the edge wires are not shielded so well as the others and it was desired to prevent the corona which would otherwise appear at the edges of these layers. With this exception, No. 14 galvanized telephone wire was used in all layers, and the wires are fastened at each end to 1-in. stranded cables. Although galvanized wire is not generally considered good practice in radio work, it was nevertheless used on this antenna because with the large number of wires employed the resistance could be kept within the usual limits.

For convenience the five parallel layers of the antenna are numbered from the top down. Layers Nos. 1 to 4 inclusive are well insulated, as shown in Fig. 1, and a long length of halyard between the insulation and the supporting towers was provided in order to permit of putting in more insulation with suitable corona shields in case this became necessary at a later date. Obviously, if this were done only layers Nos. 1 and 5 could be used, because the large diameter of shields necessary with such a long string of insulators would otherwise interfere, the layers being only 5 ft. apart. Provision was also made for the installation of corona shields on the insulator strings now used, but no trouble of this sort has been experienced thus far and these shields have not been added.

Beneath layer No. 5 are two single wires which are normally connected and have a separate lead running into the laboratory. These have a capacity of 0.002 microfarad. By various combinations of these wires with different layers of the antenna a considerable number of capacities are available, the maximum being obtained when layers Nos. 1, 3 and 5 are connected as the earth side of the system and Nos. 2 and 4 are connected with the two single wires as the high-potential side. With this combination the capacity is 0.031 microfarad. The jumpers (Fig. 2) used for connecting the various layers consist of 1½-in. copper tube provided with suitable clamps and fittings so that shifting to different capacities is an easy matter. The capacities most commonly used are 0.006, 0.012, 0.017 and 0.024 microfarad. Many others are available.

Before deciding upon the exact lengths of the antenna wires it was noted that with evenly spaced equal load-



FIG. 1—ALL FIVE ANTENNA LAYERS TERMINATE IN CABLES WHICH ASSUME PARABOLIC CURVES



FIG. 2—ONE END OF ANTENNA, SHOWING JUMPER CONNECTIONS AND LEAD INTO LABORATORY

ing the 1-in. cables to which the wires are attached would assume a parabolic curve. The lengths of the wires in each layer were calculated accordingly, and thus a uniform tension is secured in the individual wires of each layer without excessive pull on the pole supports.

Having tabulated the length of each wire, which was calculated to the nearest 0.01 ft., a convenient scheme was devised for cutting the large number of wires to exact length so as to secure the parabolic curve in the 1-in. cables. Two short posts, exactly 200 ft. apart, were set up on the site with several intermediate stakes between. The wire was unwound from the reel near one of the posts and run out with a "come along" grip to the desired length beyond the second post. A steel tape with its zero on the second post was stretched out beyond it with the wire and the end of the wire was placed at the exact tape reading before signaling.

Having the end of the wire held firmly in place on the tape, a man near the reel put steady tension in the wire by means of a "come along" grip until the wire was just raised above the intermediate stakes, and then, upon signal from the man at the tape, the wire was cut with pliers at the first stake. After cutting each individual wire the crew, consisting of two men at each end, proceeded at once to fasten it in place on the 1-in. cable which had been previously stretched, to remove twists, and laid out on the ground in position for hoisting. In cutting the wires, 1 ft. over and above finished dimensions was allowed for connections. A point 6 in. from each end was measured off with a rule, and this point was kept at the inner side of the cable while the end of the wire was given two turns around the cable and sufficient wrapping to secure it.

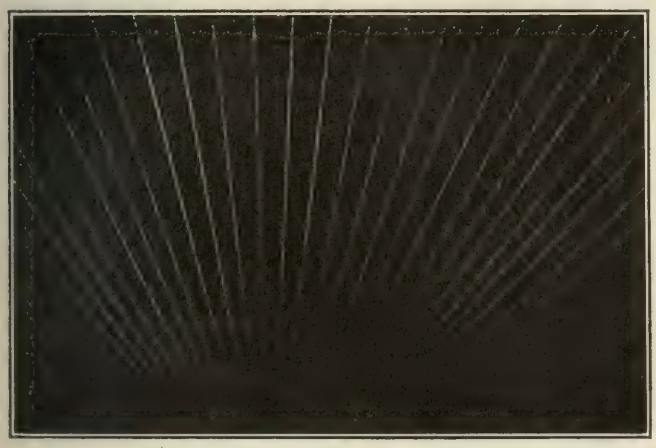
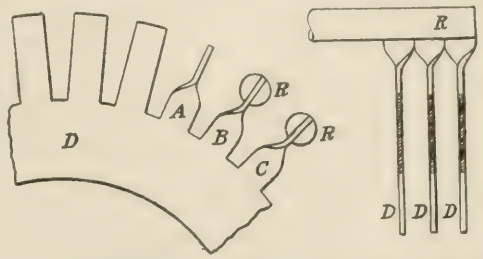


FIG. 3—NIGHT VIEW OF CORONA WITH ONE LAYER CHARGED

The antenna as a whole reaches the corona point with an undamped high-frequency current of 250 amp. at a frequency of 20,000 cycles. The accompanying night photograph (Fig. 3) shows a layer of the antenna at the corona point during test of a 200-kw. Federal arc converter. The antenna is used by the Federal Telegraph Company and was designed by its engineering staff.

Generators, Motors and Transformers

Squirrel-Cage Motors.—In the use of squirrel-cage motors trouble is sometimes experienced through the connections between the rotor bars and short-circuiting rings working loose. A British company has overcome this by a method of rotor construction using subdivided end rings and brazed joints. Each end ring is made in the form of two, three or four annular disks per side, and thereby a much greater cooling surface is obtained than with a single ring. Fig. 4 shows a portion of an annular disk *D* of sheet copper, punched with teeth. These teeth are afterwards turned at right angles, as shown at *A*, *B* and *C*, so as to fit into saw cuts previously made in the rotor bar *R* (see Figs. 4 and 5); after the disks are all in place the joints are



FIGS. 4 AND 5—PORTION OF END-RING DISK AND METHOD OF CONNECTING WITH ROTOR BARS

brazed. A rotor built in this manner is practically indestructible, as there is no solder to melt and the joints cannot work loose.—London *Electrician*, Dec. 22, 1916.

Parallel Operation of Commutating-Pole Machines.—W. B. WEAVER.—After a detailed discussion of the various aspects of this problem the author reaches the following conclusions: The brushes of commutating-pole machines should be placed on the geometrical neutral and should be shifted only as a temporary emergency measure when parallel operation cannot be obtained in any other way. The commutating-pole winding should not be made to function as a series field, and should be used for the sole purpose of insuring good commutation at all loads.—*Elec. Journal*, February, 1917.

Lamps and Lighting

Alternating-Current Arc.—C. D. CHILD.—A paper on the production of light by recombination of ions. The work of Fleming and Petavel on the intensity of the light from an alternating-current carbon arc at different phases was repeated and a similar study was made of the flaming arc and mercury arc in a vacuum. In every case the intensity of the light passes through a minimum without entirely vanishing, and this minimum occurs after the current passes through the zero value. With the mercury arc the minimum intensity occurs approximately 1/1800 second after the current becomes zero. In this case the continuance of the light indicates that the light is due to the recombination of the positive and negative ions, since there is here no chance for oxidation or other known chemical action.—*Phys. Rev.*, January, 1917.

Traction

Tractive Resistance on Curves.—EDWARD C. SCHMIDT and HAROLD H. DUNN.—An account of an investigation carried out at the Engineering Experiment Station of the University of Illinois on the tractive resistance on curves of a 28-ton electric car. The tests were made with a car such as is commonly used on interurban electric roads; it has a body 45 ft. long of the double-end type with round vestibules. This body is carried on four-wheeled trucks which are spaced 23 ft. 3 in. from center to center and which have a wheelbase of 6 ft. 4 in. The car is equipped with four 50-hp. motors, and weighs approximately 28 tons. The tractive resistance of this car was determined when running upon each of seven curves whose curvature varied from 2 to 14.5 deg., and also when running upon adjacent tangent track. The tests demonstrate that for the car in question curve resistance varies directly with both track curvature and speed, according to the formula $R_c = 0.058\ SC$, in which R_c is the curve resistance ex-

pressed in pounds per ton, S is the speed in miles per hour, and C is the degree of curvature.—*Univ. of Ill. Bulletin*, Vol. 14, No. 3, Sept. 18, 1916.

Installations, Systems and Appliances

Alternator Field Rheostat.—F. L. MOON.—A discussion of the question when it is possible to omit alternator field rheostat. A rheostat is required for the purpose of adapting a constant-voltage source of excitation to the varying excitation requirements of the alternator. If the field rheostat is omitted, a suitable source of variable excitation must be provided. The author discusses the types of excitation system, dealing first with the common exciter bus or central direct-current system and with the individual exciter system. He then takes up exciter voltage stability and the range of exciting voltage required at the alternator collector rings. Automatic voltage regulation is finally discussed. The only type of voltage regulator available until recently has, as a part of its main control, a direct-current solenoid, which is energized from the exciter bus. This necessitated the operation of the exciters in multiple, unless a regulator was provided for each unit. There is now available a regulator which has a main control entirely by alternating current and, as a consequence, controls satisfactorily independent exciters, as well as exciters in parallel. And where a separate source is available for energizing the relays, it may be used for a practically unlimited range of exciter voltage. Where an automatic regulator is used, each exciter field circuit includes two rheostats, as indicated in Fig. 6. One is intermittently

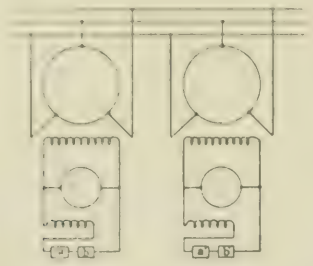


FIG. 6—INDIVIDUAL EXCITER SYSTEM



FIG. 7—EXCITER CHARACTERISTICS

short-circuited by the regulator, and the other, known as the equalizing rheostat, is used for hand adjustment. In the diagram a a' are the equalizing rheostats and b b' are the exciter field rheostats. Let the exciter saturation curve be represented by C, Fig. 7, and the volt-ampere characteristic of the exciter field winding alone by A, and with equalizing rheostat included by B. When the regulator contacts are closed—that is, the exciter field rheostat short-circuited—the total field resistance line has the position B, and the exciter voltage builds up. With the contacts open, the resistance in the exciter field circuit is greater than before, and its characteristic has the position D, say; under this condition the exciter voltage drops. The beating of the relays, therefore, causes the exciter voltage to rise and fall alternately, or to oscillate about some mean value, as E. For a different vibration of the regulator, E would be somewhere else on the curve C. A change in the equalizing rheostat also would result in a change of the location of E. Suppose more of the equalizing resistance is used; then B and D assume new positions, B' and D'; and assuming the same vibration of the regulator, the effective resistance of the shunt field circuit is increased, and the exciter voltage will drop to some value F. That this would happen is evident, since the distance between C and B is less than that between C and B', so the tendency of the exciter voltage to build up is less than before, and the distance between C and D' is greater than that between C and D, hence the tendency of the exciter voltage to drop when the relay contacts are open is increased. In this way the exciter voltage responds to readjustment of the equalizing rheostat.—*Elec. Journal*, February, 1917.

Electrochemistry and Batteries

Aluminum Rectifier.—A. L. FITCH.—An account of an experimental investigation on the counter emf. in the aluminum rectifier. The investigation shows that any method of experimentation in which an appreciable length of time must elapse during the taking of data, the cell being on closed circuit with the battery at least a part of this time, will introduce serious errors due to the change taking place in the cell itself. No attempt has before been made to explain the action of the cell on the theory that the action is due to a double dielectric, one part of which changes with the time of open circuit and the other with time of closed circuit. The present investigation shows that such a theory is plausible and fully explains all the cases investigated. The cell does not attain a steady state after a short time of closed circuit, nor does the single dielectric theory seem plausible. The theory leads to the conclusion that any electrolyte which liberates oxygen on electrolysis may be used in the rectifier. It also shows that other metals than aluminum should be available as anodes, since it only requires the metal to form a compound with the liberated oxygen and that this compound has a rather high resistance.—*Phys. Rev.*, January, 1917.

Electrophysics and Magnetism

Effect of Light Upon the Contact Potential of Selenium and Cuprous Oxide.—E. H. KENNARD and E. O. DIETERICH.—An account of an experimental research. The contact potential of selenium changes under illumination by an amount exceeding a millivolt for 0.01 candle-foot, and tending to show saturation at a value of about —0.1 volt under strong illumination. The phenomenon is complicated by fatigue effects and a slow drift of the potential with time. No emf. is produced, however, in a closed circuit. The contact potential of selenium relative to freshly sandpapered copper is about —0.4 volt in the dark. The surface potential of a plate of cuprous oxide changed under illumination by about 25 mv., but the plate also contained a small voltaic emf. which varied under illumination.—*Phys. Rev.*, January, 1917.

Emission of Electricity from Incandescent Bodies.—A. BOUTARIC.—The first part of an article in which the author outlines the facts concerning the emission of negative electrons and of positive ions from incandescent bodies.—*La Lumière Elec.*, Dec. 23, 1916.

Book Reviews

A LABORATORY COURSE OF PRACTICAL ELECTRICITY FOR VOCATIONAL SCHOOLS AND SHOP CLASSES. By Maurice J. Archbold. New York: The MacMillan Company. 222 pages. Illustrated. Price, $1.10.

A manual has been produced by the author that should prove very useful to high school, vocational and practical electrical shop students in carrying out experiments in connection with regular textbook courses. The manual is arranged in loose leaf form so that the teacher may arrange the experiments to suit conditions. Most of the tests are arranged for work with commercial apparatus which gives the student an insight into the kind of work he will be required to do in the electrical field.

To guide the student in working the tests a wiring diagram for each experiment is given in the appendix.

PRINCIPLES OF THE TELEPHONE. By Cyril M. Jansky, B. S., B. A., and Daniel C. Faber, E. E. New York: McGraw-Hill Book Company, Inc. 160 pages. Illustrated. Price, $1.50.

The first of a series of three courses devoted to the principles of the telephone is contained in this volume, which is confined mainly to subscribers' apparatus. The two parts which are to follow, treating of central office equipment and outside construction, are in preparation. Attention is given to both the Bell and the independent apparatus.

It was the intention of the authors that this series of courses should appeal to and be of practical use to men who are actively engaged in the installation, care and operation of telephone apparatus. Judging from the discussion contained in the pages of the first course the reviewer is firmly convinced that the appeal is not made in vain. Simplicity of diction and clearness of both illustrations and text, combine to make the courses of great value to the practical men who wish to know the "why" as well as the "how."

A SYSTEM OF PHYSICAL CHEMISTRY. In two volumes. By William C. McC. Lewis. New York: Longmans, Green & Company. Vol. 1, 524 pages; Vol. II, 552 pages. Illustrated. Price, $2.50 per volume.

The "system" which has been adopted by Professor Lewis as his guide in preparing these two volumes, regards all physical and chemical phenomena as divisible into two groups: (1) phenomena of physical systems in equilibrium and (2) phenomena of such systems which have not reached a state of equilibrium. By choosing this broad classification the author is enabled to show the close relation which exists between many phenomena that appear of remote relationship indeed. The phenomena of each of the two above sub-classes are then discussed: from (1) the classical kinetic standpoint, (2) the thermodynamic standpoint, and (3), the latter, according to the modified principles of statistical mechanics.

Aside from the outstanding feature of this interesting treatment of physical phenomena in a way to facilitate the reader's grouping and retention of separate facts, the volumes have been brought up to date (1916) by including recent investigations on the structure of the atom, thermodynamics of photo-chemical reactions, theory of concentrated solutions, etc. The present work is one of a series of text-books on physical chemistry edited by Sir William Ramsay and issued by the same publishers.

RADIODYNAMICS. The Wireless Control of Torpedoes and Other Mechanisms. By B. F. Miessner. New York: D. VanNostrand Company. 206 pages. 112 illustrations. Price, $2.

This is intended to provide a historical and technical description of the development of wirelessly controlled mechanisms, but is directed toward the military and non-technical scientific reader as well as toward the engineer.

The book opens with a discussion of "wireless" telegraphy, including the obsolete conductive and inductive forms and various modes of signaling by sound and heat waves. Curiously enough, Tesla's earth-conduction scheme is classified under "electromagnetic wave systems." The central portion of the book gives some descriptive matter relating to various early attempts at wireless control of boats, airships and torpedoes, and the author then takes up in some detail the work of J. H. Hammond, Jr. (whose assistant he was) in improving the military value of such devices. Various problems of interference prevention, relay operation, etc., are discussed and the author's suggested solutions described. Some ingenious proposals are brought forward, though the treatment is largely amateurish from the radio-engineering standpoint. The author seems to share the dislike of the term "audion" which exists in some quarters, for he calls this device the "Potentio" detector throughout his book. In spite of its evident weaknesses, however, the reader is likely to find some information of interest in the descriptive chapters.

THE EMISSION OF ELECTRICITY FROM HOT BODIES. By O. W. Richardson. New York: Longmans, Green & Company. 304 pages. Thirty-five illustrations. Price, $2.75.

The last few years has seen the commercial development of rectifiers such as the kenotron and the successful use of wireless detectors and amplifiers such as the audion, both pieces of apparatus depending for their action on the emission of electrons from hot filaments. In order to appreciate the possibilities and also the limitations of such apparatus the engineer should know something of the work that has been done on thermionic currents as recorded in this new text.

After a brief historical review of the experimental data and of the theories developed to explain the results obtained, the author derives the law of variation of emission of electrons with temperature, assuming that the laws that govern the escape of the electrons are the same as those that govern the increase in vapor pressure of a liquid with increase of temperature. The experimental data on the emission from metals and from compounds is then critically analyzed, one chapter being devoted to the effect of gases, and the conclusion is reached that the electron emission is caused by temperature and not by chemical action.

The second half of the text deals with the emission of the positive ions that are found when the temperature is not too high. This consists of a transient emission from fresh wires due to impurities and a permanent emission found when the material is heated in an atmosphere of various gases. The experimental data on the emission from heated salts is then examined, and the text closes with a short discussion of a number of cases of gaseous ionization whose origin is generally assigned to chemical action.

The book is written principally for physicists, and does not give an account of the technical developments of the subject. It is a mine of information, and should be a source of inspiration to electrical engineers, by whom it can be read without difficulty.

Concord Municipal Plant Not for Sale

To the Editor of Electrical World:

Sir:—I have before me your edition of Jan. 20, 1917, and have noted with astonishment the statement contained in the last paragraph of the article on page 123 entitled "Municipal Plants Should Share Cost of Regulation" that "Considerable headway has recently been made in two important," we certainly appreciate the word important, "instances (Concord and Westfield) in projects for the sale to privately owned companies of existing municipal plants."

In order that you may know the facts of the case, we are forwarding, under separate cover, a copy of our report for the year ending Dec. 31, 1915, and please note that the writer is alone responsible for what has taken place in Concord, Mass. "Business is business" and "a penny saved is a penny earned," but the voters of the Town of Concord did not wish to even consider the proposition and the Municipal Light Board and Manager of the Plant had the only contest with the voters of the Town since the plant was established to get a majority to vote for a committee of nine to look into the matter. After a strenuous contest it was voted that a committee be appointed and following a thorough investigation the committee unanimously voted against the purchase of current from outside sources.

Would you say that "Considerable headway has recently been made in projects for the sale to publicly owned plants of existing privately owned plants" if a private company approached a municipal plant and asked it to make a proposal to furnish current wholesale on its switchboard? I am quite sure that you would not, and in the opinion of the writer it is just as good business for a municipal plant to take advantage of any possible method of reducing its expenses.

Do you believe that either the Boston or New York Edison Companies would meet our rates were they supplying a residential community of 6000 people? The census gives Concord, Mass., 6500 but please note that at present we have a population of about 500 in the Massachusetts Reformatory that does not help our plant one bit. We serve a scattered community and have a plant investment of $181,000 and more than $71,000 is in lines alone with transformers and meters, making a total outside investment of $93,000.

For your information we are also forwarding a copy of our Rates, Rules and Regulations and would call your especial attention to our cooking and heating rate. We shall be pleased to forward our report for the year 1916 when it is received from the printer.

Facts are facts and when we stick to them we can harm no one. It seems to the writer that in fairness to Concord such erroneous reports should not be broad-casted all over our country. If municipal ownership of public utilities is an absolute failure it cannot be long hidden from the public for as our martyred President Lincoln said "You can fool all of the people some of the time and some of the people all of the time but you cannot fool all of the people all of the time." This applies to municipal as well as privately owned plants.

A. W. Lee,
Manager Concord Municipal Light Plant.

Readers' Views and Comments

Saving $1,000,000 on Street Lighting

To the Editor of Electrical World:

Sir:—While the Chicago street lighting system requires the installation of a further 30,000 lamps to the already existing 34,000, the War Department has recommended that the flow of water through the Sanitary District's power house at Lockport be reduced one-third of the existing 6500 cu. ft. per second. This would mean a reduction of 11,333 lamps, whereas there is need for an actual increase of 30,000 lamps during the next three or four years.

With the inability to obtain further power from the Sanitary District's station, because of the War Department's recommendation, the obtaining of requisite power has become imperative to meet the needs of future lamp increases.

Due to efficient co-operation between Commissioner W. G. Keith, of the department of gas and electricity, and the city engineer a solution has, however, been found which will be economical to both departments, and which will, it is estimated, effect a saving of 25 per cent in operating lamps.

The growth of the city has necessitated the construction of a number of buildings such as an Isolation Hospital, a bridewell, municipal shops and foundry. These buildings, grouped together, require a heating plant of considerable size; but while requiring heat during the daylight working hours this heat, or a large portion of it, would go to waste during the remaining twenty-four hours. Through co-operation between the electrical department and the city engineer arrangements have been made to utilize this heat for street lighting between the hours of 4 p.m. and 7.30 a.m. A steam turbine and generator will be installed, its power being used in the city shops, bridewell, etc., during the day, and by the city's street lighting during the night, thereby effecting economy to both departments. Now that the problem of obtaining an economical source of power is solved the entire proceeds of the $3,750,000 bond issue approved by the people last June will be devoted to line construction and other work necessary in connection with placing the 30,000 additional lamps in service.

These lights will be installed in territories not at present lighted and also improve the illumination in districts insufficiently lighted. Not the least important improvement in the proposed installation over those of previous years is that the lamps in residence districts will be operated at a low voltage, thus reducing the liability of injury and fatal accidents in those instances where persons come into contact with live wires. The immediate saving by eliminating the need for constructing a generating station for street lighting will be $1,000,000, and is made possible by co-operation of the department of public works and the department of gas and electricity, a co-operation which it is expected will increase with time and as it increases will proportionately inure to the benefit of the city.

Gilbert Rutherford.
Evanston, Ill.

Suggestion That Will Make Scientific Data Available to All

Cambridge, Mass., Jan. 26, 1917.

To the Editor of Electrical World:

Sir:—The undersigned committee on engineering of the general committee on research of the American Association for the Advancement of Science feels that it is timely to issue the following appeal to the industrial research laboratories of the country.

In the course of work done in the numerous industrial laboratories of America, many physical and commercial constants and data of great scientific interest and value are doubtless arrived at and which may, for a certain period of time, constitute an asset of considerable commercial value to the particular corporations in question. During this period everyone recognized the proprietary right of the industrial laboratories to the retention of this information.

A time frequently arrives, however, when such scientific information loses its commercial value (often by being duplicated in other laboratories), and just at this point we wish to impress upon the industries their obligation to enrich scientific literature with such facts and data, which might otherwise be lost or forgotten.

Some of our industries have been reproached with the suspicion of acting as sponges, in that they absorb an immense amount of useful information from scientific literature without giving any return in kind. This suspicion would be entirely removed if, from time to time, scientific information which has ceased to be of commercial value were contributed by them to its appropriate channel and thus became available to all scientific workers throughout the world.

If any doubt exists as to the appropriate channel for the publication of such scientific data and communications, the secretary of the A. A. A. S., Dr. J. McKeen Cattell, Garrison-on-Hudson, New York, will be glad to act as intermediary and to forward such communications to the proper scientific body.

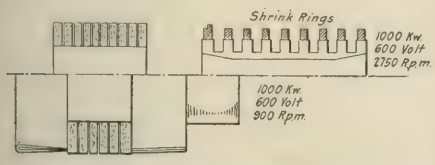
A. E. Kennelly, J. W. Richards, A. Sauveur, A. N. Talbot, C. C. Thomas

Output Limitations in Direct-Current Machines

To the Editor of ELECTRICAL WORLD:

SIR:—The writer appreciates the opportunity which you have furnished for publishing my reply to a letter by Prof. Miles Walker simultaneously with his comment on my article published in the Oct. 21 issue of the ELECTRICAL WORLD.

In that article I showed that if the maximum voltage between segments is limited to 30 to prevent flashing over, the number of ampere conductors per inch to 1000 to limit the armature heating, and the peripheral velocity to 9000 ft. per minute so that standard construction may be used, then the maximum permissible speed of a machine for a given output is fixed and in the particular case of a 1000-kw. machine must be less than about 1200 r.p.m. for a 600-volt commutat I then indicated that this limit was exceeded in Europe and cited the case of a 1000-kw., 600-volt, 2750-r.p.m. direct-current generator designed by Professor Walker



ESSENTIAL DIFFERENCES IN 2750 R.P.M. AND 900 R.P.M. 1000 KW. MACHINES

and showed that, to make such a machine possible, each armature coil had to be tapped by a commutator lead so as to give two commutator segments per coil instead of one, that the peripheral velocity of the armature was 17,300 ft. per minute and the rubbing velocity of the commutator 10,000 ft. per minute.

The essential differences between a 2750 r.p.m. and a 900 r.p.m. machine of 1000 kw. may be seen from the accompanying sketch. The constants of interest are,

Kw.	1,000	1,000
Volts	600	600
R.p.m.	2,750	900
Poles	4	6
Armature, dia., in.	24	36
Core length, in.	21	15
Max. tooth density, lines sq. in.	94,000	135,000
Core density, lines sq. in.	68,000	85,000
Frequency, cycles	92	45
Arm, surface vel., ft. per min.	17,300	8,500
Comm. rubbing vel., ft. per min.	10,000	5,000
Amp. cond., per in.	800	880
Circ. mils per amp.	550	450
Average volts per seg.	17	20

I greatly regret that any remarks I made should have seemed like criticism of Professor Walker's design. If I were compelled to build a machine of 1000 kw. to run at 2750 r.p.m. I should copy his design, which is quite liberal electrically, but I would say my prayers regularly while the machine was in operation, because on this side of the Atlantic we have not had the long experience of ultra-high-speed commutators enjoyed by the European builders. One of the large American companies which offers a line of direct-connected turbo units and also a line of geared units has not received an order for one of the former machines in the last twelve months. The operating companies evidently do not like the high-speed machine.

The original article was really written to defend the present American practice in motor generator speeds as against the 50 per cent higher speeds used in Europe for the same output, and I wish to take this opportunity to express my appreciation of Professor Walker's present book.

ALEX. GRAY.

Cornell University,
Ithaca, N. Y.

The Passing of Brother Potamian

To the Editor of ELECTRICAL WORLD:

SIR:—The regularity with which fortune favors institutions of learning by bequeathing to them the hallowed associations incident to the life-work of great members of their faculties is singularly fortunate. The roll of men preeminent in any department of progressive thought who have been intimately identified with the life of a university or a college always constitutes one of the most worthy elements of its atmosphere.

Albany Academy, had its Joseph Henry; Glasgow University, its Kelvin, and a long list of other seats of learning could be made showing similar associations.

Manhattan College, in New York, may have other claims to greatness based upon academic achievement; but in the realm of electrical science its name and that of Brother Potamian are synonymous.

Of inestimable value to the human race is it, that periodically there arrives a man, gifted, competent to achieve success in whatever walk of life he may enter; but who, possibly in answer to divine precept, pauses to analyze and record the achievements of other men. In technical literature Brother Potamian's monumental work was "The Makers of Electricity," in the writing of which he collaborated with Dr. James J. Walsh, of Fordham University. This is probably the most complete account we have of the biographical history of electricity, from Peregrinus to Kelvin.

Brother Potamian was ever alive to the value of exact record, and never knowingly passed by an opportunity to keep straight the truth of electrical history. In an editorial appearing in the ELECTRICAL WORLD and ENGINEER, some years ago, the question was raised as to whether Benjamin Franklin ever actually performed the *kite* experiments with which his name is associated; and if so whether he was not anticipated by M. de Romas, in France. To the Jan. 20, 1906, issue of your journal, Brother Potamian contributed a masterly review of the evidence in the controversy which should establish for all time the fact that Franklin undoubtedly was the first to employ a kite in electrical investigation.

As Brother Potamian has said of others, so it may well be said of him: "The lives of such men, who were inspiring forces in their day, are as illuminating as they are instructive and encouraging. Perhaps never more than now do we need such inspiration and illumination to lift life to a higher plane of purpose and accomplishment than that to which it is so prone to sink when material interests attract almost exclusive attention."

DONALD MCNICOL.

New York City.

Ground Detector Using Three Voltmeters

To the Editor of ELECTRICAL WORLD:

SIR:—The writer was greatly interested in the article by George E. Armstrong that appeared in the Dec. 9, 1916, issue of the ELECTRICAL WORLD, page 1145, and described a type of ground detector in use on the lines of the Southern California Edison Company.

The principle of the ground detector mentioned is almost identical with one that has been in use on the Brooklyn Rapid Transit System for the past seven years. The chief difference is that the Brooklyn company makes use of three voltmeters connected across the secondaries of the transformers in place of the three lights used by the Southern California Edison Company to give the visual indication.

A. K. MILLER.

Brooklyn, N. Y.

Eliminating Danger from Transil Oil

To the Editor of ELECTRICAL WORLD:

SIR:—The review of a German paper which appeared in the ELECTRICAL WORLD of Sept. 9, 1916, page 533, and discussed the possibility of reducing the inflammability of transil oil by its admixture with carbon tetrachloride, emphasized the fact that at the present time transil oil is a necessary evil, possessing a remarkable number of faults. The use of carbon tetrachloride is a move in the right direction so far as it goes. The trouble is that it does not go very far. Tetrachloride is extremely volatile, hence in mixing it with oil the element of uncertainty must be always present as to whether the oil is actually inflammable or non-inflammable, while the fact that it attacks brass and copper, is used commercially as a solvent for rubber, and is rather a powerful anæsthetic under certain conditions all mitigate against its use.

There is no doubt but that operating engineers would welcome a satisfactory and reliable substitute for transil oil, one that is non-inflammable and one without the hygroscopic characteristics of transil oil. Could such a substitute be found, and it no doubt will in time, insurance rates will be materially reduced as will also the relatively high costs for fireproof construction and other precautionary measures now in vogue for preventing fires and for permitting the oil to be removed from the danger zone quickly and safely. A sub-

stitute which is not hygroscopic will do away with the great care in handling and housing oil-cooled and oil-insulated apparatus, which is now necessary to guard against the absorption of moisture by the oil, and the rapid reduction of its dielectric strength.

The hygroscopic and inflammable nature of transil oil often works considerable hardship, for the smaller companies especially, who cannot afford effective but costly construction methods, and thus prefer to carry their own insurance rather than pay the high rates charged. Trouble is however often encountered by the larger companies on account of the opposition of the insurance interests against their installing oil-filled apparatus in close proximity to property upon which they are carrying the risk. The best example of this is the substations and transformer vaults now coming into increased usage by the larger companies to supply their customers using considerable power. These vaults or commercial substations usually are designed for oil-cooled apparatus because of the lesser space factor and attention required by them. Of course, air-cooled apparatus could be used where space permits, although the element of risk would even then not be altogether absent, while the additional cost of motor-driven blower, increased cost of operation and supervision would be strong deterrents. These transformer stations or vaults are often located right in the midst of a factory building or other load center to permit of economical distribution, low copper investment and voltage drop, etc.

For several years past one company has eliminated transil oil in some of its instrument transformers for both its own stations and those of its customers. This company uses potential transformers of 200 watts capacity on its 11,000, 1320 and 20,000-volt circuits, and it is the transformers for the two lower voltages which have an insulating medium other than transil oil. Instead of transil oil a solid insulating medium is employed. This compound solid at temperatures below about 40 deg. C. liquifies at higher temperatures. The transformer and case are warmed and the warm compound injected, when, the transformer cooling, the whole becomes a solid mass. If properly done, all interstices are filled and air pockets avoided. There are many advantages of employing such a medium. The transformer cannot very well be placed in service without the insulating medium—as sometimes occurs where oil is used—because the compound is injected by the manufacturer; since the medium is solid it cannot spill during shipment or leak through the case, nor "breath" due to atmospheric changes or absorb moisture. On the other hand, its solidity must surely make it rather troublesome to repair the winding; the possibility of air pockets forming and the possibility of ionization of this air followed by disintegration of the insulation and final failure seems not out of the question. Perhaps the greatest apparent objection to a solid insulation medium is that it is not self-healing, that is to say, if an arc starts a liquid such as oil may quench it, whereas with a solid material, with zero viscosity for the time being, serious damage could be done before the medium melts and starts to flow, and thus interpose a high resistance barrier in the path of current flow. Solid insulation compounds have been used from time to time in small-capacity transformers designed for voltages up to about 60,000, and have proved useful where movement of the unit from place to place is frequent, because of the absence of leaks, spilling, etc., but the probable limit is thought to be in the neighborhood of 5 kva., although this might be exceeded by suitable design to prevent hot spots. Such a design, for a given regulation, would, however, not be the most economical.

R. I. Elkin.

New York City.

Work for Technical Journalists in Science and Engineering

To the Editor of Electrical World:

Sir:—In the Electrical World for Oct. 14, 1916, is an editorial reference to a valuable function to be exercised by the scientific and technical press in bringing about closer relations between science and engineering. A recent movement initiated in England for this purpose may interest your readers. This movement is an attempt to promote co-operation between technical journals and universities on matters of common interest, and during the last few months steps of interest have been taken to establish this closer relation. For some years there has existed in England a Circle of Scientific, Technical and Trade Journalists, which is the section of the Institute of Journalists chiefly interested in scientific and technical matters. The very wide and active discussion that has been going on regarding the application of science to industry and the improvement of technical education in this country has shown clearly the need for fuller co-operation between engineers and scientists and the paramount importance of influencing public opinion in the right direction so that science may hold a higher place in public esteem. The war presents difficulties in the direction of any widespread educational movement, since most of the colleges have to a greater or less extent a depleted staff of instructors and of students, and those who remain are necessarily concentrating much of their attention on special work arising through the war. What can be done now is to inaugurate a campaign of education with the object of influencing the public, and particularly the manufacturers, to recognize the value of applied science, so that the ground may be prepared for future efforts. Toward this end the press can do good service, and the circle has already commenced work. The first requirement is obviously that journalists should themselves be well informed regarding modern ideas of education and research, and the steps that the authorities may rightly be expected to take for their encouragement. Accordingly, at several meetings of the circle papers have been read by leading authorities in the scientific field and discussed by the editors of technical journals. These discussions have been given wide publicity by the scientific and technical press. Among the papers may be noted one by Dr. William Garnett, late educational adviser to the London County Council, on "The Sphere of the Scientific and Technical Press in Relation to Technical Education and Research," and a similar paper by A. P. M. Fleming of the British Westinghouse Electric and Manufacturing Company, which dealt mainly with industrial research and gave an interesting account of the developments in this direction in the United States. Following these meetings steps were taken with a view to bringing about more cordial relations between the press and the leading universities.

On May 31 members of the circle were invited to the Imperial College of Science by the Rt. Hon. Arthur Dyke Acland and were shown over the chief departments by the professors, and given interesting examples of the special work which the college is now doing.

This precedent has since been followed by the Universities of Leeds and of Sheffield, which invited the circle to form a party of journalists to visit these cities from Oct. 10 to 12 as the guests of the universities. They visited the various departments of pure and applied science, inspected local factories associated with the work of the universities in these cities. In many respects the work of these two educational centers is unique, Sheffield being the center of the steel industry in England, while at Leeds there are important sections devoted to leather, color, chemistry and textile work. At both universities a considerable amount of special research work is being carried out in connection with the war, and the laboratories have been organized to devise processes for the making of material hitherto imported from abroad.

It is hoped that closer and more cordial relations between the universities and the press will follow, and that the circle will also be useful in influencing public opinion in other ways. For example, the problems arising in munition work at the present time have brought vividly home to the English nation the need of scientific management and welfare work. These are matters that require constantly to be brought before manufacturers, and the press can do valuable service by keeping the public informed. A step in this direction was taken with the reading of a paper on "The Human Element in Factories" by B. S. Rowntree, Director of the Welfare Department of the Ministry of Munitions of War, at a recent meeting of the circle.

These are only a few instances of the good work to be done by co-operation between the universities and the scientific and technical press, and a broad development of the plan seems possible.

J. S. Dow.

Shepherd's Hill, Highgate, N., London, England.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

INDUSTRY HASTENS TO THE AID OF THE GOVERNMENT

Electrical Plants and Fully Equipped Laboratories and Personnel Placed at Disposal of Government in Numbers

The United States of America, so far as industry is concerned, is rapidly being placed upon a war basis. Reports from Washington show, as the result of the notification on Jan. 31, 1917, of the German government, that unrestricted submarine warfare will be resumed notwithstanding the protests of the United States. A military war basis is also being brought about, to a certain extent.

The "mobilization of industrial resources" which has been so much talked of recently, is, in fact, now being given a practical test. Secretary Daniels of the Navy Department and Secretary Baker of the War Department have been in daily conference with members of the Naval Consulting Board and the National Defense Council. There have been filed with the navy department inventories of 1200 manufacturing plants which could produce war material, and a great many manufacturers of all classes of machinery, chemicals, etc., have placed their plants and their personnel at the disposal of the government for use if needed.

One of the outward signs of the mobilization to be seen in Washington is the fact that the State, War and Navy building has been closed to visitors. The government departments at Washington do not desire calls from contractors, builders, engineers, salesmen, etc. They can not even obtain access to the departments except upon written passes issued before Saturday, Feb. 3, and every employee, from cabinet officers and the chiefs of staff of the army and navy down, is obliged to present such passes to the sentries on duty. Representatives of the industrial resources of the country who have material to offer the government must make their offers in writing and send them by mail.

The government is placing contracts in some cases without bids and in other cases is about to ask for bids for millions and millions of dollars' worth of equipment—all sorts of machinery and supplies, which would place the country upon a war footing. Immediate purchase of reserve supplies, depleted because of the last Mexican crisis, has been ordered, and War Department purchasing agents were, on Wednesday of this week, sent out into the open markets to obtain these supplies.

There is no question that there will be written into the navy bill authorization for the Secretary of the Navy to take over for the government any private plant the government may need in a war emergency. The government has already practically taken over the private radio plant at Tuckerton, N. J., and within the past few days has replaced the civilian operators with United States navy operators. Telephone, telegraph and wireless companies all over the country have offered their services and their plants to the government, and upon one occasion immediately following Germany's announcement, the afternoon of Feb. 1, a practical test of governmental use was put into effect on long distance telephone wires out of Washington.

Early in the week when it became apparent that a national crisis was fast approaching, the electrical manufacturing plants of the country in numbers hastened to put their manufacturing facilities at the call of the government. These plants, operated as they are by engineers of practically all kinds, and the output of which has been developed only after long periods of careful research in the best equipped laboratories in the world, are undoubtedly in a position to furnish the government with such manufacturing assistance as cannot be found in any other industry.

Many plants have been occupied for some time in manufacturing munitions for England and her allies and as in most instances, these war contracts have been fulfilled, the plants are now thoroughly equipped to furnish munitions of war in large quantities in a short time. The last eighteen months have been fruitful in gaining experience in the manufacture of munitions.

Electrical manufacturers in offering their plants to the government had been careful to state that every branch of the company's service is at the disposal of the government. To the government this is significant, for in addition to the manufacturing facilities, many of the large electrical manufacturers maintain engineering laboratories equipped and manned to quickly and efficiently investigate practically any engineering problem that might arise. It will be remembered that the Naval Consulting Board at the very outset recommended the expenditure of a large sum of money for the establishment of a research laboratory where specialists would study problems connected with warfare. By their action, the electrical manufacturers have now placed at the disposal of the government, laboratories and engineering specialists in a position to investigate the very problems and conditions which the Naval Consulting Board had in mind.

REDUCTION IN RATES OF QUEENS BOROUGH COMPANY

Voluntary Offer of 12-Cent Maximum Rate Without Condition That Gas Business Shall Be Considered Too

Carleton Macy, president of the Queens Borough Gas & Electric Company, has proposed a voluntary reduction in the maximum rate for electricity from 13 to 12 cents per kilowatt-hour, effective on March 10. The announcement was made on Jan. 31 at a hearing before the New York Public Service Commission of the First District.

At a previous hearing, reported in the ELECTRICAL WORLD for Jan. 13, 1917, Mr. Macy stated that the consent of the company to a reduction in electric rates was based upon the condition that when rates were taken up both gas and electric should be considered. When the commission raised the point that it would scarcely be justified in considering the electric and gas business together, Mr. Macy withdrew his suggestion for further consideration. During the hearing of Jan. 31 he said that the reduction would be made without any conditions.

The proceeding by the commission to determine

whether the electric rates of the company should not be reduced will be continued notwithstanding the voluntary reduction proposed by the company. Engineers and accountants of the commission are making a study of the property.

NO ACTION ON STANDARD TERMINALS BY N. E. L. A.

Wiring Committee Has Not Taken Definite Position on the Question of Flat Versus Round Prongs on Flatirons

R. S. Hale of Boston, chairman of the wiring committee of the National Electric Light Association, has called our attention to the fact that the report of the recent meeting of the wiring committee has been misinterpreted so as to give the idea that the committee has taken a definite position on the question of flat versus round prongs on flatirons. The largest manufacturer of flatirons in the country has sent out a circular under date of Jan. 24, stating that there is a distinct sentiment in favor of flat contacts, either parallel or tandem, on separable plugs, and that the committee adopted a resolution suggesting to the manufacturers that the round contacts be dropped.

Mr. Hale informs us that this is not the case. He said "the wiring committee has attempted to arrange a conference of the manufacturers. If that conference should recommend either flat or round prongs, the wiring committee would welcome such action as a step toward standardization.

"If the conference should divide between flat and round prongs, then probably the best thing would be not to attempt to standardize until experience has shown which is best.

"The wiring committee endeavors to accomplish standardization by getting the manufacturers to agree, and until they agree the report of the wiring committee should not be regarded as in any way indorsing any one design as compared with any other."

CENTRAL STATIONS TAKE STEPS TO PROTECT SERVICE

Significance of War with Germany No Longer Underestimated, Especially as So Many Industrial Plants Depend Upon Electrical Power

As the war cloud hovers over this country, the significance of actual hostilities becomes more and more apparent to the central station operators. Guards have been thrown about plants and the coal piles, in order to ward off any malicious attempt to destroy property or otherwise injure service. Lighting plant managers who have been off on vacations are hurrying home in order that they may be at their plants should any emergency arise.

While there is sufficient coal at the present time, there is ever the danger, should a break come with Germany and her allies, of a serious shortage of fuel. It is no secret that a great majority of coal miners are of a nationality whose sympathies might, in case of a break, be with the Fatherland. There is also the chance that coal mine operators fearing violence on the part of the miners might refuse to allow those of Teutonic birth, to enter the shafts if the Government does not actually intern them. Such action, it is almost certain, would mean the closing down of most of the great coal mines.

In view of the fact that so many of the nation's industries depend upon electricity for power, a number of which would be called to the aid of the government should war actually occur, the maintenance of service becomes of greater importance than ever. It is for this reason, probably more than anything else, that central station operators are using such care at the present time to protect their properties. In this connection, the action of the Boston Edison company is an example of what is being done in other parts of the country.

Special precautions have been taken at the L Street and Atlantic Avenue generating plants of the Boston Edison company against damage in case of hostilities between the United States and Germany. Both stations are being flood-lighted and strong police protection has been provided on both a day and night basis. Barbed wire has been erected around the station property, this precaution also having been established at the company's general service buildings on Massachusetts Avenue.

BROOKLYN ELECTRICAL MEN MEET AT ANNUAL DINNER

Over Five Hundred Hear Addresses by W. F. Wells, Irving T. Bush, Oswald F. Quist, L. H. Pounds, Travis H. Whitney and J. W. Lieb

The eleventh annual dinner to the electrical men of Brooklyn was held at the Academy of Music, Brooklyn, on Feb. 1. The affair was attended by more than 500 men, a great many of whom are prominent in industrial enterprises, among whom were Elmer A. Sperry, inventor of the gyroscope; Irving T. Bush, president of the Bush Terminal Company; John W. Lieb, vice-president of the New York Edison Company; T. C. Martin, secretary of the National Electric Light Association, and three public service commissioners. T. I. Jones, general sales agent of the company, as toastmaster, introduced the speakers, who spoke on the subjects noted: W. F. Wells, vice-president of the Brooklyn Edison company, "Brooklyn and the Brooklyn Edison Company"; Irving T. Bush, "Brooklyn as an Industrial Center"; Oswald F. Quist, president of the Kilowatt Club, "The Contractor and the Company"; Lewis H. Pounds, borough president, "Brooklyn's Future," and Travis H. Whitney, public service commissioner, "The Public Service Commission." J. W. Lieb also spoke informally.

The theme of the dinner was "Industrial Brooklyn," and was strictly a "Boost Brooklyn" affair, the slogans in electric letters, "Brooklyn for All" and "All for Brooklyn" exemplifying this idea. The banquet hall was lighted by hidden flood-lighting projectors in colors, which gave a beautiful vari-colored effect that was spectacular to the extreme.

RELIEF PLANNED FOR THE BOSTON ELEVATED RAILWAY

Special Commission Recommends Two Measures, One Laying No Burden on Public and Other Costing Public Something

When an electric railway serving a metropolitan community as large as Greater Boston, with no "water" in its capitalization, and with a notably efficient management, appeals for financial assistance, the disposition of its case becomes of general interest to public utility men. The special commission which has been investigating the Boston Elevated Railway Company's finances has just made its report to the Massachusetts Legislature, and it is noteworthy that two classes of relief measures are recommended: First, measures which will

not lay any burden upon the public, and, second, measures which may actually cost the public something.

Under the first head fall the sale of the Cambridge subway by the company to the State, the return of $500,000 guarantee fund deposited with the State in the early days of the company's history, the grant of the right of eminent domain for the establishment of free bodily transfer inclosures where the abuses of paper checks will be eliminated, the temporary capitalization of replacements and the institution of a graduated rental for new subways, so that the burden of these last can be gradually assumed as these costly structures grow in usefulness. Under the second classification fall a certain reduction in taxation based upon earnings and representing seven-eighths of 1 per cent of gross. No increase in fares or charges for transfers is favored at this time, but the commission believes that if the measures recommended are granted the company's financial needs will be met for at least three years. A detailed investigation by the Public Service Commission, with an appropriation for expert assistance, to inquire into the efficiency of the company's administration and to report to the Legislature of 1918, coincident with a report by the Boston Transit Commission as to future subway development at Boston, concludes the commission's report.

NORTHERN WHITE CEDAR ASSOCIATION CONVENTION

Pole Production for 1916 Considered Good—Advertising and Insurance Also Discussed—J. C. Kirkpatrick of Escanaba, Mich., Elected President

The twenty-first annual meeting of the Northern White Cedar Association was held at Minneapolis, Minn., on Jan. 29 and 30. In his presidential address T. M. Partridge, Minneapolis, said one of the most important features of the association's work during the past year had been its co-operative advertising campaign. As a result of an expenditure of $5,000 in the leading technical and trade journals he said the secretary had received inquiries from all sections of the United States and Canada and from several foreign countries asking for further information about cedar poles. Later in the meeting the association voted to continue its publicity work along the lines adopted last year.

L. A. Furlong, Minneapolis, speaking for the association's pole committee, called attention to the fact that the year's shipment of 20-ft. poles closely approximated the average sales for the five preceding years. The shipments of 25-ft. and longer poles were 35,000 less than the average sales over the last five years. This is considered an excellent record in view of the fact that metals used in line construction have advanced so much in price within the last year, and this tended to curtail line construction. Mr. Furlong urged the members of the association to take these figures into consideration in providing stocks for the coming year in order that they could be able to furnish prompt deliveries on poles. W. L. Lafean, Chicago, reporting for the insurance committee, recommended that in the future each member should place all insurance with a single company through one agent. This was considered better than the plan which has been followed in the past, because it is believed that less difficulty in settling claims will result.

The election of officers resulted as follows: President, J. C. Kirkpatrick, Escanaba, Mich.; vice-president, J. E. Gerich, Milwaukee, Wis.; treasurer, W. B. Thomas, Manistique, Mich.; secretary, N. E. Boucher, Minneapolis.

RELATION OF PUBLIC UTILITIES TO THE PUBLIC

W. W. Freeman Pleads for Sympathetic Co-operation on the Part of the Public and for Rewarding Efficient Operation by Higher Returns

At a meeting of the American Institute of Electrical Engineers held in Chicago on Jan. 31, W. F. Freeman, president of the Union Gas & Electric Company and chairman of the public policy committee of the N. E. L. A., read a paper on the "Relation of Public Utilities to the Public," the features of which are given in abstract below:

"It is comparatively easy to define the proper relation of public utilities to the public, but very difficult, under present conditions, to produce such relationship in actual practice.

"The primary excuse for the public utility is the need of the public for the service which the utility is created to render. If such service is rendered efficiently and honestly, the utility is a distinct benefit to the public and is entitled to be recognized as such. The chief obligation on the part of the utility is that the service shall be first-class and the rates reasonable, and, on the part of the public, that these conditions being met, no restrictions shall be imposed which make it impossible or difficult for the utility to perform its proper functions.

"Upon this outline of axiomatic principles, there is probably little disagreement in any quarter. The difficulty arises principally in the fact that partisans on both sides claim that the opposing side is unwilling intelligently and impartially to ascertain the facts governing the cost and character of the service, and to be bound by them." Mr. Freeman said "he thoroughly believes that the public utilities generally are keenly alive to their full measure of responsibility to the public and are anxious to have the public know this and have true and full knowledge of all of the facts which bear upon their proper relations. He believes also that a majority of the public are equally sincere in a desire to acquaint themselves with the facts and deal fairly with the public utilties according to their idea of justice.

"The secret to the securing of public support for public utilities consists in arousing the enlightened self-interest of the public to a realization of the fact that only a prosperous public utility can serve the public satisfactorily and acceptably. A financially impoverished utility cannot serve the public acceptably any more than an unnourished servant can do good work for his employer. Starvation wages never produced a good output for any employer, and it is as invariably true that a public utility, living from hand to mouth, is unable to give first-class service to the public. This matter goes deeper than the mere question of wages and food. Every thoughtful person realizes that an employer who is constantly criticizing his men without just cause, or who permits others to do so, is thereby reducing the efficiency of their work and injuring his own interests. Correspondingly, a public utility which is subjected continually to criticism and abuse from thoughtless or malicious elements in the community is thereby prevented from rendering to the public as loyal and efficient service as it could otherwise do."

The speaker then outlined certain conditions which ought to be guaranteed to public utilities by the public which they serve, in order that the service shall be adequate and satisfactory at all times. Prefacing these conditions, he repeated that the public utility is bound initially to the twofold obligation of good service and reasonable rates. These should be demanded by the public as the consideration for the right to serve the public.

"The first of these conditions is the protection by the public of the bonafide investment of the utility. This can only be done by earnings sufficient to insure the stability of the property, which must include an adequate rate of return to the investors, so as to induce new capital, as required from time to time for the expansion of the business in the public interest. As to the reasonable rate of return, neither the company nor the public can assume to determine the same as against the investor who must furnish the capital. If public utilities are restricted to rates of return which are unsatisfactory to investors, the inevitable result will be to curtail further investments in utilities, which will mean denial of extended service and impairment of the present service to the public.

"There has been a tendency in past years arbitrarily to determine certain fixed percentages as representing the allowable fair rate of return for public utilities; these percentages in some instances being as low as 6 per cent per annum, more often 7, 7.5 or 8 per cent, and in some particular cases as high as 9 or 10 per cent. It must be recognized that unless the rate of return allowed to public utilities is comparable to the returns allowed in other lines of business, where the risk is no greater, that the inevitable result must be disastrous to the public." The speaker said that if the public interest is to be best served the attitude of regulatory bodies in this respect must be liberalized in the future.

"Another very desirable condition is to furnish the public utility with sufficient incentive to unusual efficiency, to insure the highest grade of service at all times. This can only be done effectively through a proper sharing of the advantages of such unusual efficiency between the company and the public. An absolute limitation as to net earnings, irrespective of the efficiency of the service rendered, can never result in the highest degree of efficiency. Human nature does not permit 100 per cent efficiency at all times without some selfish inducements being offered. In other words, there must be a stake if the company is to be expected to play the game at high pressure. Regulation of prices, based solely upon definite rates of return, tend to carelessness as to expenses since the company has nothing particularly to gain by reducing its expenses after the net revenue is equal to the allowable rate of return. The public would be better served in such a case if efficiency were stimulated by a division of results. Maximum efficiency is what the public should seek and the necessary and reasonable compensation for same should be promptly forthcoming.

"The advantages to all of the application of these primary principles to the improvement of our public relations seem so obvious that it appears strange, indeed, that there should be any hesitation at all about their recognition and general adoption."

GENERAL GOETHALS ENGAGES IN PRIVATE PRACTICE

Opens an Office in New York City for General Consulting Practice in Civil, Mechanical, Electrical and Hydraulic Engineering

Gen. George W. Goethals, recently chief engineer of the Panama Canal and Governor of the Canal Zone, has announced the opening of consulting engineering offices in the Wall Street Exchange Building, 43 Exchange Place, New York City. General Goethals has associated with him experienced specialists, including George M. Wells, former resident engineer in charge of building construction, Canal Zone, and will engage in a general consulting practice in civil, electrical, mechanical and hydraulic engineering. Special attention will be given to examinations and reports on canals, harbors, dry docks, terminals, dams, water-power developments, water supply, purification of tropical waters, refrigeration, reinforced concrete structures, organization, management and public utility work.

TELEPHONE SITUATION IN NEW YORK'S CITY DEPARTMENTS

Analysis Made to Determine Whether or Not the City Is Receiving Adequate Duct Space for Its Municipal Circuits

A comprehensive analysis of the entire telephone situation in all the departments of the city of New York was recently made by Putnam A. Bates, as electrical engineer for a special telephone and subway committee appointed by the city Comptroller and Mayor. The three following subjects were the basis of the analysis: (1) The classes of service supplied and the business relation of the New York Telephone Company with the city. (2) The value of the complete service in comparison to the total amount paid annually to the telephone company by the city. (3) Whether or not the city is receiving from the telephone company and the subway companies adequate duct space in the subways for the proper installation of its fire, police and other departmental wires and cables.

The opinion of the committee in answer to the first question was summed up briefly by saying (1) that the classes of telephone service supplied at present vary to a considerable degree; (2) that the business relations of the telephone company with the city are not as concrete as they should be, and (3) that the magnitude of the city's telephone business, if it could be provided for in its contract, would justify an increase from 25 per cent to 50 per cent in the discount allowed.

In answer to the second question, the committee stated that, after full data of requirements and terms have been accumulated, the evidence will be conclusive for the installation of a control switchboard in charge of the Mayor's department or the borough president. While it has been suggested that it might be more expedient to begin with those departments entering the combination voluntarily and trust to attracting the others by demonstrated success, there is really no feature of this centralized switchboard problem that does not permit of being successfully worked out. It was recommended that in the Municipal Building as well as in other important buildings of the city where extensive telephone service is employed, that the switchboard plan be promptly adopted.

Regarding subways, the committee is of the opinion that it would be highly desirable for the city to exercise its privilege of recapture of these subways, as the large gross rentals with the slight attendant cost of operation and maintenance would add greatly to the city's revenue, and pending a permanent or satisfactory adjustment of the entire matter, and provided that the city may require the subway companies to build such subways as the city may need without cost to the city. This construction work is to be supervised by the city so that the true cost may be determined during the process of construction. From this it is believed that the most comprehensive subway system for both departmental and commercial interests will result by following out the procedure already taken by the fire department, when it adopted the course of requiring that the subway companies provide all the subway construction necessary for the laying underground of the departmental cables.

NEW YORK STATE MOTOR VEHICLE TAX INCREASED

Flat Rate of $5 a Year Raised to $15 to $70 a Year, Depending Upon the Capacity of the Machine—Owners Protest

The New York State Senate on Tuesday passed the bill raising the State license fee on all motor trucks and automobile buses from a flat rate of $5 a year to a measured rate having a minimum of $15 and running to $70, dependent upon the capacity of the truck.

The bill was designed to produce additional revenue for the State. It has been variously estimated that the increased revenue will be between $500,000 and $650,000 annually.

There was a hearing before Governor Whitman on Feb. 6 on the recently passed Hewitt bill, which provides for the payment of increased, graduated registration fees by the owners of auto buses and commercial motor trucks. The Governor informed the automobile men that he was in favor of their proposal to have a new commission study the situation with a view to remedying any injustices which the new tax law might inflict.

The contention of the truck owners is that the law was rushed through both houses of the Legislature, giving them no chance to be heard. The commission appointed last year was authorized to fix fees for auto trucks only. It sent to the Legislature at the opening of the session a schedule, which the automobile men say they did not have an opportunity to study.

Senator Brown, majority leader, admitted later he would agree to the introduction of amendments changing certain minor features of the bill. The Governor at the close of the hearing informed Charles G. Bond, counsel for the Motor Truck Club, that he favored the proposal of the club for another commission to put the tax on a more scientific basis, but that will bring no relief to the truck owners this year.

WATER POWER LEGISLATION

Congressional Action Subject to the Whims of Senators Who Seem Disinclined to Bestir Themselves

As the result of opposition in the Senate, principally on the part of Senator Fall of New Mexico, there has been but little consideration in that body of the bill to provide for the development of water power and the use of public lands in relation thereto.

Senator Walsh of Montana, who has the bill in charge, has forced the measure before the Senate once or twice at afternoon and night sessions, but no progress was made. Senator Townsend of Michigan has also objected to consideration of the bill, because, he said, he believes "the bill is simply being used as a buffer to prevent the consideration of other legislation, and I do not care to sit quietly by and allow that to be done if it can possibly be prevented."

One of the most serious stumbling blocks in the way of the bill has been presented by Senator Fall, who has announced that he will vote against the measure, "with or without discussion," an attitude that will have its effect on other Senators because of the state Senator Fall comes from and the presumable interest of that State in the measure.

The curious fact has developed that Senator Fall's objection, or at least one of them, to the bill, is that two years ago, during the consideration in committee of a bill concerning public lands and radium, while he was a member of the committee, he endeavored to obtain from Senator Walsh permission to go to New York to attend to some business, and, he said, Senator Walsh informed him he could not be spared. This personal feeling brought about an interesting colloquy in the Senate between the two legislators during which much feeling was shown, and it served to indicate that Senator Fall is an avowed enemy of the bill, an important fact when it is considered that by reason of the Senatorial courtesy which prevails in the Senate in the absence of set rules any one Senator can block any legislative program.

ACTION BY UNITED STATES CHAMBER OF COMMERCE

Revenue Bill Criticised, Federal Trade Commission Commended, Daylight Saving Indorsed and New Work Found for Department of Commerce

Several important resolutions were passed by the Chamber of Commerce of the United States at its convention held in Washington last week, of concern to the business interests of the country. One of the most important of these was to voice the sentiment of the business men in every State in the Union of "profound appreciation of the gravity of the international relations which now confront the country" and "solemnly pledging" the business men "to stand as one behind the President in patriotic purpose whatever the eventuality."

The Chamber reaffirmed its devotion to the program of increased military preparedness, and pledged its support to any just and reasonable measures of taxation which the government may see fit to adopt, "but," the resolution read, "it feels compelled to protest against the inequitable and discriminatory methods of taxation proposed in the bill now in the House of Representatives providing for a tax on excess profits of corporations and co-partnerships." The Chamber urged that any bill passed by Congress to raise taxes should accomplish these purposes "along lines of fairness to all interests of the country so that all citizens should pay their just share of the tax."

The Chamber commended the Federal Trade Commission "as expressed by its action in freely conferring with business as represented in trade associations and assisting by constructive suggestion in guiding it along lines consistent with progress, existing law, and the public welfare."

"Daylight saving" was indorsed and legislation recommended by Congress. The Chamber reaffirmed the proposals which have been made for budgetary procedure in national affairs, alluding to the fact that the appropriations before the present Congress, when it opened, amounted to $1,600,000,000. The Chamber urged the creation for a period of not less than five years of a salaried commission to be appointed by the President of the United States to consist of trained economists and statisticians as a central agency through which the statistical activities of the Government, such as the Census Bureau, may be correlated.

The committee on the Department of Commerce proposed certain new departmental activities as follows:

First, the department should find out what it costs to do business in the United States. As the department found out enough such facts to proceed with, it should, as its second new function, deduce from them sets of reasonably attainable standards, for the various items of expense in the various lines of business. The third new function would be to tell the manufacturer and business man, that is, to circulate information concerning the methods of the more efficient. The fourth new function would be the working out of still better methods than the department found in use in any actual business.

Fortification Appropriations.—The Shorley bill making appropriations for fortifications and other works of defense carries appropriations aggregating $61,000,000, an increase of $22,000,000 over the amount appropriated for the fiscal year 1916-1917. Among the principal increases carried in the bill are the following: Electric light and power plants at seacoast fortifications, $110,000 and searchlights for important harbors, $25,000.

Barstow Management Association Formed.—The W. S. Barstow Management Association has been incorporated for the purpose of supervising the management of the subsidiary properties of the Eastern Power & Light Corporation and the General Gas & Electric Company. W. S. Barstow & Company, Inc., which has heretofore supervised the management of the subsidiary properties will continue in general executive charge and also control their financial operations.

New Large Holding Company.—A new holding company to be known as the National Utilities Company has been incorporated with a capital of $10,000,000 to take over the National Properties Company, the National Gas, Electric Light & Power Company and the Jersey Central Traction Company. These subsidiaries serve about fifty municipalities with net gross earnings for the past year of $9,327,700. Van Horn Ely, president of the National Properties Company, will be president of the new company.

Improvements Being Sought in Methods of Generating Electricity by Wind Power.—Experiments are being conducted by the electrical engineering department of the State Agricultural College at Manhattan, Kan., seeking improvements in the method of generating electricity from windmill power. In the present tests, the generator is mounted on the head of the mill, and geared direct, instead of being belted to the mill at its foot, as in the previous tests. The necessity seems to be for mills that require lower wind velocities to start them than mills now available, since there is too much idle time for mills, and too large a necessity for batteries and storage during running time.

Increased Powers for New Jersey Utility Board.—To avoid the necessity for opening up improved thoroughfares a bill has been introduced in the New Jersey Legislature providing jurisdiction over the installation of conduit lines, gas, sewer and water pipes by the Board of Public Utility Commissioners. The measure authorizes the board to order the installation of such improvements before a street is permanently improved in cases where there are not sufficient consumers along the thoroughfare to make the investment profitable at the time. In this, however, the board must be assured of reasonable interest charges upon the investment which the particular company must make until such time as new property owners render a profitable investment.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

College Gives Electrical Course for Women.—A course, it is understood, will be given at the University of California in household electricity for women. Attention will be given to the manufacture, repair and use of the electrical household conveniences and will include, besides demonstrations, practice in repairing appliances. The course, it is thought, will be given both in San Francisco and Oakland.

Homestead Entry on Water Power Sites.—The Sinnott bill was reported by the House committee on public lands on Feb. 1 providing for a homestead entry on water power sites. The bill would allow the Secretary of the Interior to permit entry on public lands reserved for power sites where location will not materially injure such lands. Entrymen would be permitted to locate subject to the right of the United States and its lessees to use the lands for the purposes for which reserved.

Reserve Power Insurance.—Plans for the immediate future contemplate, where feasible, the connection of properties operated by W. S. Barstow Management Association by transmission lines so that each of the systems so connected will have the benefit of the reserve power of the others. In the event of breakdown or overload at any particular point the reserve power of other connected plants will be used to take care of the emergency. By this plan, it is felt, maximum efficiency in the generation can be secured, as the load can be so shifted as to permit the most economical plants to be kept in continuous operation. Furthermore, it is expected that operating costs will be lower.

Worcester Lighting Rates to Be Reduced.—Rates for residential lighting in Worcester, Mass., will be reduced from 9 cents to 8 cents per kilowatt-hour on all bills rendered on and after April 1, it was recently announced by the Worcester Electric Light Company. This is the annual reduction made by the company which alternates yearly on the residential and commercial basis, and the 8-cent rate will make the two rates the same for 1917, which will be the lowest in the history of the company. The last reduction made in residential lighting was in January, 1915, when the rate was made 9 cents instead of 10. In 1914 the price on residential lighting was reduced from 11 cents to 10, at which time commercial lighting was reduced from 10 cents to 9. Last year the commercial rate was made 8 cents. Every year for the past five or more the company has made a reduction in its rates, and it plans to continue as long as business keeps on increasing.

"Pacific Service" Pay-roll.—The Pacific Gas & Electric Company of San Francisco has a list of employees totaling 5000, for which the annual payroll amounts to $5,250,000, or an average of $87.50 per month per employee.

Toledo Floodlights McKinley Statue.—Influenced by the successful floodlighting of the Statue of Liberty in New York harbor, and through the efforts of the Toledo Railways & Light Company, the McKinley monument in Courthouse Park, Toledo, will be similarly illuminated. The lighting was effected by erecting searchlights on the curb, arc lamps opposite the statue and entailed no line wires.

Minneapolis Sets Up New House-Wiring Record.—During the year 1916 a new high record was established in Minneapolis in the number of electrical wiring permits and the cost of work covered by them. Compared with 1914 and 1915 the figures are as follows:

	Number of Permits	Estimated Costs
1914	8,439	$991,755
1915	9,827	888,950
1916	11,858	1,570,365

These figures include the wiring of new houses as well as of those already built, and the estimated costs include cost of fixtures and glassware as well as the cost of wiring.

Bill to Permit Purchase of Utilities by Cities Without Use of Municipal Bonds.—A bill has been introduced in the house of the Indiana Assembly authorizing cities and towns to buy any public utility without using municipal bonds therefor and permitting any bonds issued in payment for the property to be secured by mortgage on the utility purchased. Under this bill any obligation incurred by a city or two will not be considered a debt within the meaning of the constitution. While the measure is intended to meet a local situation, it is broad enough to cover every city and town in the state which may desire to buy and operate public utilities.

Bill to Regulate Utility Employment Contracts.—A new Public Service contracts law, to be Chapter 69 of the Consolidated Laws, regulating contracts of employment between public utilities' corporations and their employees has been introduced in the New York Assembly as Bill No. 310. After Sept. 1, 1917, all employment must be by contract after a reasonable term of trial not exceeding six months, the contract to be for not less than one or more than three years, during which time the corporation may not discharge the employee nor may he withdraw from service of corporation except under certain conditions. The Public Service Commission is to approve the form of contract. For adjudicating claims arising under contracts, there is to be created by a joint action of corporations and employees a board of award of not less than three nor more than nine members, one member to be appointed by the Public Service Commission and others in equal number by the company and its employees. Strikes are prohibited.

The Engineer and Organization.—A egular meeting of the New York Sec- ion of the American Society of Me- hanical Engineers will be held at the Engineering Societies Building on Feb. 3. President Ira N. Hollis will make n address on "The Engineer and Organization."

Kansas City Rejuvenation.—The Kan- as City Jovian League held its first re- uvenation of 1917 under the direction f First Tribune J. D. Todd and Second Tribune J. F. Bratney, at the Coates House the evening of Jan. 26. The peaker was the Rev. W. S. Abernathy, who talked on the necessity of a high mark for individual aspiration, fidelity o duty and opportunity.

Future Meetings of Institute Sec- ions.—The following future meetings f sections of the American Institute of Electrical Engineers have been an- ounced: Boston—March 6. Subject: Electric Transmission for Motor Cars"; speaker W. B. Potter. Chicago —February 26. Subject: "The Making f Rates after Valuation." Fort Wayne —March 8. Motion picture entitled King of the Rails" showing evolution f transportation. Spokane—February 6. Subject: "Transmission and Dis- ribution." March 15. Subject: "Util- zation of Electricity."

New York Electrical Society to At- end Aeronautic Exposition.—By cour- esy of the International Exposition Company, the 353rd meeting of the so- iety will be held at the Pan-American Aeronautic Exposition, at the Grand Central Palace, New York City, on Feb. 4. Before the visitors make an in- pection of the exhibits a brief address vill be given by Augustus Post, of the Aero Club of America, explaining the eatures of some of the leading types f flying machines; and at the same ime illustrations of these will be hrown on the screen, and moving pic- ures will illustrate the part that air- raft is playing in modern war.

Future Institute Meetings. — The March meeting of the American In- titute of Electrical Engineers will be held in Chicago, Ill., on March 9, under he auspices of the Chicago section and he committee on protective devices. The official headquarters of the insti- ute during this meeting will be at the Hotel Sherman, where the technical ses- sions and committee meetings will be held. The subject of the meeting will be "Relay Practice." Two papers will be presented on this subject, one by Philip Torchio and the other by R. F. Schuchardt. The April meeting of the Institute will be held in Schenectady N. Y., on April 13. The program for this meeting has not yet been com- pleted. The annual business meeting of the institute will be held in New York at the Engineering Societies Building, on May 18. At this meeting the report of the board of directors is presented and announcement made of the election of officers for the ensuing year. The annual convention will be held at Hot Springs, Va., during the week begin- ning June 25. The headquarters of the institute during the convention will be the Homestead Hotel.

Associations and Societies

A complete Directory of Electrical Associations is regularly printed in the first issue of each month on the next-to-last text page.

Lynn Electrical Engineers Banquet.—The annual banquet of the Lynn sec- tion of the American Institute of Elec- trical Engineers was held at the Boston City Club on Feb. 3.

Institute of Radio Engineers.—At a meeting held on Feb. 7, in New York City, Julian Barth presented a paper on "The Influence of Commercial Condi- tions on Transmitter Construction."

St. Louis Jovians Hear Advertising Talk.—That co-operative advertising campaigns are producing great results in developing the electrical field was outlined before the St. Louis Jovian League at its luncheon meeting Jan. 30 by P. L. Thomson, advertising manager, Western Electric Company.

Lincoln Meeting for Cleveland League.—Dr. G. C. Ashmun, a former member of a company of cavalry that served as a body-guard and escort to President Lincoln from December, 1863, to the time of his death in April, 1865, gave the members of the Electrical League of Cleveland recollections of his serv- ices in 1863, 1864 and 1865 at the Lincoln meeting held on Feb. 8. Dr. Ashmun was for some years president of the Board of Education of Cleveland. In addition to this program, there was special patriotic music.

New York City Jobbers Meet.—A meeting of the Metropolitan Electrical Jobbers' Association was held in New York City on Jan. 17. Dinner was fol- lowed by an address by President C. P. La Shelle, during the course of which he congratulated the association on the splendid work it had accomplished for many jobbers in the Metropolitan zone, calling attention to the fact that this was possible only because of the loyal co-operation on the part of all mem- bers. William G. Campbell, general Eastern sales manager for the Safety Armorite Conduit Company, delivered an address in which he stated that in event of cessation of hostilities in Eu- rope he could hardly see where the electrical business would feel an imme- diate depression, as manufacturers of structural steel and accessories had on hand such a large volume of domestic orders that it would require nearly one year to complete orders for which bona fide domestic deliveries were specified. William A. Neefus of the Kirk Fuse Company spoke on "Fuses and Their Use in Electrical Constructure." The meeting concluded with an informal talk by Arthur F. Stanley, who has been called the dean of the New York retail business, having continuously been identified with the electrical industry in New York since the early 70's.

National Fire Protective Association.—Open meetings of the electrical com- mittee will be held at the New York Board of Fire Underwriters' headquar- ters on March 28 and 29.

Divisional Meetings of Supply Job- bers.—The Atlantic and Central Di- visions of the Electric Supply Jobbers' Association will hold their regular quar- terly meetings some time in March. The exact place and dates have not as yet been announced.

New York Jovian Meeting.—A regu- lar monthly luncheon meeting of the New York Jovian League was held on Feb. 7. Following a short business section W. F. Schmidt delivered a mov- ing picture lecture entitled "Speeding the Spoken Word." The film depicted the present art of telephone engineer- ing, maintenance and operation.

New York Section, I.E.S.—A. H. Rudd, signal engineer, Pennsylvania Railroad Company, read a paper enti- tled "Position—Light Signals for Rail- road Service" before the section on Feb. 8. At an informal after-meeting John W. Dudley of the Lee Lash Studios spoke on "Some Studio Problems which Face the Motion Picture Producer." This address was supplemented by an exhibition of colored fabrics by Thomas Scofield, showing how stage effects may be spoiled by the lighting man. The evening concluded with some specially arranged entertainment features.

Princeton Engineering Association in Movement to Encourage Engineering Studies.—A movement to stimulate the further development of engineering studies at Princeton University was launched by the Princeton Engineering Association at the New York-Prince- ton Club on Feb. 6, at a testimonial dinner to Dr. L. D. Ricketts, president of the American Institute of Mining Engineers and a Princeton graduate of 1881. Addresses were made by Dr. Ricketts, President John Grier Hibben, of Princeton University, and Dr. Charles Mann, of the Carnegie Founda- tion, author of a report on engineering education, soon to be made public by the Foundation. At present more than 900 of Princeton's 8000 graduates are engaged in some form of engineering activity.

Michigan Engineers Meet. — The thirty-eighth annual convention of the Michigan Engineering Society was brought to a close on Jan. 18. Topics of interest to engineers in general be- sides particular branches of engineer- ing were discussed. F. N. Menefer pre- sented a paper on the "Sixty-Foot Hydroelectric Development on the Chippewa River Now Under Construc- tion," and A. Streiff of Jackson gave an illustrated lecture on "Modern Spill- ways." Of further interest to the elec- trical engineer were two papers, one by R. D. Goodrich on "Licensing of Engi- neers" in which he advocated the regis- tration of engineers and told of laws which have been passed in other States on this subject, and the other paper by T. O. Williams on "The Value of a State Administration to Deal with Engineer- ing Works."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public-utility companies.

Reasonable Care in Stringing Guy Wires.—The Appellate Court of Indiana (114 NE 227) has held that if a telephone company secures poles along a highway, which it has right to occupy for this purpose, with guy wires, it must use reasonable care not to endanger public travel or the safety of individuals in the reasonable and ordinary use of the highway.

Workmen's Compensation.—An insurance carrier, as assignee of cause of action of widow of deceased, who was killed by electrocution from defendant's wires, was held by the Appellate Division of the Supreme Court of New York in Casualty Company of America versus A. L. Swett Electric Light Company (162 NYS 106) entitled to recover full liability of defendant and not confined to payment actually made to widow.

Degree of Care That Should be Exercised by Public.—That a person is entitled to be judged in view of the knowledge generally possessed by the community was held by the Supreme Court of Pennsylvania in the case of Smith versus Harwood Electric Company (99 A 473). The husband of the plaintiff in this case lost his life by electrocution from stepping on an iron sewer plate on which had fallen a broken electric light wire. Although warned that the wire was down, there was no evidence to show that the man knew that the iron plate was charged and the court, therefore, held the presumption to the contrary, since, it stated, men are presumed to be governed by the natural instinct which leads them to avoid danger rather than court it.

Right Denied to Sell Energy to Company in Non-Adjacent Territory.—An interesting case involving charter validity has recently been decided by the Supreme Court of Pennsylvania in Citizens' Electric Illuminating Company versus Lackawanna & Wyoming Valley Power Company (99 A 462). The defendant company contracted to supply energy to the Jenkins Electric Light, Heat & Power Company, which lies within the same territory as the plaintiff, but has no generating plant of its own. Since the Lackawanna and Jenkins companies occupied non-adjacent territory, the court held that the defendant was not under law authorized to sell energy to the Jenkins company, because the act authorizing contracts between companies applied only when both of them are authorized to supply the territory in question. Although the franchise of the Citizens company was not exclusive for the territory served, it has such an interest that the court held that it maintain a bill to enjoin the defendant's compliance with the contract.

Public Utility Regulation.—The Supreme Court of Illinois held in (114 N E 324) that the Illinois Commission cannot, where rates filed with it are attacked, require a public utility to charge a lower rate pending its determination whether the rates attacked are unjust and unreasonable. Where rates of a public utility are attacked as unjust the utility has the burden of showing that the rates are reasonable.

Highest Degree of Care Must be Maintained by Lighting Company.—The law exacts from those who avail themselves of the use of electricity in the prosecution of industry, the highest degree of care to prevent injury of others, it was held by the Supreme Court of Missouri (189 SW 816) in the case of Myers versus the city of Independence. Myers, a lineman, was working on a dead line which was suddenly charged with a deadly current and he was injured to the extent of losing a portion of one hand and one rib, and suffered other internal injuries. The court held that since the plaintiff was a young man of twenty-three, earning $2.80 per day, and had been injured to this extent, a verdict of $16,000 was not too excessive as to indicate passion or prejudice in the minds of the jury.

Workmen's Compensation to Partial Dependents.—A boy of seventeen, in previous good health, dropped dead at the moment of contact with an electric wire or the socket attached to it. He was working on a wet cement floor It was held by the Supreme Court of Minnesota (159 N. W. 755) this evidence sustains a finding that deceased died an accidental and not a natural death. Decease earned $7.50 a week. He gave it all to his parents, and lived with them, receiving his lodging, board and clothing. His father earned $18 a week. There was no other family income. This evidence is sufficient to sustain a finding that the parents regularly derived part of their support from and were partially dependent upon deceased.

General and Special Rates Distinguished.—The Birmingham Railway & Light Company made a ten-year contract with a customer providing that if it should reduce the general rates for light in the city, the rates in the contract should be reduced in proportion to such reduction. Subsequent reductions were made, and the rate charged the customer accordingly reduced, but it contended for a still lower rate on the ground that because a few of the larger business concerns in the city received a special rate in consideration of agreeing to use a specified quantity of electric energy within a stipulated period for a certain term of years, such reduction to them constituted a reduction in the general rates in the city to the amount named as a special rate to the particular contract users. The Court of Appeals of Alabama held (73 S 215) that such was not the case, since "general" and "special" are antonyms, "general" meaning, pertaining to the majority, common to the greatest number, while "special" means pertaining to one or more individuals as distinguished from the class to which they belong.

Commission Rulings

Important Decisions of Various State Bodies Involving or Affecting Electric Light and Power Utility Operation and Practice.

Illinois Commission Report Published.—The opinions and orders of the State Public Utilities Commission for the fiscal period Dec. 1, 1914, to Dec. 1, 1915, have been printed and are ready for distribution upon application to the commission's secretary, R. V Prather, Springfield, Ill. The volume has been edited and the orders have been digested and summarized by Attorney John Lewson of Springfield, Ill., formerly associate editor of the Illinois Notes, Supreme Court Reports.

Illinois & Utilities to Change Date of Annual Report.—The State Public Utilities Commission has permitted the utilities of the State to change the date of the annual report from a termination on June 30 to a termination on Dec. 31. The fiscal period covered by the utilities' report is now coincident with the calendar year and conforms to the dates upon which the majority of utilities close their books of account. The order is in line with a recent order of the Interstate Commerce Commission regarding railroad reports.

Company Not Obligated to Disconnect Service in Summer Without Notification.—The Springfield Board of Education having been assessed with a service charge against various schools during the summer months of 1915, by the Springfield Gas & Electric Company, protested to the Missouri Public Service Commission against these charges, pointing out that the schools were closed during the summer months and that such was public knowledge. The rates which the city was paying for service to its schools were based upon an annual charge. In view of this fact, the commission stated that, "if the utility each year places the customer on the schedule offering the greatest advantage based on his annual requirements, it is doubtful if any part of the charges should be remitted unless the circumstance is such as to relieve the utility of the equivalent expense. This does not seem to be the case in the matter at issue. The service charge is supposed to compensate the utility for certain investment and standby charges. By disconnecting for a short period of non-use, the company cannot remove and make use of the equipment involved, unless an appropriate charge for removing and reinstalling is made. The conclusion of this commission, therefore, is that the utility is not obligated to disconnect the service or remit the service charges for the customer during the season of no use or small use without notification from the consumer. In the instant case, the proper charge is the charge computed for each month under the rate legally effective at that time."



W. D. RAY

W. D. Ray, for the last two years ice-president and general manager of ie Pennsylvania Utilities Company of aston, Pa., which was recently sold by ie Barstow interests, has tendered his esignation effective April 1. Prior to oming to Easton, Mr. Ray was for four ears vice-president and general man- ger of the Northern Indiana Gas & lectric properties operating in Ham- ond, Michigan City and other Indiana ties, and before that he served three ears as commercial agent for the Sani- ry District of Chicago. Mr. Ray's rly years were spent as electrical en- ineer for several railroads in the Chi- go territory, and later he became de- gning engineer for the old Standard lectric Company. During the Chicago Vorld's Fair, Mr. Ray was connected ith the exposition's electrical depart- ent. At this period he collaborated ith C. K. MacFadden in the book "The ractical Application of Dynamo-Elec- ic Machinery," a little volume which as appeared in many reprintings. From 94 to 1897 he was superintendent of ie Everett, Wash., electric railway, eturning to Chicago to handle electric- otor sales for the Lorain Steel Com- any. Later Mr. Ray had charge of ie complete construction of two 75- ile electric railways in Michigan, and f the Grand-Rapids-Muskegon third- ail road. During the two years, Mr. ay has been in charge of the Penn- ylvania Utilities Company, which fur- ishes electricity, gas, and electric rail- ay service to a community of 100,000 eople in Easton and neighboring owns, considerable rehabilitation work as been accomplished, and through Mr. ay's personality and executive grasp ublic confidence and good-will have een regained in the face of difficult perating problems.

Harry G. Louser has resigned his po- ition as superintendent of the Edison lectric Illuminating Company of Leb- non, Pa., to devote his time to private nterests.

J. Henry Russell has been elected resident of the Cambridge (Mass.) lectric Light Company, to succeed the ate Joseph Q. Bennett. Gustavus oepper was appointed to succeed Mr. ussell as vice-president.

Men of the Industry

Changes in Personnel and Position— Biographical Notes

J. J. Molyneaux has been appointed auditor for the Southwestern utility properties of H. M. Byllesby & Company.

A. W. Lee of the Louisville Gas & Electric Company has been elected vice-president of the Louisville (Ky.) Engineers' and Architects' Club.

A. E. Ward of Reading, Pa., has been appointed superintendent of the Reading Transit & Light Company at Lebanon, Pa., succeeding Harry G. Louser, who has resigned, as noted on this page, to devote his time to personal interests.

J. V. Guilfoyle, chairman of the merchandising committee of the N. E. L. A., who has been manager of the appliance bureau of the United Electric Light & Power Company, New York City, is now associated with the Western Electric Company at its New York office as sales specialist.

George Estill has been appointed chief engineer of the group of electric light and power companies controlled by the Cumberland County Power & Light Company, of Portland, Me. Heretofore Mr. Estill has been chief engineer of the Cumberland County lines and of the York County Company's property. Under the new appointment he also will take charge of the Lewiston, Augusta and Waterville system and the Westbrook Electric Company.

E. B. Merriam has become head of the industrial service department of the General Electric Company, resigning his position as assistant engineer of the switchboard department to take the new position. The industrial division was recently organized to supervise the education, employment and provision of opportunities for advancement of employees at the Schenectady plant of the company. Mr. Merriam has been connected with the company for sixteen years, serving in its commercial, manufacturing, engineering, development and research departments.

John J. Carty, chief engineer of the American Telegraph & Telephone Company has been commissioned by President Wilson as a major in the Signal Officers' Reserve Corps. A statement issued by the War Department says: "The appointment of Major Carty in the Army Reserve Corps is a notable example of the value of that corps in making available to the government the services of the best talent of the country in time of national crisis." For his services in the advance of science Mr. Carty was recently also decorated with the orders of the Rising Sun and the Sacred Treasure by the Emperor of Japan.



P. H. HONOLD

P. H. Honold, the president-elect of the Electrical Contractors' Association of Wisconsin, is treasurer of the C. A. Honold Company, general contractors, Sheboygan, Wis. Mr. Honold was for four years engaged in construction work with the Sheboygan Light, Power & Railway Company and later became an erecting engineer for the Allis-Chalmers Company of Milwaukee. After experience in electrical construction work at Gary, Ind., he was for six years with W. A. Day & Company, Chicago, as general superintendent of construction, resigning to become treasurer of the Honold company at Sheboygan.

W. A. Holland, Jr., after eleven years with the General Electric Company, at Schenectady, principally in the switchboard engineering department, has resigned to take up the teaching of electrical engineering in Mackenzie College, Sao Paulo, Brazil.

D. W. Blakeslee has resigned his position in the engineering department of the Duquesne Light Company, Pittsburgh, Pa., to become electrical engineer and assistant superintendent of the Penn Electrical & Manufacturing Company, Irwin, Pa., manufacturers of switches and switchboards.

S. W. Tracy has been elected president of the Chicago Utilities Company and its three subsidiaries, the Chicago Tunnel Company, the Chicago Warehouse & Terminal Company and the Illinois Telephone & Telegraph Company. J. C. Payton has been appointed secretary of the Utilities company.

Obituary

George H. Hill, assistant engineer of the railway department of the General Electric Company, died at his home in Schenectady, N. Y., on Jan. 31. Mr. Hill was a graduate of Johns Hopkins University. More than forty patents in the electrical field had been granted to Mr. Hill, and he was the author of many articles on electric railway subjects in the technical press and the proceedings of the A. I. E. E., of which he was an active member.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

LARGE STOCKS OF HEATING APPLIANCES ACCUMULATED

Urged by Salesmen, Central Stations and the Trade Recognize Opportunity to Take Advantage of Rising Market

There seem to be many good reasons for believing that during the month of January the trade and central stations stocked up well in flatirons and toasters in anticipation of the February increase in prices. The announcement came out late in December that prices would advance on Feb. 1, and, urged by factory salesmen, the trade was quick to take advantage of this increase. Dealers, central stations and jobbers recognized an opportunity to buy at lower prices and to gain the added profit on the rising market.

It is not known to what extent deliveries have been made on these January orders. In order to enjoy the former price, shipment according to the patent license agreement must have been made before Feb. 1. All goods shipped later must be billed at the Feb. 1 prices. It is thought in some quarters that because the buying was so heavy in January some manufacturers might find themselves unable to ship all the goods prior to Feb. 1. However, if these manufacturers had the foresight to anticipate this increase in prices, and had, as a result, laid in a sufficient supply of raw materials and had stocked up in appliances—and there is no reason to suppose that they did not—they would be able satisfactorily to cope with the increased demand.

PACIFIC COAST RETAIL CONDITIONS IMPROVE

Organization of Dealers and Contractors and Effective Co-operative Plans Produce Marked Results in Merchandising Field

Marked improvement has been noticed in the conditions under which the retailer of electrical goods and the electrical contractor conduct business on the Pacific Coast. The organization of contractors and dealers over practically the entire coast field has made it possible for this branch of the industry to put into effect helpful co-operative movements involving central stations, jobbers and even manufacturers.

Although slow deliveries is a factor which has influenced trade in practically every line, yet Pacific Coast retailers have been to a certain extent automatically protected on this score. Because of the distance from manufacturing centers as well as delays in securing shipments, Pacific Coast jobbers have carried larger stocks in all lines than they would under other conditions. This has enabled the retailer to fill orders promptly and even to work on smaller stock margins than usual, which has been particularly helpful in a time when prices have so materially advanced.

Another feature of the organization program which has been carried out on the Pacific Coast is that the individual retailer and contractor has gained valuable hints on business methods. A notable result of this has been increased attention to merchandising costs. The education along this line of a considerable proportion of men engaged in the industry has produced better feeling among the trade, has reduced competition of the harmful sort, and better business methods have materially improved the contractors' credit.

There are indications that the advance in range prices has acted to decrease the number of range sales, although the effect on socket appliances has not been nearly so noticeable. It has been noticed that the number of electrical retail stores in San Francisco has not increased for some time. One of the chief reasons for this, it is believed, is that the retailer needs more assistance. The central stations, it has been suggested, could well afford to co-operate by supplying energy for demonstration at a special rate of say 1 cent per kilowatt-hour. A special meter could be installed for this purpose and this privilege extended to department stores, electrical dealers, and, in fact, any firm in a position to sell socket devices.

There is a feeling on the coast that incandescent lamps are "the neglected opportunity" of the retailers' field, their relation to the trade being the same as that which flour and sugar bears to the grocers' business. With lamps bringing in 25 to 30 per cent profit without a special effort, it is felt that with a little attention this line can be depended upon to pay the rent and carry the retailer over slack times.

CONDITIONS IN LABOR MARKET BECOMING BETTER

With no New Contracts Forthcoming War Order Plants Are Closing Down, Making Considerable Skilled Labor Available for Other Work

Within the past two or three weeks the general conditions underlying the labor market in this country have undergone a decided change. The labor market is now much easier than it was at the beginning of the year. There is still a scarcity of first-class machine operators, but of a less intense nature. The situation is most notable in New England, where the shortage of labor was first felt. Munition manufacturing plants which were largely responsible for the abnormal labor conditions had been closing down one by one or curtailing operations largely, thereby throwing numbers of skilled workmen on the market. Many of these plants that sprung up like mushrooms during the war order "panic" of 1915 have completed or are fast completing their contracts and having no new business in sight are forced to shut down.

This condition has afforded a number of electrical manufacturers an opportunity long looked for. While labor was so scarce it was frequently necessary to employ very inefficient and unskilled labor to do the work of skilled labor at skilled labor wages. The result was not always entirely satisfactory. Many electrical manufacturers within the past few weeks have been able to strengthen their force of employees by adding some of these men who had been working on war orders and by letting go men who were unskilled or inefficient.

Provided no great manufacturing activity is stimulated by the impending war cloud, it can be confidently expected that the labor situation will quickly be cleared up, and that by spring there will be a sufficiency of labor to permit uncurtailed industrial operations.

In the unskilled labor market there is still a dearth in help, for which there is no relief in sight at present. The building operations and extensions and improvements which can no longer be held back, together with the number of men required for farm help, will present a rather serious problem to manufacturers, it is expected, as soon as the frost is out of the ground.

A summary of the labor conditions in the twelve reserve districts during the first three weeks of January, made by the Federal Reserve Board, shows the following: Boston, well employed; New York, continued high wages and full employment; Philadelphia, unsettled; Cleveland, some unrest; Richmond, fully employed at good wages; Atlanta, fair; Chicago, good; St. Louis, well employed, wages high; Minneapolis, labor fully employed; Kansas City, better than

normal for season; Dallas, labor fairly well employed; San Francisco, well employed with wages advancing. The outlook in the twelve districts is given as follows: Boston, moderately satisfactory; New York, conservative, but generally favorable; Philadelphia, apparently good, but possibility of peace has added uncertainty; Cleveland, promising; Richmond, encouraging; Atlanta, good; Chicago, good; St. Louis, encouraging; Minneapolis, good; Kansas City, promising; Dallas, unemployment among building trades; San Francisco, favorable.

LONG-PERIOD DELIVERIES FOR RAW MATERIALS CONTINUE

Manufacturers, However, Accept Conditions, Ordering Accordingly, Thereby Making for More Satisfactory Situation

No general change in the raw materials delivery situation is apparent, except perhaps a psychological one on the part of buyers. In some few cases an improvement has already been noted. Carbon products, it was stated by a manufacturer of dry batteries, are being delivered promptly and in sufficient quantities. The same is said to be true of the other raw products going into the manufacture of dry batteries.

In general, however, deliveries of raw materials are just as long as they were in the fall of 1917, and in many cases longer. Brass manufacturers, steel manufacturers, foundries, etc., have sufficient orders on their books to take care of capacity production for many months, and will therefore be unable to materially better deliveries for some time. The shortage of freight cars for the past three months has been another very disturbing factor in this connection. Some roads have been forced to place embargoes on heavy freight, thereby adding a further delay in shipment.

In view, however, of the chaotic state of deliveries of twelve months ago, it can almost be said that at the present time deliveries are in an excellent state. As buyers formerly had been accustomed to receiving delivery in at least three weeks or a month, they were naturally disturbed when deliveries had to run into months and months. Factories were sending orders for rush delivery and making every effort to replenish and maintain their stock. When, however, buyers had reached that psychological state that they finally were satisfied that deliveries could not be made in as short a time as formerly, they accepted the situation as such, and made their plans accordingly. As a consequence, even though the deliveries are two, three, four, and sometimes more, times longer than prior to the war, there is very little suffering compared with what there was ten months ago. Contracts are being placed now for three-months' delivery with little more feeling in the matter than when they were placed for three weeks.

It took some time for manufacturers to adjust themselves to these conditions, but it is felt a favorable result has now been achieved. Buyers of finished products, however, have been slower in accepting these conditions, but now are rapidly coming to share their manufacturer's point of view.

ELECTRIC FAN STANDARDIZATION

Over 90 Per Cent of 1917 Output to Be Sold with Cord and Plug—Proposed Testing for Standards Will Probably Be Generally Used in 1918

Until quite recently there was little evidence of cooperation on the part of manufacturers of electric fans for the purpose of standardizing in any direction. There is now, however, evidence that the standardization rules recommended by the Fan Manufacturers' Section of the Associated Manufacturers of Electrical Supplies, are being followed out by fan manufacturers wherever possible. The standardization of nomenclature is particularly noticeable in the 1917 catalogs. The old term of "desk and bracket" has been replaced by the term "non-oscillating." Fans, therefore, are of two types, oscillating and non-oscillating.

In 1916 a number of manufacturers furnished cord and plugs with their fans and this year practically all the others have followed suit, so it is safe to say that less than 10 per cent of the 1917 output of fans will be furnished without cord and plugs. The fan manufacturers are now discussing standard length for the cord, but as yet no decision has been reached. Some are standing for one length and some another.

Considerable progress has been made in the standardization of ceiling fans. In this connection recommendations have been made regarding size, number of blades and number of speeds. Owing to the fact, however, that a number of ceiling fans which do not comply with this standard were left over from last year, it is doubtful if the recommended standard will become general practice before 1918.

In larger sized fans standardization is noticeable, but below the 12-in. sizes there is a greater variety of sizes among the different manufacturers.

UNCERTAINTY OF CONSUMER A FACTOR IN THE MARKET

Large Power Jobs Are Backward Because of Slow Deliveries and Because the Conditions of the Future Cannot Be Foreseen

Central station power salesmen, especially in the larger industrial centers, are finding that some of the big jobs they would like to close are assuming a difficult angle. It is impossible to get deliveries on the large special machines needed to make improvements in the customers' plants in less than six or eight months. The customer, however, freely admits that he cannot foresee the status of business conditions six or eight months in advance. He, therefore, hesitates to begin now improvements which will be completed at a time when he may have but little need for them. He hesitates to contract for service that, at the time it is to be delivered, he may not need. The fact that the general business situation and general market conditions are unsettled leads the ultimate consumer of electrical goods to proceed cautiously, and the fact that delivery dates are so far advanced as to eliminate the possibility of exercising this caution is delaying some large power and apparatus sales.

COPPER MARKET CONTINUES DULL

Absence of Buyers from Market and Little Disposition to Sell Promote Listlessness

No disposition is yet apparent on the part of holders of copper to sell, nor is there any indication of buying activities, either for immediate or future delivery. For these reasons the market continues to be dull, and prices remain nominal. Up to the early part of this week the rumors of war had apparently not affected the market.

Quotations on Tuesday were nominally as follows: February delivery, 33.75 cents; March delivery, 32 cents; second quarter, 31 cents; third quarter, 29.5 cents; and fourth quarter, 28.5 cents.

NEW YORK METAL MARKET PRICES

	Jan. 30 Selling Prices Bid	Jan. 30 Selling Prices Asked	Feb. 6 Selling Prices Bid	Feb. 6 Selling Prices Asked
Copper	£ s d		£ s d	
London standard spot	132 0 0		136 0 0	
Prime Lake	31.75	to 32.25†	32.00	to 33.00†
Electrolytic	32.50	to 33.50†	33.50	to 34.50†
Casting	29.25	to 29.75†	29.50	to 30.00†
Copper wire base	39.00†		39.75	to 40.75†
Lead	8.00		8.00	
Nickel	50.00		50.00	
Sheet zinc, f.o.b. smelter	21.00		21.00	
Spelter, spot	10.67½	to 10.92½†	10.17½	to 10.42½†
Tin, straits	45.75†		55.00†	
Aluminum, 98 to 99 per cent	52.00	to 54.00†	51.00	to 53.00†
OLD METALS				
Heavy copper and wire	25.00	to 25.50†	25.50	to 26.00†
Brass, heavy	14.50	to 15.50†	15.00	to 15.50†
Brass, light	11.00	to 11.50†	11.50	to 12.00†
Lead, heavy	7.00	to 7.12†	7.25	to 7.37½†
Zinc, scrap	7.25	to 7.75†	7.50	to 7.75†

COPPER EXPORTS

Total tons to Feb. 6	1,110

†Nominal.

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Features of Four Makes of Fans

The descriptions of features of four makes of fans given here supplement an article that appeared in the Jan. 27 issue of the ELECTRICAL WORLD

Sprague Electric Works of General Electric Company, New York City.—Sprague fans for 1917 will retain the features which have distinguished them in the past, chief among these being the single-field coil construction which is well known to the trade, having been used in the Sprague-Lundell fan since 1892. A new blade with a curved edge has been designed which is said to increase the efficiency of the fan. This blade also makes it possible to use an improved guard which is neat in appearance and rigid in construction. The complete fan, including motor body, base, blade and guard will be finished in black enamel. A 10-ft. cord and attachment plug will also be supplied with each 9, 12 and 16-in. fan. The fan as shipped from the manufacturer will therefore be ready to operate without additional labor or expense. Ceiling fans are of the four-blade type with a sweep of 56 in. and have three-speed switches. The Sprague "Midget" ceiling fan, which is furnished in either black or white enamel, and has a sweep of 32 in., is a very popular type, being used in large numbers in hotel sleeping rooms. All 12-in. and 16-in. non-oscillating fans may be readily converted to oscillating fans by the addition of an oscillating mechanism, which can be attached in a few minutes with the aid of a screwdriver.

Menominee Electric Manufacturing Company, Menominee, Mich.—A new low-priced 8-in. universal oscillator fan is being manufactured this year by the Menominee Company. It is built on

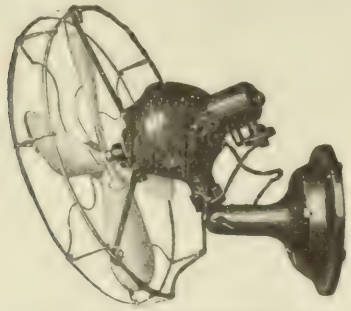


FIG. 1.—SPRAGUE CONVERTIBLE WALL AND DESK FAN

standard lines with a cast-iron body and base, and is provided with a standard oscillating mechanism and a universal motor. The blades and guard are of black japanned steel. This company will continue the manufacture of its 8-in. straight-type fan in which a few minor changes for improvement have been made. All fans this year, save for the exception of two types, will be equipped with black japanned guards, but the blades and guard holders will be made of brass, as formerly. The manufacture of special patented fans—the table fan and socket fan—will also be continued.

Lindstrom, Smith Company, Chicago, Ill.—The Breezer electric fan is especially adapted for use in small rooms, telephone booths, near the bedside, on the desk and in inclosed motor boats and automobiles. It is attractive in appearance, noiseless in operation, and is finished in nickel and black. Rubber feet are provided on the base so it will not mar the most highly polished surface. The regular 8-in. type fan is 11 in. high and 9 in. wide over all. When used as a wall fan it extends 9 in.

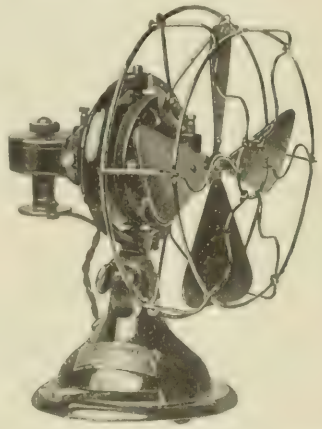


FIG. 2.—MENOMINEE 8-IN. UNIVERSAL OSCILLATOR

Units are designed for direct or alternating-current energy of any frequency and pressures from 8 to 120 volts.

Model 64, which is a regulation 8-in. fan, has a strong universal motor. The blades and guard are nickel-plated and highly polished, and the base and motor are finished in black. Rubber feet are attached so as not to mar furniture. The fans are furnished for any voltage from 12 up to 220 volts, direct or alternate current.

Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.—In addition to bringing out a new low-priced, 8-in. non-oscillating fan, the Westinghouse Electric & Manufacturing Company has incorporated a number of new features in its regular line. The complete line comprises oscillating and non-oscillating desk and bracket fans, gyrating ceiling, counter-column and floor-column fans, ceiling fans, and exhaust fans. The bodies of the fans are of drawn metal, or are die cast. The standard finish is dull black. The oscillating desk and bracket fans have three speeds and are made in 10, 12 and 16-in. sizes. The non-oscillating desk and bracket fans are made in 8, 10, 12 and 16-in. sizes, and with the exception of the new low-priced 8-in. fan, have three speeds. All 8 and 10-in. fans

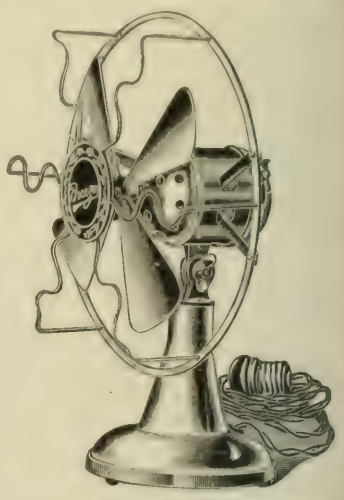


FIG. 3.—LINDSTROM-SMITH 8-IN. CONVERTIBLE FAN

have four blades and the 12 and 16-in. fans four or six blades. All desk and bracket fans are made for alternating and direct-current operation, and for frequencies from 25 to 60 cycles and pressures from 100 to 250 volts.

The blades used on the gyrator-type units have drawn-metal frames, and are known as the 12-in. "silent six" fans. One of the fan motors is geared to a mechanical drive operating on a stationary central pulley. The drive is

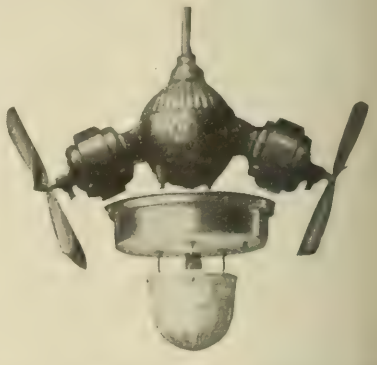


FIG. 4.—WESTINGHOUSE GYRATING CEILING FAN WITH BRASCOLITE UNIT

therefore positive and does not vary with the air reaction. The mechanism does not slow down and cannot revolve at excessive speed. Breeze at any angle desired, from horizontal to 35 deg. below horizontal, can be obtained by means of a positive wing-nut adjust-

ment at the side of the gyrating body. These fans operate at one speed, and current is controlled by a pull switch. While in the past these fans have been obtainable for use with ordinary electroliers, this year the ceiling gyrator

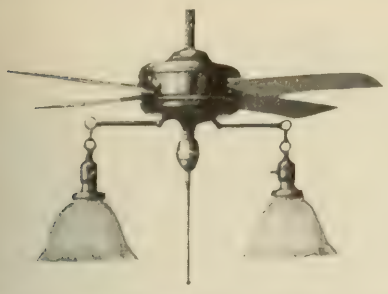


FIG. 5.—WESTINGHOUSE CEILING FAN WITH LOOP AND LINK UNITS

is provided with means for attaching Brascolites or Reflectolytes.

The ceiling fans have four blades. For alternating current with frequencies from 25 to 60 cycles and pressures from 100 to 115 volts, they are obtainable with blades having 32-in. or 56-in. sweep. The blades of the direct-current ceiling fans have a sweep of 32 in., 56 in. or 58 in. In the standard fans the air is thrown downward. On special order, however, the blades can be arranged to draw the air upward, a desirable arrangement in places where a downward breeze might disturb papers. Wooden blades with mahogany finish are used for the 58-in. and 56-in. fans. The blades for the 32-in. direct-current fan are also of wood, but have a natural finish. The blades for the 32-in. alternating-current fans are of aluminum, with frosted finish.

A 56-in. ceiling fan can be arranged for two-lamp or four-lamp electrolier attachments. The 32-in. fans can be arranged for single lamp or two-lamp electrolier attachment. A new loop and link attachment has been incorporated in the 32-in. and 56-in. alternating-current fans whereby two or four lamps respectively may be suspended by loops attached to two or four projecting arms. The lamps are mounted below the fan blades so that no shadows will be cast by the blades. Provisions have been made for equipping the 56-in. ceiling fans with Brascolites and Reflectolytes as well.

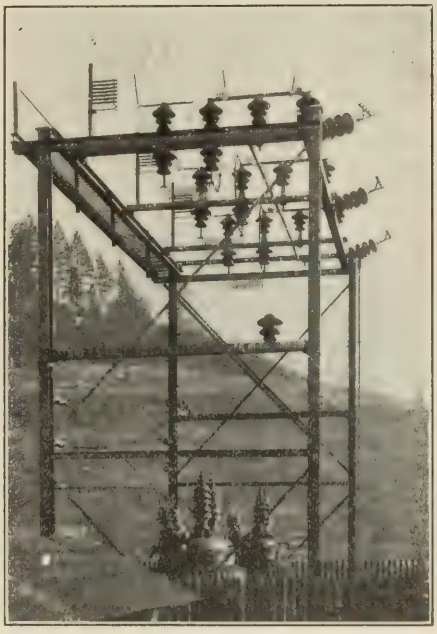
Features of Kokomo (Ind.) Oscillating Fan Company's line of fans for 1917 will be described in a later issue.

Closed Conduit Bushing

A closed pressed steel conduit bushing that has a protective top securely fastened into it is being offered to the trade by the Detroit Closed Bushing Company, Inc., 901 Kresge Bldg., Detroit, Mich. This top can be removed by the wireman with a screw driver or pliers. Attention is called to the fact that this protective feature leaves nothing to the memory of the workman. He must bush the conduit to complete the conduit installation, so that when the bushing is in place, the end of the conduit is also closed. The bushing is waterproof, thereby a protection against concrete and the entrance by foreign material.

44,000-Volt Outdoor Substation

A typical installation of the relatively inexpensive 44,000-volt type V B outdoor substations developed by the Delta Star Electric Company, of Chicago, Ill., is shown in the accompanying illustration. This steel tower substation is provided with four 35-ft. expanded-steel corner poles connected by cross members for carrying the high-tension control and protective units, transformer buses, etc. All parts are standardized, the steel being shipped "knocked down" and are easily assembled in the field. The three-pole switch is of the double-break per phase type with manually operated remote-control mechanism permitting



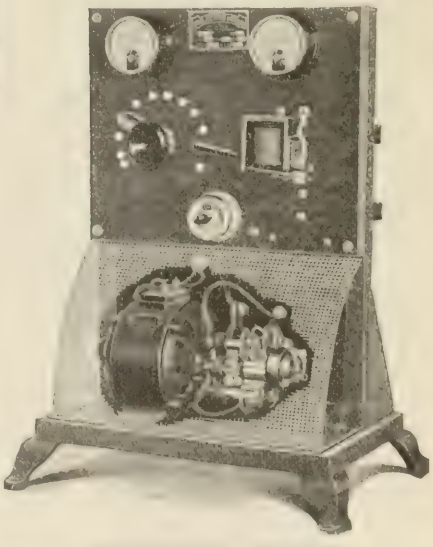
STEEL-TOWER SUBSTATION FOR 44,000-VOLT SERVICE

the switch handle to be locked near the ground level. The high-speed sphere-gap graded-resistance lightning arrester is so located that disturbances have a straight-line discharge path to earth, thus affording quick relief. Between this switch and the arrester is a right-angle fuse tap-off in conjunction with a long-turn cylindrical choke coil which presents a highly reactive path between the lightning disturbance and transformers.

Protection against short-circuits is secured by means of carbon-tetrachloride fuses in the tap-off circuit. Ordinary overloads are taken care of by the automatic oil breakers or fuses on the secondary side. By closely setting the secondary-breaker tripping mechanism and heavily over-fusing the primary side, fuse operation is confined to actual transformer or oil-switch failure, in which case the short-circuit is instantly cleared, thus preventing a local disturbance spreading to the main lines. With these stations the transformers are located at ground level and as the load requirements increase, the primary fuse and transformer ratings can be increased—no other change being necessary. These standard stations occupy 20 ft. by 10 ft. 7.5-in. ground area, thus permitting considerable increase in the transformer rating.

A Commutator Rectifier

The rectifier shown in the accompanying illustration is designed for the charging of small storage batteries, such as used with automobile ignition, lighting and starting sets. The single-circuit type is a self-contained charging plant that will charge from one to five batteries (or up to a total of 15 cells). By keeping the rectifier running twenty-four hours a day and taking out each battery as soon as fully charged, on an average, a total of thirteen 3-cell batteries, it is claimed, can be given a full charge in twenty-four hours, allowing for the average amount of residual charge. The rotating commutator principle is employed. Current from the alternating-current supply is brought to two terminals at the back of the switchboard. From these terminals the current passes through the line switch to a special induction-type motor. On the extended shaft of this motor are two collector rings and beyond them a commutator. The synchronous motor is of such design that no further attention need be given in starting than to simply close the line switch, at which time the motor will start readily and fall into synchronism, remaining so, it is said, even at a great reduction in voltage. The motor has no carbon brushes to keep in renewal. The only load on the motor



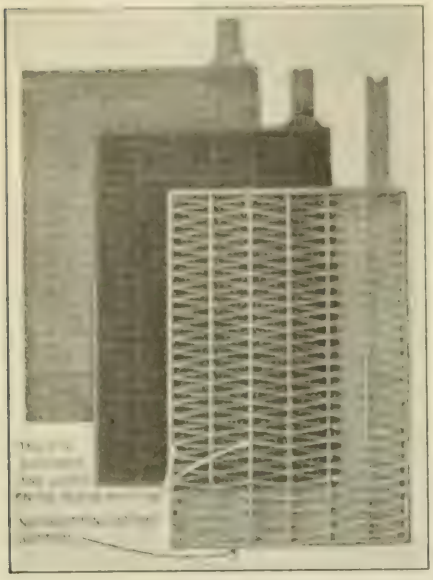
SINGLE-CIRCUIT RECTIFIER

is the friction of the brushes on the collector rings and the commutator.

Although the type shown here is of small capacity and low voltage to charge the class of batteries mentioned, larger sizes of the machines are made by the Stahl Rectifier Company, 538 South Clark Street, Chicago, Ill.

Grids for Storage Batteries

The General Lead Batteries Company of Newark, N. J., has developed the grid shown in the accompanying illustration which, it is claimed, will resist



GRIDS THAT HAVE OVERLOAD CAPACITY

sudden and unexpected strains or overloads. The diagonal ribs are intended to prevent bending at any point along the vertical bars and the fins along the vertical ribs must be broken before the plate can be bent. These fins, it is said, also decrease the length of the unsupported diagonal rib, permitting the lightening of the members without danger of their sagging during the pasting process. The fins afford projection around which the active material securely locks itself in which function they are assisted by the small shelves visible along the vertical bars.

Sewing-Machine Motor

A motor that can be readily attached to any make of stationary or drop-head sewing machine, new or old, with the exception of a few obsolete models, is made by the Westinghouse Electric & Manufacturing Company. When not in use, the motor, if mounted on a stationary-head machine, can be pushed back out of the way and the cover put on. If used on modern types of drop-head machines it can be dropped with the head. When desired, however, the motor can be removed readily by loosening one thumb screw, as it is light and portable. The complete outfit, which weighs only 7 lb., consists of a small motor which operates on either alternating or direct-current energy, a speed regulator with chain for connecting with treadle, 10 ft. of cord and plug and a round leather belt.

Being made of pressed steel, the regulator is light and substantial. There are two coils in series with the motor. When there is no pressure on the sewing machine treadle the circuit is open. With slight pressure on the treadle, a contact is made, both coils being in series, and as a greater pressure is applied the resistance is cut out in about 100 steps. Thus by varying the pressure, one stitch, or several hundred stitches a minute can be taken. When it is desired to wind the bobbin, the belt is slipped off the hand wheel and on to the bobbin wheel. A helical spring tends to force the motor away from the head of the machine and thus always keeps the belt tightened. When folding up the machine it is only necessary to loosen the belt, disconnect the plug, and swing the motor around under the head. Two hooks are furnished for attaching the service conductors to the back of the machine. Felt pads underneath the base prevent the motor from scratching the machine.

Wireless Generator

A laboratory generator called the "Oscillion," for use wherever measurements and measuring instruments are employed, has been developed by the De Forest Radio Telephone & Telegraph Company, 1391 Sedgwick Avenue, New York City. It is a generator of pure sine wave high frequency oscillations, the frequency of which depends on the wave length employed, that may be used for transmission of radio tele-



GENERATOR OF PURE SINE WAVE HIGH FREQUENCY OSCILLATIONS

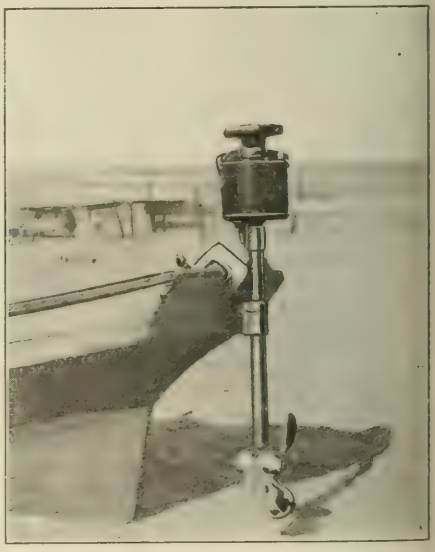
phone and telegraph signals over short ranges.

By using this instrument it is claimed one is enabled to do extensive research and calibrating work on all types of radio frequency circuits and instruments, for "heterodyne" work, beat and interference experiments. For example: A small difference of inductance or capacity can be quickly determined merely by associating one or two resonant circuits with the "oscillion" circuit, connecting a detector and telephone receivers to one of these circuits and tuning until a certain definite "beat note" is heard, say, one of 300 per second. Then vary the inductance, say, of two short parallel wires until wave frequency is altered by about twenty periods per second. (Determine these frequencies by comparison with a tuning fork note, etc.) After having determined the wave-length by means of a wave meter, the number of oscillations which caused change in frequency of "beat note" is known. Then if either capacity or inductance of full circuit is known, the minute change in capacity or inductance which caused the change in "beat note" can be determined.

An Electric Rowboat Motor

The electric motor for rowboats shown in the accompanying illustration is manufactured by the Jewel Electric Company, 112 North Fifth Avenue, Chicago, Ill. The motor is placed directly above the main driving shaft, which is contained in a telescopic tube, allowing the propeller to be adjusted to the correct distance beneath the surface of the water. The propeller is driven through a special type of propeller gearing which gives proper reduction between the motor and the propeller, this being necessary owing to the fact that the normal speed of the motor is about 3000 r.p.m. Above the motor is a small steering wheel, which enables the propeller to be turned to the right or left, or completely round if it is desired to reverse the direction of the boat. To this wheel may be fitted either a tiller or steering yoke, according to requirements. The outfit is made of aluminum and manganese alloy wherever possible, the purpose being to reduce the weight.

Attention is called to the fact that the motor complete, but without battery, weighs only 50 lb. The armature runs on ball bearings, and the commutator and brushes are of special design, suitable for low voltages, as the motor is used on from 6 to 12 volts. By means of a simple device the motor may be detached from the driving shaft and used for other purposes where power is required, and the current can be derived from the same batteries as used in the

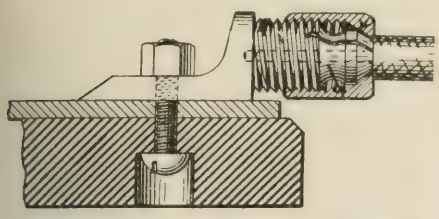


ELECTRIC MOTOR ADAPTED FOR USE ON ROWBOATS

boat. The storage batteries supplied with the regular equipment are two of 6-volt 120-amp.-hr. each. This company also supplies accumulators of 6 to 12 volts, having a rating of 60 to 120 amp.-hr.

Electrical Connector

An improved wire and terminal connector which it is claimed provides a simple, effective, strong and easily operated device is shown here as made



SIMPLE WIRE AND TERMINAL CONNECTOR

by the Frankel Connector Company of New York City. This connector is provided with a forked arm which may be secured to a binding post or screw bolt. The connector proper is provided with a longitudinal central bore. The free end is slotted longitudinally to form short gripping jaws. The wire is fastened to the connector by stripping a portion of the insulated covering and placing it into the longitudinal bore of the body. The sleeve screws up until the tapered part engages the tapered end of the connector body in such a way as to draw the two sides into contact with the wire.

Direct-Current Overload Relay

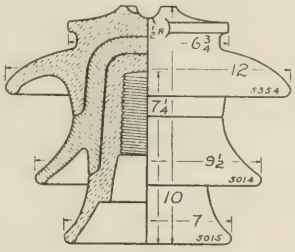
A relay has been developed by the Westinghouse Electric & Manufacturing Company, of East Pittsburgh, Pa., to give overload protection on direct-current circuits. It is particularly applicable for use in connection with three-wire generators having but four cables running to the switchboard, since by connecting the control coil of the relay to ammeter shunts, the circuit breakers can be mounted on the switchboard, yet controlled by the actual armature current as required by the Fire Underwriters. Without such connections the circuit breaker must be inserted in the circuit at the position of the ammeter shunt. This would require either the circuit breaker to be mounted at the generator, away from the switchboard, or an extra pair of leads to be run from the generator to the switchboard. This relay is known as the type TO. The operating part is a small two-pole electro-magnet with special winding. The magnet and an adjusting mechanism are inclosed in a dust-proof case of aluminum alloy.

The pull of the relay coils is opposed by a helical spring. When the pull exceeds the tension of the spring the contacts close. A calibrated adjustable arm is used to adjust the tension of the spring, in that way determining the voltage drop across the ammeter shunt at which the contacts will close. The relay contacts will close a circuit carrying 1 amp. When the circuit breaker trip coil requires more than this, an auxiliary relay switch should be used.

Type TO relays can be used with a standard 50-millivolt ammeter shunt (the same shunt that is used with the ammeter), without affecting the readings of the ammeter appreciably. By adjustment the contacts can be made to close at from 40 to 80 millivolts, corresponding to 80 to 160 per cent of full load, according to the setting made on a scale provided within the instrument allowing adjustments for all intermediate values. Where a relay is used, the circuit breaker should have auxiliary contacts to open the trip circuit when the breaker opens, thus relieving the relay contacts of this duty. Further, the type TO relay is instantaneous in operation. If a definite time element is desired a definite-time-limit relay should be used with it.

Pin Type Insulator

The Locke Insulator Manufacturing Company of Victor, N. Y., now manufactures ten designs of pin-type insulators for voltages ranging from 27,000 to 80,000. Several designs are offered



INSULATOR RATED AT 50,000 VOLTS

as new types for their rated voltages. In these units it is claimed that the electrical and mechanical characteristics provide an ample factor of safety for the most severe requirements. In the accompanying illustration is shown an insulator that has a line voltage rating of 50,000 volts. The dry arc over voltage is 175,000, the wet arc over voltage is 120,000 and the leakage distance is 23.5 in. The mechanical strength is 5000 lb.

Curb Station for Automobile Tire Inflation

An electric tire inflating outfit arranged for permanent mounting on sidewalks has been developed by the Black & Decker Manufacturing Company, 109 South Calvert Street, Baltimore, Md. This outfit is equipped with an electric tire inflating equipment such as described on page 100 of the Jan. 13 issue of the ELECTRICAL WORLD. There is a 4.5-in. 150-lb. pressure gage illuminated by a concealed lamp on this outfit. The upper compartment contains the inflating outfit and is normally kept locked so as to prevent anyone from tampering with it. The lower compartment contains a handy starting switch and a long hose. This curb station is fitted with an ornamental colum surmounted by a large opalescent globe having white lettering arranged in a green hexagon shaped field, the words "Free Air" being in large type and "Lectroflater Station" in small type.

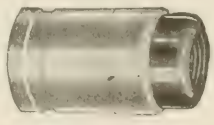
Starting and Lighting Equipment

The Westinghouse Electric & Manufacturing Company's automobile starting and lighting equipment for 1917 includes a complete line of starting motors and generators of the round frame type. The starting motors are built in a number of sizes and of such range as to be applicable to engines with a cylinder displacement up to 1000 cu. in. With the graduated range in which these motors are built it is possible to select a standard motor for any size engine which will exactly fulfil automobile requirements and still be the most economical application. The motors are all of the single-reduction type and equipped with the Bendix screw shift transmission for meshing with the flywheel gear. For the most economical performance, it is pointed out, the proper size battery, ranging from 80 amp.-hr. to 160 amp.-hr. capacity, must be used with a given size motor.

Corresponding sizes of generators are also being built for operation between engine and twice engine crankshaft speed. These machines are of the third-brush regulation type, a method which has proven very satisfactory where a large output is desired at low speed and where, at the same time, it must maintain the maximum output with reasonable relation to the ampere capacity of the battery. The approximate output of generators varies from 12 amp. maximum at 1500 r.p.m. for the smallest machine to 20 amp. maximum at 900 r.p.m. for the largest generators. Both generators and motors are designed primarily for bracket mounting, with the generator on the timing gear housing and the motor on the flywheel housing.

Medium-Base Reflector Socket

The reflector socket shown herewith has been brought out by the Arrow Electric Company, Hartford, Conn., and is built along the same lines as its regular mogul porcelain socket, except that it is designed for medium-base lamps. The socket is made of heavy porcelain and is constructed substantially throughout. The screw shells and binding posts are reinforced. An asbestos gasket is used between the inner and outer porcelain shells and a rubber gasket below the cap. All connections are made from the front of the socket. The socket is made with



SOCKET ADAPTED FOR USE WITH MEDIUM-BASE TYPE C LAMPS

⅜-in. and 0.5-in. metal caps, and ⅜-in. and 0.5-in. iron yokes. It is designed to take a standard shade-holder, and is particularly adapted for use with reflectors and fixtures employing medium-base Type C lamps.

Trade Notes

A. W. HARTMAN of the New York sales organization of the Western Electric Company, has been appointed sales manager of the Electrical Alloy Company with headquarters at 11 Union Square, New York City.

THE WESTINGHOUSE LAMP COMPANY has officially announced the construction of a large new factory at Trenton, N. J., for the manufacture of incandescent lamps. This announcement closely follows that of the Westinghouse Electric & Manufacturing Company, which is to build a $5,000,000 plant at Essington, Pa.

The site for the lamp factory at Trenton covers about 5 acres, upon which will be built a plant of 300,000 sq. ft. of floor space. The cost of the buildings and equipment will be more than $1,000,000. When in full operation, the lamp factory will employ about 600 people, manufacturing approximately 1,500,000 lamps per month. The company at present has factories at Bloomfield, N. J., New York City and Milwaukee, Wis.

L. F. TANKARD has been promoted to manager of the New York office of the Diehl Manufacturing Company.

H. W. WATTS, who has been in the New York office of the Diehl Manufacturing Company for several years has been promoted to manager of the Boston office. Mr. Watts succeeds H. A. Howard, who has resigned to devote his entire time to the companies in which he is personally interested.

HOTPOINT ELECTRIC HEATING COMPANY has increased the list price on its tea kettles from $8 to $8.50, effective Feb. 1.

WESTERN ELECTRIC COMPANY has announced the terms for its 1917 appliance campaign. To encourage progressive fan merchandising the company offers cash prizes to the dealers that submit what is considered to be the best all around appliance fan sales campaign. The board of judges will be composed of representatives of ELECTRICAL WORLD, *Electrical Merchandising*, *Electrical Review*, *National Electrical Contractor*, *Electrical Record*, *Electrical Age* and the Society for Electrical Development. All data must be in the hands of the company by Oct. 1, 1917. Awards will be made as soon thereafter as practicable.

WALTER KIDDE, engineer-constructor, of 140 Cedar Street, New York City, has incorporated his organization under the title of Walter Kidde & Company, Inc. This business was established in 1900, and from the first the functions of the engineer and constructor were combined, as it was believed that in this way the common interests of the client and the constructor could be best served. Particular attention has always been given by Mr. Kidde's organization to the electrical equipment of plants, and they have kept in the vanguard of electrical progress. They have been strong advocates of electric drive from the very beginning, and they made some of the earliest installations of direct-driven machine tools. They were among the first to apply alternating current to factory operation; they were one of the early introducers of the 480-volt alternating-current system with induction motors, and did pioneer work in the installation of synchronous motors in isolated factory plants for the improvement of the power factor. The organization includes departments of construction, hydraulics, steam and mechanical engineering, electrical engineering and chemical engineering, which work in close co-operation, and which are usually associated on the same undertaking. Mr. Kidde's chief associates will now become directors and stockholders of the new corporation, the officers of which are: Walter Kidde, president; B. G. Worth, vice-president; I. R. Lewis, secretary and treasurer. These are all members of the board of directors, which also includes Henry Lang, who is vice-president of the Ingersoll-Rand Company, and E. S. Boyer, who is associated with the American Hard Rubber Company. Mr. Kidde's other principal associates, who comprise the "engineering board" of the corporation, are: A. B. Miller, Walter S. Wainright, M. I. Butterfield and E. Schwarz. The chief draftsman is Theofiel Fliflet.

CHICAGO MICA COMPANY has appointed W. B. Cosgrave 50 Church Street, New York City, as special representative covering the New York territory.

CROCKER-WHEELER SALES CONVENTION.—On February 8, 9 and 10 the Crocker-Wheeler Company, Ampere, N. J., held a sales department convention at the Robert Treat Hotel, Newark, N. J. A discussion of present and future conditions formed one of the features of this convention. On the evening of Feb. 9 a banquet was held. All of the officers and department heads of the company were present as well as all of the executive district and branch managers of the company having charge of sales territories covering the entire country.

COMMERCIAL ELECTRIC SUPPLY COMPANY, 17 Congress Street, East, Detroit, Mich., has appointed Frederick Rietel, Jr., formerly district sales manager of the George Cutter Company, as general manager.

S. K. F. COMPANY, LTD., 15 King Street, West, Toronto, Ontario, Canada, has been recently organized to handle the S. K. F. products in Canada.

THE RICHARDSON PHENIX COMPANY, Milwaukee, Wis., announces the opening of a sales office in Cleveland, located in the Builders' Exchange, in charge of W. J. Oettinger, in order to take care of the increased business in Ohio. Mr. Oettinger was formerly connected with the engineering department at the home office.

NEW WESTINGHOUSE PLANT—Announcement has just been made by the Westinghouse Electric & Manufacturing Company that the plot of ground recently purchased at Essington, near Philadelphia, will form a new industrial center for the Westinghouse Electric interests. The site embraces about 500 acres, with a frontage of approximately 1 mile on the Delaware River. Additional transportation facilities will be afforded by tracks from the Pennsylvania and Philadelphia & Reading Railroads. This new center will be devoted to the production of large apparatus, the first group of buildings being for power machinery, principally steam turbines, condensers, and reduction gears. The initial development will cost in the neighborhood of $5,000,000 or $6,000,000 occupying about one-fifth of the area of the entire plot. The group will consist of the following buildings: Two large machine shops, an erecting shop for heavy machinery, forge shop, pattern and pattern-storage shop, and power house. Work will begin on these as soon as satisfactory building contracts can be let. The number of employees to be engaged at the new plant has not as yet been definitely determined but will number several thousand people, and undoubtedly will in the future equal the number employed at East Pittsburgh, representing over 20,000 people.

New Incorporations

THE DIXIE ELECTRIC COMPANY of Sumter, S. C., has been incorporated with a capital stock of $3,000 by B. C. Wallace, Jr., and Young Shackelford.

THE ELECTRIC STEEL CASTING COMPANY of West Allis, Wis., has been incorporated with a capital stock of $300,000 by Leo G. Smith, Chauncey Yockey, F. G. Walter, C. F. Taylor and Clark Tennant. The initial units of the company plant will cost about $100,000.

THE DEPPE MOTORS CORPORATION of Wilmington, Del., has been chartered with a capital stock of $5,000,000 to manufacture and deal in motor cars, engines and generators of all kinds. The incorporators are: Herbert E. Latter, Norman P. Coffin and Clement M. Egner, all of Wilmington, Del.

THE CROWN ELECTRIC ILLUMINATING COMPANY of New York, N. Y., has been incorporated by W. Schlessinger, S. and D. Swartz, 78 East Houston Street, New York, N. Y. The company is capitalized at $5,000 and proposes to manufacture and deal in electric arc lamps, appliances, etc.

THE DUBILIER CONDENSER COMPANY of New York, N. Y., has been incorporated with a capital stock of $75,000 to manufacture and deal in machinery, apparatus, instruments and electrical machinery. The incorporators are: M. K. Morse, J. N. Essler and K. S. Neal, 111 Broadway, New York, N. Y.

THE MORROW INSULATING COMPANY of New York, N. Y., has been chartered by H. M. Lewis, C. and J. J. Morrow, 674 Academy Street, New York, N. Y. The company is capitalized at $25,000 and proposes to do general contracting and electrical work.

THE INTERBOROUGH LIGHTING FIXTURE COMPANY of Brooklyn, N. Y., has been incorporated with a capital stock of $5,000 to manufacture and deal in gas, electric fixtures, metal goods, etc. The incorporators are: B. Markowitz, E. Fechandler and J. Ribak, 500 Thatchford Avenue, Brooklyn, N. Y.

THE WETZEL MECHANICAL STOKER COMPANY of Trenton, N. J., has been incorporated by James R. Barber, Miriam P. Swartz and E. Swartz of Trenton, N. J. The company is capitalized at $200,000 and proposes to manufacture and sell mechanical stokers, machinery and power-plant equipment.

THE INDESCO LIGHTING FIXTURES COMPANY of New York, N. Y., has been incorporated with a capital stock of $5,000 to manufacture and deal in electric and gas fixtures, motors, dynamos, and to do general electrical work. The incorporators are: H. E. Reid, A. and I. Frankenberg, 1200 Madison Avenue, New York, N. Y.

THE MOODY ENGINEERING COMPANY of New York, N. Y., has been incorporated by R. H. Jones, F. R. and R. D. Moody, 115 Broadway, New York, N. Y. The company is capitalized at $250,000 and proposes to do a general consulting, operating, electrical, mechanical and civil engineering business.

THE WHITE FLUID MOTOR COMPANY of Kansas City, Mo., has been incorporated by Thomas A. White, Z. D. Brown, I. J. Lane and I. A. Strauss. The company is capitalized at $50,000 and proposes to manufacture and deal in motor devices. The company is now being organized and will probably later arrange for the manufacture of the white fluid motor, the invention of T. A. White, which secures power from the wind for the generation of electricity.

THE QUASI-ARC WELDTRODE COMPANY of West Nyack, N. Y., has been incorporated by W. Moffatt, D. C. Alexander and F. W. Gordon, 61 Broadway, New York, N. Y. The company is capitalized at $150,000 and proposes to manufacture electrodes, weldtrodes, machinery, accessories, etc.

THE ELECTRO-DENTAL MANUFACTURING COMPANY of Philadelphia, Pa., has been chartered with a capital stock of $25,000 to manufacture electro-dental and surgical appliances, mechanical machines, etc. W. E. Hoagland, 47 West Thirty-fourth Street, New York, N. Y., is representative.

THE ADDISONE BOYCE CONDUIT COMPANY of New York, N. Y., has been chartered with a capital stock of $10,000 to manufacture and deal in electrical devices, appliances and to do a general contracting business. The incorporators are: T. M. Smith, E. G. Barton and A. S. Boyce, 16 West Thirty-third Street, New York, N. Y.

Trade Publications

RECTIFIERS.—The Stahl Rectifier Company, 536 South Clark Street, Chicago, Ill., has issued an illustrated leaflet descriptive of its commutator type of rectifier.

FANS.—The Robbins & Myers Company of Springfield, Ohio, is distributing an illustrated folder describing its 1917 line of fans.

FIXTURES.—A new fixture designed especially for nitrogen lamps is described in a leaflet issued by the Philadelphia Lighting Specialty Company, 1235 Filbert Street, Philadelphia, Pa.

POWER STATION.—The Almänna Svenska Elektriska A. B. has prepared an illustrated book descriptive of the Porjus Power Station and the electrification of the Riksgräns Railway. This company has compiled this brochure to commemorate this unique undertaking, in which it took part.

SALES SERVICE.—The February issue of Monthly Sales Service for use by members of the Society of Electrical Development, Inc., is now being distributed.

FANS.—The Western Electric Company is distributing an illustrated folder descriptive of its fans for 1917. The details for a merchandising contest are also given.

FANS.—The Robbins & Myers Company of Springfield, Ohio, is distributing two leaflets descriptive of its ceiling fans and its desk and oscillating fans.

SCREWS.—"How to Measure Screw Threads" is the title of Bulletin No. 1, recently published by the Greenfield Tap & Die Corporation of Greenfield, Mass.

ADDRESSING MACHINES.—The Elliott hand addressing machine is described in a leaflet issued by the Elliott Addressing Machine Company of Cambridge, Mass.

New England

BOSTON, MASS.—Plans have been prepared by the Edison Electric Illuminating Company for the erection of a substation. Bigelow & Wadsworth, 120 Tremont Street, are architects.

BOSTON, MASS.—The Commissioner of Public Works has recommended to the City Council an appropriation of $5,000 for the installation of an ornamental lighting system on Meridian Street from Summer Street to the Meridian Street Bridge, in East Boston.

BOSTON, MASS.—Bids will be received until Feb. 21 for the sale of nine 3-wire feeder panels, two 3-wire generator panels, two 225-hp. vertical cross compound Buckeye engines and miscellaneous piping, at the Boston, Mass., navy yard, etc. For details see proposal columns.

FRANKLIN, MASS.—The Union Light & Power Company of Franklin will soon begin work on the erection of a new transmission line from North Attleboro to Mansfield, giving the company a ring transmission through the towns of Franklin, Wrentham, Mansfield, North Attleboro. The company is also erecting extension to its high tension lines to take on the Chocolate Refiners Company and the New England Steel Company of Mansfield. A new transmission line from Woonsocket to North Attleboro has recently been completed by the company.

MANSFIELD, MASS.—Three 100-kw. and three 125-kw. 13,000-volt transformers are being installed in the municipal electric-light plant; about 1 mile of 13,000-volt transmission line will be erected in Mansfield and two 200-kw. 13,000-volt transformers will be installed. George W. Wood is manager.

NEW BEDFORD, MASS.—Bids will be received by the Board of Mayor and Aldermen, Room 309, Municipal Building, New Bedford, Mass., until Feb. 21, for centrifugal pump and electric motor for the intercepting sewer system. Form of proposal and further information may be obtained at the office of William F. Williams, consulting engineer.

PEABODY, MASS.—A 1500-kw. General Electric turbine, with Wheeler condenser and Dean jet condensers for reciprocating engines and spray pond are being installed in the municipal electric-light plant. A 125-kw. General Electric generator is being removed. W. D. King is manager.

Middle Atlantic

ALBION, N. Y.—Bids will be received by William B. Dye president of board of managers, Western House of Refuge, Albion, until Feb. 13, for construction of new cottage, including electric work, heating and plumbing at the Western House of Refuge. Plans and specifications may be consulted at the Western House of Refuge, Albion, at the New York office of the Department of Architecture, Room 1224, Woolworth Building, New York City. Drawings, specifications, etc., may be obtained at the Department of Architecture, Albany, N. Y. Lewis F. Pilcher is state architect.

BAINBRIDGE, N. Y.—The Standard Light, Heat & Power Company of Unadilla has applied to the Public Service Commission for permission to construct an electric plant in Bainbridge.

BEDFORD HILLS, N. Y.—Bids will be received by James Wood, president board of managers of New York State Reformatory for Women, Bedford Hills, N. Y., until Feb. 16 for electric work and rewiring building at the New York State Reformatory for Women. Drawings and specifications may be consulted at the State Reformatory for Women, Bedford Hills, at the New York office of the Department of Architecture, Room 1224, Woolworth Building, and at the Department of Architecture, Capitol, Albany. Lewis F. Pilcher is State architect.

BRONXVILLE, N. Y.—The Village Planning Commission has passed a resolution suggesting to the Board of Trustees that some arrangement be made with the Westchester Lighting Company for extending the underground electric conduit system from the center of the village, in connection with the next street-lighting contract with the company.

GENEVA, N. Y.—Bids will be received by Dr. W. H. Jordan, director State Agricultural Experiment Station, Geneva, until Feb. 23, for construction, heating, plumbing, drainage and electric work for administration library and demonstration building at the State Agricultural Experiment Station, Geneva. For details see proposal columns.

JAMESTOWN, N. Y.—The contract for installing new signal system and speed control appliances on the lines of the Chautauqua Traction Company and the Jamestown, Westfield & Northwestern Railway Company has been awarded to the Julian Beggs Signal Company of Terre Haute, Ind. The cost of the work is estimated at $250,000.

NEW YORK, N. Y.—The New York, Westchester & Boston Railway Company, it is reported, will build an extension of its railway from White Plains to Danbury.

NEW YORK, N. Y.—The Interborough Rapid Transit Company has acquired a site on East Fifty-seventh Street, between Third and Lexington Avenues, on which it proposes to erect a transformer station to distribute electricity to operate the trains in the new Lexington Avenue subway and other lines the company operates.

ROCHESTER, N. Y.—Plans are being prepared by the Vacuum Oil Company of Rochester for the erection of a new can factory and a new box factory; also for the reconstruction of its boiler house, which will include the installation of coal-handling equipment. The cost of the new equipment is estimated at $100,000 and the buildings at $135,000.

HAMBURG, PA.—Arrangements have been made by the Metropolitan Electric Company of Reading to supply energy to the Hamburg Gas & Electric Company from its Reading plant for local distribution. The plant of the Hamburg company will be closed down and held for emergency service.

JOHNSONBURG, PA.—Preparations are being made by the Johnsonburg Light & Power Company for the installation of a new street-lighting system in this borough.

MAHANOY CITY, PA.—The Reading Coal & Iron Company is planning to install an electric power plant in connection with other improvements at its Knickerbocker mine. The plant will supply electricity for both lamps and motors.

NORRISTOWN, PA.—The Board of Supervisors of West Norristown has awarded the Counties Gas & Electric Company of Norristown a contract for the installation and operation of a street-lighting system.

PHILADELPHIA, PA.—Plans have been filed by the Quaker City Iron Works for the erection of a new boiler house and engine plant at Salmon and Tioga Streets.

PHILADELPHIA, PA.—The Philadelphia & Reading Railroad Company is contemplating the construction of a new power house at its yards at Erie Avenue and American Street.

PHILADELPHIA, PA.—The installation of a trackless trolley to serve the Byberry section has been recommended by M. J. Ryan, Public Service Commissioner, in connection with plans for the extension of the Frankford elevated line to this point.

PITTSTON, PA.—Tentative plans, it is reported, have been prepared by the Scranton Electric Company for the installation of a large plant in Pittston. Duncan T. Campbell of Scranton is manager.

SWEDELAND, PA.—Extensive improvements are contemplated to the local plant of the Alan Wood Iron & Steel Company of Philadelphia, including the installation of an electric traveling crane with sufficient capacity to lift loaded freight cars. The cost of the improvements is estimated at $1,000,000.

WAVERLY, PA.—The Village Council has awarded the Sayre (Pa.) Electric Company a new contract for lighting the streets of the village for a period of five years, which provides for the installation of 150 lamps of 100 cp., 30 of 150 cp. and two of 250 cp. Nitrogen-filled lamps will be used.

BAYONNE, N. J.—The Lower Broadway Business Men's Association is negotiating with the City Commissioners for the installation of a new street-lighting system along that thoroughfare.

CLAYTON, N. J.—The local electric-light plant, owned by the former Moore Glass Company, has been acquired by the South Jersey Gas Company, which has been granted a franchise to supply electricity for lamps and motors in this borough and vicinity.

EAST ORANGE, N. J.—Bids will be received by the Board of Education, East Orange, until Feb. 13 for electric and gas lighting fixtures in the new extension to the Elmwood School, Burnett Street. Specifications are on file at the office of the Board of Education, High School Building, and at the office of Guilbert & Betelle, 665 Broad Street, Newark, N. J.

KEARNY, N. J.—The Egyptian Lacquer Company contemplates the construction of a new boiler plant in conection with other buildings at its works on Passaic Avenue. The cost of the buildings is estimated at $50,000.

NEWARK, N. J.—The Board of Freeholders has adopted resolutions providing for the installation of new boilers at Overbrook Hospital.

NEWARK, N. J.—The Robison-Roders Company is erecting a new power plant at its feather goods factory, 27 New Jersey Railroad Avenue, for auxiliary service. The cost is estimated at $25,000.

NEWTON, N. J.—The town committee is considering a proposal submitted by the Newton Electric & Gas Company for the installation of an electric street-lighting system to replace the gas lamps now in use. William McClintock is local manager.

BALTIMORE, MD.—The Pennsylvania Railroad Company is contemplating enlarging its Calvert Street terminals and other local improvements, involving an expenditure of $10,000,000. The motive power for hauling the trains through the tunnel and elsewhere in the city will be changed from steam to electricity.

OCEAN CITY, MD.—Plans are being prepared for the construction of an electric railway along the beach on Fenwick Island, 8 miles long. Thomas E. O'Connell, of Phoenixville, Pa., is reported interested.

HARTLAND, W. VA.—Final plans have been prepared for the erection of an electric generating station for the Hartland Power Company, in Hartland. The initial installation provides for a 1000-kw. condensing steam turbine; five miles of 13,200-volt transmission line will be erected to distribute electricity for coal mines. W. S. Barstow & Company, 50 Pine Street, New York, N. Y., are engineers.

RALEIGH, W. VA.—A tract of several thousand acres of land in Raleigh County along the New River has recently been purchased by A. D. Preston of Beckley and C. L. Miller of Hinton. The new owners, it is understood, propose to build a large hydroelectric plant and supply electricity to the coal field communities in this county.

NORFOLK, VA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Feb. 19, for furnishing and installing one 40-ton and four 10-ton bridge cranes (electrically operated) at each of the navy yards Norfolk, Va.; Philadelphia, Pa., and Puget Sound, Wash. Plans and specifications can be obtained on application to the above bureau or to the commandants of the navy yards named.

WASHINGTON, D. C.—Bids will be received by the general supply committee, Treasury Department, Washington, D. C., until March 7, for furnishing as may be ordered during the fiscal year ending June 30 1918, supplies as follows: Class (6)—Electrical engineering and plumbing supplies; (17) motor trucks, etc. Proposal blanks and further information may be obtained upon application to the general supply committee, Auditors' Building, Washington, D. C.

WASHINGTON, D. C.—Bids will be received at the office of the secretary of board of commissioners, Room 509, District Building, Washington, D. C., until Feb. 20, for construction of a central garage on D Street, between Thirteenth and Thirteen and One-half streets, Northeast, Washington. Blank forms of proposal, specifications, etc., may be obtained from the chief clerk, Engineer Department, Room 427, District Building, upon deposit of $5.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Boston, Mass., Schedule 677—144 (boiler) tube brushes. Philadelphia, Pa., Schedule 687—one electric capstan, five electric winches: Schedule 678—miscellaneous annealed brass wire. Newport, R. I., Schedule 667—2000 copper gaskets; Schedule 686—200 turbine wheels. Mare Island, Cal., Schedule 683—two air compressor plants. Norfolk, Va., Schedule 678—miscellaneous spring hard brass wire, miscellaneous iron or steel wire, miscellaneous bronze phosphor wire, miscellaneous crucible steel wire. Philadelphia, Pa., and Norfolk, Va., Schedule 678—miscellaneous soft copper wire. Washington, D. C., Schedule 677—44,000 ft. steel conduit. Charleston, S. C., Schedule 696—13 contact maker's gongs, two electric heaters, two contact bells makers, etc., two gong pulls four portable ventilating sets, one each fire-room telegraph transmitter and indicator, two mechanical engine telegraph transmitters, one indicator, five angle rudder transmitters, one shaft revolution transmitter, one electric whistle outfit. Brooklyn, N. Y., Schedule 688—ten motor-driven sewing machines. Applications for proposal blanks should designate the schedule desired by number.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

North Central

FLINT, MICH.—The Michigan United Railways Company of Owosso is planning to build an electric railway between Owosso and Flint this year. The third-rail system will be used.

JACKSON, MICH.—The Commonwealth Power, Railway & Light Company, through its subsidiary, the Consumers' Power Company of Maine, is building on the Manistee and Au Sable Rivers two new additions to its power system in Michigan. At the Manistee Junction dam 33,000 hp will be in operation by next December and two plants of 17,500 hp each on the Au Sable River will be ready by June, 1918. The company already has four plants on the river with a combined capacity of 60,000 hp.

AKRON, OHIO.—The Northern Ohio Traction & Light Company has installed a 7,000-kw generating unit in its substation in Akron, to be used until two new 20,000-kw units have been installed. The first of these units will be in use in April, and it is expected to have the second unit in operation in June. The latter part of the year the boiler capacity of the plant will be increased by 1000 hp. Considerable extensions will be made to the transmission and distribution lines in the Canton-Akron district this year.

CLEVELAND, OHIO.—Application has been filed by the Cleveland Electric Illuminating Company with the Public Utilities Commission for permission to issue $2,000,000 in bonds for improvements and extensions to its property.

CLEVELAND, OHIO.—The City Council has engaged J. H. Tufel, engineer, 1526 East Eighty-fifth Street, Cleveland, to prepare plans for extensions to the municipal electric lighting plant, to cost about $500,000. The work will include an addition to power house and installation of new equipment, etc. W. R. Davis is commissioner of lighting.

DELPHOS, OHIO.—Improvements involving an expenditure of about $100,000 are contemplated to the electric plant of the Northwestern Ohio Light Company, a subsidiary of the Federal Power & Light Company of Boston, Mass. The plans provide for rebuilding the transmission line between Delphos and Van Wert, changing the voltage from 13,000 to 30,000, which will require about 35 miles of wire. A concrete substation will be erected near the present plant to house the high-tension transformers, switches, lightning arresters and other equipment. A coal-conveying system will also be installed. R. A. Langworthy of Boston, Mass., is chief engineer; W. P. Hurd of Van Wert is district manager.

CLAY, KY.—Mitchell & Dunnigan, owners of the local electric-light plant, are contemplating the erection of an electric transmission from Clay to Dixon to supply electrical service there.

ELKHORN CITY (P. O. PRAISE), KY.—The City Council is considering the installation of a municipal electric-light plant, besides furnishing a water power upon a municipal basis. Estimates would glady be received.

GLASGOW, KY.—The Kentucky Utilities Company of Louisville, which recently took over the property of the Glasgow Electric Light & Ice Company, will erect an electric transmission line to Cave City and Horse Cave early in the spring. Albert Boyd is local superintendent.

GREENSBURG, KY.—The electric plant, franchises and holding of the Moss Milling Company of Greensburg, it is reported, will be sold at auction on Feb. 12.

HAZARD, KY.—The Kentucky River Power Company, it is reported, has plans for enlarging its central power station now under construction and will install three 2000-hp. turbines. Larger buildings will be constructed to provide space for additional equipment. One turbine will be placed in operation very soon. The company now supplies electricity for 16 mines in Perry County and has 50 miles of transmission lines. R. L. Cornell is general manager.

LA CENTER, KY.—The La Center Light & Power Company, recently organized, it is reported, will enlarge the local plant. S. T. Payne is president.

LOUISVILLE, KY.—Plans have been prepared for the construction of a terminal warehouse in Louisville for the Warehouse Architectural & Engineers' Company, to cost about $2,500,000. It is to be equipped with electric elevators and electric trucks, and will provide accommodations for manufacturing plants. A cold-storage unit will probably be added later. C. H. Moores, of Chicago, Ill., is president.

PIKEVILLE, KY.—Plans are being considered for extensions and improvements to the electric-light plant and water-works system. Estimates will be received for a 90-hp engine and a 75-kw generator.

DECATUR, IND.—The city of Decatur has awarded contract for a 500-kw steam turbo-generator and condenser, to be installed in the municipal electric plant this year. M. J. Myatt is mayor.

HOBART, IND.—The town of Hobart has awarded contract to the General Electric Company for a 500-kw condensing steam turbine, to cost $7,150, a Leffel Keerting multijet condenser, at $1,600, for delivery Oct. 1, for the municipal electric light plant. Work will begin about March 15 on the erection of 1 mile of rural transmission line, single phase, 60 cycles, 1150 volts. M. H. Owen is superintendent.

NASHVILLE, IND.—The Town Council has voted to install 21 additional street lamps in the town.

PERU, IND.—The City Council has authorized A. C. Herren, manager of the municipal electric-light plant, to ask for bids on two new generating units, one 500 kw and the other 150 kw., and for a new boiler of about 300 hp. capacity for the municipal electric-light plant.

TERRE HAUTE, IND.—The Board of Park Commissioners is asking for bids for the installation of an ornamental lighting system in Voorhees Park and Memorial Park. J. D. Fitzpatrick is superintendent of board.

CHICAGO, ILL.—Plans are being prepared for the construction of a power house for the James S. Kirk Company, 209 South La Salle Street, to cost about $200,000. E. C. and R. M. Shenkland are mechanical engineers; R. E. Pingrey is architect, all of 209 South La Salle Street.

COLUMBIA, ILL.—Extensive improvements are contemplated to the municipal electric-light plant, including the installation of two new engines, a generator and one boiler. When improvements are completed a 24-hour service will be established. E. L. Rauch is general superintendent.

DECATUR, ILL.—The Department of Public Property is contemplating the erection of 300 new ornamental lamp standards, the installation of one 12-kw. constant-current regulator and about 60 lamps of 250 cp. in Fairview Park. The municipal plant furnishes electricity for lighting the streets and public buildings. Commercial service is supplied by the Decatur Railway & Light Company. W. Logan Rice is general superintendent.

MERRIMACK, WIS.—Plans are being considered by the towns of Merrimack, Sumpter and Prairie du Sac to erect local distribution systems and transmission lines to connect with the hydroelectric plant here.

MILWAUKEE, WIS.—Commissioner Simmons has been authorized to make investigations as to the feasibility of erecting a new power house for the city hall power plant, or whether to purchase energy from the Milwaukee Light, Heat & Traction Company.

PRAIRIE DU SAC, WIS.—The Town Council, it is reported, is contemplating the erection of an electric transmission line to connect with the hydroelectric plant at Merrimack to secure electricity to operate the local system.

ROTHSCHILD, WIS.—The Marathon Paper Mills Company has engaged Vaughan & Meyer, electrical engineers, Majestic Building, Milwaukee, to prepare plans for a new power plant. The equipment will include two 400-hp. boilers, automatic stokers, feed pump, heater and auxiliary equipment.

SUMPTER, WIS.—The town of Sumpter is reported to be considering the installation of an electric distribution system and the erection of transmission lines to connect with the hydroelectric plant in Merrimack.

DULUTH, MINN.—The installation of a number of additional units to the street-lighting system has been authorized by the City Commissioners.

ST. PAUL, MINN.—Plans for the installation of an ornamental street-lighting system in Robert Street, from Eighth to Central Avenues, have been approved by the City Council. Plans are also being considered for the installation of ornamental lamps in Rice Street.

AMES, IOWA.—Orders have been placed by the Electric Light Department for a 600-kw. Curtis turbine and a Westinghouse Le Blanc jet condenser, for the municipal electric-light plant. Charles E. Warsaw is manager.

ANTHON, IOWA.—Bids will be received by L. L. Lucas, town clerk, until Feb. 15 for construction and furnishing equipment for an electric-light, power and heating plant.

CEDAR RAPIDS, IOWA.—The Board of State Railroad Commissioners has granted the Iowa Railway & Light Company of Cedar Rapids a franchise to erect and operate electric transmission lines to supply electricity for lamps, heaters and motors in Linn and Benton Counties.

EARLING, IOWA.—The Stinn Improvement Company contemplates extensions and improvements to its plant in the near future, including the installation of a 35-hp. oil engine and a 3 wire generator, 110 and 220 volts. It is also considering changing the system from direct to alternating current. E. L. Stinn is engineer.

GRINNELL, IOWA.—The Iowa Light, Heat & Power Company has been granted permission by the Board of State Railroad Commissioners to erect and maintain electric transmission lines to supply electricity for lamps, heaters and motors in Carroll County.

MARENGO, IOWA.—The Board of Railroad Commissioners has granted the Iowa Electric Company of Marengo a franchise to erect and operate an electric transmission line in Washington, Johnson and Muscatine Counties to supply electricity for lamps, heaters and motors.

PERRY, IOWA.—The Iowa Railway & Light Company is erecting a new power plant in Perry, the buildings being practically completed. The company is extending its service in this vicinity, which will be supplied from the new plant.

SERGEANT BLUFF, IOWA.—Bids will be received by the board of education, consolidated school district, Sergeant Bluff, until March 8 for construction of school building. Separate bids to be submitted for electric wiring, heating and plumbing. William L. Steele, United Bank Building, Sioux City, is architect.

NEW CAMBRIA, MO.—Preliminary estimates have been completed for the installation of an electric-lighting system in New Cambria. The plans provide for new transmission lines and distribution system. E. B. Murray, 920 Walnut Street, Kansas City, Mo., is engineer.

RIVER MINES, MO.—The Doe Run Lead Company is contemplating the installation of two 3000-kw. steam turbines, seven 500-hp. boilers and other equipment at its mines. Viele, Blackwell & Buck, 49 Wall Street, New York, N. Y., are consulting engineers.

ST. LOUIS, MO.—Bids will be received by E. R. Kinsey, president of board of public service, St. Louis, until Feb. 16, for furnishing and installing a 1000-gal. steam-driven centrifugal pump at the low-service pumping station at Chain of Rocks.

ST. LOUIS, MO.—The Granite City Steel Works, Second and Destrehan Streets, St. Louis, is remodeling its plant, including the installation of electrical power, at a cost of about $100,000. The company is a subsidiary of the National Enameling & Stamping Company of Granite City, Ill.

WEBB CITY, MO.—The installation of a municipal electric-light plant and ice factory in Webb City is under consideration.

MINOT, N. D.—The contract for the installation of an ornamental lighting system in Minot has been awarded to the Kopald Electric Company of Minot. This is the second contract awarded to the Kopald company for the installation of ornamental lamps in Minot.

DAYKIN, NEB.—All bids submitted Jan. 24 for construction of a municipal electric-light plant have been rejected. J. O. Greenawalt is clerk.

FREMONT, NEB.—The contract for electric wiring for the court house at Fremont has been awarded to the Wright Electric Construction Company of Fremont, at $4,300.

HASTINGS, NEB.—Bids will be received by the city of Hastings at once, it is reported, for a 300-hp. boiler. The cost is estimated at $10,000.

LINCOLN, NEB.—The Lincoln Traction Company has leased its power plant to the Commonwealth Power Company of Lincoln, and has entered into a contract with the power company to purchase energy to operate its system for a period of 49 years. The Commonwealth Company contemplates building dams and power stations on the Blue River to furnish power for the local traction system and the interurban railway to Omaha.

SUTHERLAND, NEB.—All bids submitted for the construction of an electric-light plant for the village have been rejected by the Village Board. The engineer's estimate of the cost is placed at $7,500.

BELOIT, KAN.—The City Council has engaged Black & Veatch, Interstate Building, Kansas City, Mo., consulting engineers, to prepare plans for an addition to the municipal electric plant and a water filtration and softening plant for the water-works system. Improvements to the electric plant will include a 150-hp. boiler, steel stack and additional electric equip-

ent. The cost of the work is estimated at 35,000. F. A. Darst is superintendent.

CALDWELL, KAN.—At an election held cently the proposal to issue $80,000 in onds for improvements to the electric-light ant and water-works was carried. Burns McDonnell, Interstate Building, Kansas ity, Mo., are engineers.

FORT SCOTT, KAN.—At an election held ecently the proposal to issue $168,000 in onds for the installation of a municipal ectric-light and power plant was car- ed.

HIGHLAND, KAN.—The Hiawatha ight, Power & Ice Company is contempla- ng the erection of an electric transmis- on line between Robinson and Highland supply electricity to the local plant, wned by M. V. Warner.

LONG ISLAND, KAN.—The installation a municipal electric-light plant in Long land is under consideration.

MANHATTAN, KAN.—Bonds to the mount of $200,000 have been authorized y the stockholders of the Manhattan City Interurban Railway Company, the pro- eeds to be used to pay outstanding in- ebtedness and for extensive improvements. V. R. West is president.

MORAN, KAN.—The contract for con- ruction of the proposed municipal elec- ic plant and water-works system has been warded to the Connor Construction Com- any, 4008 Montgall, Kansas City, Mo. All aterial and equipment, it is understood, as been purchased by the city. The cost the work is estimated at $40,000.

MULLINVILLE, KAN.—Preparations are eing made for the installation of a muni- pal electric-light system in Mullinville. nergy to operate the system will be se- ured from the Midland Water, Light & Ice ompany of Dodge City. An electric trans- ission line will be erected to Bucklin City nnecting with the lines of the Midland mpany there. The cost of the system is timated at $10,000. W. B. Rollins & Com- any, Railway Exchange Building, Kansas ty, Mo., are engineers.

SEDAN, KAN.—Bids will be received by he Board of County Commissioners of hautauqua County, Sedan, until Feb. 20 or construction of a fireproof court house, eparate bids to be submitted as follows: eneral contract; heating and plumbing; ectric wiring and lighting fixtures; wood urniture. George P. Washburn & Son, ttawa, Kan., are architects.

SYRACUSE, KAN.—New machinery, it is pected, will be installed this season at e municipal electric-light plant. The cost estimated at $15,000. J. C. Riley is man- ger.

Southern States

LUMBERTON, N. C.—Bids will be received the town of Lumberton until Feb. 21 for e purchase of $51,000 of 20-year serial onds issued by the town of Lumberton. he proceeds will be used for improvements water and light plants. Ira B. Town- nd is clerk and treasurer.

MORTIMER, N. C.—C. M. McCorkle of ewton, N. C., has purchased a waterpower te on Wilson's Creek and contemplates e construction of a hydroelectric plant velop about 2000 hp.

SPRING HOPE, N. C.—The City Council considering improvements to the munici- l electric-light plant and waterworks stem.

STATESBORO, GA.—An election will on be held to submit to the voters the roposal to issue $30,000 in bonds for im- rovements to the electric plant. Daniel L. ould is superintendent.

ZEPHYRHILLS, FLA.—The Zephyrhills ectric Company now has 4500 ft. of ansmission line under construction. The stallation of refrigerating apparatus this mmer is under consideration by the com- any. L. N. Gilbert is owner and manager.

YAZOO CITY, MISS.—The Public Service ommission has been authorized to purchase new generator and other necessary equip- ent for the municipal electric-light plant, volving an expenditure of between $20,- 0 and $25,000.

EARLE, ARK.—Plans are being prepared the Earle Light, Water & Ice Company r the installation of a new electric plant replace the one recently destroyed by fire.

EL DORADO, ARK.—The Citizens' Light Power Company, recently organized, has plied for a franchise to supply light and wer in El Dorado.

NEW ORLEANS, LA.—The Roberts-Wie- nd Pickle Company of New Orleans, re- ntly incorporated, is planning to install e 100-hp. boiler, engine, electric motors, nitary pumps, vinegar pumps and other echanical apparatus. P. H. Roberts, Metropolitan Bank Building, New Orleans, is interested in the project.

AMORITA, OKLA.—Preparations are being made by C. H. Peebles for the installation of an electric light plant in Amorita. An engine, it is understood, has been purchased.

LAWTON, OKLA.—The power plant and pumping station of the Night & Day Oil Company at Lawton was recently destroyed by fire, causing a loss of about $12,500.

DENTON, TEX.—The Acme Pressed Brick Company is planning to rebuild its power plant, recently destroyed by fire, causing a loss of about $12,000. W. R. Bennett is president.

JACKSBORO, TEX.—The Mill & Elevator Company, which recently purchased the local electric-light plant of the Jacksboro Ice & Light Company, is planning to install new machinery and make other improvements to the system.

KOSSE, TEX.—The Kosse Light & Power Company is planning to install an electric-light and power plant, to cost about $12,000. L. T. Gibbs, W. D. Allen and W. E. Allen all of Kosse are interested in the company.

PANHANDLE, TEX.—The Council is considering calling an election to submit to the voters the proposal to issue bonds for the installation of a municipal electric-light plant.

SAN ANTONIO, TEX.—The City Council has rejected all bids submitted for the installation of a police signal alarm system.

Pacific States

EVERETT, WASH.—Notice of appropriation of water rights (10,000 cu. ft. per second) on the Sauko River have been filed with the county auditor by T. Ross Carson of San Diego, Cal., and Walter von Prussentin of Ferndale, Wash. It is proposed to develop the water power to generate electricity for distribution in Skagit, Snohomish and King Counties.

OROVILLE, WASH.—The City Council has approved the ordinance granting the West Okanogan Valley Irrigation District a franchise to construct and operate electric transmission lines in Oroville.

WHITE SALMON, WASH. — Extensive improvements involving an expenditure of about $355,000, are contemplated by the Pacific Power & Light Company of Portland, Ore., in this district. Rights of way for the erection of new lines to connect the systems of White Salmon and vicinity with those of Hood River and The Dalles are now being secured.

SPRINGBROOK, ORE.—The Yamhill Electric Company of Newberg is planning to extend its transmission line to Springbrook to supply electricity in this town and adjacent territory.

BURBANK, CAL.—The city of Burbank (Electric Light Department) has recently awarded the California-Arizona Construction Company of Los Angeles a contract for the installation of 88 ornamental single-lamp standards (concrete posts), equipped with 250-cp. lamps, wire and conduit.

MARE ISLAND (VALLEJO), CAL.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Feb. 26, for one bucket dredge (electrically operated) for the navy yard, Mare Island, Cal. Drawings and specifications may be obtained on application to the above bureau or to the commandant of the navy yard named.

SAN FRANCISCO, CAL.—The contract for furnishing electric conduit and splicing materials for the Municipal Railway in Twin Peaks tunnel has been awarded to the Standard Underground Cable Company at $32,128.

CASA GRANDE, ARIZ.—Bids will be received by the city clerk of Casa Grande until Feb. 15 for the construction of an electric-light and power plant and water works system in Casa Grande, to cost about $30,000. V. A. Thompson of Phoenix is engineer.

HIGLEY, ARIZ.—The electrical district No. 2 of Higley has been formed and approved by the Board of Supervisors for the county of Maricopa. After estimates have been submitted the proposal to issue bonds for the installation of transmission lines, transformers, etc., will be submitted to the voters. The cost is estimated at $300,000. John A. Germann is chairman of trustees.

BIG SANDY, MONT.—Bids will be received by Hans L. Lehfeldt, clerk, Big Sandy, until March 1 for construction of water supply system, including a pumping station, intake well and pump pit, two 2½-in. centrifugal pumps and motors and a 100 000-gal. steel tank on a 75-ft. steel tower. Bids will also be received at the same date for construction of a sewage disposal system, including disposal plant, one pumping station, with pumps and motors, cast iron force mains and tile collector main, etc. Plans and specifications are on file in the office of the town clerk and copies may be obtained on application to the Miracle Engineering Company, Ford Building, Great Falls, upon deposit of $10.

MISSOULA, MONT.—The City Commissioners have instructed City Attorney Campbell to prepare an ordinance notifying the Missoula Light & Water Company that the city desires to purchase its entire system; also asking the company to file with the city a proposal stating the price, terms and conditions which the company will accept.

WHITEFISH, MONT.—The Great Northern Railroad Company has decided to discontinue its electric power plant in Whitefish, which has been supplying electricity for lamps and motors for its shop, yards and depot at Whitefish. The company, it is understood, has entered into a contract with the Northern Idaho & Montana Power Company to supply energy for its local needs.

DENVER, COL.—Plans have been prepared by E. M. Jackson, illuminating engineer for the Denver Gas & Electric Company, at the request of the Fourteenth Street Improvement Association, for an ornamental lighting system for that thoroughfare from Colfax Avenue to the Platte River viaduct. The standards, which the property owners have agreed to furnish if approved by the Council, will cost $150 each, and carry five lamps. The cost is estimated at $15,000. A general movement has been started among property owners in both downtown and outlying districts for the installation of ornamental lamps throughout the city

LOVELOCK, NEV.—Negotiations are under way between the Louisiana Consolidated Mining Company and the Nevada-California Company of Denver, Col., for the erection of an electric transmission line from Belmont to the old camp of Tybo, a distance of 29 miles. The cost of the work is estimated at about $30,000.

Canada

LADYSMITH, B. C.—The City Council is contemplating the purchase of a transformer for the municipal electric plant and new meters.

GLACE BAY, N. S.—The Dominion Coal Company is reported to be in the market for complete equipment for a 1500-hp. turbine plant. A. J. Tonge is general superintendent.

SYDNEY, N. S.—The Dominion Iron & Steel Company is contemplating the purchase of a 2000-kw. electric generating unit and water tube boilers of 3000 hp. for its mines at Wabana, Newfoundland. Other equipment will be purchased at a total cost of about $1,000,000.

BRANTFORD, ONT.—The wiring and equipment of the Western Counties Electric Company in Brantford Township has been purchased by the township for $4,000, and the Hydro-Electric Power Commission will be asked to proceed at once with the extension of the system to Grandview, Parkdale and Echo Place to supply electrical service to the residents of those townships.

SANDWICH, ONT.—Work will begin, it is reported, on the installation of an ornamental lighting system in the spring. C. R. McColl, 175 Assumption Street, Windsor, is engineer.

SHERBROOKE, QUE.—The City Council is considering a by-law authorizing an appropriation of $500,000 for the purchase of the Two Miles Falls power at Weedon, to develop same and erect an electric transmission line to Sherbrooke. A report submitted by Francis & Company, consulting engineers, Montreal, estimates the cost of developing the power and equipment at $1,452,900.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Feb. 23, for furnishing shop machines, steel cable, bearing metal, brass tubing, oilers, pipe covering, etc., under Circular (No. 1120). Bids will also be received until Feb. 14, under Circular (No. 2103) for furnishing 200 brass cocks and 8000 lb. sheet copper. Blanks and further information relating to these circulars may be obtained at the above office or the office of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and Fort Mason San Francisco, Cal.

1,214,815. Contact Device for Railway Automatic Signals; Calvin J. Axtell, Schenectady, N. Y. App. filed Feb. 4, 1916. Utilized on electric railway cars and locomotives.

1,214,918. Conducting Armature Sleeve; Walter J. Hayward, Columbus, Ohio. App. received June 5, 1916. Sufficiently large diameter to admit of the inward projection of the bearings.

1,214,845. Reverse-Current Relay; George A. Burnham, Saugus, Mass. App. filed Jan. 24, 1913. Employment of two differential coils, the windings of one being wound in the same direction, and the windings of the other being wound in opposite directions.

1,214,847. Signal Device for Telephone Systems; Arthur E. Case, Chicago, Ill. App. filed Jan. 10, 1913. Electrically and not necessarily mechanically connected to a telephone line.

1,214,844. Protective Device; Elmer E. F. Creighton, Schenectady, N. Y. App. filed May 2, 1912. Number of gaps in series prevent flow of current at the normal voltage of the line, but permit an abnormal voltage to discharge through the gaps to ground.

1,214,862. Welding-Machine; John T. Fagan and Cleveland H. Quackenbush, Cleveland, Ohio. App. filed July 27, 1914. Continuously operating automatic machine.

1,214,865. Bridge for Supporting Electric Fixtures; John R. Gunn, Detroit, Mich. App. filed June 7, 1915. Accommodate itself to the varying spaces that are found between joists and studs.

1,214,871. Bipolar-Electrode Electrolyzer; George Grant Hepburn, Charlton-cum-Hardy, Manchester, England. App. filed Aug. 26, 1916. For the electrolysis of the chlorids of the alkali metals.

1,214,872. System of X-Ray-Tube Operation; George R. Hogan and Hector P. MacLagan, Chicago, Ill. App. filed April 13, 1914. More intense X-Ray field is produced with simpler apparatus.

1,214,881. Sheathed Wire and Terminal Therefor; William K. Kearsley, Newark, N. J. App. filed May 23, 1916. For electric heating.

1,214,933. Electric Switch; Harry J. Morey, Syracuse, N. Y. App. filed March 28, 1912. Pull-cord.

1,214,937. Electric-Circuit Breaker; Steffen F. Nielssen, Houston, Tex. App. filed July 7, 1914. Minimum number of parts.

1,214,960. Locking-Switch; Edson O. Sessions, Chicago, Ill. App. filed June 14, 1915. With high-tension circuits.

1,214,963. Recorder for Systems of Electrical Distribution; Harold S. Sines, Chicago, Ill. App. filed Dec. 31, 1915. Improvements.

1,214,975. Projection Apparatus; John B. Taylor, Schenectady, N. Y. App. filed Feb. 17, 1916. Incandescent lamps adapted for utilization with such apparatus.

1,214,981. Toaster; Frederick A. Vollbrecht, Detroit, Mich. App. filed June 19, 1916. Improved construction.

1,214,005. Method of Bonding Rails and Like Conductors; John R. Brown, Mansfield, Ohio. App. filed May 11, 1916. Provide a connection around the adjacent ends of two rails without the use of rivet, bolt, expanding pin, etc.

1,214,011. Scale; Samuel G. Crane, Toledo, Ohio. App. filed Dec. 24, 1913. Having electric lights arranged to illuminate the chart.

1,214,014. Magneto; R. C. Danly. App. filed April 3, 1914. Improvement.

1,214,015. Magneto; Robert C. Danly, Chicago, Ill. App. filed June 28, 1915. With internal combustion engines.

1,214,021. Light or Voltage Regulator; Dwight A. Eaken, Lodi, Ohio. App. filed Dec. 13, 1915. Produce a constant voltage with a variable speed.

1,214,022. Apparatus for Wireless Telegraphy and the Like; Philip E. Edelman, Minneapolis, Minn. App. filed Aug. 19, 1912. Wireless space communication or control.

1,214,029. Maximum-Demand Indicating Instrument; Chester I. Hall, Chicago, Ill. App. filed Oct. 27, 1913. Means employed for permitting the return to zero of the indicator-actuating mechanism at the end of each one of the predetermined time intervals.

Record of Electrical Patents

Notes on United States Patents issued on Jan. 30, 1917.

1,214,053. Insulator; Bayard W. Mendenhall, Salt Lake City, Utah. App. filed Oct. 21, 1914. Plurality of trays may be used.

1,214,058. Vehicle Direction-Indicator; Warren B. Moulton and Edwin W. Moulton, Riverside, Cal. App. filed Jan. 11, 1916. Operated from the driver's seat.

1,214,067. Dynamo-Electric Machine; William H. Powell, Milwaukee, Wis. App. filed Feb. 27, 1915. For supporting brushes of dynamo-electric machines in operative position relatively to commutators and to suitable terminals or cross-connectors.

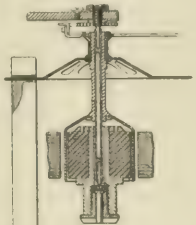
1,214,074. Time-Limit Relay-Switch; Clarence Renshaw, Edgewood Park, Pa. App. filed March 7, 1913. Automatic control of railway motors.

1,214,077. Electric Switch; Joseph Sachs, Hartford, Conn. App. filed Nov. 12, 1914. Improvements.

1,214,078. Meter-Testing Appliances; Joseph Sachs, Hartford, Conn. App. filed May 1, 1915. Improvements.

1,214,079. Convertible Cut-Out Switch; Joseph Sachs, Hartford, Conn. App. filed May 5, 1915. Quickly converted into a meter tesing cut-out switch and service connection appliance.

1,214,081. Centrifugal Switch; Harold M. Scheibe, Cambridge, Mass. App. filed Dec. 19, 1913. With fan motors of the induction type.



1,214,096—Movable Element for Electrical Measuring Instruments

1,214,083. Oil-Circuit Breaker; Hjalmar Rudman Schultz, Trafford Park, Manchester, England. App. filed March 20, 1912. Prevent undue heating of interrupters.

1,214,096. Movable Element for Electrical Measuring Instruments; Samuel Trood, Edgewood Park, Pa. App. filed Feb. 7, 1913. Means for mounting the armature and the damping disk of an instrument upon a shaft in such a manner that the shaft, armature and damping disk may be independently detached from the other component parts without disturbing the aligned and fixed relations thereof.

1,214,101. Hot-Wire Alternating-Current Limiter; Peder Wessel, Ljan, near Christiania, Norway. App. filed March 24, 1915. Hot wire is not exposed to the total electric current consumed.

1,214,116. Rectifier System; Alfred L. Atherton, Wilkinsburg, Pa. App. filed April 1, 1915. Vapor-arc type.

1,214,129. Electrical Protective Device; Harold W. Brown, Ithaca, N. Y. App. filed Jan. 7, 1914. Temperature relays.

1,214,141. Testing Apparatus; Adolph H. Daus, Chicago, Ill. App. filed Aug. 6, 1915. Apparatus for supplying current of various voltages, amperages and periodicities.

1,214,143. Dynamo-Electric Machine; George M. Eaton, Pittsburgh, Pa. App. filed July 6, 1915. Propulsion of electric vehicle.

1,214,183. Electrical Connecting Device; Franz Kratz, Stuttgart, Germany. App. filed April 30, 1914. Adapted for portable batteries in a wood or metal containing box.

1,214,186. Soldering Iron; Robert Kuhn, Detroit, Mich. App. filed Sept. 4, 1915. Electrically heated.

1,214,208. Signal for Moving-Picture Reels; Harry Louis Miller, Pittsburgh, Pa. App. filed June 25, 1915. Warn the operator when the reel is almost emptied of the film.

1,214,210. Storage-Battery Plate; Howard Stanley Mills, Astoria, N. Y. App. filed June 18, 1912. Improved conducting frame or grid.

1,214,214. Generator of High-Frequency Currents; Peder Oluf Pederson and Valdemar Poulsen, Frederiksberg, Denmark. App. filed Jan. 6, 1913. Uniform distribution of the high-frequency energy can be obtained.

1,214,235. Transformer-Secondary; Herbert L. Smith, Westerly, R. I. App. filed May 24, 1916. Secondary of minimum length and resistance.

1,214,258. Telephone System for Toll Traffic; Carolus Robert Hendrik Arntzenius, Hague, Netherlands. App. filed Sept. 19, 1913. Switching system.

1,214,265. Detector for Wireless Systems; Milton Berel and Louis Funke, New York, N. Y. App. filed March 11, 1916. Detectors of the crystal type.

1,214,271. Process of Plating; Lucian W. Bugbee, Southbridge, Mass. App. filed Dec. 4, 1916. Plating of aluminum by electrodeposition.

1,214,280. Electrical System of Distribution; Gorham Crosby, Brooklyn, N. Y. App. filed June 26, 1914. Regulation of variable speed generators, adapted to charge a storage battery.

1,214,283. Wireless Telegraphy; Lee de Forest, Palo Alto, Cal. App. filed Sept. 24, 1912. Antenna systems.

1,214,323. Controller for Heating Systems; Frederick T. Kitchen, West New Brighton, N. Y. App. filed Oct. 3, 1913. Thermostat.

1,214,353. Conduit-Box Receptacle; Harry J. Morey, Syracuse, N. Y. App. filed Sept. 17, 1913. Pull-chain receptacles for use on conduit or outlet boxes.

1,214,355. Motor-Control System; Edwin J. Murphy, Schenectady, N. Y. App. filed May 9, 1911. Actuating windings of the several switches are successively connected in the armature circuit.

1,214,375. Signaling System; Alexander H. Rudd, Media, Pa. App. filed May 26, 1916. Improvements.

1,214,433. Cabinet for Electrical Appliances; Ernest M. Crane and Chauncey R. Pelton, Detroit, Mich. App. filed March 27, 1916. For carrying the electrical appliances and switches used by a dentist.

1,214,439. Socket for Electric Lamps; Laurens P. Dixon, New York, N. Y. App. filed Jan. 6, 1914. Permitting a number of electric lamps to be mounted thereon.

1,214,440. Electric-Trolley-Railway Signal System; Benjamin M. Downs, Buffalo, and Walter S. Cook, Lackawanna, N. Y. App. filed Nov. 17, 1915. One track railway having sidings at intervals.

1,214,459. Protector for Telephone Mouthpieces; Mary Griffin Heberly, Springville, N. Y. App. filed April 26, 1916. Individual germ proof protector.

1,214,466. Register for Telephone-Calls; Edward Taylor Hull, New York, N. Y. App. filed April 12, 1916. House or other telephone.

1,214,470. Terminal Clip for Electric Conductors; Benjamin A. Jeffery, Detroit, Mich. App. filed Feb. 3, 1912. Insulation surrounding the conductor may be more or less firmly grasped.

1,214,486. Electric Cooking Apparatus; William D. Wright, San Diego, Cal. App. filed Feb. 5, 1916. For grilling and waffle baking.

1,214,492. Telephone System; Alfred E. Dyson, Chicago, Ill. App. filed April 6, 1906. Suitable step-by-step switching mechanism is operated in response to impulses sent over a calling line to automatically select and establish connection with a desired called line and is automatically restored to normal position at the end of conversation.

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Edison at Seventy

THIS headline does not, somehow, read right, for though celebrating his seventieth birthday on Sunday, Feb. 11, Edison still carries with him the very air and spirit of youth and electricity. Reaching the limit proverbially ascribed for a ripe old age, the great electrical inventor still pushes forward so ardently into new fields and throws himself so eagerly upon the new tasks of the onward-looking times, that one might well credit him with possessing the secret of perennial juvenility. As a matter of fact, Edison can never grow old; and the fact that his physical body should have to admit that it is three score years and ten seems almost like a whimsical indiscretion. His energy and tireless example, his genius and fertility, his ability to create and to turn his creations into new arts and useful industries, his cheerful serenity of soul under every disaster and discouragement—these have shaped him into an ideal which has won a world-wide recognition and which adds to the luster of American achievement and character. There are now three February birthdays in the celebration of which national pride may well find expression; two of immortal presidents and the other of one of the greatest benefactors of the human race.

The House in Good Order

POSSIBILITIES of international complication find the electric central station house in good financial order. Floating debts have been paid or cut down. Thanks to the good bond market the companies have been able to sell securities at excellent prices and have provided generally for their necessities for expansion. Large earnings met the bond dealers' requirements of a strong financial statement. Banking caution has counseled conservatism in the expansion of properties. And added to banking caution has been the shortage and high price level of raw materials. Therefore we do not look for radical change in the electric central station financial position. These properties are utilities which go steadily ahead; they are affected less by adverse business developments than other classes; they are not affected as suddenly as other forms of business. It is more from the operating side of the industry that reactions from international disturbance are expected. As was pointed out in last week's issue, intensified coal shortage is a dangerous possibility. If this develops it will demand forethought, co-operation and positive action, not only on the part of individual managers, but by the entire central station industry.

The Engineer and the Crisis

THE hour has struck and the nation wakes to face at least the possibility of entering the tremendous struggle which is rending civilization with a ferocity unparalleled even in the Dark Ages. Hostilities do not necessarily follow a breach in diplomatic relations, but a breach arising from two years of intolerable exasperation is not easily healed. And nothing save a sincere and complete reversion of purpose, which must be regarded as rather improbable, can avert actual warfare. If it comes, the engineer must rise to the occasion with an alertness and vigilance unequaled in military history. The situation is a singular one. The United States is safe from the major operations of a hostile navy, because that navy is hopelessly bottled up by superior force, and our own navy is almost equally powerless for aggression. Neither the United States nor Germany can make use of an invading army so that the probable hostilities are practically limited to those between marauding submarines and the defensive fleet on the water or in the air. The war, if it comes, will be a war of wits, of ingenuity and resourcefulness.

Right here is a field for the united engineering abilities which the country can muster; for a design of adequate defenses against the utmost technical skill and daring that submarine warfare can disclose. Much has already been done by the Allies, with some material help from American genius, in devising means for meeting the new danger. It is a curious problem, that of blocking the torpedo attacks of an unseen foe, and of finding and destroying that foe wherever it wanders. The art of trapping and countermining submarines is already somewhat developed, though it needs perfecting at the hands of American engineers, but traps and snares are not all of the hunter's business, and the greatest need lies in developing a successful method of still hunting, trailing an unseen boat through the pathless fields of the sea, finding and destroying it. All the ingenuity that can be put on submarine detectors is needed now and in the future, and this is the biggest single task that lies before the American engineer and inventor. A submarine, like a seal, has to come up to breathe, and incidentally to charge the storage batteries for further under-water operations. If electrical or other means can be found for detecting the presence of and locating, even roughly, the neighborhood of a submarine a long step will be taken toward immunity.

The task then, of destruction, resolves itself into the practice of the Eskimo hunter, waiting patiently, spear in hand, at a hole in the ice, until some unhappy seal finally comes up for a breath of air and gets the spear

point. Just so might a light cruiser lurk and listen, if able to sense the presence of her prey, until a periscope or a conning tower breaks water and the rapid fire guns begin their chatter. No great harm if they miss at first, for the pirate crew below can take their choice between going down under a storm of shell if they rise, or staying down and suffocating. Almost equally important are the possibilities of the air service, and its equipment with means for more readily locating the submarine, which cannot look above to see its foe, and yet may disclose itself to the vigilant watchers. Once located it may be a case of signalling to a convoying destroyer to take up the scent, or perhaps of the hawk's swoop with a hundred pounds of high explosive instead of talons. These and similar problems must be solved for the sake of the not distant future even if hostilities should be for the present averted. This work of submarine defense is one that calls for all the skill and ingenuity that the engineering profession can muster, and that skill cannot be bent to any end more useful in the country's service.

The Uses of Reactors

THE convention of the American Institute of Electrical Engineers held this week in New York disclosed two very interesting studies of the employment of reactors in the large stations and their protective effect in case of accident. The development of the principles of reactive protection has been a rather long one. In the beginning of power transmission work there was a strong feeling that for stability and good regulation machines of low reactance were desirable, as indeed upon general principles they were; but it soon became evident that not only were low reactance generators somewhat expensive to build, but they were particularly subject to injury in case of short-circuits, and while they would run admirably in parallel if carefully handled, they were liable to exchange at times a great deal more current than one would wish. Further, as automatic regulating apparatus developed, the need for low inherent regulation diminished, so that standard types of generators soon acquired sufficient reactance advantageously to limit the short-circuit current and the aspirations of current interchange in parallel running. At a very early day, too, the use of main line reactors in connection with lightning arresters showed its usefulness, but as machines became bigger and bigger, and stations grew to larger capacity, the dangers of short-circuits and the difficulties of switching increased in a somewhat astonishing ratio and the modern reactor found a most useful place. When used in sectionalizing a bus, for instance, reactors are of great value in keeping down short-circuits, and wherever employed act as limit valves in keeping down dangerous currents.

Of the two papers presented before the institute, that of Mr. Junhke gives a vivid account of the serviceable quality of the reactor system in a serious cable breakdown near one of the great generating plants of the Commonwealth Edison Company. Cables do break down, and when the break is near a big station considerable damage may be done before the automatic apparatus can clear the lines. In this instance, before the disconnecting circuit breakers had finished their work 80,000 kw. of system load had been cut out. The details of the accident were carefully examined, and it was found that the short-circuit had produced sufficient mechanical forces on the cables to disrupt connections at an oil switch, which still further complicated the situation. The disturbance was severely felt over the entire system, with a generating capacity of more than a quarter of a million kilowatts and a load of about 200,000 kw. Investigation showed that the maximum short-circuit current poured into the fault was something like 58,000 amp. Had the reactors not been in circuit to limit the feeding in of energy to the fault the total short-circuit current would have been nearly double that amount, which would have put an instantaneous thrust of more than 1000 lb. per foot on some of the parallel conductors involved, which might have wrecked portions of the switchboard besides putting an enormous and perhaps impossible overload on the oil switches. With all these tremendous electrical mechanical strains not a single piece of generating apparatus was disabled, quite contrary to the situation before reactors were installed. With the reactors in service the interruption proved exceedingly short, one section losing about 50,000 kw. for five minutes and the other sections much less and for shorter periods. The incident seems to be a very complete demonstration of the value of reactors, especially in the great inter-connected distribution systems that form a part of the service of every large city.

The second paper, by Mr. Johnson, deals with the similar use of the reactors in hydroelectric stations. The advantages gained here are the same as in the case just mentioned, though their presence protects the machinery from enormously heavy short-circuits, and also assists greatly in localizing whatever disturbances may exist. It is found that a comparatively moderate amount of reactance gives good results in these particulars, but that it is unwise to push this kind of protection too far on account of the effect of increased reactance on the system upon the stability of synchronism and on the power surge. It is quite possible, as will be readily seen, to increase the reactance up to a point where there is serious instability in case of a sudden disturbance, enough even to throw machines out of phase. In fact, amounts less than this will sometimes produce instability enough to cause hunting of apparatus in parallel, sometimes rather difficult to control.

Mr. Johnson gives a very instructive discussion of this very practical case, illustrating it by a striking example of the effect of a surge in a station containing four groups of large generators with about 12 per cent reactance between the groups. In this case a surge was started by suddenly dropping a load of about 20,000 kw. from one bus section, and involved all the sections until the circuit breakers were opened. The instability was sufficient to start violent hunting with the power surging back and forth at a period of about one second

t quite enough to trip the overload relays set for one ond time limit, while the turbine governors in en- avoring to catch up with the situation made it worse. is therefore clear that somewhat careful investiga- n of the reduction of stability by reactance is desir- le before their amount is determined, and it looks ry much as though a compromise must generally be de between the amount of inductance which would desirable for protection alone and that which is safe om the standpoint of stability. Mr. Johnson's paper tains data for the examination of this condition, and worth the serious study of engineers who are dealing th large power stations involving a parallel operation many units. We cannot leave the subject finally with- t hinting that it is possible to overwork the principle parallel operation at the busbars, however theoret- lly beautiful it must seem. There are cases, particu- ly in power transmission, when it is not bad policy cut feeders loose from direct connection with each ner and parallel them through a distant connection, a long line is sometimes a very valuable buffer.

ermeameter for Testing Steel

THE properties of steel alloys, or grades of steel; are becoming of increasing importance in construc- n, and in the manufacture of tools. These properties come the more important, in view of the precision with hich the chemical and physical treatment of steel can controlled and predetermined in the modern steel fur- ces. Some of the properties of these steels can only determined by chemical or mechanical tests. A few them are capable, however, of being determined by gnetic tests. In order to apply a magnetic test, it is ly necessary to provide a short bar or prism of the terial, and to insert it in a suitable permeameter. The article by Frank P. Fahy on page 315 describes a nvenient form of permeameter which, while capable of ing used for the measurements of permeability and of steresis in a single sample bar, is particularly adapted the speedy comparison of the permeability of a sam- bar with that of a known standard bar. For most rposes of the shop or factory, it is the comparative asurement, rather than the absolute measurement, hich is in greatest demand. In order to measure the solute permeability or hysteresis in a sample bar, with engineering precision, many precautions have to be taken to avoid errors; but in order merely to compare these quantities in a sample bar and in a standard bar, most of these sources of error can be eliminated in a good form of permeameter.

Insulation of High-Voltage Transformers

THE development of high-voltage systems and apparatus has rendered necessary the study of the electrostatic circuit; just as the development of the dynamo machine necessitated the study of the magnetic circuit. An essential difference between the two circuits is that whereas the magnetic circuit comprises closed loops of magnetic flux, each magnetic flux loop forming an endless chain, the electric circuit ordinarily is incomplete or is completed through a conducting source, electric flux being conceived of as issuing from a positive charge and terminating upon a negative charge.

Prof. Alfred Still contributes a useful article to this number, on the principles and practice of the electric design of transformer terminals. In the evolution of transformer design the first step was the working of the magnetic material up to a suitable predetermined value. The next was the thermal working of the structure, so as to control the temperature elevations under load. More recently, mechanical stresses under overload conditions have had to be recognized and protected against. Finally, dielectric stresses have had to be computed and guarded against. The completed modern transformer in a high-tension system is one in which magnetic, thermal, mechanical and electric stresses are all taken into account, preregulated, and guarded against, the materials being worked at suitable densities of magnetic, thermal, mechanical and electrical flux.

The laws of electric flux are somewhat more complicated than those of magnetic flux, owing to peculiar difficulties in securing perfectly homogeneous dielectrics. Moreover, some of the phenomena of leakage and ionization occurring with dielectric stresses, have no counterparts in magnetics. For these reasons, dielectric design is more complicated and troublesome than magnetic design. Professor Still's article is directed both to the theoretical and practical sides of the subject, and is worthy of careful consideration by students of transformer design.

The Coming Issues

NEXT week in the commercial number of the ELECTRICAL WORLD for February, one of the leading articles of the issue will treat of a method of analysis of the central station's load as a guide to greater effectiveness in future commercial effort, pointing out how emphasis upon certain kinds of new business can be made to work an improvement in load-factor conditions. Another contribution to this number places an interesting aspect on the effect which the increasing efficiency of incandescent lamp sources may be expected to have on the central station's lighting business and the relation of the lighting load to the other principal classes of central station business. Additional articles on the subject of foreign-trade expansion for electrical manufacturers and jobbers, to which the ELECTRICAL WORLD has already given considerable attention in the past, will also be presented in the Feb. 24 number. Besides these commercial features the number will contain the regular departments for the engineer and operating man. For the electrical commercial man interested in detail merchandising methods, ELECTRICAL MERCHANDISING for this month, issued Feb. 15, contains a number of timely ideas and plans for house-wiring business, together with an important and useful new section on store equipment and store methods and plans for selling vacuum cleaners and other appliances.

The 210,000-Kw. Buffalo Steam Station—III

Features of Turbo-Generator and Condenser Operation Together with Arrangements and Connections of Switching and Protective Apparatus

SECTIONS of this article have appeared in the Jan. 27 and Feb. 3 issues of the ELECTRICAL WORLD. The first installment contained a description of the coal-handling and firing apparatus and boiler equipment. The second article described the construction and operating features of the steam end of the station dealing especially with the economizers, make-up water evaporators, steam piping and method of maintaining a balanced draft. This section, which is the final one, contains a discussion of the electrical features of the station, including the main turbo-generators, switching and protective equipment.

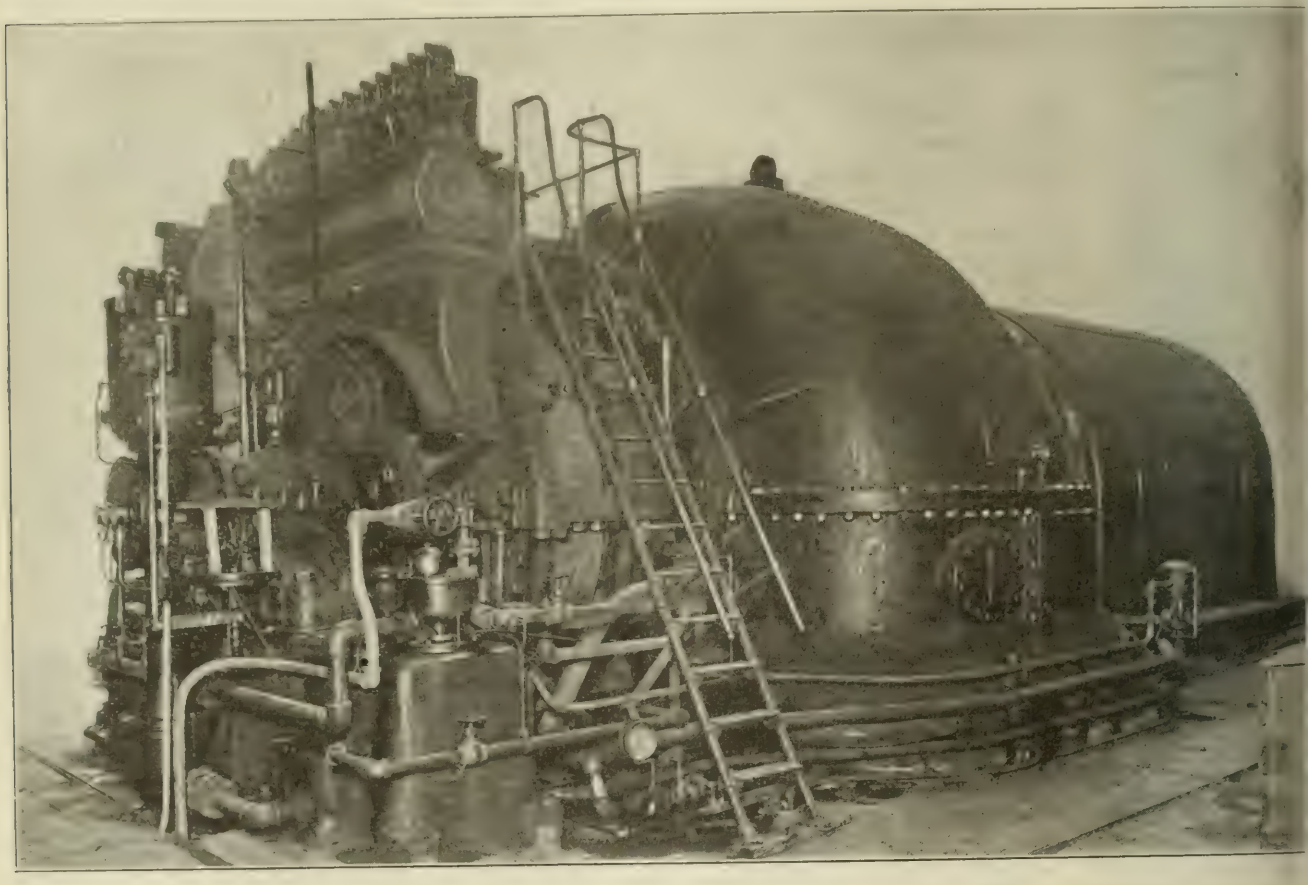


FIG. 1—ONE OF THREE 20,000-KW. TURBO-GENERATORS INSTALLED IN THE BUFFALO STATION

At present three 22,222-kva., 12,000-volt, three-phase, 25-cycle, two-pole General Electric generators driven by horizontal turbines are installed in the station. The turbines are designed to operate at 250 lb. pressure and at 250 deg. superheat, the steam temperature under these conditions at the throttle being 656 deg. Each turbine is provided with a 10-in. low-pressure connection so that steam from the auxiliaries may be introduced when necessary to obtain a station heat balance. Solenoid-operated trips are connected with the main throttle, auxiliary throttle and vacuum breaker of each unit so that the opening of the main generator circuit will simultaneously shut off all steam from the machine and destroy the vacuum. Schutte & Koerting trip valves and vacuum breakers are in service, the solenoids being operated by 125-volt direct current, the electric release in no way interfering with the usual mechanical trip gear.

The condensing equipment for each turbine, which was furnished by the Westinghouse Electric & Manufacturing Company, consists of a 33,000 sq. ft. surface condenser with two 25,000 gal. per minute circulating pumps, two hot-well pumps and one double LeBlanc air pump, all turbine driven. The condensers are of the straight down-flow type. A portion of the tubes nearest the steam inlet is utilized as a primary heater through which the condensate is pumped before going to the feed-water heater, this arrangement permitting the condensate being heated to a temperature very nearly equal to that of the exhaust steam. The system of spring supports used makes it unnecessary to have an expansion joint located between the turbine exhaust and the condenser steam inlet. On account of the slight movement of the condenser with expansion, provision for this movement has been made in the layout of all piping to the condenser.

The circulating water pumps are of the horizontal double suction, centrifugal type, each direct connected through herringbone reduction gearing to a horizontal non-condensing steam turbine. Under winter conditions it is expected that one circulating pump per unit will suffice. Both pumps running together are capable of circulating 40,000 gal. per minute under normal head conditions. The turbines and pumps are so designed that either unit can be speeded up to start the system working with the siphon broken at the discharge outlet of the condenser. The hot-well pumps are of the ho

ontal, two-stage centrifugal type, each direct connected o a horizontal non-condensing turbine. Each pump vhen running alone is capable of removing the total con- ensate from the condenser when the latter is operating nder maximum load and discharging against an ex- ernal head of 80 ft. Two LeBlanc pumps are mounted n the same shaft with the driving turbine and oper- ted at 2500 r.p.m. The auxiliary turbines are designed o operate with a steam pressure of 275 lb. and 275 deg. uperheat, the back pressure being about 18 lb. per quare inch absolute. They have sufficient capacity, owever, to carry their full load when supplied with aturated steam at 200 lb. gage pressure. Each main urbine is provided with the usual free-exhaust outlet, cated near the top of the condenser and discharging hrough a 36-in. spiral riveted galvanized-iron riser car- ied to the roof through the boiler house. The at- nospheric relief valve is located in a horizontal run be- ween the condenser and the riser.

Along the water front parallel to the building is an pen intake flume. At one end is an intake and screen vell divided into four compartments provided with acks at the entrance and removable screens located arther back. The main discharge tunnel extends along- ide of the intake well and between the latter and the uilding, discharging into the river a suitable distance ownstream from the intake. From each unit in the tation the discharge tunnel is carried directly over the ntake tunnel, the individual intake tunnels crossing nder the main discharge tunnel. At the south end f the intake compartments is a by-pass tunnel con- ecting with the main discharge tunnel. The by-pass ay be opened in cold weather in order to allow warm ischarge water to flow in front of the intake and revent freezing at the racks. In very cold weather a arge part of the total discharge water may be directed hrough this passage by closing off enough of the main ischarge tunnel to the river. Stop logs are provided n the tunnel connections to each unit, so that any one ay be shut off for cleaning or repairs. All tunnels nd wells are reinforced concrete.

Three 300-kw. Terry combination turbine and induc- ion motor-driven exciters are installed in the main tur- ine room, but at present one unit is located on the asement floor pending the installation of the fourth ain generating set. Normally the motor drives the xciter in each set, but in case the speed falls 4 per ent or more, the turbine governor automatically throws he load upon the turbine and thus maintains the speed. n case of trouble on the main circuits, the exciters can e depended upon to take care of themselves without ttention, freeing the operators for other duties. In ase the load conditions permit the economical use of he exciter turbine exhaust in the heaters, it is possible o operate at a higher all-day efficiency than with either straight motor-driven or steam-driven exciter, as the rive can be shifted to the motor during periods of light oad, while under heavy loads with large demand for xhaust steam for feed-water heating the turbine drive an be cut in, thus insuring maximum economy of oper- tion.

A complete permanent testing plant is a feature of his station. On account of the use of hydraulic dry acuum pumps for all three main condensers, it was ecessary to install a rotating dry vacuum pump to allow ests being made on the condensers. A gasometer is rovided so that volumetric tests can be made at any ime. The central testing system for station auxiliaries ncludes a 1400-sq. ft. surface condenser, so arranged hat the exhaust from any of the auxiliaries may be ondensed, and a weir for measuring this condensate, hecking up boiler feed, hot-well discharge, etc. An utomatic coal-sampling plant is located in the coal- elevating tower, a separate sampler and crusher being provided for each elevator.

The main generators are self-ventilating, drawing 45,000 cu. ft. of air per minute through basement ducts leading from louvers at the outside of the building to the machine casings. As stated in a previous section of this article, heated air from the generators is discharged

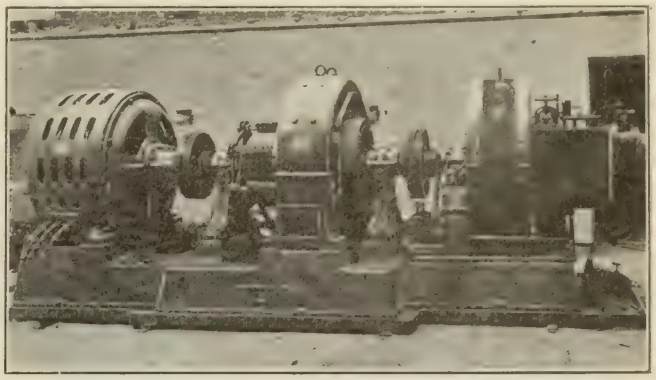


FIG. 2—COMBINED TURBINE-MOTOR-DRIVEN EXCITER

from the main units into the forced-draft fans supplying air to the boiler furnaces. Hand-operated dampers are provided in the generator cooling air intake ducts so the air supply may be shut off in case of a generator burnout. These dampers are equipped with alarm signals to warn if they are accidentally closed. Space is allowed for the future installation of air washers. The ducts are screened to prevent entrance of insects. Six sets of temperature coils are installed in the stator windings of the main generators, with the usual connections to indicating instruments on the switchboard.

Just off the turbine room is a six-story switch and bus section, which is 35 ft. wide and extends the entire length of the building. The main switchboard equipment is located on the fifth floor, reactors, switches and buses occupying floors below, as indicated in the accompanying cross-sectional drawing. The generators are connected to the outgoing feeders, as illustrated in the

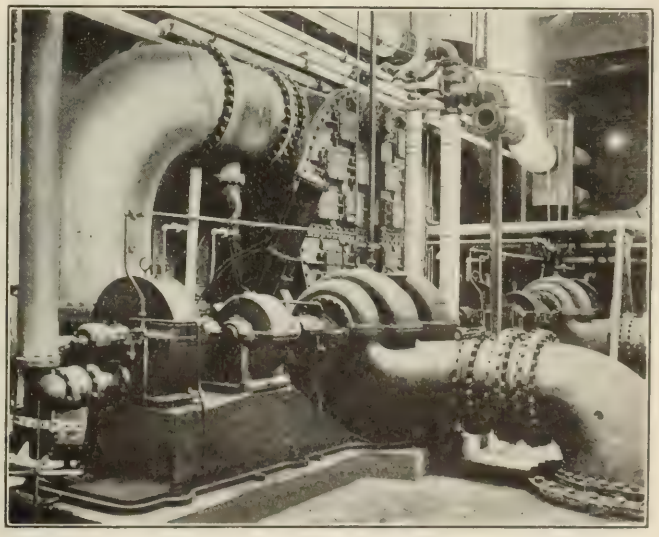


FIG. 3—ARRANGEMENT OF TURBINE-DRIVEN CIRCULATING PUMPS

accompanying wiring diagram, no main transformers being required. The delivery of energy at line voltage and the moderate voltage involved, namely, 12,000, simplified the electrical design with respect to conductor spacing and transformers; but on the other hand, the great number of outgoing feeders involved and arrangements for providing flexible and uninterrupted service

necessitated liberal space provision for housing the electrical equipment in a symmetrical manner.

Each generator is connected through disconnecting and non-automatic oil switches to a reactor bus. From this bus connections are made through 2 per cent synchronizing reactors and oil switches to a common synchronizing or transfer bus and through 5 per cent main

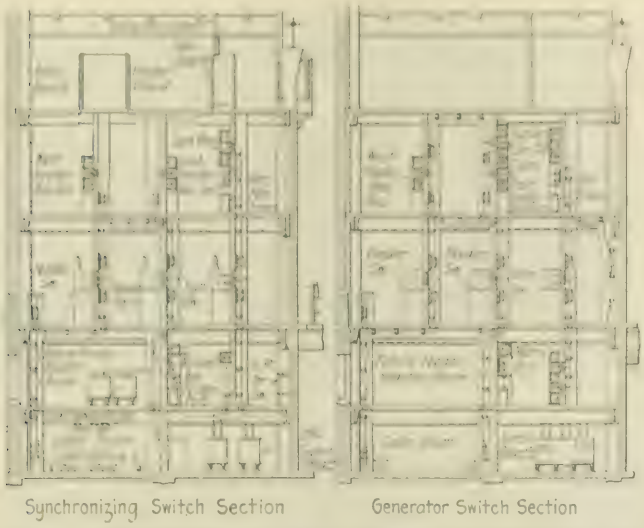


FIG. 4—ARRANGEMENT OF APPARATUS IN SYNCHRONIZING AND GENERATOR SWITCH SECTIONS

or generator reactors and non-automatic selector oil switches to sectionalized feeder buses. Separate feeder-bus sections are provided for each generator, these sections being in duplicate and so arranged that any section of the main wiring may be disconnected for repairs without interfering with the service. Arrangements are made to permit the future installation of twelve feeders (total) from each feeder bus. Each feeder is connected through an automatic oil switch and provision is made for the installation of feeder reactors when the generating capacity of the plant is increased. Duplicates of any of the oil switches may be installed and connected to parallel by utilizing spaces provided for

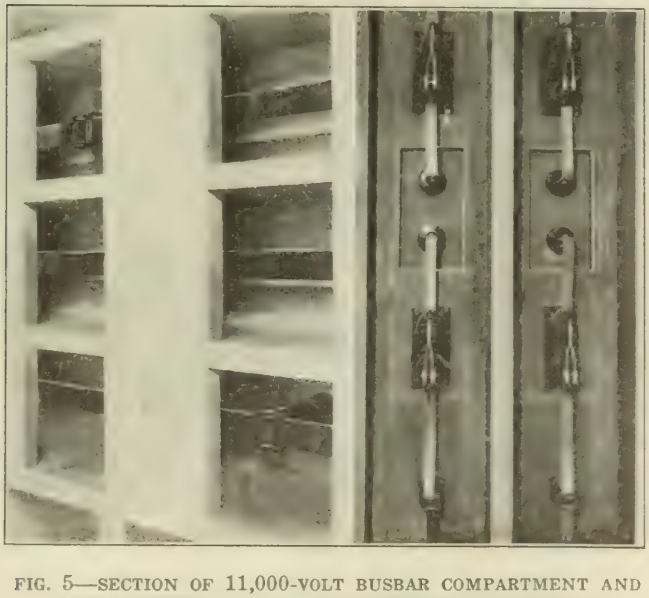


FIG. 5—SECTION OF 11,000-VOLT BUSBAR COMPARTMENT AND ARRANGEMENT OF OIL DISCONNECTING SWITCHES

feeder switches and reducing the number of feeders. This arrangement will probably never be required for the main switches, but may be found desirable for important feeders where repairs to an oil switch, instrument transformers or reactors would interrupt service.

A static discharger is connected to each feeder-bus section through expulsion-type fuses. Provision is made for connecting the end feeder sections together through an oil switch by a ring bus. For the present, disconnecting switches and a short section of the ring bus are provided for connecting the first two feeder sections, thus providing two means of supplying energy to the present end feeder bus. The neutral connection of the Y-wound generators is brought out and grounded through an oil switch and 5-ohm resistor.

Each exciter is capable of exciting all three gener-

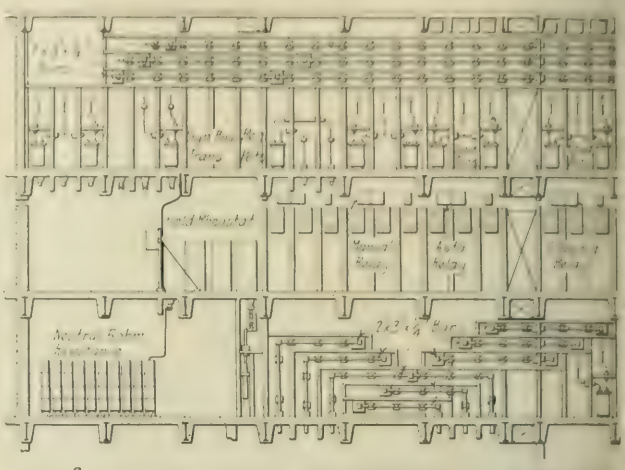


FIG. 6—BUS AND SWITCH ARRANGEMENTS IN GENERATOR SWITCH SECTION

ators. The units are connected to a sectionalized single bus through remote-control, electrically operated circuit breakers. Field connections are also made through remote-control, electrically operated circuit breakers and motor-operated field rheostats. Space is provided for the installation of a second exciter bus. Energy for driving the exciters and other auxiliaries is obtained from two banks of step-down transformers, either bank being sufficient for the service. Duplicate transformers are provided for lighting service. These transformers are supplied through oil switches from a 12,000-volt sectionalized bus, which in turn is supplied through two feeder oil switches, one of which is connected to the synchronizing bus and the other to the third section of feeder bus. The low-tension sides of the transformers energize a sectionalized bus to which the exciter motors, station auxiliaries, distributing panels and lighting transformer circuits are connected through oil switches. Knife selector switches are provided for connecting lighting transformers to either section of low-tension bus. A similar provision is made for connecting any auxiliary distributing panel through the oil switch of any other auxiliary panel.

All six terminals of each generator's windings are connected with current transformers, which trip the main generator, neutral and field switches, and the throttle, mixed pressure and vacuum valves on the turbine through the medium of a relay and auxiliary switches in case the armature windings break down. A second relay is placed in the trip circuit for the control switch. This is connected to trip the generator oil switch and throttle, mixed pressure and vacuum valves.

The generator leads are provided with varnished cambric insulation and are carried in concrete-incased fiber duct suspended from the turbine room floor. In the electrical bay they are connected to strap copper buses. Beyond this point all main conductors are flat strap copper segregated by barriers and carried on busbar supports supplied by the Philadelphia Electric Company.

A length of 45 ft. per generating unit is provided in

the electrical bay. The bay is divided into two vertical sections by a 12-in. reinforced concrete supporting wall extending up to the switchboard floor. In addition, there are 8-in. reinforced concrete walls for supporting buses and conductors and for segregating the electrical equipment. Each 45-ft. length is separated from the adjacent units by a 4-in. reinforced concrete wall, all passageways in which are provided with fire doors. Where conductors pass through walls or floors porcelain bushings set in sandstone slabs are provided, thus completely segregating the equipment in separate rooms. The rooms containing the main and synchronizing reactors are provided with forced ventilation to carry off the heat liberated from the reactor coils. All other rooms are ventilated by a natural draft system of ventilating ducts terminating in roof monitors.

All main switch cells are made of reinforced concrete, the barriers and bus compartments consisting of sandstone slabs 2.5 or 4 in. thick. Floor beams are incased in concrete, so they too will serve as barriers. Intermediate ceiling barriers are also made of reinforced concrete cast with the floors. All switches are placed 7 ft. center to center, making barriers and conductors fall 28 in. apart. All main conductors run uniformly in the 7-in. switch cell spaces and there are no crossovers except through the buses.

The oil switches installed at this station are of the Westinghouse top-connected type, the disconnecting switches being mounted on the back of the wall. Connections were made so that bottom-connected switches could be installed, having one disconnecting switch mounted on the back of the wall and the other in a subcell compartment. The doors for the oil switch disconnecting switches are interlocked with the oil-switch operating mechanism, so that the doors cannot be opened unless the oil switch is open. The main switchboard, supplied by the Westinghouse company, is of the vertical panel type and is divided into generator feeders and auxiliary sections.

Direct current for oil-switch operation and emergency service is furnished by sixty storage cells of 200 amp. rating on a one-hour discharge basis. The cells were supplied by the Electric Storage Battery Company. For charging them a 25-kw. General Electric motor-generator set has been installed. In general, the General Electric Company provided the main and exciter generators, station service transformers, station service oil switches, transformer service and bus and station service switches. The generator, synchronizing and feeder oil switches, static dischargers, ground resistors and reactors were furnished by the Westinghouse Electric & Manufacturing Company. A General Electric automatic load-control system will be installed in the near future. Each main turbine is equipped with an

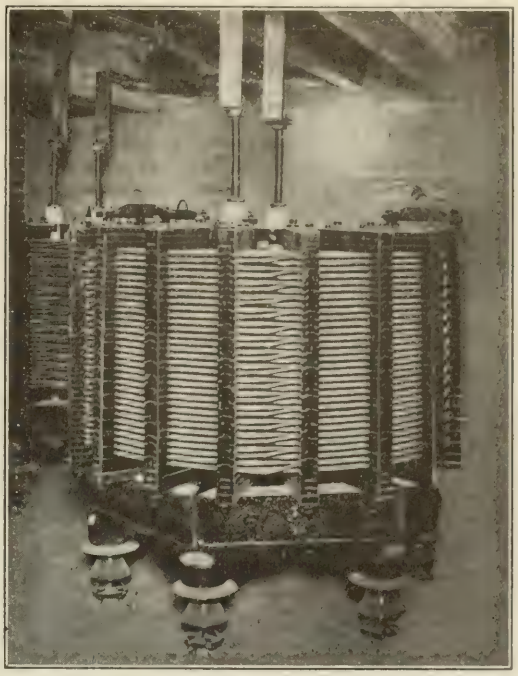


FIG. 8—METHOD OF MOUNTING SYNCHRONIZING AND GENERATOR REACTORS

unusually complete installation of indicating and recording instruments including Frahm vibration tachometers and Bristol recording instruments. The station is provided with a Richardson oil filter and sight-feed indicators of the same make which are used on the water-cooling lines to the main and auxiliary turbine bearings. A Morgan crane and two Otis elevators are also installed in the plant.

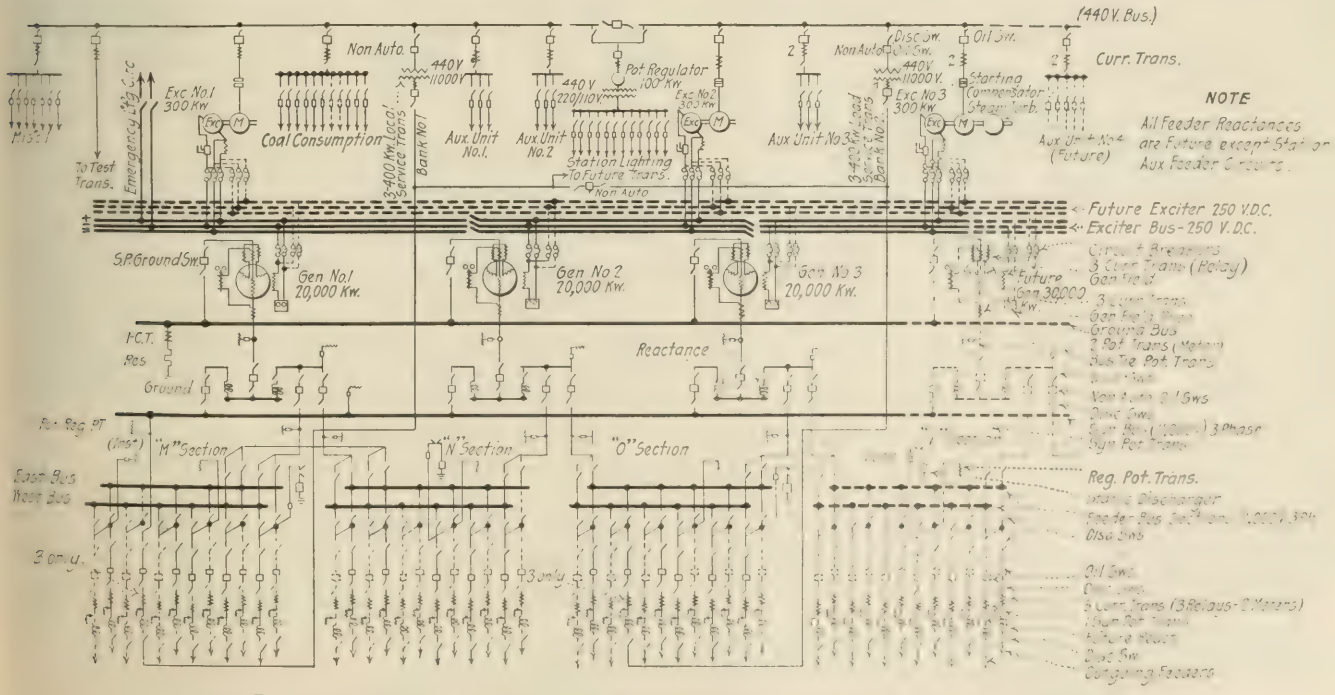


FIG. 7—CONNECTIONS BY WHICH ANY GENERATOR MAY BE JOINED WITH ANY FEEDER BUS

Insulation of High-Voltage Transformers

First of Two Articles Taking Up the Fundamental Principles Underlying All Problems of Insulation and Giving Data Which Will Enable the Determination of Insulation Dimensions for Different Services

By Alfred Still
Professor of Electrical Design, Purdue University.

SERIOUS difficulties are not encountered in insulating machinery and apparatus for working pressures up to 10,000 or 12,000 volts, but for higher pressures (as in 150,000-volt transformers) designers must have a thorough understanding of the dielectric circuit,* otherwise insulation cannot be correctly and economically proportioned. In this article information has been assembled which should make the fundamental principles of insulation readily understood and should enable an engineer to determine in any specific design of transformer the thicknesses of insulation required in any particular position as between layers of windings, between high-tension and low-tension coils, and between high-tension coils and grounded metal. The data and principles outlined should also facilitate the determination of dimensions and spacings of high-tension terminals and bushings. In presenting this information two questions are considered: (1) What is the dielectric strength of the insulating materials used in transformer design? and (2) how can the electric stress or voltage gradient be predetermined at all points where it is liable to be excessive?

Apart from a few simple problems of insulation capable of a mathematical solution, the chief difficulty encountered in practice usually lies in determining the distribution of the dielectric flux, the concentration of

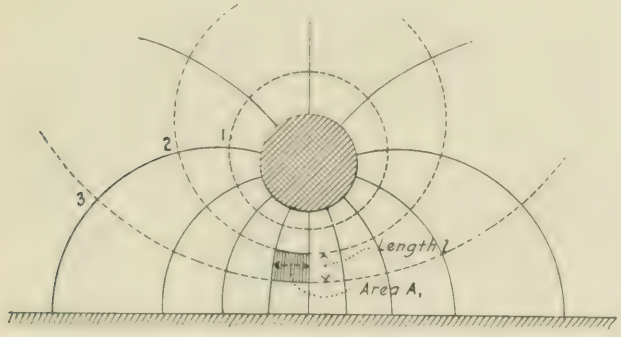


FIG. 1—DISTRIBUTION OF DIELECTRIC FLUX AND EQUIPOTENTIAL LINES BETWEEN ENERGIZED SPHERE AND FLAT PLATE

which at any particular point may so increase the flux density and the corresponding electric stress that disruption of the dielectric may occur. The conception of lines of dielectric flux, and the treatment of the dielectric circuit in the manner now familiar to all engineers in connection with the magnetic circuit has made it possible to treat insulation problems† in a comprehensive manner.

The Dielectric Circuit

The analogy between dielectric and magnetic circuits may be illustrated by Fig. 1, where a metal sphere is supposed to be placed some distance away from a flat metal plate, the intervening space being occupied by air, oil or any insulating substance of constant specific capacity. This arrangement constitutes a condenser of which the capacity is (say) C farads. If a difference of potential of E volts is established between the sphere and, the plate, the total dielectric flux, ψ will have to satisfy the equation

$$\psi = EC \qquad (1)$$

where ψ is expressed in coulombs, E in volts and C in farads.

The quantity ψ coulombs of electricity should not be considered as a charge which has been carried from the sphere to the plate on the surface of which it remains, because the whole of the space occupied by the dielectric is actually in a state of strain, like a deflected spring, ready to give back the energy stored in it when the potential difference causing the deflection or displacement is removed. Instead, the dielectric should be considered as an electrically elastic material which will not break down or be ruptured until the "elastic limit" has been reached. The quantity ψ, which is called the dielectric flux, may be thought of as being made up of a definite number of unit tubes of induction, the direction of which in the various portions of the dielectric field is represented by the full lines in Fig. 1. The name of the unit tube of dielectric flux is the coulomb.

If the sphere were the north pole and the plate the south pole of a magnetic circuit, the distribution of flux lines would be similar. The total flux would then be denoted by the symbol Φ, and the unit tube of induction would be called the maxwell. In place of formula (1) the following well-known equation could then be written:

$$\Phi = Mmf \times \text{permeance} \qquad (2)$$

This expression is analogous to the fundamental equation for a dielectric circuit, the electrostatic capacity C being, in fact, a measure of the *permeance* of the dielectric circuit, while $\frac{1}{C}$ sometimes called the *elastance*, may be compared with reluctance in the magnetic circuit.

The dotted lines in Fig. 1 are sections through equipotential surfaces. The potential difference between any two neighboring surfaces, as drawn, is one-quarter of the total. At all points the lines of force, or unit tubes of induction, are perpendicular to the equipotential surfaces. Furthermore, the flux density, or coulombs per square centimeter, through any small portion A of an equipotential surface over which the distribution may be considered practically uniform is

$$D = \frac{\psi}{A} \qquad (3)$$

The capacity, or *permittance*,* of a small element of the dielectric circuit of length l and cross-section A is proportional to $\frac{A}{l}$, or with the proper constants inserted,

*The reciprocal of *elastance*.

* "Insulation and Design of Electrical Windings," by A. P. M. Fleming and R. Johnson—Longmans, Green & Co.
"Dielectric Phenomena in High-Voltage Engineering," by F. W. B. MacNutt—Macmillan Company.

†The dielectric circuit is well treated from this point of view in the following (among other) books:
"The Electric Circuit," by V. Karapetoff—McGraw-Hill Book Company, Inc.
"Electrical Engineering," by C. V. Christie—McGraw-Hill Book Company, Inc.
"Advanced Electricity and Magnetism," by W. S. Franklin and B. MacNutt-Macmillan Company.

$$\text{Electrostatic capacity} = C = \left(\frac{10^9}{4\pi(3\times10^{10})^2}\right)\frac{kA}{l} \text{ farads} \quad (4)$$

wherein the numerical multiplier results from the choice of units. Factor k is the specific inductive capacity, or dielectric constant, of the material ($k = 1$ in air), while the unit for l and A is the centimeter. This expression for capacity may conveniently be rewritten as

$$C_{mf} = \frac{8.84\,kA}{10^3\,l} \text{ microfarads} \quad (5)$$

Values of k are given in the accompanying table together with the dielectric strengths of the materials. These figures are only approximate, those referring to dielectric strength merely serving as a rough indication of what the material of average quality may be expected to withstand. The figures indicate the approximate virtual or r.m.s. value of the sinusoidal alternating voltage which, if applied between two large flat electrodes, would lead to the breakdown of a 1-cm. slab of insulating material placed between the electrodes.

What is generally understood by the *disruptive gradient*, or stress in kilovolts per centimeter, would be about $\sqrt{2}$ times the value given in the last column of the table. Thus, if a battery or continuous-current generator were used in the test, the pressure necessary to break down a 0.75-cm. film of air between two large flat parallel plates would be $1000 \times \sqrt{2} \times 22 \times 0.75 = 23{,}400$ volts.

DIELECTRIC CONSTANT AND DIELECTRIC STRENGTH OF INSULATORS

Material	Dielectric Constant, k	Dielectric Strength, Kv. per Cm.
Air	1	22
Transformer oil	2.3	..
Paper (dry)	2	80
Paper (oil impregnated)	3	100
Pressboard (dry or varnished)	3	125
Pressboard (oil impregnated)	5	150
Treated wood (across grain)	3 to 6	70
Porcelain	4.5	110
Varnished cambric	5	200
Mica	6 to 8	600
Micanite	5 to 7	300
Glass	4 to 10	90
Conductors	Infinity	..

Returning to formula (3), let *electric flux* or *quantity* of electricity, ψ, be expressed in terms of capacity and emf., with a view to determining the relation between flux density and electric stress. The formula (4) may be written

$$C = Kk\frac{A}{l} \text{ farads}$$

where K stands for the numerical constant. Substituting in equation (1) $\psi = E \times Kk\frac{A}{l}$

$$\text{whence } D = Kk \times \left(\frac{E}{l}\right)$$

Since E/l is the potential gradient, or volts drop per centimeter, which is sometimes referred to as the *electrostatic force* or *electrifying force*, and denoted by the symbol G, therefore

$$D = Kk \times G \quad (6)$$

The analogous expression for the magnetic circuit is, $B = \mu H$.

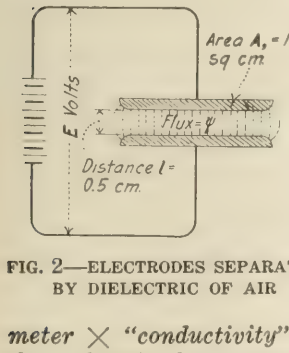


FIG. 2—ELECTRODES SEPARATED BY DIELECTRIC OF AIR

In the case of a dielectric circuit, *electric flux density = emf. per centimeter × "conductivity" of the material to dielectric flux*, while in the magnetic circuit *magnetic flux density = mmf. per centimeter × "conductivity" of the material to magnetic flux.*

Since the electric stress or voltage gradient G is directly proportional (in a given material) to the flux density D, it follows that when the concentration of the flux tubes is such as to produce a certain maximum density at any point breakdown of the insulation will occur at this point. Whether or not the rupture will extend entirely through the insulation will depend upon the value of the flux density (consequently the potential gradient) immediately beyond the limits of the local breakdown.

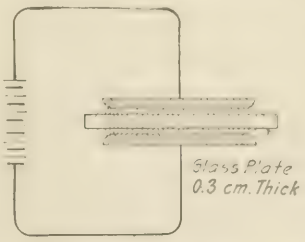


FIG. 3—ELECTRODES SEPARATED BY AIR AND GLASS

Given two electrical conductors of irregular shape, separated by insulating materials, the problem of calculating the capacity of the condenser so formed is very similar to that of calculating the permeance of the magnetic paths between two pieces of iron of very high permeability separated by materials of low permeability. There is no simple mathematical solution to such a problem, so the best that can be done is to fall back on the well-established law of maximum permeance, or "least resistance." According to this law the lines of force and equipotential surfaces will be so shaped and distributed that the *permittance*, or capacity, of the flux paths will be a maximum. With a little experience, ample time, and a great deal of patience the probable field distribution can generally be mapped out, even in the case of irregularly shaped surfaces, with sufficient accuracy to emphasize the weak points of the design and to permit determining the maximum voltage gradient approximately.‡

Before illustrating the application of the above principles to the design of transformer insulation, it will be advisable to assemble and define the quantities which are of interest to the engineer in making practical calculations.

Symbol:

E, e = emf. or potential difference (volts).

l = length, measured along line of force (centimeters).

A = area of equipotential surface perpendicular to lines of force (square centimeters).

$G = \frac{de}{dl}$ = potential gradient (volts per centimeter).

C = capacity or permittance (farads or microfarads) $\left(\text{farads} = \frac{\text{coulombs}}{\text{volts}} = \text{flux per unit emf.}\right)$.

K = constant = 8.84×10^{-14} (farads per centimeter cube, being the specific capacity of air).

k = dielectric constant, or relative specific capacity, or permittivity ($k = 1$ for air).

ψ = dielectric flux, or electrostatic induction ($\psi = CE = AD$ coulombs).

D = flux density = $\psi/A = KkG$ (coulombs per square centimeter).

CAPACITY OF PLATE CONDENSER

Imagine two parallel metal plates, as in Fig. 2, connected to the opposite terminals of a direct-current generator or battery. The area of each plate is A square centimeters and the separation between plates is l centimeters, the dielectric or material between the two surfaces being air. The edges of the plates should be rounded off to avoid concentration of flux lines. If the area A is large in comparison with the distance l, a uniform distribution of the flux ψ may be assumed in the air gap, the density being $D = \psi/A$.

‡This method of plotting flux lines is explained, in connection with the magnetic field, at some length in the writer's book, "Principles of Electrical Design"—McGraw-Hill Book Company, Inc., 1916.

By formula (5) the capacity is $C_{mf} = \frac{8.84 \times A}{10^{9} \times l}$ microfarads, since the specific capacity of air k is 1. Assuming numerical values, let $A = 1000$ sq. cm., and $l = 0.5$ cm. Then, $C = \frac{8.84 \times 1000}{10^{9} \times 0.5} = 1.77 \times 10^{-6}$ farads.

If $E = 10{,}000$ volts, the potential gradient will be $G = \frac{10{,}000}{0.5} = 20{,}000$ volts per centimeter. There will be no disruptive discharge, however, because a gradient of 31,000 volts per centimeter is necessary to cause breakdown in air.

By formula (1) the total dielectric flux is $\psi = 10{,}000 \times 1.77 \times 10^{-6} = 1.77 \times 10^{-2}$ coulombs.

Charging Current with Alternating Voltage

The effect of an alternating emf., the crest value of which is 10,000 volts, would be to displace the above quantity of electricity $4f$ times per second, f being the frequency. The quantity of electricity can be expressed in terms of current and time thus, *quantity = current × time*, or *coulombs = average value of current (in amperes) during quarter period × time (in seconds) of one quarter period.* Therefore $\psi = I \times \left(\frac{2\sqrt{2}}{\pi}\right) \frac{1}{4f}$, where I stands for the virtual or r.m.s. value of the charging current on the sine wave assumption. Transposing terms, $I = \frac{4\pi f \psi}{2\sqrt{2}}$. If E is now supposed to stand for the virtual value of the alternating potential difference, $\psi = CE \times \sqrt{2}$, whence $I = 2\pi fCE$, which is the well-known formula for calculating capacity current on the assumption of sinusoidal wave shapes.

Capacities in Series

When condensers are connected in parallel on the same source of voltage, the total dielectric flux is evidently determined by summing up the fluxes as calculated or measured for the individual condensers. In other words, the total capacity is the sum of the individual capacities. With condensers in series, however, the total flux, or displacement, will be the same for all the capacities in series, therefore the calculations may be simplified just as for electric or magnetic circuits by adding the *reciprocals* of the conductance or permeance. The conception of *elastance*, corresponding to resistance in the electric circuit and reluctance in the magnetic circuit, thus has certain advantages. In the dielectric circuit *elastance* = 1 ÷ [*permittance (or capacity)*] = $1/C$.



FIG. 4

For a concrete example assume that a 0.3-cm. plate of glass is inserted between the electrodes of the condenser shown in Fig. 2. The modified arrangement is illustrated by Fig. 3. On first thought it might appear that this arrangement would improve the insulation, but care must always be taken when putting layers of insulating materials of different specific inductive capacity in series, as this example will illustrate. In addition to the elastance of a 0.3-cm. layer of glass there is the elastance of two layers of air of which the total thickness is 0.2 cm. Assuming that the value of the dielectric constant K for the particular quality of glass used is 7 and that G_g and G_a are the potential gradients in the glass and air respectively, then, by formula (6), $KG_a = 7KG_g$, whence $G_a = 7G_g$.

Taking the total potential difference between electrodes as 10,000 volts, the same as used in considering Fig. 2, $E = 10{,}000 = 0.2G_a + 0.3G_g$, whence $G_g = 5880$ volts per centimeter, and $G_a = 41{,}100$ volts per centimeter. Such a high gradient as 41,100 would break down the layers of air and would manifest itself by a bluish electrical discharge between the metal plates and the glass. On the other hand, the gradient of 5880 volts per centimeter would be far below the stress necessary to rupture the glass. Nevertheless a discharge across air spaces should always be avoided in practical designs because of its injurious effect on the metal surfaces and also on certain types of insulating material. It should be observed that the introduction of the glass plate has appreciably increased the capacity of the condenser. For example, with the same voltage ($E = 10{,}000$) as before, the total flux is now $\psi = AD = 1000\ (8.84 \times 10^{-14} \times 41{,}000) = 3.47 \times 10^{-2}$ coulombs. This value is nearly double the value calculated with only air between the condenser plates.



FIG. 5

As a practical application of the principles governing the behavior of condensers in series, consider the insulation between the coils and core of an air-cooled transformer, *i.e.*, of which the coils are *not* immersed in oil. In addition assume the insulation consists of layers of different materials made up as follows:

Material	Total Thickness — Mils	Total Thickness — Centimeters	Dielectric Constant (k)
Cotton brading and varnished cambric	70	0.178	5
Micanite	125	0.317	6
Pressboard	62	0.158	3
Air spaces (estimated)	24	0.061	1

Then suppose it is desired to determine how high an alternating voltage can be applied between the coils and the core before the maximum stress in the air spaces exceeds 31,000 volts per centimeter, the gradient which will cause disruption and static discharge, with the consequent danger to the insulation due to local heating and chemical action. Assuming the coil forms one flat plate of a condenser of which the other plate is the iron frame or core, it can be considered that the equivalent of a number of plate condensers in series is obtained, the total elastance being

$$1/C = 1/C_1 + 1/C_2 + 1/C_3 + 1/C_4$$

By formula (4), the individual capacities for the same surface area are proportional to k/l, therefore

$$KA/C = l_1/k_1 + l_2/k_2 + l_3/k_3 + l_4/k_4.$$

Since $\frac{KA}{C} = \frac{KAE}{\psi} = \frac{KE}{D} = \frac{KE}{KG_{air}} = \frac{E}{G_{air}}$, the permissible maximum value of E is,

$$E = 31{,}000 \left(\frac{0.178}{5} + \frac{0.317}{6} + \frac{0.158}{3} + \frac{0.061}{1}\right)$$

$$= 6260 \text{ volts (maximum).}$$

The r.m.s. value of the corresponding sinusoidal alternating voltage is $6260/\sqrt{2} = 4430$, which is the limiting potential difference between windings and grounded metal work if the formation of corona is to be avoided. A transformer having insulation made up as previously described would be suitable for a 6600-volt three-phase circuit with grounded neutral, but for higher voltages the insulation should be modified or oil immersion should be employed to fill all air spaces. If the oil-cooled construction is employed, the previously-considered insulations (slightly modified in view of possible action of the oil upon the varnish) would probably be suitable for working voltages up to 15,000.

A large factor of safety must be allowed when determining the distance between electrodes measured over the surface of an insulator. Whether or not sparkover will occur depends not only upon the condition of

the surface (clean or dirty, dry or damp), but also upon the shape and position of the terminals or conductors. It is therefore almost impossible to determine, other than by actual test, what will happen in the case of any departure from standard practice. Surface leakage occurs under oil as well as in air, but generally speaking, the creepage distance under oil need be only about one-quarter that necessary in air.

An important point to consider in connection with surface leakage is illustrated by Figs. 4 and 5. In Fig. 4, a thin disk of porcelain (or other solid insulator) separates the two electrodes, while in Fig. 5, the same material is in the form of a thick block providing a leakage path (l) of exactly the same length as in Fig. 4. The voltage required to cause spark-over will be considerably greater for the block of Fig. 5 than for the disk of Fig. 4. This condition exists because the flux concentration due to the nearness of the terminals in Fig. 4 begins breaking down the layers of air around the edges of the electrodes at a much lower total potential difference than will be necessary in the case of the thicker block of Fig. 5. The effect of the incipient breakdown is, virtually, to make a conductor of the air around the edges of the metal electrodes, and a very slight increase in the pressure will often suffice to break down further layers of air and so result in a discharge over the edges of the insulating disk. The phenomenon of so-called surface leakage may thus be considered as largely one of flux concentration or potential gradient. Sometimes it will be easier to eliminate trouble due to surface leakage by altering the design of terminals and increasing the *thickness* of the insulation than by adding to the length of the creepage paths.

In a later issue of the ELECTRICAL WORLD will be published the second installment of this article which contains practical rules applicable to the insulation of high-voltage windings and a discussion of subjects dealing with the more practical side of insulation problems.

A Permeameter for Magnetic-Mechanical Testing

Construction and Operating Features of a Simple and Accurate Device for Measuring the Permeability and Hysteresis Constants of Steel

BY FRANK P. FAHY

ONE of the major difficulties which have hitherto attended systematic attempts to correlate the magnetic and mechanical properties of steels has been due to the lack of a suitably designed permeameter capable of making rapid and accurate measurements of single specimens over a large range of sizes. While it is true that comparatively rough magnetic measurements may at times be sufficient to permit of drawing conclusions as to physical condition, experience indicates that a higher order of accuracy than is usually reached, especially in regard to the hysteresis constants, is demanded for successful testing.

A great deal of attention has been given to the study of the magnetic characteristics which accompany changes in structure due to thermal and mechanical treatment of steels. It is, for instance, well known that a steel which is physically hard, as determined by the file, brinell or other hardness test, is generally magnetically "hard." Among many others, Guthe[1] and Maurer[2] have recorded the magnetic characteristics which accompany the various stages of temper in several grades of heat treated carbon steel. Goerens[3] has found the magnetic properties peculiarly sensitive to the degree of cold working in steels of widely-varying composition. Sanford[4] in a paper about to appear, describes results on material tested for homogeneity. Burrows[5] has reviewed the work already done in correlating magnetic and mechanical properties.

As the result of extended work along these lines, the writer has found that in a given material the magnetic characteristics may be used to indicate the mechanical characteristics. The value of a magnetic test lies in the fact that it offers a method of examining magnetic materials for certain characteristics which affect their mechanical performance, without in any way sacrificing their subsequent utility. Manufacturers of steel products are coming to realize the need of a stricter test control of their output, especially where heat treatment of expensive material is concerned, and interest in this method of test has been stimulated.

[1] *Trans., A. I. E. E.*, Vol. XIV, 1897.
[2] *Revue de Métallurgie, Mémoires*, 1908, Vol. V.
[3] *Jour. I. S. I., Memoirs*, Vol. III, 1911.
[4] *Bulletin of the Bureau of Standards*, Vol. XIV, 1916.
[5] *Bulletin of the Bureau of Standards*, Vol. XIII, 1916.

The instrument here described was developed in an endeavor to produce a permeameter of high accuracy devoid of complications and so adapted that it may be used either to compare the permeability of two specimens, one of which partakes of the character of a standard, or to measure permeability and the hysteresis constants for a single specimen. Fig. 1 shows the permeameter as designed for the measurement of bars, rods, and plate material. This same form has been used in the examination of tools such as drills and saws. The device has now been in use for some time and has given entire satisfaction in the sizes constructed.

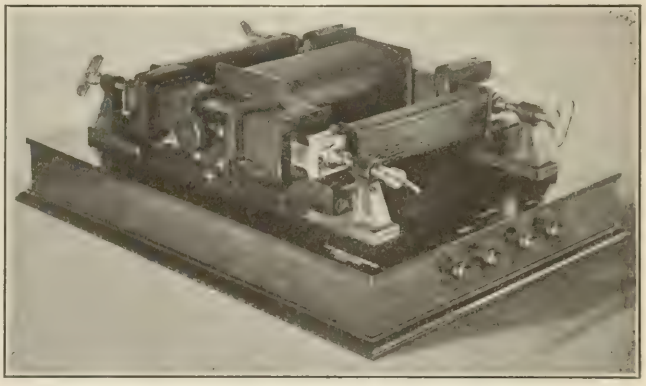


FIG. 1—PERMEAMETER FOR MAGNETIC-MECHANICAL TESTING

THE MAGNETIC CIRCUITS

In Fig. 2 is shown the permeameter in plan and elevation. B represents the base of the apparatus upon which is mounted a magnetic core of H-shape so fashioned as to form two symmetrical magnetic circuits, each of which includes the crossbar J in common. The remaining portions of one of these circuits embrace the core arms Y, Y and the air path between such arms; while the other includes the core arms Y', Y' and a similar air path. The crossbar J is divided midway between its ends into two sections separated by a small air gap, which may be closed to a greater or lesser extent by a screw piston, P, of magnetic material, actuated through the knurled head N.

The ends of the transverse core portions forming a part of each of the two parallel magnetic circuits are adapted for bridging by specimens of magnetic material. In Fig. 2 a standard specimen, *A*, the magnetic characteristics of which are known, bridges the core arms *Y*, and a test specimen, *X*, the magnetic characteristics of which are to be determined, bridges the core arms *Y'*. Clamps *O* serve to hold the specimens in place. The ends of the core arms *Y* and *Y'* are slotted to permit the insertion of bushings *W*, which vary in form according to the shape of the material bridging the core arms. The adjustable air gap in the crossbar *J* is designed to create a demagnetizing force within the core itself, which may be varied to suit requirements. When the gap is open to its fullest extent the magnetic poles created there, when the magnetizing current is broken in the act of reversing the current, are of material assistance in reducing the time constants of the magnetic circuits. This demagnetizing force may be adjusted to reduce to a negligible amount the magnetic field in the

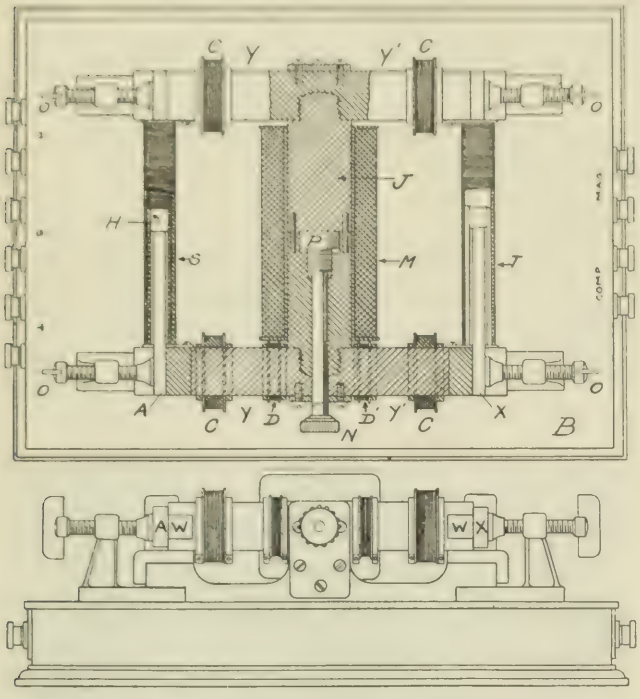


FIG. 2—PLAN AND ELEVATION OF PERMEAMETER

region occupied by the test specimen due to the residual properties of the core itself. Under this latter condition direct measurements of residual induction are simplified.

The magnetomotive force is applied in two sections—one over the crossbar *J* by means of current in the magnetizing coil *M*, and the other distributed in equal parts over the core arms *Y Y'* by means of current in the compensating coils *C*. The currents in these two sections are independently adjustable. The test coils indicated by *D*, *D'*, *S* and *T* are each of the same number of turns and placed as shown in the figure; *D* and *D'* on opposite arms of the same transverse core portion, and *S* and *T* uniformly wound on coil forms through which the standard and test specimens *A* and *X* respectively may be inserted. A test coil, *H*, of a relatively large number of turns is wound uniformly on the same form which carries the test coil *S*. The test coils *S* and *T* are of the same mean cross-sectional area.

Fig. 3 shows diagrammatically the flux paths within the magnetic core due to the magnetomotive forces generated by currents in the coils *M* and *C*. The magnetic field due to current in the magnetizing coil has the direction indicated by the arrows, or the reverse according to the direction of the current. The field due to current in the compensating coils has the direction indicated by the dotted line, its direction at any time depending upon the direction of the current in the compensating coils. It will be seen that when current is flowing in both magnetizing and compensating coils that one magnetic circuit has the magnetomotive force due to the magnetizing coil augmented by the current in the compensating coils, while the other magnetic circuit has its mmf. decreased by the same amount.

Internal Electrical Connections

Fig. 3 shows also the internal electrical connections of the permeameter. The magnetizing and compensating coils are connected to the binding posts marked "Mag" and "Comp" respectively. The test coils, *S*, *D*, *D'*, and *T* are permanently connected in series, taps being brought out to binding posts marked *S* and *T*. This series connection is carried out in such a manner that upon reversal of the current in the magnetizing coil *M*, the integrated emf. induced in the coils *S* and *D'* acts in the same direction and in opposition to the integrated emf. simultaneously induced in the coils *D* and *T*. Connection to the adjacent binding posts of the pairs marked *S* and *T* enables observation of the differential effect of the coils *D* and *D'* to be made. The permeameter is initially adjusted, so that this differential effect is zero when no specimens are in the apparatus.

The test coil *H* is connected to the binding posts marked *H*. This coil is used to determine the magnetic potential difference existing between its ends when it encircles air only, that is, when no specimen is inserted within it. The average magnetic potential drop per unit length of the winding *H* is equal to the average magnetizing force. The area turns of the coil are determined by measurements of the coil in a uniform field such as is produced by a long solenoid, and corrected empirically to allow for the difference between the length of the coil and the free length of the test specimen between contacts at the opposite pole faces.

A rugged D'Arsonval galvanometer, considerably overdamped, is employed as an indicating instrument. The galvanometer is calibrated by means of a mutual inductance of fixed value, the secondary of which remains permanently in the galvanometer circuit. A multiple point switch permits the galvanometer to be connected at will to the various test circuits.

The permeameter may be used for either relative or absolute measurements. That is, it may be used (a) to determine the normal induction of a specimen of unknown magnetic characteristics by comparing it with a standard or known specimen, or (b) to determine directly the normal induction and hysteresis of a specimen. The method of procedure depends to a considerable degree upon the accuracy desired. Where approximate values only are required the procedure is extremely simple.

A specially designed handle which engages the individual switches by means of latchets permits of the operation of the magnetizing and compensating switches either singly or in unison and also controls the insertion of resistances in determining hysteresis data.

1. *Approximate Determination of Normal Induction—By Comparison.*

The standard specimen *A*, the normal induction of which has been predetermined, is inserted in the coil *S* and the unknown specimen *X* in coil *T*. Both specimens are clamped in place. The magnetizing coil *M* is energized and the specimens demagnetized, if desired, by repeated reversals of a successively decreasing magnetizing current. The magnetizing current is then set at any desired value, subjecting both standard and test specimens to the effects of the same magnetomotive force, and the galvanometer deflection due to the reversal of

flux in the coil S, resulting from a reversal of current in M, is read. The galvanometer is then connected to the coil T and the deflection observed when the current in M is again reversed. The induction corresponding to the deflection due to the coil S, referred to the known data for specimen A indicates the magnetizing force to which both specimens are subjected. The deflection due to coil T indicates the induction in the specimen X. (Both observed inductions are, of course, subject to a correction due to the difference in area between the bars and the test coils.) Other points on the induction curve for X are obtained in a similar manner.

If it is desired to determine the induction in X without the necessity of inserting it within a coil, the galvanometer is connected so as to read the differential effect of the coils D and D'. The differential induction indicated, when algebraically added to the induction observed in coil S, gives the induction in specimen X.

2. *Accurate Determination of Normal Induction—By Comparison.*

The normal induction of a test specimen found in the foregoing manner is only approximately correct save when the standard and test specimens are of equal area and have similar permeabilities over the entire range of magnetizing forces. When these conditions do not obtain, errors of greater or less magnitude arise according to the degree of departure, because of the different magnetomotive force drops which exist in corresponding parts of the two parallel magnetic circuits and which result in dissimilar leakage characteristics. If the difference in the fluxes linking the test coils D' and T is less than the flux difference between D and S, a deflection of the galvanometer is observed when the latter is connected to S, D, D', and T in series and the current in M is reversed, which may be reduced to zero by means of current in the compensation coils C. These compensating coils are so energized that the magnetomotive force in the magnetic circuit which includes the test specimen is augmented over that due to the main solenoid alone, while the magnetomotive force in the circuit including the standard specimen is decreased. The magnitude of this compensating magnetomotive force is adjusted until, upon the simultaneous reversal of the magnetizing and compensating currents, the residual deflection of the galvanometer is zero. Then the leakage flux through the air path which is in parallel with the path of the coil T is equal to the leakage flux through the air path which is in parallel with the path of the coil S. Since these two leakage air paths are symmetrical and carry the same magnetic flux, the same difference of magnetic potential must exist between the ends of the path encircled by the coil T that exists between the ends of the path encircled by the coil S. This adjustment is to be made for each point on the normal induction curve. In measuring the induction of A and X the currents in M and C are reversed simultaneously.

3. *Absolute Determination of Normal Induction*

Absolute measurements of normal induction are made without the use of a standard bar, which must be removed from the permeameter. Compensation for unequal magnetomotive force drops in the two magnetic circuits should be made as in 2, except when approximate results only are desired. The measurement of the magnetizing force and induction are made while reversing simultaneously the currents in M and C. The deflection of the galvanometer, when it is connected to H, gives directly the magnetizing force acting on the specimen X. For the coil H which is wound uniformly along the length of the coil S, may be used to measure the difference in magnetic potential and hence of the mean magnetizing force for this region, which is also the mean magnetizing force along the path of the coil T within which the test specimen lies. The induction of the specimen X is read when the galvanometer is connected to T as before.

4. *Absolute Determination of Hysteresis Data*

Measurement of hysteresis data for a specimen is made without the use of a standard bar, the magnetizing force being read from coil H and the induction from coil T as in 3. For the sake of brevity, the determination of residual induction and coercive force only will be described.

Residual Induction.—Compensation is effected for the maximum induction desired. The current in coil M is reduced to zero, and the compensating current varied at the same time so that, the galvanometer being connected to S, D, D' and T in series, the residual deflection is zero. Returning to the condition of maximum induction the deflection due to these current changes is observed when the galvanometer is connected first to H and then to T. If the gap adjustment is correct the true magnetizing force will be zero when the

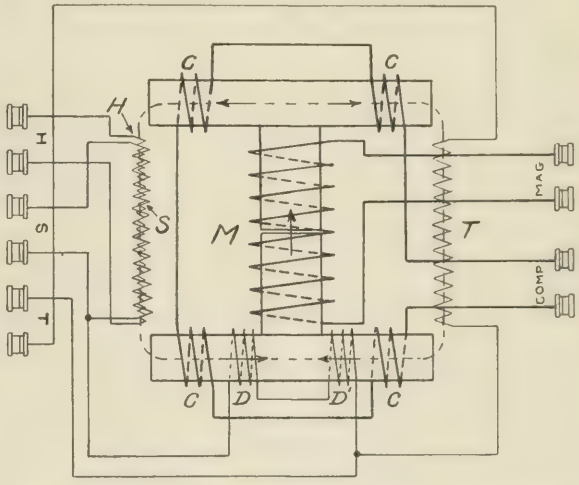


FIG. 3—FLUX PATHS AND ELECTRICAL CONNECTIONS

current in M is reduced to zero. The change in induction is indicated by the deflection due to T. It is not essential that the gap adjustment be correct, since a positive or negative magnetizing force, as required, can be applied by means of current in M so that the true magnetizing force is zero.

Coercive Force.—Compensation is effected for the maximum induction desired as before. The current in coil M is reversed and at the same time reduced in value, the compensating current being varied as required simultaneously so that the galvanometer deflection due to coil T indicates a true induction equal to zero. These adjustments are to be made under such circumstances that the residual deflection due to coils, S, D, D' and T is zero as when obtaining residual induction. The deflection due to the coil H, upon reducing to zero the magnetizing and compensating currents required to produce zero induction in the test specimen, indicates the coercive force.

The permeameter described has been designed for magnetic-mechanical testing and meets the requirements of accuracy, simplicity, and ease of manipulation which such work demands. The special switching devices employed and the use of an overdamped galvanometer so arranged as to permit of removal of the damping at will permits of considerable rapidity in adjusting compensation and the taking of observations. In many cases the degree of accuracy desired may not call for compensation, but even where accuracy is required the operations are sufficiently simple as to demand little previous experience on the part of the user.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

SPECIAL ARRANGEMENTS TO WORK ON LIVE LINE

Voltage-Changing Scheme Used by California Company to Remodel 11,000-Volt Line Near Sea Shore While Alive

BY L. M. KLAUBER

Superintendent Electric Department, San Diego Consolidated Gas and Electric Company

The San Diego (Cal.) Consolidated Gas & Electric Company recently found it necessary to rebuild a 3.5-mile section of its 11,000-volt distribution lines in order to provide for a future increase in voltage to 22,000.

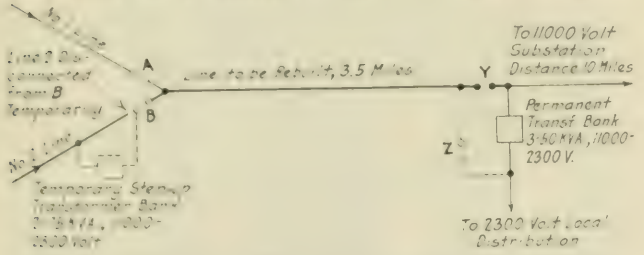


FIG. 1—LAYOUT OF 11,000-VOLT LINE THAT WAS CHANGED

In this particular section a duplicate tie line was not available, and it was necessary to maintain service in the 10-mile section beyond the part to be remodeled. It was not possible to effect the extensive changes desired with the line "alive," since it is close to the sea shore, with poles and crossarms damp, and insulators covered with salt dust.

The load beyond the section to be rebuilt did not exceed 100 kw. in the daytime; however, it was approximately 300 kw. at night. It was therefore decided to lower the voltage of the line section worked on during the daytime to 2300 volts and raise it to 11,000 at night to take care of the peak load. The arrangement of the lines is shown in Fig. 1. At the end of the line toward the generating station two lines tie into the section worked on, as shown in the sketch.

To carry out the scheme mentioned, two 75-kva., 11,000 to 2300-volt transformers were mounted on a horse-drawn truck and placed under the pole containing switch *B*, as indicated in Fig. 1. For safety the transformers were fenced in, as shown in Figs. 2 and 3. Line 2 was then disconnected from switch *B* and was connected instead to the primary of the temporary transformer bank.

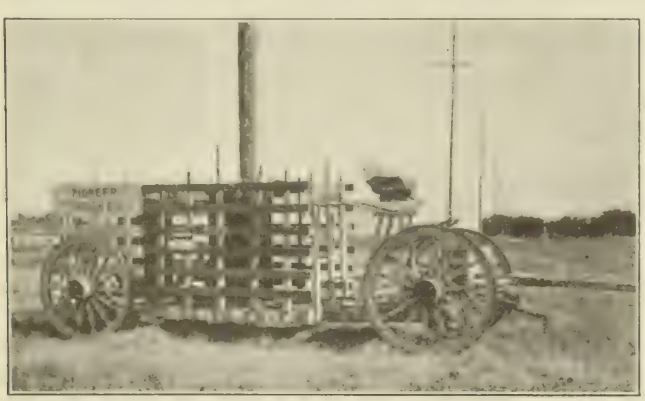


FIG. 2—PORTABLE TRANSFORMERS USED FOR CHANGING VOLTAGES FROM 11,000 TO 2300

At the outer end of the section there was available a small permanent step-down station of 150-kva. rating, furnishing three-phase energy at 2300 volts to a suburban town. It was decided to use this station as a step-up bank in the daytime, and for this purpose a temporary switch *Z* was connected in the circuit as shown. In the morning switches were operated as follows: Open *A*, open *Y*; close *B*, close *Z*. At night the order was open *B* and *Z*; close *A* and *Y*. Telephones were available at each point, and during the two weeks the rebuilding was in progress the line was changed over each night and morning without accident and with only momentary shutdowns.



FIG. 3—PORTABLE TRANSFORMERS CONNECTED TO LINE AS SHOWN AT B IN FIG. 1

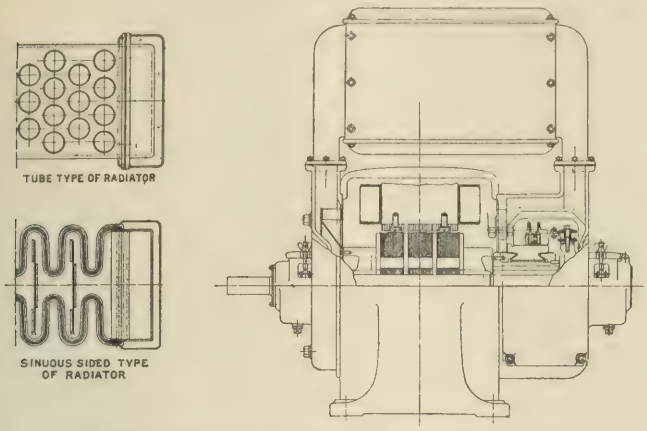
The work of remodeling done on the line included changing two of the conductors from No. 6 to No. 4 (the other being already of the larger size), and installing new crossarms, insulators and pins. The old crossarms were first lowered and temporarily fastened to the poles about 6 ft. below the top. The two wires to be changed were then attached to the old crossarms and the new crossarms mounted in position and the new wires pulled in. The work was further complicated by the cutting out of six transpositions which were in the line as originally built.

Methods for Inclosing Motors for Explosive or Moist Surroundings

Of the many expedients that have been employed to totally inclose electric motors, the one shown in the accompanying illustration, as described in a recent issue of the London *Electrical Review*, seems to possess points of interest. The purpose of the construction shown lies in a practical means of providing large radiating or air-cooling surfaces in such a manner that the system can be applied to standard machines. The construction is such that the surface can easily be adjusted by the manufacturer to suit any requirement.

The cooling surfaces are made in various forms, illustrations of two of which are shown here. In the first

of these the radiator proper consists of a box with end pieces designed to join with vertical openings in the motor end covers. Through this box pass in a vertical direction a number of thin metal tubes. Inside the back bearing of the motor a fan is fitted on the armature shaft which causes a circulation of air through the machine and through the radiating box. The arrangement



TUBE AND CURVED SIDED TYPES OF RADIATORS FOR TOTALLY INCLOSED ELECTRIC MOTORS

of the tubes, etc., is such that the air impinging on the thin vertical tubes brings about a large cooling effect. The advantages claimed for the system are that increased radiating surface is not only provided, but that as the tubes are thin compared with the motor frame the radiation is much greater, and that it is hence possible to approach within quite reasonable limits, the capacity of a ventilated motor of given frame size without the use of excessive radiator dimensions.

Another possible form of this invention is also shown in the illustration. In this case the tube radiator is replaced by one having thin sinuous metal sides with top and bottom covers, and also having mounted inside radiator baffle plates which cause the air to impinge in a thin stream against the outside surfaces, so that this type performs the same functions as the tube radiator. It is said that this type of motor is especially suited for use in either an explosive, dust laden or wet atmosphere.

Welding Outfit Saves Expense in Manhole Repairs

The oxyacetylene welding outfit shown in the accompanying illustration is employed by the Commonwealth Edison Company of Chicago in making repairs on manhole covers and on manhole frames. The usual repair required on a manhole frame consists of building up worn down flanges and edges. Sometimes, however, a cracked frame is repaired. In either case the building up or the welding is done without removing the frame. When a manhole cover is broken a new one is taken out and put in its place. The broken one is brought into the shop and repaired there with this apparatus. This course is pursued because it is necessary to preheat the heavy cover over an open fire to prevent it from cracking during the welding operation.



FIG. 1—OPERATOR AT WORK BUILDING UP A WORN MANHOLE FLANGE

This welding outfit has been in use since last August, and none of the covers repaired has failed when put back into service. Badly worn flanges which were built up have caused no further complaint. A conservative estimate of the saving effected by using this process in repairing is placed at $20 per frame. This saving is made possible on this work because with other methods the frames must be taken up, and the expense of tearing up and replacing pavement adds to the cost. By using this method of repairing covers it has been possible to effect a saving of $2 per cover.

Air in Water Causes Pipe Corrosion

BY H. A. HOLMES
Consulting Engineer, Pensacola, Fla.

Recently the writer was called upon to discover the cause of pipe corrosion which appeared to be due to electrolysis. In Fig. 1 is shown the location of the building and its proximity to a street car line and bay. One of the first things noted on starting the investigation was that the corrosion shown in those pipes which had been removed was greatest on one side of the hot water pipes which had come from horizontal runs. This side was afterwards shown to be the top. To satisfy the authorities voltage readings were taken along the pipes.

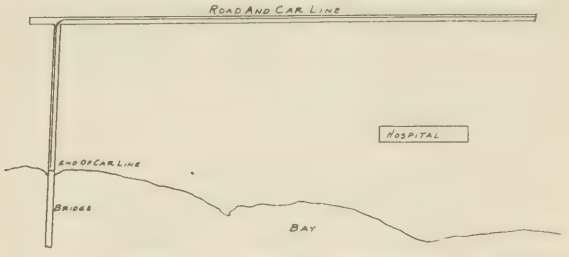


FIG. 1—LOCATION OF BUILDING WHERE PIPE CORROSION WAS OBSERVED

The maximum reading obtainable was over a stretch of about 100 ft. and amounted to slightly over 1 millivolt. This potential was ascribed to galvanic or thermo-electric action between the zinc on the pipes and the copper leads, because of the fact that the voltage did not change appreciably with the length of the pipe included between the leads. To refute galvanic action, rods of zinc, copper, brass, iron and platinum were placed in a glass where hot water could run on them. Potential readings were taken with the following results:

EMF. BETWEEN METALS IN HOT WATER

	Zn	Cu	Fe	Brass	Pt.
Pt.	0.6	0.17	0.38	0.03	0
Brass	0.55	0.10	0.35	0	
Fe	0.3	0.12	0		
Cu	0.25	0			
Zn	0				

These potentials disappeared when metals were placed in contact, hence they could not be responsible for the corrosion.

A similar test was made with metal rods in hot water allowed to stand which gave voltage readings between metals as follows:

	Zn	Fe	Brass
Brass	0.15	0.1	0
Fe	0.15	0	
Zn	0		

This would indicate that the material which had been

so active had almost disappeared. A test made with cold water showed almost similar results.

With this data in hand, the writer was able to approach the authorities and prove to them that the entire cause of the trouble was the air which was contained in the water in large quantities. This was easily noticed in drawing a glass full of water from the faucet.

Scheme for Thawing Ice from Crane Trolley Wires

BY J. H. EDWARDS

Several times each winter considerable trouble has been experienced at the shops of the Chicago, Rock Island & Pacific Railroad at Silvis, Ill., due to the accumulation of ice and sleet on the trolley wires of outdoor traveling cranes. Scrapers and sleet-cutting wheels have proved impractical, due to the type of the collector system used. It was therefore decided to install a resistance permanently on the trolley line for thawing the ice by electricity.

The first 220-volt line so equipped consists of two No. 2/0 bare copper wires each 1200 ft. long hung on brackets from 30-ft. poles and serving several gantry cranes. A 0.312-ohm, 500-amp. grid resistance was mounted in a weatherproof box about 4 ft. from the ground on a pole at the opposite end from the main feeders. This resistance was connected through a switch so it could be thrown directly across the end of the No. 2/0 trolley line. The resistance of the line (0.19 ohm) plus that of the grid resistance is sufficient to limit the current to about approximately 440 amp., thus heating the trolley wire.

This device was used for the first time on an accumulation of sleet about 5/16 in. thick. In ten minutes after the switches were closed all traces of sleet had disappeared from the trolley wires. The actual power cost in this case was less than 40 cents.

High Potential and Ground Tests on Commercial Circuits

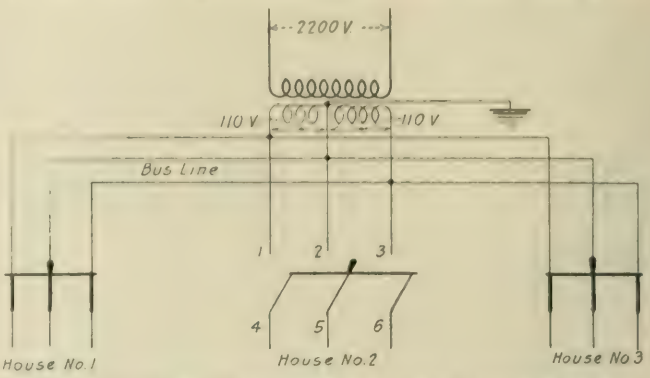
The use of a voltmeter and an instrument potential transformer to detect high-voltage grounds on customers' 110-volt circuits has been found to give good results when carried out in the following manner. It is advisable for the tester to first make a test for high voltage on the circuit before testing for grounds. The instrument transformer should be used in this test, with the service switch left closed and readings taken from each wire to ground. Zero readings indicate the circuit clear of high voltage, while any deflection of the pointer will indicate high voltage. In this case each house on the circuit should be cleared by opening the service switch and the line department called to locate the fault.

VOLTMETER READINGS UNDER CLEAR AND GROUND CONDITIONS WHEN TESTING HOUSE CIRCUITS AT POINTS IN ACCOMPANYING SKETCH

	Volts	
1, 2, 3 to ground	110-0-110	Incoming line clear
1, 2, 3 to ground	0-110-220	No. 1 grounded outside of house
Tests on House Wiring		
1 to 4, 1 to 5 1 to 6, 3 to 4 3 to 5, 3 to 6	All zero	Clear

If not zero, the line on which the reading is obtained is grounded.

In testing for a ground, all lamps should be turned off, the line switch opened and readings taken from wires 1, 2 and 3 to ground. If the readings are 110-0-110 respectively, the incoming line is clear. The house wires should then be tested with the switch still open. If there is no deflection when readings are taken between the points 1-4, 1-5, 1-6, 3-4, 3-5 and 3-6, shown in the sketch, the house circuit is also clear. If there is a deflection of the voltmeter on any of these tests, the line on which the reading is obtained is grounded. However, if when testing from 1, 2 and 3 to ground the readings 0, 110 and 220 are obtained, the test indicates that the neutral is not grounded, but that there is a ground on an outside wire. The tester must then go to



CIRCUITS TO WHICH REFERENCE IS MADE IN GROUND TESTS

the transformer to ascertain if the wrong wire has been grounded. If the line wiring is correct the tester must go to every house on the circuit until the house with the ground is found.

Advantages in Bonding Underground Cable Sheaths

The bonding of the lead sheaths of underground cables is a matter affecting the life of the sheaths, the continuity of service and the cost of maintenance in most large underground distributing and transmission systems. Bonding the sheaths tends to prevent electrolysis of the lead, or at any rate delays the rate at which it occurs, is often the means of preventing costly if not disastrous manhole fires, and more or less prevents the intense heat from an arc from spreading over an extensive area. Bonding is obviously therefore an important factor in striving for continuity of service, low cost of upkeep and long life of underground cables. Bonding of sheaths is relatively more important the larger the underground conducting system, because the larger the system the greater the current carrying capacity of the cables; the greater the capacity behind a short-circuit, the more congested are the manholes and the more extensive the damage in any case tends to be. Bonding the individual sheaths of all cables and connecting them together in each and every manhole and grounding tends to prevent electrolysis by offering a more direct path to ground, and one of lower resistance, to stray or foreign current, than from the sheath through the damp ducts and soil to earth.

Not the least value of bonding is that it reduces to a minimum the likelihood of manhole fires, and tends to make a disturbance due to an arc or short-circuit of as short duration as possible. In large cities where the underground system has grown, the size of the cables and the station capacity behind them has likewise increased. Each cable has large current carrying capacity, with almost unlimited capacity behind it for an appreciable period of time under short-circuit conditions. When a sheath is bonded to earth and a short-circuit occurs between the conductor and the sheath the current rush is in all probability of sufficient magnitude to operate the current interrupting devices at both ends of the defective line. On the other hand where the sheath is not grounded an arc once started may

persist for a considerable length of time without making itself visible on the station meters. With the unbonded sheath, and favorable resistance of conductor, the resistance of the two serves to act as a stabilizing resistance for the arc, which plays on adjacent cables and causes extensive damage. With unbonded sheaths this has often happened, the indication that something was wrong only making itself evident through the breakdown of some cable under the influence of the arc from the cable originally in trouble.

Unbonded sheaths are probably the most prolific cause of manhole fires. The insulating materials used in underground cables are inflammable, once they become ignited, and once such a fire starts it burns vehemently, causing havoc, costly damage and serious interruptions.

In some instances manhole fires, of course, start from short-circuits of alternating or direct current cables. High voltage, high capacity cables usually break down and either open the circuit breakers at the station without opening the cable sheath or else the cable explodes. In either instance the arc usually goes out before much damage is done. With the lower alternating-current voltages, 2200 to 6000 volts, the cable may explode or the conductors burn off completely before the station supply is interrupted. It is the large direct current feeders, at voltages of 250 and 600 volts which are the ones from which the most extensive arcs, and the ones lasting the longest, are to be expected. The remedy is to do the bonding so thoroughly that the resistance of the return path of the short-circuit current is low enough to permit sufficient current to flow to operate the overload tripping devices at the station or stations.

Control Schemes for Print-Shop Motors

Several methods of mounting and controlling motors for print-shop applications in the plant of the David Press, Worcester, Mass., are shown in the accompanying illustrations. In Fig. 2 a 0.5-hp. motor is connected to a 12-in. by 18-in. Golding job press through a friction pulley. Power is applied to or cut off from the motor terminals by a push-button switch attached to the under side of the press shelf. Speed control is permitted by a pedal at the right of the machine, which shifts the motor brushes through the medium of levers and connecting linkwork. The motor has a speed range of about three to one, easy gradations being permitted by the operator varying the pressure on the pedal.

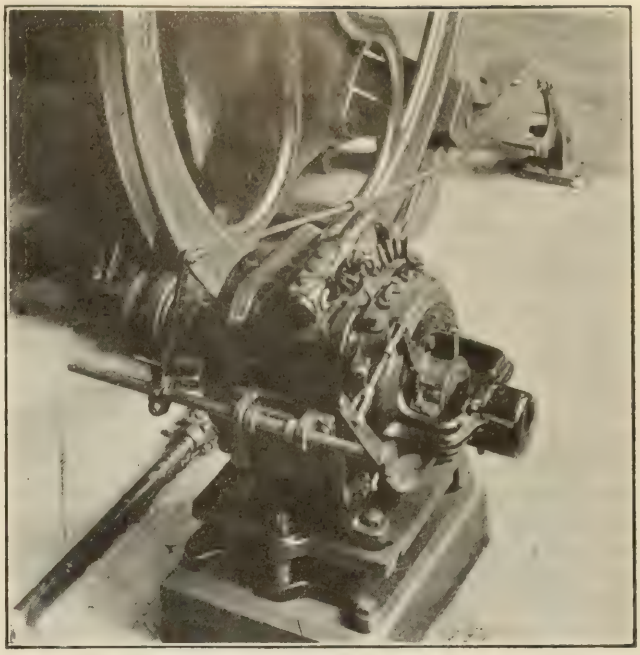


FIG. 2—GOLDING PRESS DRIVEN BY MOTOR WITH BRUSH-SHIFTING ATTACHMENT

Rheostat control and an automatically operated main switch are provided for the 1.5-hp. motor driving the 13-in. by 19-in. Standard automatic press shown in Fig. 1. A flywheel is installed in addition to the pulley to absorb peak loads and thereby regulate the speed. The main switch which may be seen in the foreground between the rheostat and flywheel, is connected with the main operating lever of the press by a link so that it will be opened and closed simultaneously with the operation of this lever. All wiring to the main switches as well as the branch circuits to the rheostat and motor are inclosed in conduit with condulet terminals.

Two monotype machines are in use in the plant, each being equipped with a 0.5-hp. motor having an adjustable set of resistance disks at one end of the shaft by which the speed can be varied from bare turn over to normal. This control equipment was furnished with the motor by the Kimble Electric Company, the makers of all the variable-speed and some of the constant-speed motors in the plant. Most of the motors are single-phase units designed for variable-speed operation.

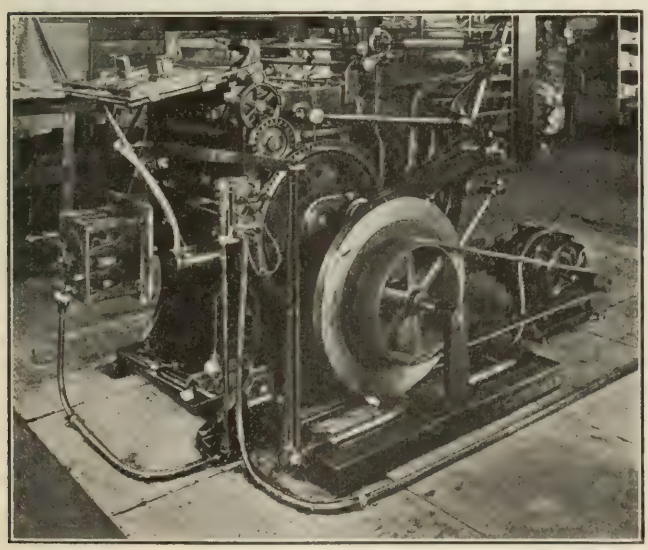


FIG. 1—STANDARD AUTOMATIC PRESS WITH SPECIAL CONTROL ARRANGEMENTS

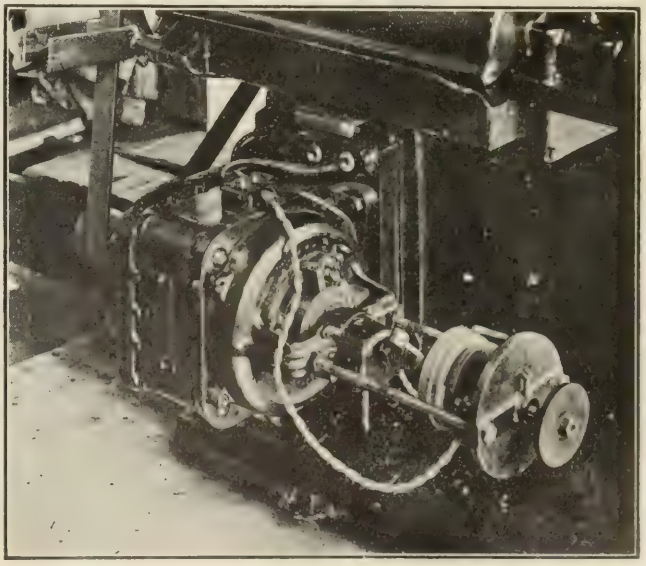


FIG. 3—VARIABLE-SPEED MOTOR INSTALLATION FOR A MONOTYPE MACHINE

CENTRAL STATION SERVICE

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CO-OPERATING WITH THE BUILDER IN WASHINGTON

The New "All-Electric" Arlington Apartment Building, One of Several Structures to Be Electrically Equipped Throughout

BY G. P. MANGAN
District Manager Potomac Electric Power Company

"Do it electrically" is the pass-word—both upstairs and down—in the new Arlington Hotel Apartments in Washington, D. C., where complete electrical appointments have been the outcome of systematic co-operation between the central station and the builder and owner, J. J. Moebs.

The suites in this building were designed to meet the needs of those whose living arrangements do not require housekeeping quarters, but who may wish to prepare food in their apartments on special occasions. Some of the suites have kitchenettes which contain small electric ranges; also cold storage vaults and ice-water faucets, both of which are supplied from an electric refrigeration plant. The other suites have serving stands, each of which is equipped with an electric coffee percolator and an electric grill.

All suites have electric grates in the fireplaces. These grates are of black iron, into which is fitted a specially designed frame work which is covered with broken glass. Under the frame work is a red electric lamp, giving a very cheerful and homey effect.

Any tenant in this very modern building may 'phone to the office on the first floor and secure the use of an electric vacuum cleaner or an electric iron, a generous supply of both being always on hand. The owner has also provided electric clothes washing machines and an electric mangle for the use of the tenants.

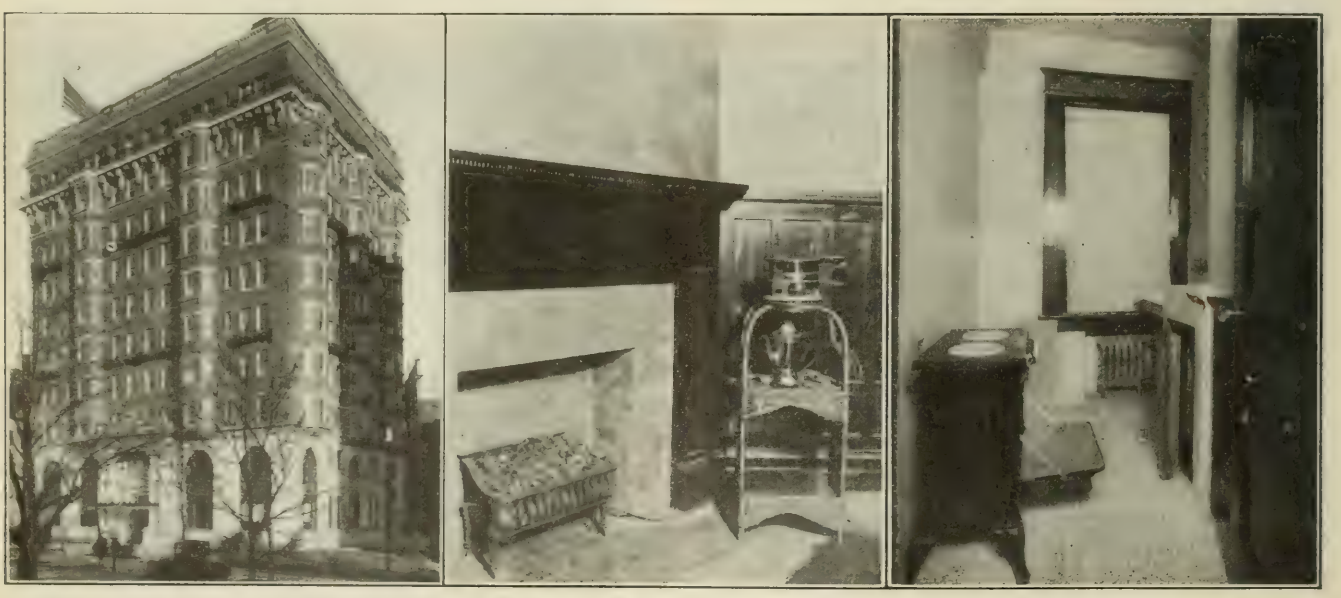
An electric dish-washing machine is used in the public café, and the ice cream served there is prepared in an electric freezer connected to the electric refrigeration plant. In the café, welsh rarebits, "ringtumdidee" and savory oyster stews are prepared in electric chafing dishes. An electric floor polisher maintains a dancing glaze under foot.

Of course the building is electrically lighted throughout, and the two elevators are both electrically operated.

Obviously, the owner is thoroughly converted to the electric way of doing things. It happens, however, that to a great extent, the installation is a "repeat order." Several of Mr. Moebs' buildings have had electric lights, electric elevators, and electric refrigeration plants in operation for a number of years. About eighteen months ago he completed a building in which he installed electric ranges in all of the housekeeping apartments in the building. These ranges have been in regular operation and besides cooking very satisfactorily and at an economical cost, they have occasioned very little expense for upkeep.

This same builder is now erecting a building which will have large housekeeping apartments. Each apartment will have an electric range and an electric fire place and the building will provide electric refrigeration, vacuum cleaners, electric irons, electric washing machines, mangle and other electrical conveniences such as are available in the Arlington apartments. In addition there will be a garage in the basement equipped with the requisite outfits for charging electric batteries.

These facts indicate clearly the advantages to be gained by a central station company by closely co-operating with the progressive building operators in their localities. Washington is not a manufacturing city. Being unable to secure much large power business, we naturally turn to the classes of business that can be developed, and domestic applications of electricity open a wide field for our efforts. The building operator is deserving of our best attention and we do everything we can to render him every service that lies in our



THE NEW ARLINGTON APARTMENT BUILDING, WASHINGTON, D. C., AND VIEWS OF A TYPICAL ELECTRIC KITCHEN AND ELECTRIC FIREPLACE IN ONE OF THE LIVING ROOMS

power. Of course, we take advantage of every opportunity to suggest new ways in which electricity can further popularize his buildings, but we are careful to avoid freak ideas and to suggest something that will stick—something that will produce "repeat orders."

A CUSTOMER POLICY THAT BRINGS FRIENDS AND BUSINESS

Practices of a Successful Central Station with Respect to Sales Organization, New Contracts, Prompt-Payment Discounts, and Service Disconnections

In a certain American city the local electric lighting company is the favorite utility of the public. It is not uncommon, for example, to hear householders remark: "If the telephone company and the gas company would only do the same as the electric light company does!" Such comments serve to illustrate the friendly regard in which the company is held, but back of such sentiment of course, stands the definite customer policy which has been wrought by far-seeing executives. It is the purpose of the following paragraphs to tell of some of the practices of this company's sales department in dealing with the public, because it is believed that these methods are in a good share responsible for the friendly sentiment.

Without offering prospective patrons any special inducements this company last year secured business from owners of nearly 5000 already-built houses. The figure is typical of the company's records for recent years, yet this central station does not and never has conducted special house-wiring campaigns. In the city referred to people seem to wire new houses just as they pipe them for water. In fact, it has been said repeatedly that every house in this community costing more than $1,500 is without exception wired for electric service when it is built; none of them uses combination gas and electric fixtures.

If the question is asked of the company's sales department, "How do you get the residential electric service business?" the answer given is, "We handle the residential business as a matter of routine. It is a year-round affair with us. For a long time we have been offering attractive residence rates. Our average residence rate is 5.6 cents per kilowatt-hour, and the average annual return from residence customers last year was $19.50. We have assured our patrons good service by always anticipating increases in load and providing power-house and line equipment to meet the demands. Now we are installing about 1000 services a month."

The sales department consists, besides the sales manager, of ten commercial lighting salesmen, seven power salesmen, one residence lighting salesmen, a force of counter clerks who are also salesmen, and the usual group of clerical aids. This sales department handles all of the company's dealings with the public. Each of the ten lighting salesmen is assigned a district, but the seven power salesmen have no particular districts. Their work is assigned on the more important power prospects according to their ability and experience. Each is provided with an automobile so that he can cover a large territory. The business handled is divided by classes and not by its geographical location.

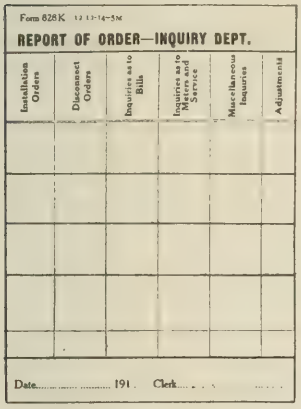
In order to avoid duplication of effort and conflict, it has been ruled that prospective small power business belongs to the salesman who first discovers it and claims it by filing a card in the office of the sales manager to signify that negotiations have been opened. These methods of allotting business, it is thought, make each salesman continually alert in his search for new business. Every man searches every source for "leads."

The salesmen are also charged with the duty of retaining business after it has been secured. The detailed work of securing data on isolated plant installations and other prospective power customers is lifted from the shoulders of the power salesmen by a testing division. The salesmen sometimes assist in this work when their special knowledge is required.

The counter salesmen are quite often selected for their positions with the fact in view that they will later be promoted to the commercial lighting or power-sales divisions. They must be courteous and be of the salesman type, for, surprising as it may seem, they handle 95 per cent of the contracts taken by the company. In one month of 1915 these counter salesmen waited on 18,000 people.

Of the 4563 contracts taken in a typical month 1060 required services to be run. In only 214 instances meters were installed before contracts were signed, and 319 meters had been in service where the account was merely transferred to a tenant's successor. Five per cent of these contracts were taken by salesmen and the balance were signed in the office. That is the reason the company needs but one residence lighting salesman.

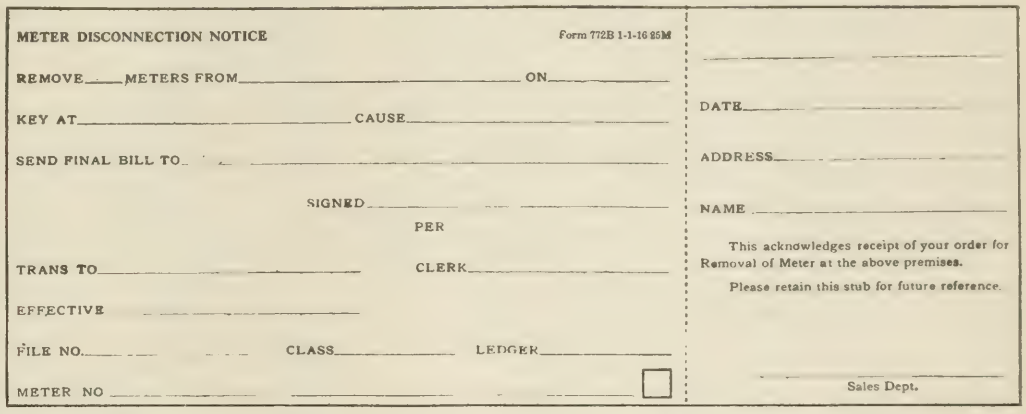
The commercial lighting and power salesmen are charged with the duty of calling upon customers after contracts have been signed at the office and seeing whether some other type of contract would be more profitable to the customer. Theirs is the duty of keeping customers satisfied. These salesmen formerly asked prospective customers not to go to the office to sign contracts, but to call them when they were ready for service. But this procedure has been stopped because it leaves a prospect with the impression that the sales-


Form 628K 12-13-14-5M

REPORT OF ORDER—INQUIRY DEPT.

Installation Orders	Disconnect Orders	Inquiries as to Bills	Inquiries as to Meters and Service	Miscellaneous Inquiries	Adjustments

Date..... 191. Clerk.....


METER DISCONNECTION NOTICE Form 772B 1-1-16 85M

REMOVE____METERS FROM_____ ON_____

KEY AT_____ CAUSE_____

SEND FINAL BILL TO_____

SIGNED_____

PER

TRANS TO_____ CLERK_____

EFFECTIVE_____

FILE NO._____ CLASS_____ LEDGER_____

METER NO_____

DATE_____

ADDRESS_____

NAME_____

This acknowledges receipt of your order for Removal of Meter at the above premises.

Please retain this stub for future reference.

Sales Dept.

FIG. 1—SERVICE MUST BE RENDERED TO RESIDENCE CUSTOMERS WITHIN TWENTY-FOUR HOURS OF SIGNING CONTRACTS. FIG. 2—METERS ORDERED DISCONNECTED ARE NEVER REMOVED IN THE AFTERNOON LEST HOUSEHOLDERS BE BY MISTAKE DEPRIVED OF SERVICE SO LATE THAT IT COULD NOT BE RESTORED BEFORE DARK

man is receiving a commission directly from the money the customer pays. In other words, the prospect thinks that he is being asked to pay for needless sales service. So prospective customers are asked to call at the office to sign contracts if possible. On request, however, a contract will be taken to the customer.

Although it does not publish the fact locally, the company allows each customer the privilege of forgetting the prompt-payment discount date once a year and does not penalize for this forgetfulness unless it happens more than once in twelve months. Payment of bills at outlying banks and drug stores is urged, since it reduces congestion at the company's general office on the discount days.

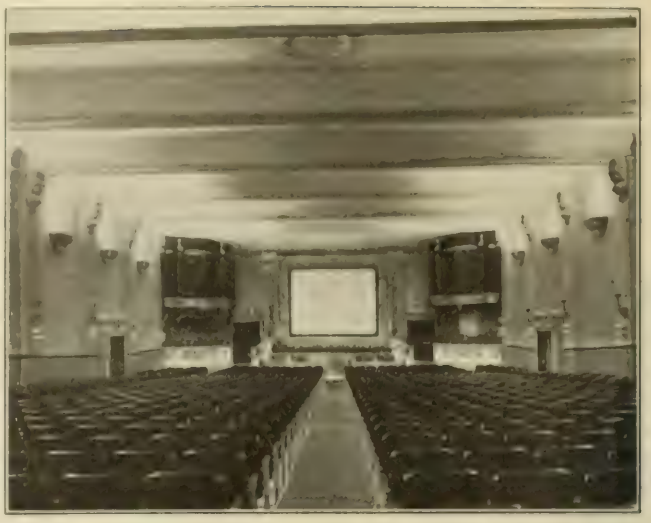
For the further convenience of its patrons the company supplies duplicate bills on request. The station from which these bills are furnished is on the main floor of the office building, so that the forgetful customer is not put to any great inconvenience. That this service must be helpful to customers is evidenced by the fact that last year saw 35,456 requests for duplicate bills. Of these 19,747 were made because the customers stated bills had not been received, and 9077 customers stated that bills had been received but later lost.

It is a rule with the company that service must be rendered to residence customers in less than twenty-four hours after the contract is signed. To make possible such rapid action on contracts, a great deal of time and thought have been given to simplification of order work. While the customer making application is waiting a few minutes at the counter a boy determines his credit standing by checking the application against an open-topped file containing a list of uncollectable accounts and cut-off orders. Every two hours during the forenoon orders taken over the counter are transmitted to the meter installation department. Orders taken in the afternoon are put through the office routine by a night force and are placed in the hands of the meter department on the following morning.

Meters ordered out on a cut-off order are never removed in the afternoon. This practice has been adopted because it eliminates the possibility of any householder being by mistake deprived of service so late in the afternoon that it would be impossible to restore it before he had suffered considerable inconvenience.

When a customer orders his service discontinued he is issued a receipt in the form of a stub torn from the disconnect order. This stub is considered authentic evidence in case a dispute arises later regarding the time the disconnection was ordered. It has been found to prevent disputes and to provide an excellent check on the accuracy of the work of the company's employees.

These are some of the methods the company employs to insure good service to its patrons, but without the *esprit de corps* that prevails throughout the organization the officers believe the system could not accomplish its full purpose.



CHICAGO THEATER AUDITORIUM LIGHTED BY SIDE-WALL REFLECTOR BOXES

Theater Lighting from Side-Wall Indirect Reflector Boxes

BY J. L. STAIR

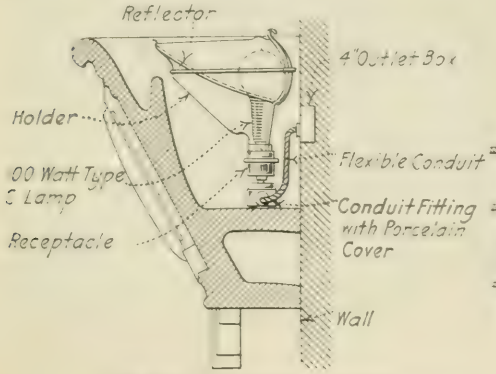
Although very pleasing results can be obtained with hanging fixtures, the present tendency of interior lighting for theaters is toward the use of other than ceiling outlets. One of the newer treatments is that in which the illumination is from concealed sources, located in side-wall brackets, boxes or coves. With no ceiling fixtures the auditorium looks much higher.

The auditorium of the Germania Theater, Chicago, is lighted by such side-wall boxes which conceal the indirect lighting units and reflectors. The lamps are mounted in a number of wall lighting boxes arranged as shown in the sectional view.

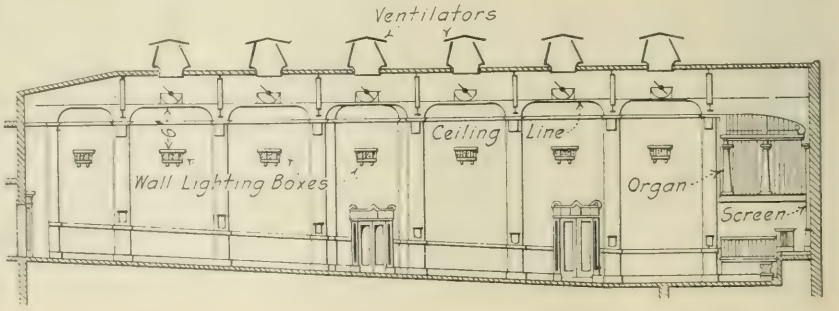
Each group of three lamps is wired on two separate circuits; the center unit in each box being supplied from one circuit for "dim" illumination during film productions, while the other two are on a separate circuit. The two outer units, together with the center unit, provide the brighter lighting for intermissions, and when it is desirable to have the room darkened for the pictures the center units are used alone.

The auditorium of this theater is 60 ft. wide and 100 ft. long, and the average ceiling height is about 24 ft. There are fourteen side-wall boxes in all. Each reflector contains a 100-watt gas-filled tungsten lamp. Fourteen hundred watts, or 0.21 watts per square foot, is required during the performance to provide the dim illumination.

The architect for the Germania Theater was Adolph Woerner, and the electrical contracting work was done by the Emmons Electric Company, Chicago.



SECTION THROUGH REFLECTOR BOX



ELEVATION OF AUDITORIUM SHOWING POSITION OF LIGHTING UNITS

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

TEMPERATURE DISTRIBUTION IN ELECTRICAL MACHINERY

A Review of B. G. Lamme's Recent Analysis of the Fundamental Principles of Heat Distribution and Temperature in Electrical Apparatus

A RECENT A. I. E. E. paper by B. G. Lamme on "Temperature Distribution in Electrical Machinery," is of fundamental importance, as it discusses in some detail the underlying basic principles of heat generation, heat flow and heat dissipation on which the resultant temperatures at different points in electrical machinery depend. Compared with the usual problems of heat flow, discussed in text-books on thermodynamics, the problem for electrical machinery is rather complicated in that there are several different sources of heat generation, simultaneously active. Thus there is heat generated by losses in the copper conductors, obeying one law; while there is heat generated in the iron parts under a quite different law; and there may be heat generated by windage and friction, according to a third law.

Mr. Lamme first considers the general conditions of

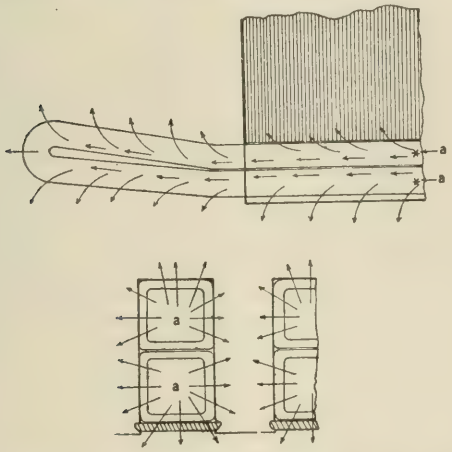


FIG. 1—ARMATURE SLOT WITH SURROUNDING IRON AND TWO SEPARATE COILS PER SLOT

heat dissipation from an armature coil. In Fig. 1 is represented an armature slot with the surrounding iron, and with two separate "coils" per slot, as is now the most common practice. Let it be assumed that the point *a* represents the "hot spot," or part at highest temperature in the apparatus. The heat from this part can flow along two general paths, namely, longitudinally through the copper conductor itself to the end windings, and thence to the air, and laterally through the insulation to the surrounding iron, or to the ventilating ducts. From the iron the heat flow is then through various paths to the external cooling air. Both the longitudinal and the lateral heat flow are discussed separately by Mr. Lamme in some detail.

In the discussion of the lateral flow of heat through the insulation to the iron Mr. Lamme points out that if a given amount of heat is to be conducted through a path of given resistance, the temperature in the heat-generating part will rise until heat is conducted away. Let Fig. 2 represent the temperature conditions in a section of an armature. Assuming, for example, the temperature of the copper inside the coil insulation as 100 deg. C., the iron temperature as 70 deg. C., and the air temperature as 30 deg. C., then the following conclusions may be drawn.

1. From the outer coil (the one next to the air gap) through the wedge to the air gap, the temperature drop will be 100 — 30 = 70 deg. C. Obviously, any temperature measurement made outside the wedge, next to the air, will approximate the temperature of the air and not of the copper. Any temperature measurement made beneath the supporting wedge will measure some intermediate temperature between the copper and the air. If the temperature drop through the wedge should be equal to that through the insulation, then a measurement underneath the wedge should show half the temperature drop through insulation and wedge, and obviously, the measured temperature would be far below that of the copper.

2. If the temperature is measured at the outside of the coil, between the iron and the insulation, it would approximate the average of the temperature of the iron and of the outside insulation, or practically the temperature of the iron. If the iron should be at different temperatures at the sides of the slot and at the bottom, then obviously different readings would be obtained, depending upon the location of the measuring device. It is evident that such temperature measurements give no indication whatever as to the true internal temperatures

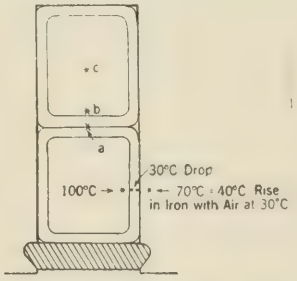


FIG. 2—TEMPERATURE CONDITIONS IN A SECTION OF AN ARMATURE SLOT

of the coil, for the heat flow and the resistance of the insulation are nowise involved in the measurement.

3. At a point, *a*, between the two coils, there should be but little heat flow through the insulation, unless the copper is comparatively narrow. If there is but little heat flow through the insulation at this point, then eventually the temperature at the point *a* must rise to approximately that of the copper in the two coils. Therefore, a measuring device located at *a* will approximate the temperature of the copper itself, and is, in general, a good indication of the hot spot at that part of the winding. Therefore, as a practical method of temperature determination, a thermo-couple located at *a* is about the most satisfactory device that we have. However, the location of the point *a* along the slot is also of importance on account of the longitudinal flow of heat in the conductor and the consequent temperature drop. In other words, the direction of heat flow in the coil itself, must be taken into account. Therefore, a thermo-

couple, located as above, is only satisfactory when the general location of the hot spot is known beforehand. This is usually determined, in a general way, for a given type or line of machines, by locating several thermo-couples along the slots.

With narrow slots and comparatively thin conductors, and especially with very heavy insulation, there is some flow of heat through the insulation which lies between the two coils, this heat passing out sidewise to the iron. In such case, the point *a* may be of somewhat lower temperature than the copper. It may happen also, in some cases, that, due to unequal losses and heating of the two coils in the same slot, one is at a higher temperature than the other. In such case, due to the heat flow between the coils, the temperature indication at *a* will not show better than an average of the two temperatures. Furthermore if the temperature at *c*, in a coil subdivided into many insulated conductors, is materially higher than at *b*, then the temperature indication at *a* may not be a close approximation to the maximum temperature.

Mr. Lamme then takes up the heat flow through the iron parts and the final dissipation of the heat to the air. With respect to the latter he points out that there is usually a considerable drop in temperature from the solid surface to the cooling air itself, the amount of such drop depending upon the ventilating conditions. In practice, there appears to be a film or layer of air which adheres very closely to the solid surfaces. This forms a sort of heat insulating film, retarding the flow of heat to the cooling air. In air ventilation, the effect of any considerable air movement over the surface appears to be that of scouring this hot film away from the surface and replacing it with a film of cooler air.

Mr. Lamme then discusses the equalization of temperature, some fallacies in temperature guarantees and errors in temperature measurement, and emphasizes in conclusion that no hard and fast rules can be made for determining the facts in the case, and that the best rules and methods now practicable are only approximate. The present limitations set for insulating materials are much higher than were considered practicable only a few years ago. This is not because the limits have been raised, but because, through a better understanding of the facts, the real upper limits of temperature as fixed by durability of insulation, are now known to be considerably higher than was believed to be the case only a short time ago. If the real limits were in accordance with former beliefs, then all the evidence of the more accurate modern tests and data would indicate that the vast majority of the existing electrical machines should have "roasted out" comparatively early in their operation. The higher temperature limits were there, but were not recognized. Now we recognize them and attempt to make reasonable allowances for differences between the measurable temperatures and the actual hottest parts. The present method may be crude, but we are not going at it in a blind manner, as was formerly the case.

Formerly manufacturers took the real responsibility for making a machine that was safe for the service, whatever the guarantees called for. To-day the responsibility is still his, but he is attempting to educate the public to a knowledge of his real problems, and to a recognition that temperature determination is far from being an exact art. There is no sharply-defined line between good and bad in the insulating materials as affected by temperature, consequently there is no sharp line between safe and unsafe temperatures.

The complete paper of Mr. Lamme, which will repay studying in detail, is published in the November, 1916, issue of the *Proceedings* of the American Institute of Electrical Engineers.

Lamps and Lighting

Effect of Brightness and Contrast in Vision.—P. G. Nutting.—A paper presented before the Illuminating Engineering Society, in which the author outlines those relations between lighting and good seeing which center upon the psychophysical laws relating perception to the flux density of light at the retina, all other relations between lighting and seeing being simple physical and geometrical optics. Of chief interest at every brightness level are (1) the lowest perceptible brightness, (2) the faintest perceptible contrast, and (3) the highest comfortable brightness. Precise data on threshold, contrast and glare sensibility are given over the whole visual range (from 10^{-6} to 10^{+4} millilamberts). A new quantity, the discrimination factor, a direct measure of seeing quality, is defined.—*Transactions, Illumin. Eng. Soc.*, Dec. 30, 1916.

Apparent Brightness; Its Conditions and Properties.—Leonard Thompson Troland.—A paper read before the Illuminating Engineering Society. This paper is a discussion of brightness from the psychological and physiological points of view. Visual response is analyzed into successive stages, and the relations of apparent brightness with the "intensity factors" of these stages are considered. The measurement of the retinal image, the laws of variation of the sensitivity and selectivity of the retina for brightness, the Purkinje effect, and intensity factors in the optic nerve conduction are considered in the light of new experiments. Taken on experimental grounds the thesis is defended that brightness sensitivity as expressed by the ordinary "visibility curve" rests upon a single physiological process, which is independent of the mechanism of color perception. This proposition is applied to the problems of heterochromatic photometry in conjunction with the results of new measurements dealing with the methods of direct comparison and of flicker. The conceptions underlying the definition of "light" are analyzed from the point of view of the psychologist.—*Transactions, Illum. Eng'ing Soc.*, Dec. 30, 1916.

Generation, Transmission and Distribution

Westphalian Waterpower Plant.—E. Trieber.—An illustrated article on the Moehne Valley water-power plant in Westphalia in Germany. The Moehne a tributary to the Ruhr River, the flow of which is regulated by eleven reservoirs, the Moehne Valley reservoir being the largest, with a capacity of 130,000,000 cu. ft. of water. But as most of the water is only intermittently available the station must be worked in conjunction with some steam-power plant. The whole of the output of the hydraulic station is taken by the Westphalian Verband-Elektrizitätswerk in Dortmund, which also controls the working of the station. The greater part of the energy is transmitted at 25,000 volts over a distance of 33 km. (21 miles) to the town of Neheim, and thence to a transformer substation at Menden. Here there are four transformers, each with an output of 1500 kva., reducing the voltage to 10,000 for transmission a further distance of 38 km. (23 miles) to a power station at Kruckel, near Dortmund. The power stations at Kruckel and in the Moehne valley usually run in parallel. The yearly flow of water from the Moehne is about 255,000,000 cubic meters; about 53 per cent of this amount can be stored in the lake. The mean flow of water is about 7.8 cubic meters per second. The available fall varies from 33 m. to 13 m. according to the depth of water in the storage lake. The mean output may be taken at about 1200 kw., measured at the terminals of the generation, but as the output is only spread over the hours of the peak of the load the output is reckoned on a basis of four times this amount.

The Westphalian station, therefore, contains four machines, each of 1200 kw. capacity.—London *Electrician*, Jan. 19, 1917.

Installations, Systems and Appliances

Balancers for Three-Wire Direct-Current Systems.—THOMAS CARTER.—The first part of a full treatise on the design and theory of balancers for three-wire continuous-current systems for the use of students. The present installment deals with preliminary matters and gives the general theory of the balancer. After an introductory note the author deals with early three-wire systems, early types of dynamos for three-wire systems, the use of batteries as balancers, static balancers and rotary balancers, the three-wire system without the balancer, the equivalent resistance of a three-wire system, and the three-wire system with the middle wire connected to an elementary balancer. The article is to be continued.—London *Electrician*, Jan. 12, 1917.

Electrophysics and Magnetism

X-Ray Reflection and Atomic Structure.—A. H. COMPTON.—A highly theoretical paper on the intensity of X-ray reflection and the distribution of the electrons in atoms. In the first part of this paper an expression is derived for the energy of a beam of X-rays of definite wave-length which is reflected from a crystal. The result is in accord with that previously derived by Darwin, and shows that the intensity of the reflected beam depends not only upon the angle of reflection, but also upon the arrangement of the electrons within the atoms of the reflecting crystal. The form of the equation for the energy in the reflected beam is shown to be independent of the degree of perfection of the crystal and of the length of the wave-trains of which the X-rays consist. In the latter part of the paper a study is made of the possible distributions of the electrons in atoms which will account for the observed energy in the reflected beam of X-rays. It is shown that there is no possible distribution of the electrons which will lead to Bragg's empirical law for the intensity of reflection; it is found rather that any formula for this intensity must depend not only upon the angle of reflection, but also upon the wave length of the incident rays. Attention is called to the fact that Bragg's experimental data indicate differences in the reflection from certain crystals which can arise only from differences in the distribution of the electrons in the atoms of which the crystals are composed. Assuming a number of electrons in each crystal equal to the atomic number, and making certain plausible assumptions concerning the arrangement of these electrons in rings, it is found possible to account in a satisfactory manner for the observed intensities of the X-ray spectra. Although the particular distributions assigned to the electrons in the atoms of calcite and rock salt may not be the only ones which will account for the observed intensities of the X-ray spectra, it seems probable that these distributions are not far from correct. The results of this investigation seem to show conclusively that the electrons are not concentrated within a very small distance from the center of the atom, as is assumed in Crehore's theory of atomic structure. On the other hand, the conclusions arrived at are in good accord with the theory of the atom due to Bohr.—*Phys. Rev.*, January, 1917.

Units, Measurements and Instruments

Determining Transformation Ratio and Phase Lag in Current Transformers.—P. DE LA GORCE.—An illustrated description of a method for determining the ratio of transformation and the phase lag in commercial current transformers for various frequencies and for various adjustments of the constants of the secondary circuit. Fig. 3 shows the arrangement of the test. I_1 and I_2 are the primary and secondary currents of the transformer T under test. The primary circuit contains a non-inductive resistance R_1, an ammeter A_1 and the current coil of a wattmeter W_1, the potential coil of which is supplied from a voltage E_2. The voltages E_1 and E_2 are supplied by two machines coupled together in such a manner that the phase-angle between E_1 and E_2 can be adjusted to any desired value. The secondary of the transformer is closed through an inductance, L, and a non-inductive resistance, R_2, to represent the inductance and resistance of the measuring instruments supplied by the transformer; r and ρ are non-inductive resistances, and G is a vibration galvanometer. If the primary and secondary current were in exact opposition the determination of the ratio of transforma-

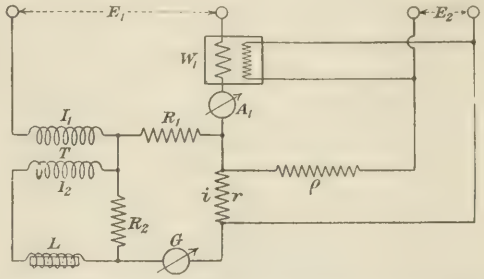


FIG. 3—ARRANGEMENT OF TEST FOR DETERMINING TRANSFORMATION RATIO AND PHASE LAG IN CURRENT TRANSFORMERS

tion would be given by the relation $R_1I_1 = R_2I_2$ if R_1 and R_2 were regulated until the galvanometer G gave no deflection. In reality the vector R_1I_1 makes an angle α with the vector R_2I_2 (supposed to be reversed) and a difference of potential equal to the vectorial difference between the two vectors is applied to the galvanometer. In order to bring the galvanometer to zero and measure α, the phase difference between E_1 and E_2 is adjusted until the wattmeter W_1 reads zero, thus showing that the current i in the resistance r is in quadrature with the current I_1, and then the resistance r and ρ are suitably regulated. Under these conditions we have

$$R_1I_1 = R_2I_2 \cos \alpha,$$

$$\tan \alpha = \frac{ri}{R_1I_1},$$

$$i = \frac{E_2}{r + \rho},$$

from which equations the ratio of transformation I_1/I_2 and the angle of phase displacement α can be easily deduced. Notes are added on several details of design and on precautions to be taken, and the results of tests are given. One result of these tests is that with the transformer in question doubling the secondary resistance changes the ratio of transformation by only 0.005, but that the angle of lag is considerably increased, especially at light loads.—From *Bulletin* de la Soc. Internat. des Elec.; July, 1916, translated in abstract in London *Electrician*, Jan. 12, 1917.

System of Remote Control for an Electric Testing Laboratory.—P. G. AGNEW, W. H. STANNARD and J. L. FEARING.—In a laboratory in which a large number and variety of electrical instruments are tested, it is important that means be provided for the rapid and accurate control of the electric generators which provide the current for testing. In this paper an elaborate system of this kind which is in use at the Bureau of Standards is described. The control rheostats are not handled by the observers directly, but are operated by small motors which are controlled from any one of several laboratory rooms by means of small, multiple-lever switches.—*Scient. Paper, Bureau of Standards*, No. 293, Oct. 12, 1916.

Readers' Views and Comments

Radiation from Helical Tungsten Filaments

To the Editor of ELECTRICAL WORLD:

SIR: In connection with the interesting discussion of the radiation from helical tungsten filaments, given in your issue of Nov. 25, 1916, page 1062, attention may be called to the issue of May 19, 1910, Vol. 55, page 1314, especially Fig. 2, which shows graphically the physical reasons why tungsten (and, in fact, all metals which have a lower reflecting power in the blue than in the red) radiates selectively in the visible portion of the spectrum in such a way as to make the amount of radiation relative to that of a black body greater in the blue than in the red. This is due to the fact that in the blue the absorption (100-reflection), and hence the emissivity, is from 8 to 10 per cent higher than in the red.

In March, 1914, the problem was presented to me to search the infra-red emission spectrum of highly incandescent tungsten wire in the form of hair-pin and helically wound filaments to determine whether there is a difference in the shape of the spectral energy curves. The 1914 data appeared in your issue of Nov. 28 (Vol. 64, page 1048). The measurements with the optical pyrometer were described in the terminology appropriate to that instrument, *viz.*, "apparent temperature." But it was not my intention to convey the idea that "this increase in brightness was the same as that due solely to increased temperature," for even at that early date experimental data (Worthing, *Phys. Rev.*, 3, page 67, January, 1914) indicated that the observed increase in brightness of some 40 to 50 per cent from within the helix could not be explained solely on the basis of a higher temperature within the helix.

The results of my first tests may be summarized as follows: (1) For reasons to be fully explained in a more complete paper the tests with the microscope pyrometer were not decisive enough to settle the question of reflection from within the helix. (2) The polarization test seems a fair test of this phenomenon (reflection), although some of the polarized light might be due to direct emission. (3) The infra-red tests show that the unsymmetrical spectral energy distribution is due to a great extent to "blackening" of the radiation by reflection within the helix, although some of this blackening might be due to crimping of the inside of the turn of the wire.

In more recent tests all the measurements were made on the same filament, by projecting an image of a small area of the inside or the outside of the turn of the helical filament, upon the spectrometer slit, which was cut down to 1×0.5 man opening. The results obtained are shown in Fig. 1, in which curve *I* gives the spectral distribution of energy radiated from the inside, and curve *O*, from the outside of the turn of the helical filament of tungsten mentioned in the previous paper. These data thoroughly prove that the increased brightness of the light coming from the inside of the turn of the wire is due to reflection of light coming from three or more adjacent turns.

Measurements made with a physical photometer indicated that the light coming from a given area within the helix was 1.87 times as bright as from a similar area on the outside of the turn. On the assumption that the reflecting power of tungsten is 52 per cent at 0.55ω, this increased brightness can be produced by the superposition of light reflected from (and emitted by) three adjacent turns. The computed intensity would then be 1.94 as compared with the observed value 1.87 just mentioned.

Using the observed energy curve, *O*, and increasing the radiation at various wave lengths by the factor for three reflections gives curve *A*, which coincides very well with the observed curve *I*, of the energy from the inside of the turn. This close agreement is especially marked in view of the fact that no correction is applied to the reflecting powers of tungsten, which were observed at room temperature. Now, it is well known that in the infra-red the reflection from metals decreases with rise in temperature. For example, at 2.5ω, where a value of $R = 0.84$ (20 deg. C.) was used, if the reflecting power decreased to $R = 0.80$ at 2300 deg. C. (which is not improbable) then the observed curve *I* and the computed curve *A* would coincide within 2 per cent, which is as close as the experimental data at this point.

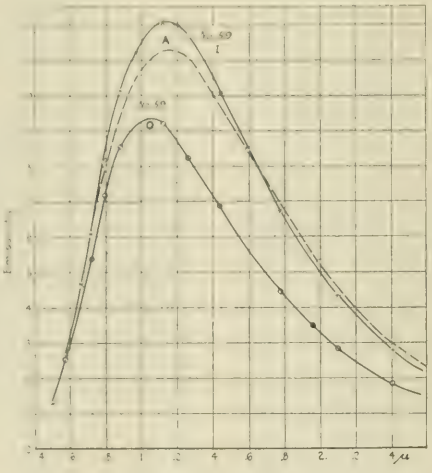


Fig. 1—Spectral distribution of energy radiated from the inside *I* and outside *O* of the turn of a helical filament of tungsten in a nitrogen-filled lamp.

To the writer the most striking thing is the increase in light efficiency introduced by actually increasing black body conditions when, as is well understood, an increase in light efficiency is to be sought by decreasing the infra-red radiation. In the present case the blackening of the radiation from the inside of the filament is 36 per cent greater than the radiation from the outside (in my previous communication this ratio was only 1.07, *i.e.*, 7 per cent greater, which was inconsistent with the idea of 80 to 100 per cent internal reflection). But since convection losses, in an incandescent hair-pin filament in a gas, cause a far greater dissipation of energy than that due to an increase in infra-red radiation (in reality a decrease in visual rays caused by reflection and absorption within the helix) introduced by winding this filament into a helix, we have in the present case an excellent illustration of increased light efficiency by increasing black body conditions.

W. W. COBLENTZ.

Washington, D. C.

Design of Dynamo-Electric Machinery

To the Editor of ELECTRICAL WORLD:

SIR: Your number of Oct. 21, 1916, contains what seems to be a criticism of a design of a 1000-kw. direct-current machine described in my book, "The Specification and Design of Dynamo-Electric Machinery." Prof. Alex. Gray is considering the most economical speeds of dynamos, without reference to the prime movers. Admittedly in this case, the ultra-high-speed motor or generator does not compare favorably with the moderate high-speed machine. But the 1000-kw. generator described by me is designed to meet the requirements of the steam-turbine designer, who can build a very much more economical turbine of 1000-kw. at 2750 r.p.m. than at 900 r.p.m. The saving in steam consumption alone would pay for the generator altogether. Provided a satisfactory 1000-kw. generator can be built to run at the high speed (and Professor Gray will admit that the constants of the machine in question are well within the limits prescribed by him), the question whether a gear should or should not be used between turbine and generator is one which is easily settled by considerations of first cost and efficiency. I think that the future will show that for sizes up to and including 1000 kw. at 600 volts it will be cheaper, more efficient, and generally more satisfactory to direct-connect the generator. The question largely turns upon commutator construction. With the right commutator construction, there is no difficulty in running at 10,000 ft. per minute. The brush drop at this speed can be made lower than is often found on low-speed generators. As for commutation, it is possible to make this highly satisfactory at these great speeds up to very much greater outputs than are at present contemplated.

MILES WALKER,

Professor of Electrical Engineering, The Victoria University of Manchester.

Manchester, England.

[This communication was inadvertently omitted from last week's issue, and should be read in connection with Prof. Gray's reply, appearing in that issue.—Editor.]

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

COUNCIL OF AMERICAN ENGINEERING SOCIETIES

Plans Under Way to Facilitate Co-operation Between the Engineering Societies and to Extend the Usefulness of Professional Engineers

At the annal convention of the American Institute of Electrical Engineers held at Cooperstown, New York, on June 24, 1913, Dr. William McClellan presented a suggestion for the engineering profession, to form a national body representative in its membership of all national engineering societies. All trade and business organizations were to be excluded and the object of the society was to assist in the realization of the ideals of the engineering profession and to extend the usefulness of the professional engineer as a servant of the community.

Any national society of professional engineers with or without associated grades of membership was to be eligible and representatives from these societies were to be elected annually. The new organization was to be supported by an annual assessment of members of societies on a per capita basis.

Among the functions then outlined by Dr. McClellan were the following: The engineering association was to arrange an annual convention of engineers for discussion of engineering in general, of the engineering profession and of any relative subjects except scientific and technical subjects such as would naturally and properly come before the meeting of member societies. The association would hold not less than two meetings each year at which the objects of the association would be discussed and recommendations forwarded to the member societies if desirable. It would investigate and report on with recommendations any subjects that might be referred to it by a member society. It would also appear at congressional, legislative or other hearings where it may be desirable for the purpose of assisting in a proper decision of questions affecting the public good. It would make recommendations at any time to public officers as to policy in relation to matters in which the engineering profession may be interested on its own account or on account of its share in responsibility for public progress.

An organization such as then outlined is now in process of formation and was referred to by President Buck of the American Institute of Electrical Engineers at the convention of that body in New York City this week. As outlined by President Buck the functions of this engineering council are to provide for convenient co-operation between engineering societies for the proper consideration of questions of general interest to engineers and to the public and to provide the means for united action of questions of common concern to engineers.

Although at this writing the actual formation of such a council has not been consummated it is generally understood that its organization will not be long deferred. Preliminary meetings have already been held and a tentative set of by-laws drawn up. Among the national engineering societies which in all probability will be eligible for membership are the following: American Society of Civil Engineers, American Society of Mechanical Engineers, American Institute of Electrical Engineers, American Institute of Mining Engineers, American Chemical Society, American Electrochemical Society, American Institute of Chemical Engineers, United Engineering Society, American Electric Railway Association, American Railway Engineering Association, American Society of Heating and Ventilating Engineers, American Society of Refrigerating Engineers, Mining and Metallurgical Society of America, National Electric Light Association, Society of Naval Architects and Marine Engineers, Society of Automobile Engineers, Aeronautical Society, Illuminating Engineering Society, and the American Gas Institute.

WATER-POWER LEGISLATION BY PRESENT CONGRESS UNLIKELY

Senate Conferees, Unable to Agree on a General Dam Bill, Are Discharged and Appointed as New Conferees

Senator Shields, on behalf of the conferees of the Senate, and Representative Adamson, on behalf of the House conferees, have presented to the two Houses of Congress a report that they are unable to agree on the general dam bill, with the implication that there is no chance of its passage by this Congress. After a debate in the Senate on the question of whether the conferees should be discharged, it was agreed that they should be, and Vice-President Marshall appointed new conferees, namely, Senator Shields, Senator Bankhead and Senator Nelson, to see what they could do in framing a new bill which might meet some of the objections of the House conferees, discharging the old conferees, who were the same men. The significance of this parliamentary move, is that the new conferees are not bound to abide by the old bill passed by the Senate, and they have the power to bring in a new bill.

When the report of the disagreement of the conferees was presented in the House of Representatives by Judge Adamson, the House agreed to accept the report and discharge the House conferees. No provision was made for naming new House conferees. The effect of this action was to send the papers in the matter of the bill back to the Senate, as the action was taken on Senate Bill 3331, popularly known as an amendment to the general dam act, which originated in the House, and for which Senate Bill 3331 was a substitute. This is the proposed amendment to the act of June 23, 1910, to regulate the construction of dams across navigable waters, and to provide for the improvement and development of interstate commerce.

It will be necessary under these circumstances for the Senate to bring in a new bill. There is now nothing before the House to consider.

The impression continues in Washington among the best-informed circles that there will not be any water-power legislation at this session of Congress. One well-informed man, who did not care to be quoted, stated to a representative of the ELECTRICAL WORLD in Washington on Wednesday night that it might be to the interest of advocates of water-power legislation to

concentrate upon those who are to be members of the next Congress, and to pay attention, in this connection, to the possibilities in general preparedness and defense measures, with a view to co-ordinating the interests of water-power legislation advocates and additional defense measures advocates. In view of the international situation it seems to be certain almost beyond the shadow of a doubt that an extra session of Congress, with the greatly changed new Congress in their seats, will be called. It is believed in Washington that the new Congress in all probability will be almost a continuing body.

INDUSTRIAL MOBILIZATION CONTINUES ON LARGER SCALE

Censorship Liable to Go Into Effect to Prevent Papers from Printing News of Activities in the Industries

The mobilization of industrial resources, as a consequence of the international situation created by Germany in the renewed threat of ruthless submarine warfare has continued in Washington during the past week. Perhaps it is more proper to say that this mobilization has continued on a larger scale throughout the country under the direction of the national government at Washington.

The Council of National Defense has held various meetings in Washington with its advisory commission. The council gave out a statement showing what the organization of its work will be, in the case of eventualities, and what its present preparedness now is, in which it is announced that Hollis Godfrey will be chairman of a section of the work devoted to science and research, including engineering and education; Howard Coffin will be chairman of a section which will be occupied with munitions and manufacturing, including standardization and industrial relations, and Bernard Baruch will be chairman of the section devoted to raw materials, minerals and metals.

Representatives of trades, business and professions are being asked to deal with these men directly for the discussion of problems in industrial mobilization which may affect the national welfare. The time is rapidly coming, a Washington correspondent of the ELECTRICAL WORLD reports, when there will be very little, if any, publicity given to these measures of industrial mobilization for national defense. In other words, a censorship is liable to go into effect any day. Already certain steps have been taken by the government in regard to censorship and the plans for an extension of this precaution are upon a scale which will preclude the possibility of business men obtaining news of their industries from the daily newspapers. Even now, the news sent from Berlin by wireless is being censored by the State Department before publication in this country, and the proposed act of Congress providing for a general censorship is ready for rapid passage by Congress. In these circumstances, the best Washington opinion is that leaders in industry will do well to place themselves in personal communication with the government, without waiting "for any eventuality."

Irrespective of the international political situation, which has heretofore seemed to be based upon a waiting policy, so far as the government is concerned, with the possible idea that an "overt act" might bring about eventualities, reports from Washington show that administration officials are beginning to take stock of the cumulative effect of incidents, which, one administration official said Wednesday night, are to be likened to "the whereases in the Declaration of Independence."

INADEQUATE APPROPRIATIONS HANDICAP PATENT OFFICE

Commissioner Ewing in His Annual Reports Outlines Conditions Affecting His Office and Asks for Increased Allowance

Protests against inadequate appropriations for the personnel of the patent office are voiced by Commissioner Thomas Ewing in his annual report to Congress on conditions at the office of which he has charge. The tremendous work and self-supporting character of the office are contrasted in his report with what the commissioner claims to be the utter indifference on the part of Congress. A doubling of present appropriations is recommended.

Having pointed out that the receipts of the office exceeded expenditures provided for by the last appropriations by $228,173.03, and that the office has succeeded in materially reducing the vast number of pending applications, Mr. Ewing vigorously protests against what he claims to be the failure of Congress to duly consider the important work which is carried on at the office.

"The conditions in the office respecting the examining corps have been steadily growing worse relative to the amount of work which the office has had to do during the last quarter of a century," says Commissioner Ewing in his report.

"In point of training the showing is excellent; 85 per cent of the examiners and assistant examiners are graduates of colleges or technical schools; 43 per cent are members of the bar and more than 11 per cent in addition have had a thorough course of study in law, and more than 20 per cent in addition are studying law, so that 75 per cent are either trained in law or are in course of training.

"But the comparison of the size of the examining corps in the year 1890 with the present time and of the extent of the searches at these two dates presents a deplorable situation.

"In 1890 there were 189 members of the examining corps, of whom thirty were examiners. The assistant examiners who make the searches numbered 159. Each assistant had to report on 251 applications per year.

"In 1916 the corps numbered 367, of whom forty-three were examiners and 324 assistant examiners. Each assistant must report on 210 applications per year."

Mr. Ewing goes on to point out by a series of comparative statistics that the force relative to the work which it has to do is less than 50 per cent to-day what it was in 1890 because of the greater volume of search now necessary.

"In order that such a situation may be met at all," he goes on, "it is absolutely essential that the best method of classification should be adopted, the classification completed and kept up to date. Yet when I laid all of these facts before Congress and pointed out, as indicated in an earlier section of this report, that at the present rate of reclassification now going on it could not be completed in under twenty-five years, I succeeded in obtaining no relief whatsoever. Every recommendation that I made during the past year has been refused.

"I can attribute this indifference of the Congress in respecting my suggestions to lack of information as to the situation, and I therefore submit for the consideration of Congress the following facts:

"This office deals with all the effort of the world in every field of industry to advance the useful arts."

The great interest involved in the successful conduct of the patent office, not merely of private, but of public

concern, are then illustrated by the commissioner by a series of examples.

"All of this vast development," he continues, "comes before the office to be passed on, not by a group of men with time to study and keep abreast of what is being done, but by men whose entire effort is devoted merely to the task of keeping up with the enormous flood of applications which they must pass on, and the mistakes and oversights, of which, under the circumstances, there are inevitably many, cause enormous disturbance of business.

"Our admirable system of granting patents on examination was established primarily to safeguard the public interest by the avoidance of unwarrantable grants. It was originated by this government eighty years ago. At that time the system, both in this country and abroad, was to make grants on registration.

"Since we adopted our present system in 1836 it has been adopted by other enlightened industrial nations.

"The Congress, by withholding adequate appropriations for this office, is, in effect, transforming our system into the old system of granting patents on registration, while at the same time the safeguards of a registration system necessary to the public interest are not provided.

"After a most careful study of the conditions in the office during the past three years I feel no doubt that it will pay the public without regard to the fees collected if the amount spent on the office were doubled."

EDISON CELEBRATES HIS BIRTHDAY WITH EMPLOYEES

Notable Men in the Electrical Industry Also Pay Him Homage, and He Is Presented with a Huge Birthday Cake Symbolizing His Chief Inventions

Many plans were proposed for the celebration of the seventieth birthday of Thomas A. Edison, but the only one which the ever-young and indefatigable inventor would entertain was that of his own employees out at the works at West Orange, where a great variety of miscellaneous industries have grown up under his personal direction and management, carried on in a group of vast buildings which are probably the best example that exist in the world to-day of cement structures of their kind.

The Edison birthday falling on Sunday, the dinner to celebrate it was held on Saturday, Feb. 10, and in order to secure space big enough for the purpose, a whole floor was cleared in the Edison storage-battery building, some 600 ft. long, where gathered about 1800 male employees, some sixty guests and old associates, and one woman—Mrs. Edison. The reception given to the "Big Boss" on his entrance to the huge dining hall was one long to be remembered for its enthusiasm. Several special features distinguished the occasion, including telegrams of congratulation to Mr. Edison from all parts of the world, among them being the following letter from President Wilson, regretting his inability to be present:

"I wish with all my heart that I might be present to take part in celebrating Mr. Edison's seventieth birthday. It would be a real pleasure to be able to say in public with what deep and genuine admiration I have followed his remarkable career of achievement. I was an undergraduate at the university when his first inventions captured the imagination of the world, and ever since then I have retained the sense of magic which what he did then created in my mind. He seems always to have been in the special confidence of Nature herself. His career already has made an indelible impression on the history of applied science, and I hope that he has many years before him in which to make his record still more remarkable."

One item was a testimonal casket from Missouri with 35,000 signatures, from the Governor of the State and citizens. A delightful poem was read from Charles L. Edgar of the Boston Edison company. A huge birthday cake was presented by John W. Lieb on behalf of



SEVENTIETH-BIRTHDAY CAKE OF THOMAS A. EDISON

the New York Edison Company, and all of the 1861 guests got a piece of the cake, which, however, strange to say, remained outwardly intact and uncut, it and its panels of Edison plants and inventions remaining complete for the real domestic celebration next day.

The cake was 40 in. in diameter or 10.5 ft. in circumference, with a height of 40 in. It had on it seventy miniature electric candles, lighted from Edison storage batteries, symbolic of Mr. Edison's seventieth birthday. On the top of the cake was the figure of Liberty lighted by a tiny incandescent lamp representing a torch. The general color scheme of the frosting and medallions on the cake was white, yellow-orange and ivory. The cake had three decorative bands, two with appropriate dedicatory inscriptions, and the band around the base containing twelve plaques symbolic of Mr. Edison's principal inventions, including the incandescent lamp, storage battery, moving picture machine, telephone, bipolar dynamo, electrolytic meter, phonograph, cement mill, cement house, stock ticker, electric locomotive. Four medallions with the bust of Mr. Edison and the official seal of the United States typified his patriotic service to the country.

Vocal and instrumental talent of all kinds was provided by the artists and employees connected with the affiliated Edison interests of the Orange works. The beautiful indirect lighting arrangements were furnished by the Edison Lamp Works of the General Electric Company at Harrison, N. J. The Edison band gave performances throughout the evening, including an original Edison march by its leader, Professor Campione.

A. I. E. E. MID-WINTER CONVENTION

Internal Temperature of Generators—Use of Reactors —Motor Control and Electric Strength of Air Among Important Topics Discussed

At the fifth annual mid-winter convention of the American Institute of Electrical Engineers held in New York City on Wednesday, Thursday and Friday of this week eleven interesting papers on a variety of scientific and practical engineering subjects were presented. The general scheme of the program, which facilitated the discussion of the problems brought up, was a grouping of the papers into a standards session, a protective devices session, an electrophysics session and two motor control sessions with a lecture on Thursday evening which took up engineering problems brought about by the present international crisis and a special talk on phases of modern physics. All sessions were well attended, the total registration being about 500 members and guests.

President Buck's Remarks on Engineering Co-operation

In opening the meeting on Wednesday morning President H. W. Buck reviewed developments in the industry since the general meeting last June in Cleveland, Ohio, and commented especially on the progress, brought about by engineers and scientific bodies which has resulted in a closer co-operation between engineering and pure science. He called attention to a recently organized section of the Society for the Advancement of Science which will be devoted to engineering problems and to the plans now under way for the creation of an organization that will be known as the Engineering Council for United Engineering Societies. This body will represent the interests of all existing societies and be the means through which all engineers can express themselves on public and engineering matters relating to human affairs. A new phase of co-operation open to all engineers which has been brought about by the present international crisis was also mentioned, namely, the assistance that can be rendered our government in carrying out preparedness plans. A committee of the institute will have charge of this work and all members through a general classification of their interests and ability will be given an opportunity to take active part in developments as they are worked out by the government.

Following President Buck's address, Dr. C. R. Mann of the Carnegie Institute of Technology outlined the report of the committee on engineering education which will shortly be presented in final form. Dr. Mann stated that the committee during the past three years has analyzed the basis on which engineering schools were started and has attempted to determine wherein their aims and work differs from the conception laid down by Professor Rogers for the Massachusetts Institute of Technology in 1860.

Standards Session

The paper on "Internal Temperatures of Alternating-Current Generators," by Ralph Kelly, scheduled for the Wednesday morning session, was ably abstracted in the absence of the author by Prof. Alex. Gray. The author discussed the theoretical considerations involved in the calculation and measurements of internal temperatures of machines to explain the wide divergence between internal and surface temperatures of different classes of generator stators. A method of calculation for internal temperatures was given which was based on simple heat laws and on data obtained from many tests. By means of tests and of parallel calculations, the effect on the internal temperatures of changes in frequency, core lengths, thickness and quality of insulation, armature current density and core densities was explained. The author pointed out that the difference in the internal temperature rises of generators of different frequencies is caused mainly by the difference in the core loss. He showed by data that in a 50-cycle generator the losses are considerably greater than in a 25-cycle generator both having the same core length and armature densities, with the core densities in the 50-cycle generators slightly smaller. The temperature difference in the two machines due to the increased iron loss caused by the higher frequency is accounted for nearly by the temperature rise in the lower section of the tooth.

It was explained that a change in core length affects the initial temperature in two ways. It changes the volume of armature material to be ventilated and to a lesser extent it changes the proportion of heat transmitted to the coil ends. Of the two effects the change of armature material to be ventilated with a change of core length is the most important. Current density has an important direct bearing on internal temperatures since it largely determines the heat loss that must be transmitted through the insulation. The tooth and core densities have a similar effect on the internal temperature as the generator frequency since both affect the copper temperature through the core loss. The author concludes his paper by stating that although the wide divergence between surface and initial temperatures of different classes of generators is regular and can be justified, it is plain that there is no one average figure that can be used for that difference for all classes of alternating-current generators.

The following took part in the discussion of this paper: H. G. Reist, Schenectardy, N. Y.; Prof. Comfort A. Adams of Cambridge, Mass.; W. F. Dawson, Lynn, Mass.; H. M. Hobart, Schenectady, N. Y.; and Prof. Alexander Gray, Ithaca, N. Y.

Professor Adams outlined the work of the standards committee of the Institute in promoting the need for a consideration of internal temperatures when rating generators and explained some of the differences of opinions held by operating engineers. He criticised some of the assumptions made by the author for the basis of his calculations as being difficult to determine and check. He referred particularly to the velocities of air moving over the surfaces considered and pointed out how difficult it is to employ constants or formulas that are accurate for machines of various types and proportions.

Mr. Dawson explained the value of temperature coils for checking armature losses. He also emphasized the need of considering windage loss which he maintained is about equal to the core loss, with the core loss from 2 to 2.5 times the copper loss.

Mr. Hobart substantiated the opinions of other speakers in reference to the difficulties in investigating accurately the internal temperatures of machines, stating that there is a variation of from 10 per cent to 20 per cent in results secured by the different methods which are available. He warned against placing too much faith in temperature detectors, explaining that their greatest virtue was reliability and as aids in indicating variations in temperatures, rather than furnishing a means of detecting accurately temperature values for hot spots. In commenting on the effects of frequency on internal temperature, Mr. Hobart stated that frequency times operating density was a rough measure of the core loss and therefore the internal temperature of machines of different types.

Professor Gray pointed out that the effect of insulation tightness was to make it possible to make use of higher copper densities for the same temperature gradient. He questioned the formula given by Mr.

Hobart that the core loss variation may be taken as the first power of frequency and density, pointing out that the curve of core loss against density is not a straight line as it might be inferred from such a relationship. He stated that high temperatures in machines are not new developments, some old machines having operated successfully mainly on account of liberal design and the fortunate use of mica insulation.

Electrophysics Session

At the session held Thursday morning, the three papers presented dealt with the following subjects: "Corona and Rectification in Hydrogen," "The Electric Strength of Air," and "Oscillating Current Circuits by the Method of Generalized Angular Velocities." The first paper, which was prepared by J. W. Davis, Urbana, Ill., and C. S. Breese, took up an investigation of the formation of corona in hydrogen between a wire and a concentric cylinder.

The aim of the second paper by J. B. Whitehead, Baltimore, Md., and W. S. Brown was to make a careful determination of corona-forming voltages for alternating and for positive and negative continuous voltages in the same apparatus and under the same conditions. The observations on the negative corona were found to give values higher than any heretofore obtained. Qualitative indications of the correctness of Townsend's theory of ionization by collision were given.

V. Bush, Chelsea, Mass., the author of the third paper, by generalizing Kirchoff's law obtained a simple method of determining generalized angular velocities, frequencies and decrements of free oscillation.

Motor Control Sessions

Four papers were presented at the morning and afternoon sessions on Friday, two dealing with the control of direct-current motors and two with induction motor operation. "Industrial Controllers with Particular Reference to the Control of Direct-Current Motors," was the subject of a paper presented by H. D. James, Pittsburgh, Pa., in which he outlined the results of a number of tests on standard motors equipped with automatic starters to investigate the conditions when a direct-current shunt motor is started from rest and the effect on: (1) the load driven by the motor; (2) the power supply; and (3) the motor operation. A number of oscillograph curves were shown for the performance of motors rated at 15 to 20 hp. at 230 volts.

The second paper on direct-current motors, written by K. L. Hansen, was a mathematical analysis of starting characteristics. Mathematical expressions for current, speed, torque and power at any time during the acceleration period were derived for a shunt, series or compound motor connected to a supply circuit.

A number of transient conditions existing in asynchronous machines immediately after certain changes in the circuit connections are made, were described in a paper by R. E. Hellmund, East Pittsburgh, Pa. The principal subjects which were considered are undesirable peak currents, which may be caused by the damping effect of the short-circuited rotor windings and the overvoltages, obtained with certain control arrangements.

In the paper by A. A. Gazda it was shown that continuous operation of wound-rotor induction motors with unbalanced external secondary resistance is feasible. The effect of such operation upon power factor and heating was discussed and curves were presented showing the performance of polyphase motors with single-phase secondaries.

Protective Devices Session

Two important practical papers presented at the protective devices session on Wednesday afternoon revealed the results of recent studies of the performance of current-limiting reactors with different layouts in hydroelectric and metropolitan generating stations.

According to J. Allen Johnson, Niagara Falls, the amount of reactance required for protective and disturbance-localizing purposes is of the same order of magnitude as that which will produce instability of synchronism, so no installation of reactors can be safely undertaken, at least in hydroelectric plants, without a thorough preliminary investigation. First of all the protective and localizing functions of reactors are quite distinct. The former, since all the evil effects of heavy current—mechanical forces, heating, etc.—are proportional to the square of the current, is measured in terms involving the square of the total reactance; and the latter is measured in terms of the first power of the reactance involved.

Considering the results of a short-circuit which originated within 600 ft. of Quarry Street station and was followed by another on the same line inside the station (Chicago), P. B. Juhnke said that the influence of reactors must be pronounced exceedingly beneficial. Despite the nearness of the disturbance to the Quarry Street station not a single piece of generating station apparatus was disabled as was almost invariably the case before reactors were installed. Even on the section directly affected everything was ready for immediate resumption of service as soon as the trouble was cleared. Furthermore, no evil results attended the operation of the system during and after the trouble; no oil switches failed; and, most important of all, comparatively little load was interrupted on the sections protected by the sectionalizing reactors.

The paper presented by Max H. Collbohm, Madison, Wis., pointed out the danger to which Y-connected transformers, connected with long transmission lines, are exposed through the building up of excessive potentials at the neutral under conditions of lightning disturbance. This, the author explains, is due to the neutral acting as a reflecting point and allowing the potential to build up to three times the individual potentials induced on the separate lines. As a remedy for such trouble, the author recommends the connection of a sphere gap between ground and neutral.

All three of the foregoing papers were discussed at the same time by F. H. Kierstead, Pittsfield, Mass.; H. R. Woodrow, New York; L. F. Blume, Pittsfield, Mass.; A. R. Cheyney, Pinellas Park, Fla.; W. R. Bullard, J. B. Taylor, New York; R. F. Schuchardt, Chicago, and Comfort A. Adams, Cambridge, Mass. Mr. Woodrow pointed out the advisability of basing the rating of bus reactors on some definite current—either that of one generator or the total carrying capacity of busbars. Mr. Cheyney presented a written discussion in which he emphasized the need of bus reactors and cited a few advantages of feeder reactors. Mr. Taylor called attention to the definite relation between synchronizing power and reactance. In addition he expressed the belief that Y-connected transformers are no more vulnerable to lightning trouble than delta-connected units and that the potential at the neutral will not build up to three times that impressed on the lines due to lightning disturbance just because three circuits join at the neutral. Mr. Summerhayes favored comparing the effects of reactors by basing their performance on that obtained when the synchronizing power is the greatest. Mr. Adams likened a bus reactor to a mechanical coupling between two generators. If the reactance is too low (comparable with a rigid coupling) the stress imposed on the machines and system during synchronizing may be severe whereas too high a reactance (comparable with a flexible coupling) may reduce the synchronizing power too much.

NEW OPPORTUNITIES FOR ELECTRICS FOR CITY USE

Central Station Executives and Engineers Discuss Plans for Extending Use of Electrics Through Co-operation with Manufacturers and Better Selling Methods

That conditions warrant the intensive development of the electric vehicle at this time was evident in papers and discussions at a conference of central station executives held at New York City on Feb. 14, under the auspices of the Electric Vehicle Section of the National Electric Light Association. The meeting was called by Chairman E. S. Mansfield of the Electric Vehicle Section to obtain an informal discussion of the problems before the electric vehicle industry, and to secure advice of central station officials on further steps to be taken in promoting the electrical vehicle.

The whole problem of city transportation, it was stated, is up before the minds of the public and there is an opportunity for the central stations to get a share of this business, especially in the larger cities. A better understanding of the merchandising problems of the vehicle were also brought out in the discussion. As a result of the meeting Chairman Mansfield announced that the executive committee will shape plans for special committees to take up the suggestions along the lines laid down looking especially toward an enthusiastic meeting at the May convention.

Opening the program of brief papers and addresses W. H. Blood, Jr., first vice-president of the Electric Vehicle Association, traced the history of the battery car and the commercial efforts attending its introduction. Looking toward the future, he urged co-operation with the manufacturers to bring down the first cost of electric vehicles, the reduction of rates for charging so far as possible, and perhaps the establishment of some universal battery exchange system to facilitate vehicle operation.

Co-operation of All Interests

Frank W. Smith, Jr., vice-president of the United Electric Light & Power Company, New York City, declared that the central stations of the country have already done much for the vehicle, but made a plea for further co-operation of all interests concerned in the development of electric vehicle business—the car manufacturer, the battery manufacturer and the central station. He spoke of the success that has attended the use of fleets of electric vehicles in cities, and cited the co-operative plan proposed by the Ward Motor Vehicle Company in a four-page advertisement in the ELECTRICAL WORLD of Feb. 10, a plan which, said Mr. Smith, follows closely along the lines of a plan which he himself had separately originated, but not published.

F. M. Feiker, editor of the ELECTRICAL WORLD, spoke from the standpoint of a daily user of an electric passenger vehicle, and recounted his own experience in securing charging rates and garaging service for his car. Mr. Feiker urged that manufacturer and central station think more in terms of the customer who is to use the car, and that study be given to ways to make it easy to buy and easy to operate the electric.

The City Transportation Problem

The magnitude of the transportation problem in the larger cities of the country and the opportunity thus opened for electric vehicle haulage, was presented by W. P. Kennedy, consulting transportation engineer, New York City, in a paper analyzing the electric truck problem from the viewpoints of (1) the present activities of the central station; (2) the electric vehicle as a staple for which there exists a demand; (3) the introductory work of earlier days; (4) comparison of growth of electric vehicle business with other accomplishments in the central station field, and (5) activities of central stations to develop applications of electric vehicles based upon value of revenue produced.

Mr. Kennedy produced figures to show that the electrics now in use in thirty-five industries aggregate in value $36,000,000, and, consuming 90,000,000 kw.-hr. per year, return to the central station industry at 4 cents per kilowatt-hour an annual revenue of $3,600,000. Data was also tabulated showing the income from the passenger and commercial electric vehicles already in use in each of the principal American cities, and the income which might be obtained by converting the local horse population into electric transportation on the basis of an estimated income of $100 per year per horse "electrified."

Proposals to Promote Vehicle Development

In summing up the brief addresses that made up the prearranged program, Chairman Mansfield enumerated some of the disadvantages which have been charged against the electric vehicle, and suggested measures to bring about a greater development of the electric vehicle business. At various times proposals have been made, for example, to have central stations take over the control of the local electric vehicle business, to install universal battery and garage service, to initiate an advertising and publicity campaign, and to inaugurate local electric taxicab service as a means of interesting the public in the electric vehicle.

W. H. Johnson, vice-president of the Philadelphia Electric Company, expressed his personal interest in the electric vehicle, and declared that the high initial cost of the electric can be overcome by salesmanship.

W. W. Freeman, vice-president of the Union Gas & Electric Company, Cincinnati, pointed out that where active work has been devoted to the electric vehicle, excellent results have been accomplished, and said he hoped that the good work might go on.

A. W. Young of the Public Service Electric Company, Newark, N. J., declared his confidence in the electric vehicle, and told about the success of the New Jersey company in holding its electric vehicle customers by means of its inspection service.

George B. Foster, Commonwealth Edison Company, Chicago, declared that the electric vehicle business is well worth the effort, and cited the results that are being obtained in Chicago. He admitted, however, that prejudice against the electric vehicle often exists within an electric company's own ranks, and pointed out that unless this is checked such prejudice may be imparted by the employees to the public.

The Electric in New York's Transportation Situation

J. W. Lieb, Jr., vice-president of the New York Edison Company, called attention to the opportunity before the electric vehicle, offering as it does a solution for the transportation problem in cities. "The terminal charges in a metropolis like New York," said Mr. Lieb, "often total more than the cost of haulage." Where electric vehicles are sold in fleets, said the speaker, battery difficulties are relegated to second place.

"Serious problems incidental to the high price of coal and the rising cost of supplies of all kinds, make these trying times for the central station executive," continued Mr. Lieb. With such officials preoccupied with their larger administrative problems, said the speaker, it is not likely that promotion efforts just at this time will secure the attention and results that might be accomplished under more normal condiions.

Frank W. Frueauff of H. L. Doherty & Company,

New York City, particularly emphasized the points of "a mental attitude of prejudice" against the electric, and the need for better salesmanship, both of which had been mentioned by previous speakers. Mr. Frueauff suggested that the latter problem is one which should be laid before the Commercial Section of the N. E. L. A. for the development of a selling plan. He urged that the central station executive impress upon his salesmen the idea, for example, that each horse-drawn or gasoline vehicle is virtually an isolated plant which might be replaced by electric power.

Referring to the objection of high first cost of the electric vehicle, P. D. Wagoner, General Vehicle Company, reminded the audience that an electric truck's life is from three to five times that of a corresponding gasoline truck, and urged that the price of the gasoline truck be multiplied by such a factor when making any comparison of the first costs of the two types of vehicle.

NIAGARA FALLS INDUSTRIES PLEDGE GOVERNMENT SUPPORT

Electrochemical Plants in Position to Be of Great Service—Additional Protection Given to Power and Industrial Properties

Large electrochemical and power industries at Niagara Falls and Buffalo, N. Y., have pledged their support to the government in the present situation with Germany. Assurances have been given that in the event of war these valuable plants will be turned over to the government if they are needed. Several months ago the Industrial Preparedness Committee completed a survey of industries at Niagara Falls, at the direction of the Naval Advisory Board. This information is now available to both the Navy and War Departments. Almost every chemical and manufacturing plant in Niagara Falls is making some product that can be directly or indirectly used for war purposes. The products of many of the electrochemical plants are used in the manufacture of explosives. There are other plants that can be converted into munitions factories without much difficulty.

Francis A. J. FitzGerald, president of the FitzGerald Laboratories, Inc., of Niagara Falls and president of the American Electrochemical Society, told a correspondent for the ELECTRICAL WORLD that the society is willing to co-operate with any government department regarding the products of electrochemical industries and their adaptability to war purposes. He said the public relations committee of the society has already offered its services to the government. Mr. FitzGerald is chairman of the committee and F. Austin Lidbury of the Oldbury Chemical Company and Dr. E. G. Acheson of the Acheson Graphite Company are members.

"Niagara Falls electrochemical industries are prepared to render an invaluable service to the War Department," said Mr. Fitzgerald. "Of course a shortage of electric power is now seriously affecting these western New York industries, but in time of need all available power could be diverted to their use."

Chlorates, which are manufactured at several of the upriver plants, are used extensively in the manufacture of explosives. One plant makes chlorine for the Du Pont Powder Company's Niagara Falls branch. Electrodes used in many Canadian munitions plants are the products of the Star Electric Company and the Acheson Graphite Company.

The Schoellkopf Aniline & Chemical Works, Inc., of Buffalo, the largest manufacturers of aniline colors and coal-tar products in the United States, can easily be converted into the manufacture of chemicals for explosives and munitions. The company is now involved in the erection of additions and improvements to its plant involving the expenditure of almost $5,000,000. This is one of the largest users of electric energy in western New York.

Since the situation with Germany has reached such an acute stage additional protection has been given to these large electrochemical and power industries along the American Niagara frontier. At the Niagara Falls Power Company the force of guards has been doubled, and no one without authority is allowed to approach the grounds. At the Hydraulic Power Company similar conditions prevail, and a special force of armed guards has been retained by the large Niagara Falls electrochemical industries, which are co-operating with each other in the matter of protection. Because of the absence of the Seventy-fourth Regiment and the Third Field Artillery of the New York National Guard from Buffalo, it is reported that two New York City regiments will be moved to the American Niagara frontier to protect important industries. Both Buffalo regiments are on the Mexican border.

CO-OPERATION OF ENGINEERS FOR DEFENSE AND RESEARCH

Government Should Spend Large Sums in the Encouragement of Research, Says Elihu Thomson at Boston Banquet

Readiness to co-operate with the government in all emergencies, was the underlying thought expressed at the eighth annual banquet of engineers of Boston and vicinity, held at the Boston City Club on Feb. 7. Prof. C. A. Adams of Harvard University was toastmaster, and 451 engineers representing all branches of the profession were in attendance. Richard A. Hale, president of the Boston Society of Civil Engineers, urged comprehensive work along the line of water storage development by co-operation among beneficiaries. President Ira N. Hollis of the American Society of Mechanical Engineers outlined the work of the National Engineering Council with respect to preparedness, and Professor Adams emphasized the importance of instituting engineering standards in symbols and terminology as a means of bringing all branches of the engineering profession together for the public welfare.

Dr. Elihu Thomson, consulting engineer, General Electric Company, spoke emphatically regarding the importance of research in the field of pure science as leading up to engineering developments and triumphs. The present emergency, the speaker declared, emphasizes the need of encouraging scientific investigation. "The United States has much room for improvement in this direction, viz., supporting research for its own sake," said Dr. Thomson. He cited Lord Kelvin as an instance of a scientist and engineer combined and brought out the point that had Lord Kelvin's advice as a physicist been followed in the operation of the first Atlantic cable, the initial failure would probably have been obviated.

To neglect our industrial needs now, Dr. Thomson pointed out, would amount to political suicide. We should have been prepared years ago for such a crisis, he said, but in a democracy discussion in public threatens the progress of necessary secret measures of defense, since an appropriation ordinarily cannot be obtained without exhaustive airing of particulars. We need a definite program laid out by engineers and followed with all speed. Our government should spend large sums in the encouragement of research and every higher educational institution should include science in

its curriculum. The encouragement of research cannot be carried to excess. Before closing, the speaker illustrated how discoveries in pure science have laid the foundations of subsequent engineering progress from the time of Davy to the present day.

Dr. Hugh Cabot of Boston addressed the meeting upon his experiences in charge of a Harvard unit in France, and the evening closed with an illustrated lecture on submarines by E. H. Ewertz, superintendent of the Fore River Shipbuilding Corporation.

ELECTRICAL PORCELAIN DISCUSSED

Authorities at Joint Meeting of American Electro-Chemical Society and Other Chemical Societies Outline Developments in the Ceramic Industry

At a joint meeting of the American Electrochemical Society, American Chemical Society, and the Society of Chemical Industry, held at the Chemists' Club, New York City, on Friday evening, Feb. 9, several noted authorities on the subject of ceramics spoke on the history and manufacture of chemical and electrical porcelain in the United States. Among the speakers were Dr. Binns, director of the New York State School of Clay Working and Ceramics at Alfred, L. E. Barringer, president of the American Ceramic Society and chief engineer of the department of insulation of the General Electric Company, and Dr. Bleininger, U. S. government expert on clays and clay products.

Dr. Binns gave a brief résumé of the history of porcelain manufacture and then explained and illustrated the methods used here and abroad in the making of porcelain. Mr. Barringer told, with the aid of lantern slides, how porcelain insulators are made in the General Electric Company's insulator plant. The furnace used in this plant is in the shape of a long, narrow tunnel, the heat being applied to the products in the central section from the sides and top. The molds are placed on flat cars that pass through the tunnel at a specified speed. While in the tunnel the molds are heated and cooled gradually by this method. This furnace has been in continuous operation fourteen months. He mentioned the properties of porcelain and also several drawbacks, such as brittleness, being easily cracked, cannot stand very high heat, therefore unsuitable for places where there are heavy arcs. Dr. Bleininger enlarged on the properties of porcelain from the chemical standpoint.

FIRE HAZARD OF HOUSEHOLD ELECTRICAL APPLIANCES

National Board of Fire Underwriters Calls Attention to Fires Caused by Careless Handling of Small Devices

The National Board of Fire Underwriters has called attention to a new form of fire peril which has caused much destruction. Because of their convenience, small electric devices, such as pressing irons, curling irons, toasters, electric pads or blankets, electric plate warmers, and electric sterilizers or heaters are now to be found in almost every community. If these were used with proper care the danger would be negligible, but, unfortunately, a portion of their users do not realize the peril of leaving them in circuit when not in use. In such cases these devices tend to become overheated, whereupon they are likely to set fire to anything combustible with which they are in contact.

According to the fire underwriters most of these fires are small, but the aggregate loss is large, and occasional instances show extensive damage. Fires of this class furnish a special peril to life, being most frequent in dwellings and often breaking out at night. A characteristic example is that in which an electric pressing iron is left upon the ironing board, with the circuit closed and then forgotten. In such a case the fire may not occur until some hours later.

This form of hazard is already assuming large proportions. The Actuarial Bureau of the National Board of Fire Underwriters in one day noted approximately 100 reports of fires from this cause, out of a total of 2000 losses in the day's reports, and it estimates that small electrical devices are causing fires at the rate of 30,000 or more in the course of a year.

Most of these fires, it is claimed, are entirely preventable, and are due to carelessness on the part of the user. Various "safety" devices have been added by certain of the manufacturers, and among them are some that are fairly effective, but there is one absolute precaution which, the underwriters say, should be borne in mind at all times by every user, namely, that of shutting off the current when the device is not in use.

CENTRAL STATIONS STRUGGLE WITH FUEL PROBLEMS

Two Companies Negotiating for Desirable Coal Properties to Insure Sufficient Supply at Reasonable Cost

In order to improve existing fuel conditions the General Gas & Electric and Eastern Power & Light Companies have taken under advisement the policy of furnishing fuel to their subsidiary properties through the purchase or lease of some desirable coal properties. A careful investigation has been made of certain coal properties and options taken on them. The closing of these options will depend upon tests now under way at the plants of subsidiary companies and under actual operating conditions.

The subsidiaries of the General Gas & Electric and Eastern Power & Light Companies are now using 250,000 tons of coal per annum, and the demand is constantly on the increase. It is felt that with relatively steady load conditions on the combined utility properties, provision for storage at the mines and the present storage capacity at the several subsidiary plants it will be possible to operate the mines at a uniform output during the entire year, so that with selling expense eliminated, these utilities should secure coal at a very favorable rate after Sept. 1, 1917.

Commenting on the fuel situation W. S. Barstow, himself a well-known utility man and consulting engineer and head of the companies in question, said:

"One of the most important items of expense which a large public utility company is obliged to consider is its fuel cost. In very large properties with high load factors, the coal item is the greater part of the operating expense.

"Prior to the European war the price of coal was fairly uniform, from year to year and season to season, owing to the comparatively quiet business conditions and a favorable labor situation. There was, of course, a natural upward tendency in price, due to the steadily increasing cost of labor and other factors of general progress, but these increases were readily absorbed by the steady improvement in power-house efficiency. But with the starting up of munitions plants, the suddenly increased demands of the shipbuilding industry, increased freight transportation and the springing up of hundreds of new manufacturing enterprises there was

brought about a condition in the coal industry which is without parallel and which is likely to continue for an indefinite period. With the demand for coal doubling every four years, under fairly normal conditions, it does not seem likely that the price will return to the basis of two or three years ago, even though the war should prove of short duration. In fact, it is not probable that anything short of a serious industrial panic will ever again bring coal back to its former price level.

"Up to the middle of last year many public utility companies were able to purchase coal at the mines at from 70 to 90 cents per ton. They are now paying an average price, on yearly contracts, of $1.55 per ton at the mines, and at the present moment no contract for future delivery can be made for less than $2.50 per ton. Those companies which are buying in the open market—and many of them must get part of their supply thus, owing to delays in delivery on contract coal—are paying from $4.25 to $5 per ton at the mine.

"Of course, the price to manufacturers has increased proportionately. But the manufacturer, when he finds it too costly to make his own power, has the central station with its fixed rates to fall back upon. Many have already done this. Many others are signing contracts for power who, a few months ago, gave scant attention to electric drive."

MASSACHUSETTS UTILITY PRACTICES LOOKED INTO

Rate and Contract Publication, Meter Standardization and Service Supply Discussed Before Legislative Committee

Publication of all existing rates and contracts for electric service, the transfer of meter supervision to the sealer of weights and measures, and the enforcement of electrical supply beyond normal limits of distribution were advocated in two recent hearings before the committee on public lighting of the Massachusetts Legislature, opposition being voiced by the Massachusetts Electric Lighting Association and other representative central station interests. F. J. Southgate, Worcester, Mass., a former electrical contractor, appeared in behalf of the printing of all rates and contracts by central station and power companies, with the date of publication on all schedules, the forbidding of changing prices prior to their posting and the filing of complete copies with the Gas and Electric Light Commission. The speaker contended that discrimination has arisen through the granting of special rates to contractors for window display lighting.

Upon request of the committee, Chairman A. R. Weed of the Gas and Electric Light Commission said that the statutes require the electric companies to furnish such information as the board requires relative to rates in vogue, and that in 1912 the commission issued an order requiring the filing of all schedules and special contracts and all changes in rates. In 1916 the order was reissued, as it appeared that in one or two instances it was not being fully complied with. These data are open to the public upon request at the office of the commission, and in view of the rapid advance of the electrical industry and the frequent changes in rates that are not only necessary, but desirable and in the public interest, the commission has not felt it necessary to recommend legislation requiring the printing of all rates in force. The board can apply to the courts in case any company disregards its instructions. The elimination of special contracts is proceeding in due course. Everett W. Burdett, for the Massachusetts Electric Lighting Association, said that at the time of the consolidation of the Edison Electric Illuminating Company of Boston and the Boston Electric Light Company, about 1500 special contracts were in vogue. These have been eliminated as fast as possible, until to-day only seven or eight remain.

W. Rodman Peabody, for the Turners Falls Power & Electric Company, objected to the proposed legislation on the ground that scarcely any two contracts for hydroelectric power are the same in terms, on account of the differences in conditions prevailing among customers of such companies. These companies are required to file such contracts with the Gas and Electric Light Commission, and in case printing should be required the burden would be very severe. The speakers on behalf of the companies disclaimed any desire to suppress rates, but contended that present provisions for their publicity are sufficient.

Meter Standardization

Placing all electric meters under the supervision of the sealer of weights and measures was advocated by the Dorchester (Mass.) Board of Trade. J. W. Cowles, superintendent of the department of installations Boston Edison company, explained to the committee the care taken to insure accuracy in meter service, emphasizing the factory, laboratory and installation tests conducted by the Boston company. On Feb. 1 there were 106,700 meters in service on the Edison system and the company now makes 75,000 routine tests of meters annually, the period ranging from two to twenty-four months per meter, depending upon size and type. In case of complaint against a meter, the records of the billing and accounting department are checked, after which a special test is made of the meter in service and reports made to the billing department and customer as to the finding. The customer is charged nothing for this test, but is informed that if he is not satisfied the meter can be given a check test by the Gas and Electric Light Commission at a cost usually running between $1.50 and $5. In case the customer is correct, he does not have the meet this additional outlay. On the Edison system seventy-five technically trained men are constantly engaged in meter testing, and demand as well as integrating meters are tested regularly.

Unprofitable Service Extensions

One of the bills before the committee required the Boston Edison company to furnish service within ninety days upon written demand whenever six residential customers on any street or private way where wires may be laid, owning property within 1000 ft. (of the street), and within 1 mile of existing service. L. L. Elden, electrical superintendent of the company, outlined the method of handling extensions of doubtful profit. In such cases, where one customer desires service, he is asked to guarantee a return on the cost of extension spread over usually from three to five years. The energy consumed is credited against his guarantee, and if other customers are connected, all their payments for energy are credited against the first consumer's guarantee. Only five guarantees were asked for by the company in the past year in the entire Edison territory of 600 square miles. Mr. Elden said that in general underground distribution costs five or six times as much as overhead supply. The guarantee is based upon yielding a fair return upon the investment, including maintenance and depreciation. Thus, a 250-ft. extension costing, say, $185, would be expected to carry a guarantee of about $27 per year, while the same length of underground extension, costing perhaps $800, would demand a return of $120. Renewal of the poles every twelve years would be necessary, but generally inside of two or three years the territory develops sufficiently to extinguish the initial burdens of the remote customer.

Commission Rulings

Important Decisions of Various State Bodies Involving or Affecting Electric Light and Power Utility Operation and Practice.

Illinois Commission Takes Stand That Ultimate Use of Service Determines Rate, Not Apparatus.—In the case of Redmond versus East St. Louis Light & Power Company wherein reparation is asked for alleged overpayments on electric bills for service rendered to a moving picture theater under a lighting rate instead of a power rate, the State Public Utilities Commission of Illinois takes a different position from that of the New York first district commission in Vandeau Amusement Company versus Edison Electric Illuminating Company of Brooklyn (1916-E. P. U. R. 1046), and follows somewhat the position of the Montana commission in Orpheum Theater versus Helena Light & Power Company (1917-A. P. U. R. 65).

The complainant's theater takes three classes of service from the respondent's mains, namely, general lighting, sign lighting, and spot-lighting for the moving-picture screen. To convert the electricity used for the moving-picture machine from alternating current to direct current, the complainant has installed a motor-generator set, which is metered on the alternating-current side, thereby throwing all losses upon the consumer. The complainant avers that this is a power service inasmuch as the motor-generator set is of itself a power device. The respondent avers that the use to which the moving-picture machine is put, lighting, should prevail as classification for the service.

The New York commission, in the Vandeau case, has held that this sort of service to moving-picture theaters is power. The Illinois commission holds that the ultimate use to which the service is put in reality determines the classification; and also holds that the service rendered the complainant's motion-picture machine approaches a power characteristic and should receive recognition as such in a properly classified rate.

In discussing classification of utility service, the commission says, in part:

"The question, therefore, may be narrowed down to one of whether the service in question is used for lighting purposes or for power purposes. Here again the obvious intent of the company in developing its schedule of rates and classifying the same must be considered, since these schedules return to the utility a certain net revenue, which, for the purpose of this proceeding, may be considered just and reasonable in amount. The reasons for making a different rate for lighting and power purposes are perhaps three in number. The first reason is because of differences in the customer's characteristics in utilizing the service, *i.e.*, the hours of use, the times of day and quantities used. The second reason is because of differences in the quality of service rendered by the company, due to the fact that voltage fluctuations for power service need not be confined within the limits required for adequate lighting service, and further due to the fact that the expense of maintaining the customer's installation may be dissimilar for the two classes of service. The third reason is because of differences which may exist in the value of the service to these classes of consumers, which takes cognizance of the costs at which the service might be replaced by other means and the relative advantages which such other means might possess for performing the desired functions.

"It must be appreciated that in developing rates to serve lighting consumers, and rates to serve power consumers, the characteristics and the character of service necessary on the average for each of these classes of consumers must be considered; that is, it is because the average lighting consumer and the average power consumer have different characteristics that the difference in the rates is permissible, and it would be obviously impracticable to compare the characteristics of an individual lighting consumer with the characteristics of an individual power consumer. Consequently, it would, therefore, be unfair to assume that a long-hour lighting user is entitled to power rates, since to give him such rates would destroy the average previously established for the lighting class of consumers, and in the case of a large consumer, might materially alter the characteristics of the class as a whole. It would appear that since the classification of rates is based upon these fundamental characteristics for the various classes of service, the manner by which the ultimate service is obtained or the intermediary which is used in obtaining it is not of great importance, provided the use of this intermediary does not materially affect the essential characteristics of the ultimate use of the service. An instance in which the use of the intermediary does materially influence these characteristics exists in the case of service rendered for charging storage batteries, since the conditions under which the batteries are ultimately used are in no way reflected in the conditions under which the utility service is used for charging the batteries.

"Power rates are not fixed because of the fact that power service is usually rendered to a specific piece of mechanical equipment called the motor, but are rather determined by the inherent characteristics which power applications have. Neither are lighting rates fixed by the fact that the electricity is purchased for application to the terminals of an apparatus for giving light, but are rather determined by the fact that the lighting consumers, as a class, have certain inherent characteristics in their use of the service, which go to determine the expense to the utility of furnishing the service."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public-utility companies.

Concurrent Negligence for Faulty Construction and Maintenance.—Where an injury from a collision is due both to a runaway horse and to the obstruction of a telegraph pole, both the runaway and the obstruction may be regarded as the proximate cause, but the runaway, though a proximate cause, will not relieve the telegraph company from liability, if the injury would not have resulted but for the negligent obstruction, it was held by the Court of Appeals of Kentucky (189 N. W. 707). Where a telegraph pole was out of line with the other poles, and was 4.5 ft. from the fence, and a foot from the traveled portion of the road, it was for the jury to say whether it was on or so close to the traveled way as to make it dangerous or unsafe for the traveling public.

Furnishing Safe Place to Work for Employees of Independent Contractor.—The Supreme Court of Vermont held in (99 A. 241) Richards vs. Consolidated Lighting Company that where the defendant arranged with a traction company to have such company remove its ashes as required, and the traction company engaged another to perform the work, a teamster of such third person carrying away the ashes, the defendant merely directing removal according to necessity, is not an employee of defendant for whose negligence it is liable. An owner does not owe to a person employed on his premises in the service of an independent contractor any duty to furnish a safe working place, yet as such employee is on the premises by invitation, the owner if retaining control must exercise reasonable and proper care to see that the premises are absolutely safe.

Compliance with Statute Not Evidence of Proper Construction.—While the laws prescribe certain rules for the construction of electric lines, compliance with the statute is not evidence of proper construction, it was held by the Supreme Court of Washington in Haas vs. Washington Water Power Company (160 P. 954) except in those particulars covered by the statute, so that evidence that by the use of lightning arresters the defendant electric power company's wires would have been so grounded as to prevent excess of current from entering appellant's premises on service wires is admissible. Where it appeared that the defendant took the only practical method of discovering the cause of trouble on its line, and there was a conflict in the testimony of its witnesses as to the amount of current turned on to make the test, whether the defendant was guilty of negligent operation was held for the jury.

Electrical Goods in Cuba.—A report on "Electrical Goods in Cuba," by Philip S. Smith, special agent of the government, has just been published by the Bureau of Foreign and Domestic Commerce. A copy of this publication, known as special agents' series No. 128, will be sent on receipt of 5 cents.

Cincinnati Company Makes Refund.—On account of a compromise reached between the city of Cincinnati and the Union Gas & Electric Company on the Cincinnati electric rate, the company is refunding to consumers about $30,000, representing the difference between the old rate and the ordinance rate over which the controversy arose.

Income from Electric Cooking.—The sale of energy by the Washington Water Power Company of Spokane, Wash., for cooking has made a notable advance during the past year, it was stated in the company's annual report for 1916. The present annual income from this source is in excess of $50,000, and it is expected that this will be doubled during 1917.

New Plant for Port Arthur, Tex.—According to an official announcement, the Port Arthur Light & Power Company will erect a new power generating station shortly at an approximate cost of $400,000. The plant, which will be built near the existing station, will be constructed on the unit plan, provision to be made for future extensions up to an ultimate capacity of 28,000 kw.

"Here We Are."—The first issue of a new company paper entitled "Here We Are" has been issued for distribution among the employees, officers and owners of the Georgia Railway & Power Company, Georgia Railway & Electric Company, Atlanta Gas Light Company, Atlanta Northern Railway Company, Suburban Gas & Electric Company of Decatur, Ga., and Carrollton (Ga.) Electric Company.

1917 New York City Electric Vehicle Handbook Now Ready.—The handbook showing the locations of all electric automobile charging stations in New York City and vicinity, published annually by the New York Electric Vehicle Association, together with route maps, is now ready for distribution. It will be sent free to any one requesting it. The 1917 edition has several features—information as to the maximum amperage and voltage available at different charging stations; the house service may be obtained, and prices charged for boosting. Besides this there are clear, concise instructions as to boosting, and the possibilities it gives to obtain additional mileage in short order. The maps in the pamphlet show a tremendous increase in the number of charging stations recently established within the hundred miles centering around New York City, and an increase also in the facilities of the stations already in existence to meet the constantly greater demands upon them. New York City's map, including the Bronx, is dotted with the little red squares that mean charging stations, while many of them are also fitted for garage service.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Tax on Energy Sold Outside City by Municipal Plant.—The Tacoma, Wash., city council has adopted a resolution favoring a gross income tax on city light plants for the sale of power outside city limits. This resolution seeks to eliminate one of the strongest arguments of the opponents to home rule legislation, allowing municipally owned utilities to sell water, light and power, or extend street car lines outside city limits. One of the strongest arguments against the bill is that city owned plants are not subject to taxation.

Lehigh Valley May Electrify Part of Main Road.—The Lehigh Valley Railroad is investigating the feasibility of electric operation of its main line, from Jersey City to Wilkes-Barre, about 176 miles, and the Mahanoy and Hazleton division, from Penn Haven Junction to Mount Carmel, about 52 miles. It is planned to employ the generating plants of the Lehigh Coal & Navigation Company at Harwood and Hauto, with the installation of new power units and necessary transmission system. The improvement is estimated to cost about $11,000,000.

Movement for Increased Adoption of Metric System Gaining Headway.—During the sixty-ninth meeting of the American Association for the Advancement of Science, in New York during Christmas week, 1916, a conference was held, designated the "metric conference," at which were present representatives of national business organizations, the United States Department of Commerce, and men prominent in engineering and educational work. The object of this conference was to discuss the Pan-American use of the metric system. Its outcome was the formation of a permanent organization to be known as the American Metric Association, to further the adoption of the international meter, gram and liter, which have been legalized in the United States since 1886. The officers of the association are as follows: President, George F. Kunz; first vice-president, Wm. Jay Schieffelin; second vice-president, E. P. Albrecht; third vice-president, O. E. Stanley; treasurer, Arthur P. Williams; secretary, Howard Richards, Jr., 156 Fifth Avenue, New York. The executive committee consists of H. V. Army, Fred. R. Drake, A. E. Kennelly, S. W. Stratton and W. P. Wilson. The association now maintains an office at 156 Fifth Avenue, New York, and is especially desirous of receiving catalogs of manufacturers who use the metric system for domestic or export purposes.

Public Utility Monopoly Bill Before West Virginia Legislature.—What is known as the Johnson bill, designed to prevent the duplication of public utilities, is now before the legislature of West Virginia. It provides that no permit shall be granted by the State Public Service Commission to a corporation to furnish telephone service in any municipality, or to furnish heat, light, water, electricity, transportation or other like service, when a similar service is already being furnished by another corporation, unless the commission finds that the public service will be promoted thereby. The bill has some bitter enemies in both branches of the Legislature, but apparently it is favored by a majority of the members of the House.

Bill to License Pennsylvania Electricians.—Among the bills introduced in the Pennsylvania Legislature was one which provides for the examination, licensing and registration of electricians in cities of the second and third class. The act defines the master and journeymen electricians. The bill provides that sixty days after the measure becomes a law it shall be unlawful for any master electrician or journeyman to carry on or work at the business of electrical construction. Application for a license must be made to the head of the electrical bureau. Licenses shall issue upon the approval of a board of examiners, who are to be appointed by the mayor and consist of the chief city electrical inspector, one inspector from the National Board of Fire Underwriters and two competent electricians of at least nine years' experience in building construction wiring, and not connected with the city government, who shall examine all applicants for license under the provisions of this act. Master electricians shall pay $5 and journeymen $1 as an examination fee.

A Bill to Create Water Power Development Commission for New York State.—Bill No. 698 has been introduced into the New York State Assembly and referred to the committee on ways and means, creating a water power development commission to consist of the State engineer and surveyer, the conservation commissioner, the attorney-general and the superintendent of public works, for the purpose of investigating the character, value and extent of location of surplus waters of the State available for power or other electrical developments. The sum of $40,000 is appropriated for expenses and salaries. The members of the commission shall serve without additional compensation, and shall report to the Legislature Feb. 1, 1918. It is expected that the measure will have the support of the majority party at Albany, it having been introduced in the Senate by Senator Sage, chairman of the Finance Committee. There has also been presented a bill amending Sec. 86 of the transportation corporations law, by prohibiting the charging or collecting of rent on electric meters either directly or indirectly by public utilities.

Dallas Club Discusses Storage Batteries.—An educational talk by G. L. Barrett, general manager, Willard Storage Battery Company of Texas, was given before the Dallas Electric Club and Jovian League on Feb. 5 on the subject of "Storage Batteries."

Street Lighting Specifications.—At a joint meeting of the Pittsburgh Section of the American Institute of Electrical Engineers and of the Illuminating Engineering Society on Feb. 13, W. E. Reed, consulting engineer, presented a paper on "Street Lighting Specifications."

Ohio Electric Light Association Meeting.—Arrangements are being made with the Cedar Point Resort Company to hold the annual convention at the Breakers Hotel during the week beginning July 16. It is the intention of the association to hold a five-day convention beginning Monday afternoon, July 16. The calendar of standing committee meetings for the remainder of the fiscal year follows: New-business co-operations, Dayton, March 14, and Youngstown, May 16; station operating, Cincinnati, April 24; transmission and distribution, Toledo, Feb. 21, and Canton, April 11; meter, Toledo, March 23.

Mid-Winter Meeting of Ohio Station Operating Committee.—The Ohio Electric Light Association station operating committee held its mid-winter meeting at the Hotel Ohio in Youngstown on Feb. 14. The following program was scheduled for the morning: "Selecting, Educating and Handling Power-House Labor," by H. W. Bromley of Youngstown; "Safety First in Power Plants," by Herman George, Youngstown; "Effect of Steel Mill Operating on the Method of Operating Stations," by Philip H. Marble, Youngstown. After lunch there were two inspection trips, one to the Lowellville plant of the Mahoning & Shenango Railway & Light Company, and the other to the Youngstown Sheet & Tube Company.

Kansas City Jovians in Civic Work.—The Jovian League of Kansas City, at its recent semi-monthly meeting, heard a report on the work of the Signal Corps from Kansas City at the border, by Ruby D. Garrett, captain of the company. Oliver Wroughton, a director of the Anti-Motor Thief Association, talked on the marked gain in co-operative activity among the civic bodies of Kansas City, mentioning the part taken by the Jovian League, and asked the League to appoint a representative on the central committee of the association, which is radically reducing the number of thefts of motor cars in Kansas City. The executive committee will appoint the representative. President P. L. Lewis announced the appointment of a committee to serve with a board the mayor is forming, to study the question of light and power supply for Kansas City, Mo. He named A. P. Denton of the Denton Engineering & Construction Company to act on the board, and E. L. Foutch of the B-R Electric & Telephone Manufacturing Company and R. D. Obermeyer of the General Electric Company to assist in preparation of data.

Associations and Societies

A complete Directory of Electrical Associations is regularly printed in the first issue of each month on the next-to-last text page.

Meeting of Connecticut Electrical Men.—The winter dinner of the Connecticut Get-Together Club of the National Electric Light Association will be held at the Hotel Bond, Hartford, on Feb. 19, at 6.30 p. m.

High Frequency Discharge.—E. E. F. Creighton, General Electric Company, delivered an address on Jan. 19 before the Detroit Engineering Society on the subject, "High Frequency Discharge." The lecture was accompanied by stereoptican views, demonstrations and experiments.

Radio Club of America.—At the Feb. 16 meeting of the club, Prof. L. A. Hazeltine of Stevens Institute of Technology presented a paper entitled, "Dielectric Losses and Capacity of Multilayer Coils." Following the presentation of the paper, discussion was opened on both this paper and on Professor Morecroft's paper, entitled, "Inductance and Capacity Phenomena," which was presented at the January meeting.

Northwest Electric Light & Power Convention Plans.—The program committee of the Northwest Electric Light & Power Association, of which M. C. Osborn of the Washington Water Power Company is chairman, at a meeting on Jan. 26 made an initial layout of the program of the annual convention to be held in Spokane, Wash., on Sept. 12, 13, 14 and 15 of this year. In the preparation of the program, it was decided by the committee that all papers should be of a composite nature, with an editor-chairman for each, and assistants selected from the best talent that can be secured from the various member companies, on the subjects to be discussed. To prevent duplication of ideas, the editor-chairman of each paper will present for the association's deliberations the ideas of the various members of his committee in one paper, the main idea being to eliminate all theories and confine themselves to the results obtained in practice. The Washington Association of Electrical Contractors and Dealers, which anticipates an attendance of 100, will hold its annual convention at the same time and place, namely, the Davenport Hotel, and will have a joint meeting with the Northwest association at the opening session, on Sept. 12 in the morning, at which time the usual address of welcome by the Mayor, a response, an address by the president of the association, and the reports of the committees will be presented and a paper by J. C. Ralston, a member of the American Society of Civil Engineers, entitled, "Aphorisms." The following program has been laid out: Wednesday, Sept. 12, in the afternoon, a paper on "Practical Central Station Salesmanship," the following committee, of which Lewis A. McArthur, Pacific Power & Light Company, is editor-chairman: George Bowen, Northwestern Electric Company; S. A. Hoag, Puget Sound Traction, Light & Power Company; H. W. Lines, Portland Railway, Light & Power Company; Lewis A. Lewis, Washington Water Power Company. Thursday morning, a paper on "How the Engineer Can Assist the Commercial Department," by the following committee, of which George E. Quinlan of the Puget Sound Traction, Light & Power Company is editor-chairman: E. H. LeTourneau, Portland Railway, Light & Power Company; A. S. Hall, Pacific Power & Light Company; D. F. Henderson, Washington Water Power Company; L. T. Merwin, Northwestern Electric Company. Thursday afternoon, a paper entitled, "Co-operation in Modern Home and Apartment House Wiring Practice," by the following committee, of which A. C. McMicken, Portland Railway, Light & Power Company, is editor-chairman: H. H. Scofield, Pacific Power & Light Company; J. R. King, Puget Sound Traction, Light & Power Company; F. O. Broili, Northwestern Electric Company; Foster Russell, Washington Water Power Company. Both sessions on Friday will be devoted to the report of the range committee. W. R. Putname, Utah Power & Light Company, Salt Lake City, Utah, will act as chairman of the committee on which will act S. M. Kennedy of the Southern California Edison Company and S. V. Walton of the Pacific Gas & Electric Company, and others who will be an nounced later by the chairman. In connection with the range committee report, a paper will be read by H. B. Peirce of the Washington Water Power Company, Spokane, Wash., on "Busbar Diversity of Ranges," compiled from data gathered from the study of residential feeders and other sources; also a paper by B. L. Steele, professor of physics at the Washington State College, entitled, "Comparative Tests of Coal, Kerosene and Electricity for Cooking," (a) "Cost of Typical Meal for Five Persons by Coal and by Electricity; (b) Cost of Cooking for Five Persons One Week, by Coal with Water-Back Attachment and Without Water-Back Attachment and with Electricity; (c) Efficiency Tests on Coal Range, Kerosene Burners and Various Electric Ranges." The "Experience and Wrinkles" paper read at the convention two years ago in Spokane, was thought to be of a great deal of value to the association, and will be revived this year, edited by Lewis A. Lewis of the Washington Water Power Company . These wrinkles are any devices, short cuts, methods or experiences which have been worked out and used to advantage in carrying out one's business. Mr. Osborn has stated that this is intended to be a convention, the program of which is made up by all the membership of the association.



R. E. LEE

Rufus E. Lee, who for many years has been general manager, secretary and treasurer of the Lee Light & Power Company of Clarinda, Iowa, has tendered his resignation to become effective March 1. Mr. Lee was connected with the company and its predecessors in the capacity of general manager since the business was started in 1902. The company at that time had less than 100 customers, and a plant of about 100-kw. rating. At the present time the system serves 2200 consumers in ten different municipalities from a plant rated at 1500 kw. The Lee Light & Power Company also operates a central steam-heating system, manufactures ice, and does a general cold-storage business. During his fifteen years in the central station business in Iowa, Mr. Lee has been a very active member of the Iowa Electrical Association, and during 1914 held the office of president of that organization. After March 1 he will reside at Cedar Rapids, Iowa, and will devote his attention to the operation of a large artificial ice plant in that city.

E. K. Sheble, who has been secretary of the Washington Construction Company, of Seattle, Wash., has resigned to join the organization of the Stone & Webster Engineering Corporation of Boston, Mass., as superintendent of construction. Mr. Sheble was connected with the Washington Construction Company for seven years, and was also connected with the engineering department of the city of Seattle for three years.

W. L. Goodwin, who was formerly Pacific Coast manager of the Pacific States Electric Company, has accepted a position with the General Electric Company at Schenectady, N. Y. At the farewell dinner tendered to Mr. Goodwin by prominent San Francisco electrical men the guest of the evening was presented with a handsomely engraved gold watch by the members of the Socket Club. At the annual banquet of the Pacific Coast Jobbers' Association at Del Monte, Cal., on Jan. 13, Mr. Goodwin's work in the interests of Pacific Coast business was also highly commended.

Men of the Industry

Changes in Personnel and Position— Biographical Notes

S. F. Bastow, who for the last four years has been joint manager of Bruce Peebles & Company, Ltd., Edinburgh, Scotland, has accepted the position of chief engineer to British Dyes, Ltd. Mr. Bastow's headquarters will be at Huddersfield.

J. C. Kirkpatrick, the president-elect of the Northern White Cedar Association, has for many years been one of the leading figures in the cedar-pole industry. He became identified with the pole trade about twenty-five years ago as general manager of the Pittsburgh and Lake Superior Iron Company when this company began cutting poles from its lands in the Northwest. In 1907, when the National Pole Company was formed to take over the cedar department of the Pittsburgh and Lake Superior Iron Company, Mr. Kirkpatrick assumed the presidency of both companies. He is also president of the American Cross Arm Company and is interested in other corporations.



P. H. PALMER

Phil H. Palmer, who was recently appointed general superintendent of the Indiana Railways & Light Company, with headquarters at Kokomo, Ind., has been connected with the Kokomo electric lighting and interurban property for the last thirteen years in various capacities, beginning as electrical engineer and superintendent of the lighting and power department for the predecessor company—the Kokomo, Marion & Western Traction Company. Prior to this, Mr. Palmer was for five years manager of the Bloomfield (Iowa) Electric Light & Water Company. Mr. Palmer succeeds T. C. McReynolds, former vice-president and general manager of the Kokomo property, who has removed to Arizona on account of his health.



A. S. HALL

Albert S. Hall has resigned his position as manager of the Hood River Gas & Electric Company of Hood River, Ore., to take up work with the Pacific Power & Light Company in the capacity of district manager. In his new duties Mr. Hall will make his headquarters at Pasco and Kennewick, Wash.

H. T. Glover, who was formerly sales manager of the Esterline Company, Indianapolis, Ind., has resigned. Mr. Glover's present address is 1841 Talbott Avenue, Indianapolis, Ind.

John H. Bunting, who for the last four years has been joint manager of Bruce Peebles & Company, Ltd., Edinburgh, Scotland, has been appointed general manager of the company.

E. J. Mehren, editor of the *Engineering Record,* has been elected first vice-president of the McGraw Publishing Company, Inc., publisher of the ELECTRICAL WORLD, succeeding Hugh M. Wilson, resigned. He will continue as editor of the *Engineering Record,* devoting to each position half of his time.

L. S. Small, formerly manager for the Texas Power & Light Company at Tyler, Tex., has become connected with the Commonwealth Light & Power Company as general manager of a group of twenty-two properties in the Central West, of which he will take charge about May 1. Meanwhile Mr. Small is doing engineering work for the General Engineering & Management Corporation in the South.

Obituary

James Terry, president of the Terry Steam Turbine Company of Hartford, Conn., died on Feb. 3, at the age of 44 years. Mr. Terry was born in Hartford and was graduated from Sheffield Scientific School of Yale University in 1895. He was the son of the late E. C. Terry, the inventor of the turbine, who founded the present company in 1906. James Terry, upon the death of his father about nine years ago, followed up the commercial development of the company, bringing it to its present successful stage.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

VOLUME OF INCOMING ORDERS FOR SUPPLIES MAINTAINED

Diplomatic Break with Germany and Consequent Probability of War Practically Unfelt in the Electrical Manufacturing Industry

No traces of that panicky condition which generally follows closely on the heels of any announcement of a break in diplomatic relations with first-class foreign powers were evident in the electrical manufacturing industry since diplomatic relations with Germany have been discontinued. Manufacturers of practically every kind of electrical equipment and allied apparatus were almost unanimous in stating that the volume of incoming orders had shown practically no shrinkage since the President's last note to Germany. There have been cases, however, it is known, in which, coincident with the President's message to Congress announcing his decision, incoming orders have dwindled practically to zero. However, in view of the fact that so many concerns have felt no change, it is not improbable that any changes occurring may be due to other than war causes and in which the cessation of incoming orders may be only of a temporary character.

Ever since Germany first publicly made her offer of peace, industrial concerns in this country have been in a panicky condition. Peace, it was realized, would bring about a falling market, in which the losses would be proportionate to the rapidity of decline. For that reason, buyers have been made to place long-time contracts. Sufficient time has elapsed, however, since that peace proposal occurred, for manufacturers to prepare, and it seems quite probable, in view of present circumstances, that any conditions incidental to any act of this nation affecting its international standing have been very largely discounted.

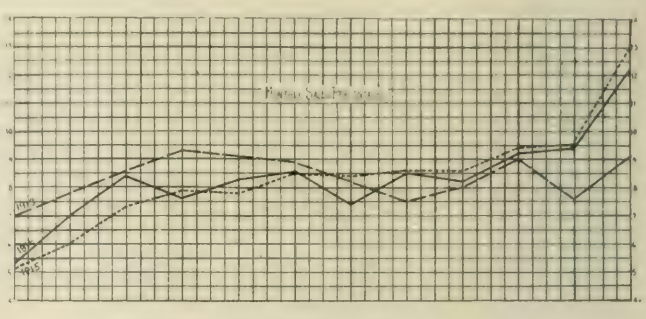
It is also doubtful if the people of the United States expect any such calamity to occur, if war is declared, as is now being enacted in Europe. In many minds, the declaration of war means another and greater industrial spurt. In that event, electrical buying would undoubtedly be very much greater.

1916 AS A JOBBING YEAR IN ELECTRIC SUPPLIES

Monthly Variations in Sales Compared with 1915 and with 1913 Show Little Resemblance to Conditions of Normal Activity

Above is presented a diagram showing the monthly variations in jobbing sales of electric supplies for 1913, 1915 and 1916. The points on these curves represent the percentage of the total year's sales made in each particular month. These three curves were selected in order to compare conditions existing during the pressure of an unusual volume of business with that of a normal year, 1913. In 1913 it will be noted the year opened up small, increasing to the spring peak in April, when it dropped off during the summer to a low point in August, and then increased again up to October, with a falling off in November and another gain in December. This is considered a normal curve. Here the spring building finds its reflection in the curve. There is always a great amount of building, particularly of outdoor construction, that begins in the spring, after the frost is out of the ground. There is also the annual drive for house-wiring prospects. These sales keep up pretty much till the hot weather sets in, when there is a decided drop. Practically all purchases have been made beforehand for any summer construction work, and, furthermore, the work is generally small owing to the great heat. Construction work becomes more active in the fall, and this is also reflected in the curve.

In 1915, however, it will be noticed the curve is generally one of ascending proportions. It will be remembered that the year 1915 opened after a half year of war, with industry practically at a standstill. There was little or no buying, money was scarce, and business therefore slack. Gradually, however, business worked up to the spring peak, but instead of following normal conditions the curve continued to keep upward as buying began to increase with the influx of war orders. From that time on to the end of



MONTHLY JOBBING SALES PERCENTAGES

the year business in electrical supplies became very brisk, particularly in the months of September, October, November and December, when the demand for all kinds of electrical machinery and supplies became acute.

The past year, which is the largest year ever experienced in the electrical industry, opened as the others with a small percentage, increasing to a spring peak in March, rather than April. This condition, however, it is probably true, was brought about by a further buying ahead than in previous years, in order to be assured of a satisfactory delivery. In April the sales dropped off, but the gains again increased to a peak in June. July was smaller, and August still larger, and from then on to the end of the year there was a gradually increasing curve, to an almost as large a percentage in December, 1916, as December, 1915.

It is thus noticed that the 1916 curve bears but little resemblance to the 1913 curve. In 1913 the sales followed the regular seasonal variations. In 1916, however, such was not the case. In 1916 frequently an anticipated rise in price caused buyers to flock into the market in order to buy on the rising market.

Since the accompanying curves depict national conditions, local jobbers, in making comparisons with their own curves, must take into consideration their geographic position. Thus Southern jobbers would find the spring peak coming earlier, while some of the Northern jobbers might find it coming later.

POLES PURCHASED DURING 1915

Telephone and Telegraph Companies Lead with Requirements of 1,680,880, Followed by Electric Railways, Light and Power Companies with Requirements of 1,430,122

Statistics of the number of poles purchased during 1915 in the United States by telephone and telegraph companies, steam and electric railroads, and electric light, heat and power companies have been compiled by the Forest Service through its office of industrial investigation. It is estimated that the figures given in the accompanying tables

represent between 90 and 95 per cent of the poles purchased.

Of a total of 4,077,964 poles purchased in 1915, as will be seen from Table I, 2,521,769, or 61 per cent, were cedar. The other woods in order of volume of sales were chestnut, pine, oak and cypress. Data for the years 1912, 1913 and 1914 have been omitted because statistics are not available. Compared with 1911, the last year for which statistics were available, 1915 sales represent an increase of 659,944 poles, or 16 per cent. The number of poles sold in 1915 is the largest reported in any single year.

The annual demand for poles, which now exceeds 4,000,000, the report states, is supplied principally from three different regions of the United States. The northern white-cedar region of the Lake States, the chestnut region of the

TABLE I—POLES PURCHASED IN 1915, AND FROM 1908 TO 1911, CLASSIFIED BY KIND OF WOOD

Kind of Wood	1915	1911	1910	1909	1908
All kinds	4,077,964	3,418,020	3,870,694	3,738,740	3,249,154
Cedar	2,521,769	2,100,144	2,431,567	2,439,825	2,200,139
Chestnut	651,643	693,489	677,517	608,066	516,049
Pine	546,233	161,690	184,677	179,586	116,749
Oak	199,442	199,590	265,290	236,842	160,702
Cypress	67,644	72,995	75,459	77,677	90,579
All other	91,233	190,112	236,184	196,744	164,936

Eastern portion of the country, and the Western red-cedar region of the Northwest, which includes Idaho, Oregon and Washington.

Most of the cedar poles purchased were the Northern white variety, which were purchased largely by telephone and telegraph companies and steam railroads. Electric railways, light and power companies, however, it was noted, purchased more of Western red than any other type of pole. These companies also had a large demand for pine poles.

Most of the pine reported was that commonly known as Southern yellow pine, and includes longleaf, shortleaf and loblolly. Western yellow pine was also reported in small quantities. Oak poles were purchased in practically the same manner as in 1911, while cypress poles showed a decrease. The use of cypress as a pole timber seems to be falling off each year. Cedar, chestnut and pine, together, formed more than 91 per cent of all poles reported purchased. The minor species reported were redwood, spruce, tamarack and osage orange. All of these, however, were reported in small quantities.

In Table II there is shown by years the number of poles purchased according to the class of purchaser and kind of wood. Telephone and telegraph companies were the principal purchasers, reporting more than 44 per cent of the total number of poles purchased. Electric railways and

TABLE II—POLES PURCHASED IN 1915, CLASSIFIED BY KIND OF WOOD AND CLASS OF PURCHASER

Kind of Wood	Total	Telephone and Telegraph Companies	Electric Railways, Light and Power Companies	Steam Railroads
All kinds	4,077,964	1,680,880	1,430,122	966,962
Northern white cedar	1,747,210	1,029,219	239,864	478,127
Chestnut	651,643	336,496	275,304	39,843
Western red cedar	567,770	105,590	422,312	39,868
Pine	546,233	69,787	388,210	88,236
White oak	177,799	34,644	13,110	130,045
Red cedar	117,545	21,386	8,424	87,735
Southern white cedar	89,244	16,661	14,686	57,897
Cypress	67,644	24,162	18,174	25,308
Red oak	21,643	6,912	13,001	1,730
All other	91,233	36,023	37,037	18,173

light and power companies purchased about 35 per cent of the total, while steam railroads purchased 21 per cent. A decrease of 721,844 poles, or 30 per cent, was reported by the telegraph and telephone companies, as compared with the number purchased by these companies in 1911, while the electric railways, light and power companies reported an increase of 642,473 poles, or 44 per cent. The steam railroads also reported an increase.

In Table III is shown the number of poles purchased, classified according to lengths and kind of wood. Poles are usually purchased in the round form, although occasionally a purchaser reported several species being sawed. However, these were of minor importance, and were either redwood or Western pine. The figures in the table have been divided into classes differing in length by 10 ft. Of the total number purchased, 2,768,135, or 67 per cent, were under 30 ft. Poles of these lengths are commonly used by telephone and telegraph companies. The poles under 20 ft. in length were reported chiefly by the rural telephone companies. Among the prominent woods reported under this classification were Northern white cedar, pine, and white oak. The number of poles ranging from 30 to 50 ft. in length aggregated about 30 per cent of the total, while those exceeding 50 ft. in length represent but a small proportion.

TABLE III—POLES PURCHASED IN 1915, CLASSIFIED BY LENGTH AND KIND OF WOOD

Kind of Wood	Total	Less Than 20 Ft.	20 to 29 Ft.	30 to 39 Ft.	40 to 49 Ft.	50 Ft. or More
All kinds	4,077,964	1,236,694	1,531,441	980,091	256,236	73,502
Northern white cedar	1,747,210	540,565	755,311	373,874	67,358	10,102
Chestnut	651,642	23,992	255,951	295,717	63,676	12,307
Western red cedar	567,770	17,874	314,010	139,041	71,608	25,237
Pine	546,233	373,688	69,931	65,004	23,914	13,696
White oak	177,799	120,393	33,550	16,120	5,998	1,738
Red cedar	117,545	94,997	14,870	5,624	1,541	513
Southern white cedar	89,244	4,414	13,282	49,264	15,734	6,550
Cypress	67,644	13,048	22,211	26,316	4,542	1,527
Red oak	21,643	3,737	16,341	1,280	139	146
All other	91,233	43,986	35,984	7,851	1,726	1,686

All of the leading woods covered by the table contributed poles of all lengths, although red oak contributed but a small per cent of the larger poles. More than half of the white-oak and pine poles were under 20 ft. in length.

In comparing the 1911 purchase of poles with the 1915 purchase, an increase of 832,966 poles under 20 ft. in length was reported, while the number between 20 ft. and 30 ft. showed a decrease of 330,375. The total number of poles purchased in the other lengths did not vary greatly from the 1911 figures, slight increases in all being reported for 1915.

COPPER MARKET QUIET

Few Sales of Large Blocks During Past Week at Prevailing High Prices

A few sales of 1,000,000-lb. lots of copper and over were reported during the past week at the prevailing high prices. There was no excitement, however, and the market continued its quiet tone. Prices are up 0.5 per cent from last week. There are some inquiries for first-half copper, but there is little or no activity in second-half copper.

There is a surplus of production over contracts for the second half year. Now, however, that the federal government is beginning to make preparations for war, should it arise, there is every indication that the surplus now seen will shortly be covered.

Under these conditions, there can hardly be any expectation of lower prices during the current year.

Quotations on Tuesday last for electrolytic were as follows: February, 34.5 cents; March, 34 cents; second quarter, 33 cents; third quarter, 30.5 cents; and fourth quarter, 29.5 cents.

NEW YORK METAL MARKET PRICES

	Feb. 6 Selling Prices Bid	Feb. 6 Selling Prices Asked	Feb. 13 Selling Prices Bid	Feb. 13 Selling Prices Asked
Copper	£ s d		£ s d	
London, standard spot	136 0 0		138 0 0	
Prime Lake	32.00	to 33.00†	33.00	to 34.00†
Electrolytic	33.50	to 34.50†	34.00	to 35.00†
Casting	29.50	to 30.00†	30.50	to 31.50†
Copper wire base	39.75	to 40.75†	40.50	to 41.50†
Lead	8.00		8.50	
Nickel	50.00		50.00	
Sheet zinc, f.o.b. smelter	21.00		21.00	
Spelter, spot	10.17½	to 10.42½†	10.42½	to 10.67½†
Tin, straits	55.00†		53.25†	
Aluminum, 98 to 99 per cent	51.00	to 53.00†	51.00	to 53.00†

OLD METALS

Heavy copper and wire	25.50	to 26.00†	26.00	to 27.00†
Brass, heavy	15.00	to 15.50†	15.50	to 16.00†
Brass, light	11.50	to 12.00†	12.00	to 13.00†
Lead, heavy	7.25	to 7.37½†	7.50	to 7.75†
Zinc, scrap	7.50	to 7.75†	7.50	to 7.75†

COPPER EXPORTS

Total tons to Feb. 13 11,719

†Nominal.

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Chemically Treated Sandstone for Switchboard Service

A natural sandstone which has been chemically treated to toughen it and make it impervious to moisture is a recent product of the Stone Base and Panel Company, 315 Schultz Building, Columbus, Ohio. It is claimed that this stone can be used wherever marble has been employed heretofore, being equal to marble in its resistance. It is said to have a fine texture, and is free from dry seams, metallic veins and other imperfections. Attention is also called to the fact that this stone is tough and strong and has a certain amount of flexibility which slate and marble do not have. This stone, which is made up in any size and thickness desired, with an even texture throughout, has been approved by the Underwriters' Laboratories.

Telescopic Crosshead Pin and Eccentric Oilers

The Richardson-Phenix Company of Milwaukee, Wis., has recently brought out a complete line of telescopic crosshead pin and eccentric oilers which contain many new features. In Fig. 1 the telescopic oiler is shown supported by means of a crossbar, *B*, and an upright, *A*, which is screwed directly into

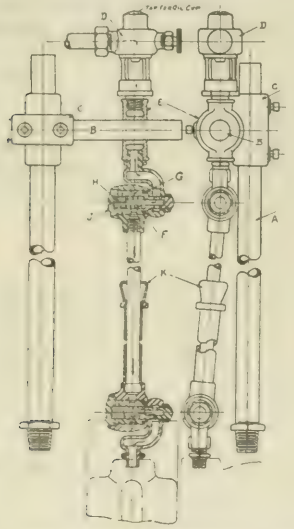


FIG. 1—GENERAL ARRANGEMENT OF TELESCOPIC OILER AND SUPPORTING STAND

the engine frame. These two bars pass through fitting *C* which provides for both horizontal and vertical adjustment. The oil is fed through the Richardson sight feed *D* connected directly to the oiling system, or when so desired the oil can be fed from an oil cup mounted on top.

The path taken by the oil after leaving the sight feed is indicated by arrows. It passes down through the go-round *E*, the top knuckle joint, down through the telescopic tubes, then through the bottom knuckle joint and then into the bearing.

Details of construction of the knuckle joint are shown in Fig. 2. An important feature is the method of keeping the joints oil-tight. A spiral steel piano wire spring (5) holds the two halves of the joint against the composition washer (8), which is inserted between the stationary parts (1) and (2) and the oscillating parts (3), (6) and (7). The outer end of the spiral spring bears against a hardened steel pin (6) in the cap (7). The joint is so designed that

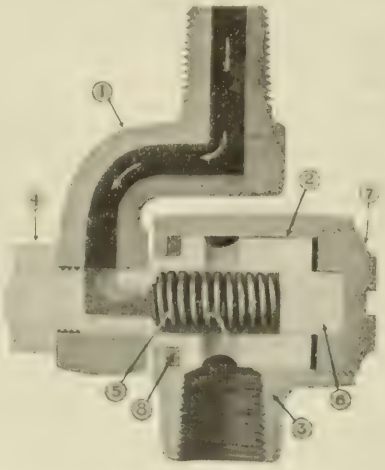


FIG. 2—DETAILS OF CONSTRUCTION OF KNUCKLE JOINT

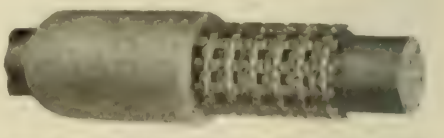
the bearing points of the spring are inside of the fittings, where they are protected from dust and grit and where they are continually flooded with oil, reducing friction and preventing wear. The spring automatically takes up for any wear which might occur, it is claimed, keeping the joint tight after years of service.

The knuckle joint is a bronze casting. All parts are machined to jigs or on automatic machines, insuring complete interchangeability. The telescopic tubes are annealed steel tubing. The upright *A* is 1 1/16 in. and the cross bar *B* ⅞ in. solid bars of cold rolled steel, accurately fitted to the openings in the fitting *C*.

A feature of the R-P telescopic oiler to which attention is called is that there are no outside springs or projecting parts which are unsightly, dangerous, and liable to catch in the waste used by the operator when wiping around the engine.

Cable Covering

A brick lath covering for electric cables in manholes as protection against fire, as well as against short circuits, is being made by the Composite Metal



METHOD OF APPLYING BRICK LATH TO PROTECT MANHOLE CABLES

Lath Company, 128 Broadway, New York City. This covering is made of a mesh of steel wire upon which ordinary brick or terra cotta has been baked in such a way as practically to inclose the wire. It comes in large sheets 40 in. wide and 16 ft. long, which can be cut into strips about 3 in. wide and wound spirally about the cable to be protected. A mixture of two parts sand to one part Portland cement is then wiped on by hand to a thickness of about ⅝ in. It is said that this covering can be easily applied in confined spaces such as are frequently found in manholes.

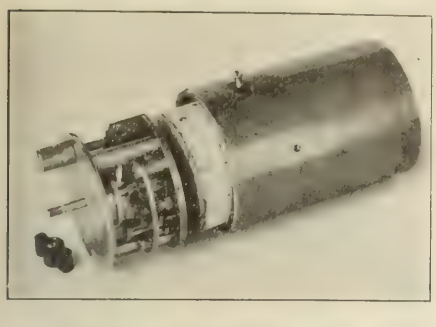
Combination Switch and Rheostat

An improved type of a liquid resistance device which is entirely automatic applies current gradually to a lamp or motor and requires the same attention as a snap or knife switch has been developed by W. B. Crossland of Merchantville, N. J.

The switch is composed of a wall box and flush plate, a cylinder which incases the container for the liquid and a time device carrying a cut-in for retarding the movement of the container to a predetermined time. The liquid container is divided by a perforated partition through the center. One compartment contains the electrodes which are tapered, and so arranged that the encroachment of the liquid on and around them lowers the resistance allowing the current to build up to normal, at which time the cut-in short-circuits the liquid. On the other hand, as the liquid leaves the compartment, diminishing and draining it from the electrodes, the resistance is increased until the circuit is opened. Then a cut-out performs its function by cutting the container entirely from the circuit.

To open the circuit the container is turned over a half turn with the electrode compartment up when the liquid

flows off, opening the circuit. The movement that turns the electrode compartment to the top and opens the circuit keeps the spring in the time device to a high tension, and also operates the cut-out.



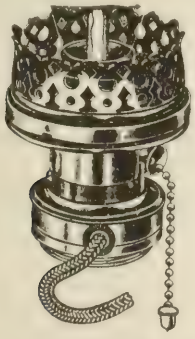
VIEW SHOWING PARTS OF COMBINATION SWITCH AND RHEOSTAT

To close the circuit, the time device is released by a push button and propelled by the spring, the device moves the container back one-half turn, placing the electrode compartment below. This immerses the electrode, relieving the resistance until the current is brought to normal as the time device firmly places the cut-out in its socket and short-circuits the liquid.

By the gradual application of the current to the lamp, it eliminates the over shoot, shock and sudden expansion relative to the instantaneous heating effect by carrying the lamp over its most trying ordeal and keeping the filament as far as possible from the fusing point the longest possible service is insured, defects in the filament will not materialize, and the burning hours of lamps containing filament from the same mixture will be consistent. When used in connection with motors it is impossible to start the motor other than slowly and evenly.

Oil Lamp Converter

The Plume & Atwood Manufacturing Company of Waterbury, Conn., is marketing a device designed to assist in the easy conversion of an oil lamp into an electric lamp. As shown in the

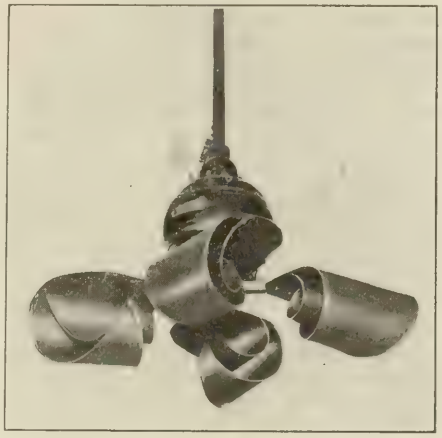


OIL LAMP CONVERTER WITH PULL CHAIN SOCKET

accompanying illustration, the device consists of a threaded collar which will fit into the burner socket of a No. 3 oil lamp, a standard electric lamp socket equipped with either a pull chain or a key, and an ornamental brass holder. Six feet of silk-covered cord and a separable attachment plug is also furnished with each converter. Adapters may also be secured, by means of which these converters can be used in sizes of lamps other than No. 3.

Ceiling Fan Blade

The four-leaf-clover fan blade shown in the accompanying illustration is a development in ceiling fan blades for circulating air in crowded rooms as restaurants and the like. These blades are made of thin sheet metal, suitably decorated, and equipped with standard castings, so as to be interchangeable with the blades of any of the standard types of fan motors. The action of these fan blades is the reverse of that of ordinary paddle designs. Instead of blowing down the hot air from the upper portions of the room on the head of the occupants, causing disagreeable drafts, annoyance from smoke, etc., fresh cool air from the lower part of the room is drawn up and distributed horizontally along the plane of the



FOUR-LEAF-CLOVER SHAPED CAILING FAN BLADE

blades. This action, it is said, greatly increases cooling effects through improved circulation. It is also claimed that because of the principle employed in the design of these blades, the amount of air handled is greater than that handled by any of the ordinary paddle blades, while the power consumption at the same speed is less. These fan blades are a product of the Roth Wind Power Ventilator and Fan Company, 18 East Forty-first Street, New York City.

Combination Table Stove

The combination electric table stove shown in the accompanying illustration consists of a steel stand and a rectangular deep water pan with cover, all nickel plated finish. The heater consists of two steel plates welded together and inclosing between them the heating element. The water pan and heater are provided with ebonized wooden handles and the latter contains the terminals of the heating element. Additional accessories furnished with this stove are a toasting screen and a broiling screen. The device is equipped with 6 ft. of flexible connection cord and a feed-through three-heat switch. A tray upon which to rest the stove during use is also included.

This appliance affords a very complete outfit as a combination frying pan, griddle or hot plate, and the three-

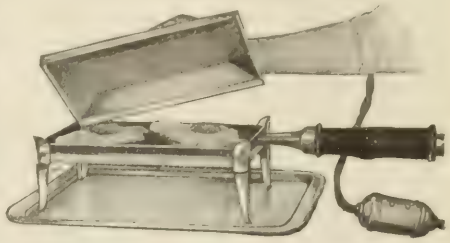


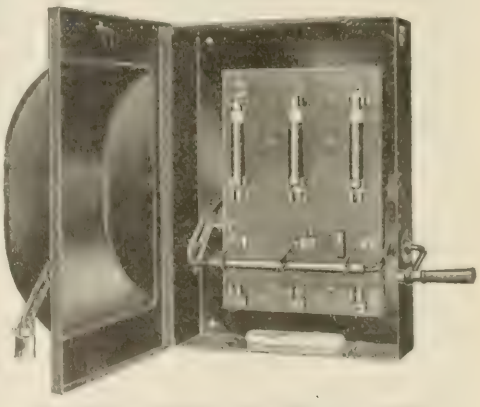
TABLE STOVE THAT CAN BE IMMERSED IN WATER FOR CLEANING

heat feed-through switch not only gives control of the temperature, but assists in preventing the use of unnecessary current. Another noteworthy feature to which attention is called is that the entire device can be immersed in water for cleaning. The Cutler-Hammer Company of Milwaukee, Wis., is the maker of this stove.

Motor Starting Switches

Steel inclosed motor starting switches designed for small three-phase motors have been developed by the Detroit Fuse & Manufacturing Company of Detroit, Mich. The switches are of the double-throw, knife-blade type with the running side arranged for fuses. A steel latch inside the cabinet prevents throwing the switch from off to running position without first being thrown into the starting position. This latch also makes necessary a quick change from starting to running position.

The switch is equipped with a lock-off device which prevents carelessness in closing the switch while someone is working on the line or apparatus controlled by the switch. This motor



STARTING SWITCH FOR SMALL THREE-PHASE MOTORS

starting device is furnished with star-delta starting connections, and when so used a separate main line switch must be installed ahead of the starting switch in accordance with the National Electrical Code.

Root Mean Square Current Meter

In order to measure the root mean square current expeditiously, accurately and economically, Mr. J. L. Davis in 1910 invented the original root mean square current meter. It has proven to be a very convenient and valuable instrument, especially in railway testing work, and should be equally valuable in the industrial field when variable current values are to be measured in terms of the root mean square value.

The measurement of current by this meter depends upon the generation of heat, by passing all or part of the current through a resistance immersed in a given quantity of water. Since the heat generated is proportional to the square of the current, the temperature of the water will (except for heat losses) be raised in the same proportion. Every change in current value will virtually be integrated, on the basis of the square of the current, at infinitely small time intervals, by the rising temperature of the water. Rapid radiation of heat is prevented by the use of a vacuum jar. To determine the r.m.s. current it is only necessary to observe the elapsed time and the rise in water temperature. By applying these values to current curves the r.m.s. current can readily be determined.

The principles on which this instrument is built free it from many of the difficulties of meters in which magnets and moving parts are employed. It will measure the effective or r.m.s. current values on either alternating or direct current and, unlike many alternating-current instruments, its accuracy is not affected by frequency, wave form, etc.

The original meter consists of a small coil supported by two small rods passing through a cork. The rods serve to conduct the current to the coil from the terminals on the top of the element. The thermometer is supported at the lower end by an insulating disc and metal clip. Originally, the top of the thermometer was held by the cork through which the rods pass. With this instrument it was necessary to remove the cork and element to read the thermometer, which permitted heat to escape. This, while not serious, had a slight effect on the accuracy of the instrument. This meter was arranged for use on direct-current only. The shunt was designed for three different current values.

The present meter as made by the Westinghouse Electric & Manufacturing Company has an element consisting of a resistance wire supported on porcelain insulators, mounted on a metal framework. The leads to the resistor are taken through the cork to terminals on the top of the meter. Heavy extra flexible leads are used to connect the meter terminals to the shunt or transformer secondary. The lower end of the frame holds four spring fingers which prevent the element from swinging sidewise and breaking the glass container.

In operation, the temperature of the water tends to be slightly higher at the top than at the bottom of the water column. A stirring rod, in the hollow tube which supports the framework of the element, is attached to two vanes, which, when moved up and down, thoroughly mix the water, causing a uniform temperature throughout. This is used previous to taking temperature readings.

A 100 deg. C. thermometer is provided with a special bushing, and is inserted through a hole in the cork until the bushing is seated in the lid and holds the thermometer firmly. When the thermometer is not in use, the hole in the lid is closed by a small cork attached to a chain. A standard vacuum jar is used to hold the water and element. In case of breakage, which is very infrequent, these vacuum bottles can be bought in the open market. Breakage is usually the result of accident or very rough usage, such as an ordinary voltmeter or ammeter would be unable to withstand without injury.

Special shunts are used for direct-current work. They are made of manganin, and are provided with removable covers, arranged to permit all connections to be made before putting the cover in place. This feature protects the operator and others from all live parts. The supporting straps are so arranged that the shunt can be placed on the floor and still get proper ventilation. It can also be mounted underneath the bottom of a car, or on a wall by means of ordinary wood screws or bolts.

With direct current it is permissible to use the instrument on 1500 volt circuits, the element and shunts being designed for this voltage. They can be used on any higher voltage, provided the instrument, shunt, leads and operator are properly insulated from the opposite side of the circuit. On railway motor equipments where ground return is used, the shunt should be connected in the circuit on the ground side of the motors. This gives maximum safety and permits the use of the meter on the highest voltage.

On alternating-current the instrument is applicable to any voltage, provided a series transformer with standard insulation is employed.

For making a test on direct-current apparatus, a shunt of the proper capacity is connected in the circuit carrying the current to be measured. Where the r.m.s. current values are sufficiently low the meter is connected directly in the circuit. For alternating current, a series transformer with a 5-amp. secondary is used instead of a shunt.

A definite quantity of distilled water, at a temperature of approximately 20 deg. C., is put in the vacuum jar at the beginning of the test. When starting with the water at this temperature, the instrument can be kept in the circuit for a period of approximately ten hours, provided the r.m.s. current does not exceed the rating of the element or shunt. As a matter of fact, the test can be started with the water at almost any temperature which will permit it to be finished without bringing the water too near the boiling point. A correction factor is applied for initial temperatures which are more than 5 deg. C. above or below an initial temperature of 20 deg. C. Simultaneous readings of water temperature and time should be taken at frequent intervals. In tests on railway equipments, these readings can be taken at such points as will facilitate the determination of r.m.s. currents for any section of a run. In fact, in any class of variable load work, the time of taking the readings can be so arranged that the r.m.s. current can be obtained for the whole period of test, or any intermediate period, or combination of periods.

The calibration curves are determined by passing a constant current through the meter and plotting the results of these readings, separate tests being made for each current value. These curves show only the current which passes through the element. Assume that with a 50 amp. shunt in the circuit, the temperature rise for the first five hours of the test is 25 deg. C. The curves show that the r.m.s. current through the element is 3 amp. Multiplying this value by 15 (the multiplier for this particular shunt) gives a value of 45 amp. for the r.m.s. current in the main circuit.

It is said that the effect of radiation and conduction of heat from the bottle is slightly greater at the higher temperatures. In the ordinary test, the final temperature of the water will usually not be over 60 to 70 deg. C. (40 to 50 deg. rise above an initial water temperature of approximately 20 deg. C.). In the usual test the effect of radiation of heat will be relatively small, being approximately 6 deg. in a period of ten hours. The average test will not cover more than two to six hours.

This meter is most valuable under varying load, varying cycle conditions. These conditions are probably more prevalent in railway work than in any other line; but industrial, mill and mining work undoubtedly follow as a close second. In each class of work there are motors and generators working beyond their thermal capacity; while on the other hand, there are probably as many which are not working up to their full rated capacity. In either case the over-all operation is inefficient. The first, because the life of the insulation is short, and repair bills in general are unnecessarily high. The second, because these machines are not operating at their maximum efficiency; and in the case of motor cars the excess weight must be transported at a loss, to say nothing of the excessive first cost, due to purchasing an oversized machine. These conditions can usually be avoided, or remedied, by knowing the actual load conditions under which the apparatus is working. In railway work this applies to equipments for locomotives, cars, substations, power stations, etc., either alternating or direct current.

In industrial, mill and mine work the instrument can be used to great advantage in checking the load on motors for blooming mills, bridges, hoists, cranes, ore bridges, building elevators, mine locomotives, mining machines and auxiliary motors of all kinds.

Trade Notes

E. TUCKER, who recently retired as vice-president of the Greenwood Advertising Company (Western), has formed a new company under the name of the Tucker Electric Sign System for the purpose of designing, manufacturing and leasing electrical advertising signs and accessories. Mr. Tucker's new headquarters will be at 1112 West Sixteenth Street, Los Angeles, Cal.

ALLEN & GARCIA COMPANY, Chicago, Ill., announces the establishment of a power department which will be in charge of C. M. Garland. The electrical work in connection with this department will be handled as at present by W. C. Adams. The work of the department will consist of consultation, design, construction, operation and the scientific management of power properties, steam, gas and electrical, together with appraisals and reports.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has recently taken a long lease on and now occupies a large four-story building situated on the corner of Thirty-sixth Street and Tenth Avenue, New York City. The entire building is being utilized as a service station, repair shop and warehouse. While the former shop, located at 512 West Twenty-third Street, was equipped to handle repairs of every kind, type and size of electrical machinery, and was one of the largest in New York City, employing about seventy men, it was inadequate to care properly for the demands made upon it.

BOUND BROOK OIL-LESS BEARING COMPANY of Bound Brook, N. J., announces the election of its second vice-president, Spencer Weart, as president, and the election of the general manager, George Oakley Smalley, as treasurer.

THE COMBUSTION ENGINEERING CORPORATION, 11 Broadway, New York City, announces the doubling of the size of its New York offices. This change was made to accommodate the increase in business due to the constantly increasing demand for its type E stoker for bituminous coal, and the Coxe stoker for anthracite coal. The company further announces the organization of six additional erecting units, each under the direction of a superintendent for field work, and the establishment of a service department under the direction of John Morris, who has been associated with the company since its organization. Mr. Morris will have under his direction a corps of competent engineers who will keep in constant touch with the trade with the idea of rendering the customers of the corporation, free inspection and engineering service at all times. The company closed the last year (1916) with more than three times as much business as it had ever done in any one year before, and with orders booked ahead for delivery far into the coming year.

RADIO OUTFITS ADMITTED FREE OF DUTY.—The "incalculable benefits" of wireless telegraphy are so great that tariff duties should not stand in the way of free entry of radio apparatus, was the decision of the United States Court of Customs Appeals recently handed down in the case of the Government owned Panama Railroad Company, which operates a line of steamships between New York and Canal Zone points. From the testimony it appeared that the wireless stations installed on the boats in 1912, following the enactment by Congress of a law requiring ocean passenger vessels to be equipped with radio apparatus, proved unsatisfactory, and by 1914 had, according to expert testimony, become "old-fashioned." The company ordered wireless outfits constructed in a foreign country and shipped to New York, where later they were installed aboard the liners. The stations, as imported, were complete in every detail, including receivers, electrical apparatus and wireless outfit. A special agent of the Treasury Department reported to Collector Malone that, as the new outfit had been placed on "old" boats, the equipment was excluded from the tariff's provision for "all articles necessary for vessels' outfit and equipment," appearing in Subsections 5 and 6 of Paragraph J of Section 4 of the Tariff act of 1913. The collector accordingly demanded a 20 per cent tax as "manufactures in chief value of metal, not specially provided for," as appearing in Paragraph 167. The Board of General Appraisers sustained the railroad's claim for duty exemption, but the Government appealed. Judge Barber, who wrote the decision for the court, decided that in a strictly technical sense the replacing of the old by the new apparatus constituted a "repair" within the meaning of one of the provisions of Paragraph J.

THE GENERAL ELECTRIC COMPANY has recently organized an industrial service department to supervise education, employment, and provision of opportunities for advancement of employees at the Schenectady plant of the company, under the management of E. B. Merriam, for several years assistant engineer of the switchboard department of the company.

KANDEM ELECTRIC COMPANY, INC., distributer for Menominee Electric Manufacturing Company, has moved to 58-60 Reade Street, New York City.

J. G. WHITE & COMPANY, 43 Exchange Place, New York City, announces the election as vice-president of the company of Russell B. Marchand, formerly treasurer of the company; Douglas I. McKay, formerly assistant to the president, and Sanger B. Steel, formerly manager of Caine-Webber & Company, Chicago.

PRECISION INSTRUMENT COMPANY, New York City, announces that the Vincent & Gilson Engineering Company is representing them in New York at 30 Church Street.

WARD MOTOR VEHICLE COMPANY, Mount Vernon, N. Y., has put out a memorandum book of vest-pocket size. In addition to the usual information found in such books there are many tables designed to facilitate calculations. Anyone desiring a copy of this book will receive one by addressing the company.

Trade Publications

INSULATORS.—The Locke Insulator Company of Victor, N. Y., is distributing Supplement No. 1 to its "Insulator Book." This book presents ten designs of pin-type insulators for voltages ranging from 27,000 to 80,000.

RAILWAY SYSTEM.—The Strauss Inverted Elevated Railway System is described and illustrated in a bulletin recently issued by the Strauss Transit System, Inc., 185 Jefferson Avenue East, Detroit, Mich.

ELECTRIC APPLIANCES.—The Hotpoint Electric Company of Ontario, Cal., is distributing a list price sheet on Hotpoint electric appliances, superseding all previous issues.

ENGINEERING DATA.—Data for Central Station Engineers is the title of a bulletin now being distributed by the Metropolitan Engineering Company, 35 Vestry Street, New York City. This bulletin contains forty-five pages of interesting and useful data for the central station man.

SAFETY PRACTICES.—The National Council, Continental and Commercial Bank Building, Chicago, Ill., has prepared three safe-practices leaflets, entitled "Ladders," "Stairs and Stairways" and "Boiler Rooms." These leaflets are presented in loose-leaf form and discuss accident hazards and the best practices for their elimination.

BANK TELLER'S MACHINE.—The Teller Protector Company, Inc., of Richmond, Va., has issued a booklet descriptive of its Teller's Protector Machine.

PIPE STANDARDS.—The National Tube Company of Pittsburgh, Pa., has prepared and is distributing an appendix to its 1913 edition of Book of Standards. This contains tables and useful information pertaining to tubular goods as manufactured by this company. For the most part, the information in this book is supplementary to the first book, but in several cases it replaces other data entirely. The book contains almost 200 pages of useful information.

SOOT BLOWERS.—"Increasing To-day's Profits" is the title of a book recently published by the engineering department of the Diamond Power Specialty Company of Detroit, Mich. The book is of special interest to the man who is responsible for the economical operation of the power plant. The various points discussed are illustrated making the text easily understandable. The text is written to interest both the technical man and the person who is not acquainted with the technical phraseology. This company has also issued new editions of Bulletins 118 and 119. The first describes in a very interesting manner the new metal Insuluminum, with high heat resisting qualities and which is used in the construction of the Diamond Soot Blowers for water-tube boilers. Bulletin 119 describes and pictures the Diamond Mechanical Soot Blower system for water-tube boilers.

New Incorporations

THE DEKALB (Mo.) LIGHT & POWER COMPANY has been chartered with a capital stock of $16,500 by R. D. Reed, William Call and H. L. Graves.

THE ELECTRIC LIGHT & POWER COMPANY of Ferdinand, Ind., has been incorporated by William R. Sauer, John P. Reinacker and Richard Eiberg. The company is capitalized at $10,000.

THE SOUTH DAKOTA HYDRO-ELECTRIC COMPANY of Pierre, S. D., has been incorporated with a capital stock of $15,000,000 for the purpose of developing the water power of the Missouri River by the erection of a large dam at Big Bend. George W. Adams of Council Bluffs, Iowa, is at the head of the company.

THE DIXIE ELECTRIC COMPANY of Sumter, S. C., has been incorporated with a capital stock of $3,000. The officers are: Young Shackleford, president, and B. C. Wallace, Jr., secretary and treasurer.

THE OSTERBURG (Pa.) LIGHT & POWER COMPANY has filed application for a charter for the purpose of supplying electricity for lamps and motors in St. Clairsville, Osterburg, Imler, King, Claysburg, Sarah Furnace, Sproul and surrounding territory in Bedford and Blair Counties. The incorporators are: D. O. Rohm, W. H. Rohm and John H. Zinn.

THE W. S. BARSTOW MANAGEMENT ASSOCIATION of New York, N. Y., has been incorporated by O. C. Swenson, J. B. Taylor and W. S. Barstow of Great Neck, N. Y. The company proposes to manage and supervise public utility properties, light, heat and power plants.

THE ELECTRICAL MANUFACTURING COMPANY of Wilmington, Del., has been incorporated with a capital stock of $250,000 by F. O'Keefe, George C. Steigler and E. E. Wright of Wilmington, Del. The company proposes to manufacture electrical devices for cleaning, polishing, etc.

THE NEW JERSEY ELECTRIC & AUTO SUPPLY COMPANY of Newark, N. J., has been incorporated to manufacture electrical goods for automobiles. The incorporators are: Jerome J. Rafferty, H. L. and M. B. Doolittle of Newark, N. J.

THE EMPIRE SALES COMPANY of Newark, N. J., has been incorporated by J. W. Palmer, H. A. Reeves and W. Hagney. The company is capitalized at $125,000 to manufacture motors.

THE STORAGE BATTERY SUPPLY COMPANY of Hackensack, N. J., has been incorporated to manufacture storage batteries. The incorporators are: G. R. Williams, 313 Main Street, Hackensack, N. J., William J. Hurst and W. J. Dailey.

THE HERZOG LAMP COMPANY of Union Hill, N. J., has been incorporated, with a capital stock of $25,000, by Edward J. Simon, 149 Palisade Avenue, Union Hill; John T. Simon and William F. Herzog. The company proposes to manufacture incandescent lamps.

THE EFFICIENCY ELECTRIC COMPANY of East Palestine, Ohio, has been incorporated, with a capital stock of $30,000, by A. J. Wayman, L. M. Keyes, William G. Morris, J. C. Chamberlain and R. N. Chamberlain.

THE J. T. CRAIG ELECTRIC COMPANY of Crafton, Pa., with a capital stock of $5,000, by J. T. Craig, P. J. Morgan and James Rooney of Crafton.

THE ARROWHEAD ELECTRIC COMPANY of Milwaukee, Wis., has been chartered, with a capital stock of $25,000, by A. U. Stetten, L. E. Fichan and E. W. Passmore.

THE MAXWELL ELECTRIC COMPANY of Steubenville, Ohio, has been incorporated, with a capital stock of $10,000, by R. B. Maxwell and others.

THE NATIONAL ELECTRIC COMPANY of Jacksonville, Fla., has been incorporated, with a capital stock of $5,000, by R. B. Murphy, R. L. Chamberlain and C. E. Gervais.

THE FLAGG MARINE SIGNAL COMPANY has been incorporated under the laws of the State of Massachusetts, with a capital stock of $100,000, to manufacture the Flagg safety fog horn, invented by J. Walter Flagg, treasurer of the Worcester (Mass.) Loan Company, and electrical supplies. It is not yet decided where the plant will be located.

New England

RUMFORD, ME.—Preparations are being made by the Rumford Falls Power Company for the installation of two 5000-kw. (each), 11,000-volt generators. Charles A. Mixer is superintendent.

YARMOUTH, ME.—The town of Yarmouth has applied to the State Legislature for permission to construct and operate a municipal electric light plant.

BOSTON, MASS.—Bids will be received by the schoolhouse commissioners of the city of Boston, 1st City Hall Annex, Boston, until Feb. 23 for construction of an Elementary School for upper and lower grades, Oliver Wendell Holmes District, Harvard and Glenway Streets, Dorchester, Boston, Mass. A deposit of $25 will be required for a complete set of plans and specifications. For a set of heating and ventilating or electrical plans with specifications a deposit of $15 will be required.

CHELSEA, MASS.—Plans are being considered by Mayor Edward E. Willard for the installation of a municipal lighting and heating plant for the City Hall, central fire station and public library.

PROVIDENCE, R. I.—Plans are being considered by the City Council to utilize the waste water that will run over the large water supply dam at Kent, now under construction, to generate electricity for lighting the streets of the city of Providence. R. L. Brunet, engineer of the city public service board, has been authorized to secure data as to the amount of water that will pass over the dam.

SOUTH NORWALK, CONN.—An extensive system of ornamental lighting, covering nearly 2 miles of streets, is under way with the expectation that it will be completed this year. Steel standards and low-wattage Mazda C series lamps will be used. Plans are being considered for a new generating station for the South Norwalk Electric Works, to be located on property already acquired on the local harbor front. Albert E. Winchester is general superintendent.

Middle Atlantic

BROOKLYN, N. Y.—Bids will be received by the President of the Borough of Brooklyn, Room No. 2, Borough Hall, Brooklyn, until Feb. 21 for furnishing and installing the mechanical equipment of the sewage pumping station at Morgan Avenue and Maspeth Avenue, section No. 3, of storm sewers and sanitary sewers in Maspeth Avenue. Blank forms and further information may be obtained at the office of Bureau of Sewers, 215 Montague Street, Brooklyn.

BROOKLYN, N. Y.—Bids will be received by the Department of Health, Centre and Walker Streets, New York, until Feb. 21 for furnishing material and labor required in connection with alterations and other work in the kitchen building at Kingston Avenue Hospital, Borough of Brooklyn, as follows: (a) Kitchen equipment and platform scale; (b) refrigerators; (c) gas and electric lighting fixtures; (d) electric dumbwaiter; (e) electric freight elevator; (f) plumbing and gas fitting. Plans may be seen and further information obtained at the above office.

BUFFALO, N. Y.—Plans are being prepared by the Central Star Laundry Company for the erection of a power plant at 21 Northland Avenue. R. J. Reidpath & Son, Builders' Exchange, Buffalo, is architect.

CANISTEO, N. Y.—Orders have been placed by the Up-to-Date Advertising Company of Canisteo for electric generators of 150 hp. to supply electricity to operate its entire plant. The plant will be equipped for electrical operation throughout. J. H. Anderson is manager.

HAMBURG, N. Y.—Extensive improvements are contemplated by the Intervillage Electric Company of Hamburg to its plant and transmission lines in Erie County, involving an expenditure of about $10,000. The work will inculde the construction of a new power house in Hamburg, and the erection of additional electric transmission lines between Hamburg, Depew and Lancaster. The Intervillage Electric Corporation and the Depew, Lancaster & Buffalo Electric Company of Depew contemplate consolidating their lines for the more economic distribution of power. Both companies secure energy from the Niagara, Lockport & Ontario Power Company.

KINGS PARK, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until Feb. 28, for construction, heating, plumbing, drainage and electric work for Employees' Home at Kings Park (N. Y.) State Hospital. Drawings and specifications may be consulted at the Kings Park Hospital, New York office, Department of Agriculture, Room 1734, Woolworth Building, and at the Department of Agriculture, Capitol, Albany. Lewis F. Pilcher is architect.

NEW YORK, N. Y.—Bids will be received by J. T. Fetherston, commissioner of street cleaning, Room 1211, Municipal Building, New York City, until Feb. 21 for furnishing as follows: Class (1) 31 gasoline electric tractors and spare parts, class (2) 31 gasoline tractors and spare parts. Blank forms and further information may be obtained at the above office.

NIAGARA FALLS, N. Y.—The contract for the construction of the new substation of the International Railway Company of Buffalo, to be erected at Twenty-fourth Street and Allen Avenue, has been awarded to Braas Brothers. The cost of building is estimated at $31,000 and the equipment at $150,000. This station will supply energy to operate the Niagara Falls street car lines and also for the International Company's new fast service line from Niagara Falls to Buffalo, now under construction.

PALMYRA, N. Y.—Bids will be received by W. W. Wotherspoon, superintendent of public works, Capitol, Albany, N. Y., until Feb. 20 for construction and equipment of a power station at Lock 29, Barge Canal, Palmyra, N. Y., under canal contract 141.

ROCHESTER, N. Y.—Application has been filed by the Rochester Railway & Light Company for permits to erect three buildings, to cost about $140,000. These structures will form part of the power plant now under way at the Lower Falls and will include a power station, 75 ft. by 90 ft.; operating house for dams, 25 ft. by 15 ft., and an intake and rack house, 36 ft. by 100 ft.

PHILADELPHIA, PA.—Work has begun on the erection of an addition (eight stories high) to the plant of the Electric Storage Battery Company, at the corner of Nineteenth Street and Allegheny Avenue, to cost about $500,000.

PHILADELPHIA, PA.—Plans are being considered by the Lehigh Valley Railway Company, it is reported, for equipping its main line from Jersey City to Wilkes-Barre, a distance of 176 miles, and the Mahanoy and Hazleton division from Penn Haven Junction to Mount Carmel, 51.8 miles, a total of 228 miles, for electrical operation, at a cost of from $10,000,000 $20,000,000.

PITTSBURGH, PA.—The Board of Public Education has sold to Allegheny County the South School, at Ross and Diamond Streets. The County Commissioners, it is understood, will erect a power house on the site.

PITTSBURGH, PA.—The City Council has adopted an ordinance authorizing the Mayor and the director of the department of charities to advertise for bids for the installation of an electric-light plant in the power house at Mayview and also appropriating the sum of $46,500 to pay for same.

ATLANTIC CITY, N. J.—Plans have been prepared by the Bell Telephone Company for the erection of a five-story telephone exchange building at Pacific and Mount Vernon Avenues.

BAYONNE, N. J.—A petition has been presented to the City Commissioners by the Lower Central Broadway Business Men's Association for the installation of a street-lighting system on Broadway from Tenth to Eighteenth Streets.

NEWARK, N. J.—Plans are being considered by the building committee of the Common Council for the installation of a high-pressure water system and electric-lighting plant at the East Side Public Bath, to cost about $12,000.

PERTH AMBOY, N. J.—The Public Service Electric Company will supply energy to the plant of the Roessler & Hasslacher Chemical Company on Fayette Street. An underground conduit system will be installed from the power station on Buckingham Avenue to the chemical plant.

BOONSBORO, MD.—The power house of the Antietam Power & Electric Lighting Company on Antietam Creek at Breathedsville was damaged recently by a large flywheel breaking loose.

OCEAN CITY, MD.—The Delmarvia Utility Company is contemplating changing its system to 60 cycle, three phase, 2300 volts in the next few months. H. T. Moore is manager.

CHARLESTON, W. VA.—The Fairmont & Clarksburg Power Company has applied to the Public Service Commission for permission to condemn land and construct four dams across the Buckhannon, Middle Fork and Tygart's Valley Rivers for the purpose of developing water power to generate electricity.

GRAFTON, W. VA.—The Grafton Gas & Electric Company contemplates the installation of new equipment, doubling the output of its plant, at a cost of about $10,000.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until March 12 for the installation of underground concrete oil reservoirs, piping, boilers, heaters, buildings, etc., at the naval station at Guantanamo, Cuba.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Feb. 26 for furnishing and installing one 1000-kw. direct-current turbo-generator at Portsmouth, N. H., and one 1000-kw. turbo-alternator at Charleston, S. C. Drawings and specifications may be obtained on application to the above bureau or to the commandants of the navy yards named.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Mare Island, Cal., schedule 721—48 vibrating bells, 30 steam brass whistles, 900 lb. copper wire; Schedule 719—3400 ft. plow steel wire rope; Schedule 713—one 30-in. motor-driven engine lathe. Philadelphia, Pa., Schedule 704—15 tool and carbon boxes, six searchlight projectors, 30 wooden reels to carry cable, 13,500 ft. double-conductor flexible cable, 1500 carbons for 30-in. lamps, 11 gasoline generator sets; Schedule 701—one air compressor; Schedule 712—24 water gages; Schedule 700—two main air pumps. Brooklyn, N. Y., Schedule 716—1800 lb. crankshaft, 28 steam traps; Schedule 703—furnishing and installing engine room, mechanical telegraphs; Schedule 711—21,500 ft. interior communication cable, 251,200 ft. single and twin-conductor wire; Schedule 702—two ringing dynamotors, one telephone motor generator, 141 fire control telephones, etc.; Schedule 697—miscellaneous insulating material. Washington, D. C., Schedule 707—34 steel recoil cylinders, miscellaneous tampions, sponge heads, rammer heads, etc., 206,742 lb. lapwelded steel tubes. Norfolk, Va., Schedule 712—miscellaneous seamless steel boiler tubes. Boston, Mass., Schedule 717—one engine outer telegraph system. Brooklyn, N. Y., Boston, Mass., Schedule 702—telephone switchboard. Applications for proposal blanks should designate the schedule desired by number.

North Central

GRAND RAPIDS, MICH.—A permit has been granted to the Consumers Company for the erection of an addition to its steam power plant on Wealthy Street, S. W., to cost about $68,000.

BLUFFTON, OHIO.—At an election to be held March 6 the proposal to issue $35,000 in bonds for improvements to the municipal electric-light plant and water-works system will be submitted to the voters.

CLEVELAND, OHIO.—The construction of a substation at 2162 Ashland Road, to cost about $300,000, is reported to be under consideration by the Cleveland Railway Company.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, Ohio, until Feb. 27 for surface condenser for the department of utilities, division of light and heat. Specifications may be obtained on application to the office of the division of light and heat, room 305, new City Hall.

DAYTON, OHIO.—Bids will be received by the Board of Education of the city school district of Dayton, at the office of C. J. Schmidt, clerk of board, until Feb. 27 for electric wiring, electric-light fixtures, vacuum cleaner, plumbing and gas fitting and heating and ventilating for the Cleveland School, located in Ohmer Park, Dayton. Bids will also be received at the same time and place for electric wiring, electric-light fixtures, vacuum cleaner, plumbing and gas fitting, and heating and ventilating for the Whittier School, located in Edgemont, Dayton. Plans and specifications may be obtained at the office of Albert Pretzinger and Edward P. Musselman, architects, 1155 Reibold Building, Dayton.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

FOSTORIA, OHIO.—The installation of a sprinkler system and construction of a new power plant is reported to be under consideration by the Seneca Wire & Manufacturing Company, of Fostoria.

JAMESTOWN, OHIO.—The plant and holdings of the Jamestown Electric Light Company has been taken over by the Dayton Power & Light Company. The local power plant will be closed down as soon as transmission lines to Jamestown are erected to supply energy from the Dayton power plant.

KENT, OHIO.—Plans are being prepared for rebuilding the local electric plant, which was recently taken over by the Northern Ohio Light & Traction Company. It is proposed to use the power house for a substation to distribute electricity for lamps and motors in Kent.

SCOTT, OHIO.—The installation of a municipal electric-lighting system in Scott is reported to be under consideration.

COVINGTON, KY.—The City Commissioners are considering the question of establishing a municipal electric-light plant in Covington.

MURRAY, KY.—The contract for construction of the municipal electric-light plant has been awarded to W. E. King, of Covington, Tenn.

BREMEN, IND.—Specifications are now being prepared for changing the municipal pumping system from steam to electric drive. E. R. Haus is superintendent.

INDIANAPOLIS, IND.—Bids will be received by the board of school commissioners of the city of Indianapolis, Ind., Wimmer Building, until Feb. 27 for work and materials in the Central Library, Meridian and St. Clair Streets, separate bids to be submitted as follows: (1) For construction and erection of the fixed and movable wood furniture and other joiner and cabinet work; (2) for furnishing and installing gas and electric-lighting fixtures. Plans and specifications may be obtained upon application to Paul P. Cret & Zantzinger, Borie & Modary, Architects, 139 South Fifteenth Street, Philadelphia, Pa., upon deposit of $10.

MONGO, IND.—The Farmers' & Merchants' Light & Power Company, of Mongo, has applied to the Public Service Commission for authority to issue $500,000 in capital stock, the proceeds to be used to purchase and improve five dams and water power plants on the St. Joseph and Fawn Rivers in Northern Indiana and Southern Michigan. The cost of improvements and hydroelectric developments is estimated at $278,250.

NAPPANEE, IND.—Work has been started on the installation of a 375-kva., 60-cycle, 2300-volt Westinghouse condensing turbine in the municipal electric-light plant. Myron D. Kizer is manager.

TIPTON, IND.—Improvements to the municipal electric-light plant, involving an expenditure of about $12,500, are under consideration.

CHICAGO, ILL.—The Turner Manufacturing Company, manufacturers of picture frames, has purchased an entire block on the Chicago, Burlington & Quincy Railroad on Ogden Avenue, one block west of Crawford Avenue, on which it proposes to erect a new factory, at a cost of about $225,000. The plans provide for a power plant, dry kilns and sprinkler system.

CHICAGO, ILL.—Bids will be received by the South Park Commissioners, Fifty-seventh Street and Cottage Grove Avenue, Chicago, until Feb. 21 for construction complete of an electric substation at Marquette Road and Hamilton Avenue, including sewer and electrical conduit. Specifications and blank forms may be obtained at the above office. J. F. Neil is secretary.

CHICAGO, ILL.—The Chicago Telephone Company has begun work on the erection of a new office building on Washington Street, between Franklin and Market Streets. It will be eleven stories high and will house the Main, Franklin, Central and Randolph exchanges. Work has also been started on a new building to be known as the Kildare office, which will serve a part of the territory now being handled from the Irving office. It is also proposed to erect another building to be known as the McKinley office, to be located at 2238 West Thirty-seventh Street. An addition is also proposed to the West office, to provide more space for switchboards. Plans for outside construction by the company provide for the building of a new tunnel to carry its cables under the Calumet River at Ninety-fifth Street, and another tunnel under the north branch of the Chicago River at Irving Park Boulevard.

DU QUOIN, ILL.—The proposal to install an ornamental lighting system in the downtown district will be submitted to the voters this spring.

GIBSON CITY, ILL.—Bids, it is reported, will be received by the city clerk, Gibson City, until April 1 for construction of water-works system and electric-light plant.

HARRISBURG, ILL.—Work will begin this spring by the Southern Illinois & St. Louis Railway Company of Harrisburg on the construction of the proposed electric railway to connect Harrisburg, Pittsbugh, Marion, Johnston City, West Frankfort, Benton and Herrin, a distance of 60 miles. Contract has been awarded for 18 motor cars.

ROCK ISLAND, ILL.—Bids will be received at the office of the commanding officer, Rock Island Arsenal, Ill., until Feb. 28, under circular 1042, for furnishing four hydraulic turbine units complete and four additional ring curbs for future units. For further information address George W. Burr, commanding officer ordnance department. U. S. Army.

AMERY, WIS.—E. J. Schneider, owner of the local hydro-electric power plant, has awarded contract for the construction of a dam and the development of another similar plant (also on the Apple River) 4 miles below Amery. The proposed dam, which will be built of reinforced concrete, will be 200 ft. long with a 23-ft. head. It is estimated that 800 hp. can be generated, although but 480 hp. will be used at present. Electricity generated at the plant will be transmitted to Turtle Lake, Almena, Comstock and Clayton, Wis.

BROOKLYN, WIS.—The Village Trustees have granted the Brooklyn Electric Company a franchise to install a distribution system in this village.

CUDAHY, WIS.—The Federal Rubber Manufacturing Company is contemplating an addition to its power plant in Cudahy, at a cost of about $200,000.

CROSBY, MINN.—The installation of a municipal electric-light plant in Crosby is reported to be under consideration.

NORTHROP, MINN.—The village of Northrop is contemplating the installation of an electric-lighting system in the near future. Energy will be obtained from the electric plant at Rapidan.

ST. PAUL, MINN.—The St. Paul Gas Light Company, it is reported, contemplates the construction of a hydroelectric power plant on the upper levee, to cost about $1,000,000.

BURLINGTON, IOWA.—Bids will be received by the Citizens Water Company, Burlington, Iowa, until Feb. 28 for a horizontal cross compound crank and fly wheel condensing pumping engine with a capacity of 4200 gal. per minute for pumping water from the river to the settling tanks. Alternate proposals will also be received at the same time for a centrifugal pump for the same work. The centrifugal pump may be driven by a steam turbine or by a compound Corliss condensing engine. Frank Lawlor is superintendent.

OSAGE, IOWA.—The Osage Electric Light, Heat & Power Company has been granted a new franchise and also a new contract for street-lighting. The company is now in the market for 46 ornamental single-lamp standards, complete with Novalux tops suitable for 250-cp. series Mazda, type C, lamps. Everything complete except the lamps; also for approximately (not less than) 6000 ft. of No. 8 double-conductor cable. Thomas Ferris is manager.

ROCKWELL CITY, IOWA.—The general contract for the construction of administration and pathology buildings and power house at the Industrial Refuge for Females at Rockwell City has been awarded to the Bailey-Marsh Company, Metropolitan Life Building, Minneapolis, Minn. The cost of the work is estimated at $100,000. H. E. Liebbe is state architect.

PORTAGEVILLE, MO.—The local electric-light plant, recently destroyed by fire, causing a loss of about $9,000, it is reported, will be rebuilt. J. B. Drerup is owner.

KIMBALL, S. D.—The South Dakota Hydroelectric Corporation, recently incorporated with a capital stock of $15,000,000, proposes to develop the water powers of the Missouri River in South Dakota to operate hydroelectric plants. George W. Adams of Council Bluffs, Iowa, is promoter. The head office of the company will be located in Kimball.

REDFIELD, S. D.—Bids will be received by the South Dakota State Board of Charities and Corrections at the State School for Feeble-Minded at Redfield, until March 6 for the construction of a main building, including general contract work, heating and ventilating, plumbing and electrical work, in accordance with plans and specifications prepared by C. H. Johnson of St. Paul, Minn., architect. Copies of plans may be obtained at the office of the architect upon deposit of $25.

FULLERTON, NEB.—The Fullerton Electric & Power Company contemplates the construction of a dam across the Cedar River.

ERIE, KAN.—An ornamental street-lighting system, consisting of 24 single units, is now being installed by the Electric Light Department.

HANOVER, KAN.—The Council is contemplating the purchase of an oil engine of about 100 hp., and two new alternating-current generators, one of which is to replace the one now in use. It is possible that a new building will be erected. J. G. Granzer is superintendent.

KANSAS CITY, KAN.—The Water & Light Department has recently entered into contracts with Wilson & Company, packers, and with the Kansas City Tire & Rubber Company to supply electricity at their plants. Arrangements are being made by both companies for the installation of electrical equipment.

LYNDON, KAN.—The erection of an electric transmission line to connect with the local central station is under consideration by the towns of Scranton, Overbrook and Carbondale. In view of this the installation of a 250-hp. Busch, Sulzer Diesel engine and generator in the municipal electric plant is under consideration.

MOUND VALLEY, KAN.—The Prairie Oil & Gas Company is contemplating the construction of a power plant and tank farm.

SENECA, KAN.—The electric light commission contemplates the erection of an electric transmission line to St. Benedict, a distance of 1½ miles from the present terminus at Axtell.

WICHITA, KAN.—The Wichita Railroad & Light Compay contemplates extending its College Hill line from Roosevelt Avenue to East Street. The cost of the extension is estimated at $50,000.

Southern States

RALEIGH, N. C.—Surveys, it is reported, are being made by the Carolina Light & Power Company of Raleigh for the construction of an additional power plant on the Pee Dee River below Blewitt's Falls.

PORT ROYAL, S. C.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Feb. 26 for construction of wood-frame hospital, including complete plumbing, electric-lighting and heating system, at naval hospital, Marine Recruiting Station.

AMERICUS, GA.—The Americus Public Service Company is reported to be contemplating extensions to its generating and distributing systems.

ELIZABETHTON, TENN.—Plans are being considered for the construction of a dam across Watauga River, 5 miles west of Elizabethton, to develop the water power. J. H. Grayson, of Bristol, is reported interested.

ST. BERNARD, ALA.—Plans are being prepared for extensions to the municipal electric power plant, including the installation of new equipment and water softening plant, for which $90,000 in bonds were recently voted. Edgar B. Kay, P. O. Box 151, Cincinnati, Ohio, is engineer.

CLARKSDALE, MISS.—Proposals will be received by the City Commissioners until Feb. 27 for the purchase of the following machinery: One 18-in. by 18¼-in. Harrisburg-Fleming automatic engine, directly connected to a 200-kva., 60-cycle, three-phase, 2300-volt Crocker-Wheeler generator, complete with a 9-kw., 125-volt exciter, one 32-in. Vermont marble switchboard, complete, and other plant accessories. Proposals should be addressed to R. E. Stratton, Jr., city clerk. For details see proposal columns.

GULFPORT, MISS.—Bids will be received at the office of the director of works of the Mississippi Exposition Company, Gulfport, until Feb. 21 for furnishing material and installing illuminating system and electrical work on the buildings of the Mississippi Centennial Exposition. Plans and specifications may be obtained upon deposit of $25 for plans for buildings and $5 for plans for illumination of grounds upon application to A. W. Lewin, electrical engineer, 631 Audubon Building, New Orleans, La., or John T. Connell, director of works, Gulfport, Miss.

YAZOO CITY, MISS.—Improvements are contemplated to the municipal electric-light plant, to cost about $20,000.

MARSHALL, ARK.—The electric-light plant owned by the Marshall Roller Mill Company has been purchased by Thomas Matlock. The plant will be removed to a new location and improvements made, including the installation of a new engine.

PINE BLUFF, ARK.—The control of the Pine Bluff Company, which owns the local electric lighting, water works and street railway system, has been purchased by W. F. Rinehart of Thornton, Ark., H. C. Couch of Arkadelphia, J. H. Watkins of New York, N. Y., and others. The new owners, it is reported, propose to make extensions and improvements to the system.

MARKSVILLE, LA.—The Marksville Electric Light & Ice Company is contemplating installing equipment to make clear ice. At present raw water is used as comes from the well. E. M. Kuglheett is vice-president and general manager.

ALTUS, OKLA.—The erection of an electric transmission line from Altus to Duke is reported to be under consideration.

ALVA, OKLA.—The property of the Alva Light & Power Company has been purchased by the Albert Emanuel Company of Dayton, Ohio. The purchase price is said to be $100,000.

BILLINGS, OKLA.—The City Council will soon call an election to vote on a bond issue for the installation of an electric-light plant.

FAXON, OKLA.—An election will be held on Feb. 20 to vote on the proposal to issue $1,000 in bonds for an electric-lighting system.

STROUD, OKLA.—Bids will be received by the town of Stroud, Okla., until Feb. 23 for furnishing material for water-works and extensions to electric-lighting system, as follows: For furnishing and installing on foundations furnished by the town, one 120-hp. Diesel oil engine, complete with all accessories, directly connected to a 75-kva., three-phase, 60-cycle, 2300-volt generator, belted type, with exciter and rheostats. Alternate bids will be received for one 120-hp. crude oil engine, semi-Diesel type with generator, or one 120-hp. natural gas engine with generator; also one 50-kva., three-phase, 2300-volt generator, one switchboard, transformers, lightning arresters, street hoods, choke coils, pump, motor and one 10,000-gal. steel fuel oil tank. Plans and specifications may be obtained at the office of the Benham Engineering Company, consulting engineer, Oklahoma City, upon payment of $5.

WANETTE, OKLA.—Bonds to the amount of $8,000 have been voted for the installation of an electric-lighting system.

WATONGA, OKLA.—The city of Watonga is reported to be considering the purchase of an oil engine for the municipal electric-light plant.

ALICE, TEX.—The electric light and power plant, owned by the Alice Cotton Oil Company, has been purchased by Morrison & McCall of St. Louis, Mo. The new owners propose to enlarge the plant and erect electric transmission lines to San Diego and a number of other towns in this section.

CLINTON, TEX.—Extensive improvements are contemplated to the local electric plant of the Northern Texas Utilities Company in the near future. R. O. Bass is local manager.

DALLAS, TEX.—Extensive improvements and extensions, involving an expenditure of from $1,000,000 to $2,000,000, are under consideration by the Dallas Automatic Telephone Company.

DALLAS, TEX.—At the election to be held in April four franchise propositions will be submitted to the voters and will include the Strickland-Hobson franchise on the lighting and street railway plants of the city, a franchise for the Dallas Automatic Telephone Company and for the Dallas Gas Company.

GUSTINE, TEX.—The Delco electric-light system in this city has been purchased by Dillard & McQuarters of Gustine. Improvements and extensions will be made to the plant and system.

PORT ARTHUR, TEX.—The Port Arthur Light & Power Company, controlled by the Stone & Webster Management Association, Boston, Mass., is contemplating extensive additions to its electric generating station, which will include the erection of a new building, 97 ft. by 46 ft., 50 ft. high, served by a 40-ton electric traveling crane; circulating water tunnels for supplying and discharging water to condensing plant; erection of concrete stack, 10 ft. in diameter, 200 ft. high. The equipment will include a 4000-kw. horizontal steam turbine, with surface condenser and auxiliary pumps; steam will be supplied by two 600-hp. water tube boilers arranged for oil burning equipment with necessary auxiliary pumps for feed water purposes, switchboard equipment and transformers necessary to make connections to existing service.

WICHITA FALLS, TEX.—The Wichita Falls Electric Company contemplates extending its transmission lines to Henrietta, a distance of 18 miles.

Pacific States

PUGET SOUND (BREMERTON P. O.), WASH.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until March 14 for furnishing and installing an alternator in connection with an engine furnished by the government, boilers, condensers, pumps, motors, switchboard, equipment, piping, wiring, lighting, etc., for the heating and power plant at the naval torpedo station, Puget Sound, Wash. Drawings and specifications may be obtained upon application at the above bureau or to the commandant of the navy yard named.

SEATTLE, WASH.—The Aero Alarm Company, recently incorporated, has announced that it has purchased the controlling interest in the Instantaneous Alarm Company, which owns the stock of the American District Telegraph Company of Seattle. This gives the Aero company important franchise privileges, including direct electrical connection with the headquarters of the Seattle Fire Department, the American District Telephone Company having underground conduits in the principal parts of the city. Fire and burglar alarms, watchman supervision and messenger service will be included.

SEATTLE, WASH.—The contest between the city of Seattle and the American Nitrogen Products Company for the Sauk-Suiattle power site in Snohomish and Skagit Counties has been decided in favor of the company, which will develop the same. The initial cost is estimated from $1,000,000 to $5,000,000; the ultimate development will require an expenditure of $25,000,000 or more. The company, it is understood, will begin investigation work at once, with a view of actual development, beginning with 10,000 hp., which will ultimately be increased to 250,000 hp. The first development, it is understood, will be located near the town of Derringer. C. F. Graff, Securities Building, Seattle, Wash., is president and general manager of the company.

SPOKANE, WASH.—Preliminary work has been completed for a hydroelectric development on the Pend Oreille River, about 125 miles north of Spokane. The proposed project will consist of a dam 375 ft. high above the bed of river and about 250 ft. long at crest. Hugh Cooper, 101 Park Avenue, New York, N. Y., is engineer.

TACOMA, WASH.—Tentative plans have been prepared by the City Council involving an expenditure of more than $2,000,000 by the city of Tacoma for the acquisition and development of an additional hydroelectric power plant, or $300,000 for the construction of an auxiliary steam station to the present municipal system to meet the estimated demand for energy to be supplied to the proposed army post at American Lake, and for various shipbuilding concerns in Tacoma. H. F. Gronen, commissioner of light and water, has asked the Council for permission to employ a special engineer to work out plans for the proposed addition to power station.

VANCOUVER, WASH.—The Standard Electric Power & Chemical Company, recently incorporated with a capital stock of $40,000,000, proposes to develop water power sites on the Deschutes River and transmit the energy to Vancouver and establish a nitrate producing plant here. Work will not begin until next summer.

MOLALLA, ORE.—The property of the Molalla Electric Company has been purchased by E. G. Robinson, of Canby, Ore. The company furnishes electrical service to the towns of Canby, Barlow, Aurora, Hubbard and Donald. E. G. Robinson is president and manager of the company.

FRESNO, CAL.—At a mass meeting held recently the landowners of Fresno County voted approval of plans to construct a reservoir at Pine Flat, at a cost of $9,000,000, to supply water to irrigate 1,000,000 acres in Fresno, Tulare and Kings Counties. A committee will be named to ascertain if the Fresno Irrigation District desires to enter the project. Hydroelectric power for drainage will also be developed.

KESWICK, CAL.—The Northern California Power Company of San Francisco is contemplating the erection of a 60,000-volt transmission line from Keswick to French Gulch, a distance of 15 miles, in the spring. The 60,000-volt line from the Balakala Mine to Gladstone and thence to French Gulch, 8 miles long, will be taken down.

MARE ISLAND, CAL.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Feb. 20 for furnishing miscellaneous quantity of electric cable, conductors and wire at Mare Island, Cal., under Schedule 628.

SAN DIEGO, CAL.—County Board of Supervisors has awarded the franchise to construct and operate electric lines along certain highways in Orange County to the Consolidated Gas & Electric Company.

SAN FRANCISCO, CAL.—The Public Utilities Committee of the Board of Supervisors has authorized the construction of a municipal railway on Market Street from the Ferry through the Twin Peaks Tunnel to Sloat Boulevard and connection with the Church Street line. The cost is estimated at $655,000.

SAN FRANCISCO, CAL.—The fourth high-tension transmission line of the Sierra & San Francisco Power Company of San Francisco will be erected to connect with the 204,000-volt transmission line reaching San Francisco from the power plant of the company on the head waters of Stanislaus River. The new 60,000-volt line will connect with the transmission line at Manteca and will tap territory south of there. The cost of the work is estimated at $36,000. The company will also erect a new substation at Oakdale, to cost about $10,000.

SONORA, CAL.—An election will be called to vote on the proposal to issue $20,000 in bonds for the construction of a municipal electric-lighting system. Wires will be placed underground.

JULIAETTA, IDAHO.—Improvements are being made to the plant of the Juliaetta Milling Company. The flat rate will be discarded and meters installed and a day service established. F. C. Holbrook is owner and manager.

YUMA, ARIZ.—The City Council has engaged F. E. Trask, engineer, Union Trust Building, Los Angeles, Cal., to prepare estimates of cost of construction of a municipal electric-light and water-works system.

BILLINGS, MONT.—The Town Board has engaged the Mackintosh-Walton Company, consulting engineers, of Oklahoma City, to prepare plans for extensions to the municipal water and light plant. The proposal to issue bonds for the proposed work will soon be submitted to the voters.

GREAT FALLS, MONT.—Bids will be received by the City Council of Great Falls, Mont., until Feb. 20 for a motor-driven combination street sprinkler and sweeper. Bids to be addressed to W. H. Harrison, city clerk.

Canada

EDMONTON, ALTA.—The Edmonton Power Company, it is reported, is making surveys for the construction of a railway (80 miles long) from Edmonton to its new power plant site. Work will begin on the construction of the power plant as soon as the railway is completed, which, it is estimated, will take about a year. E. W. Bowness is manager and engineer.

BRANTFORD, ONT.—The City Council is considering the question of developing a hydroelectric plant on the Grand River. H. F. Leonard is city clerk.

BRANTFORD, ONT.—The Brantford Hydro-Electric Power Commission has been authorized to remodel and extend its distribution lines, to be purchased, and to supply electrical service to the districts of Grandview, Exchange Place and Parkdale.

TORONTO, ONT.—Tenders will be received by the Chairman of the Toronto Electric Commissioners, Toronto, until March 28 for synchronous condensers. Specifications may be obtained at the office of the purchasing agent, 15 Wilton Avenue, Toronto.

TORONTO, ONT.—A permit has been secured by the British Forgings Company to put in foundations for an electric plant at the foot of Cherry Street, near the Harbor Commission's ground area, for the Imperial Munitions Board. The cost of the plant is estimated at $25,000.

ALTON, QUE.—The by-law authorizing the installation of hydroelectric power was carried.

MONTREAL, QUE.—Tenders will be received by Norcross Brothers, 10 Cathcart Street, contractors for the construction of the temporary station for the Canadian Northern Railway Company, for roofing, electrical work, heating, plumbing, plastering, excavating and structural concrete and purchase of 100 tons of reinforcing steel; also tiles and paving blocks, to cost approximately $150,000.

VERDUN, QUE.—The city of Verdun has received authority from the Legislature to expend $250,000 for the installation of underground conduits. A. S. Claeson is city engineer.

14,256. INSULATOR; William H. Williams, Carey, Ohio. App. filed Sept. 19, 1916. Designed to hold one or more wires, and to hold wires which cross each other at an angle.

1,214,500. ANODE FOR VACUUM DISCHARGE -TUBES; Charles Frederick William Bates, Cleveland, Ohio. App. filed Aug. 17, 1915. Anodes or targets for tubes.

1,214,511. TELEPHONE SWITCHING SYSTEM; Henry Peter Clausen, Mount Vernon, N. Y. App. filed June 7, 1915. Cord circuit for manual systems.

1,214,512. TELEPHONE SWITCHING SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed Sept. 2, 1916. Manual type.

1,214,515. SWITCH-SELECTOR; Oscar A. Danielson, New York, N. Y. App. filed Nov. 2. 1914. For use in keyboard transmitters for printing telegraph systems.

1,214,528. ELECTRIC SHIP PROPULSION; William L. R. Emmet, Schenectady, N. Y. App. filed Jan. 2, 1915. Provision of an important controlling apparatus.

1,214,540. ELECTRICALLY OPERATED TABULATING AND LIKE MACHINE; Christian Augustine Everard Alfred Greene, London, England. App. filed Nov. 15, 1915. Improvements.

1,214,591. ANTENNA FOR RADIOTELEGRAPH STATION; Gustav Reuthe, Sayville, N. Y. App. filed April 29, 1916. Use a transmitting antenna having a counterpoise and divides the counterpoise into individual sectors which can be separated electrically from each other.

1,214,610. TELEPHONE RECEIVER; Naho Tannaka, New York, N. Y. App. filed Sept. 30, 1915. Diaphragms are cushioned.

1,214,613. VAPOR ELECTRIC APPARATUS; Percy H. Thomas, Upper Montclair, N. J. App. filed Sept. 12, 1912. Such as can be successfully operated on a constant-current circuit.

1,214,615. ELECTRICALLY CONTROLLED BRAKE; Walter V. Turner, Edgewood, Pa. App. filed Oct. 3, 1914. Means for limiting the maximum rate of reduction in brake pipe pressure to a predetermined degree.

1,214,616. ELECTROPNEUMATIC BRAKE; Walter V. Turner, Edgewood, Pa. App. filed Oct. 3, 1914. To an equipment in which the brakes are applied by electrically venting fluid from the brake pipe.

1,214,620. MEANS FOR PRODUCING ELECTRICAL OSCILLATIONS WITH THE AID OF AN AUXILIARY OSCILLATION CIRCUIT; George von Arco and Alexander Meissner, Berlin, Germany. App. filed Sept. 17, 1912. Improvements.

1,214,624. ALARM FOR RAILROAD CROSSINGS; Beecher D. Whitcomb, Shawomet, R. I. App. filed July 26, 1915. Novel means for controlling the return of the core to normal position.

1,214,638. SELECTIVE LOCKOUT TELEPHONE SYSTEM; Frank W. Adsit, St. Paul, Minn. App. filed June 30, 1914. Improvements.

1,214,644. ELECTRIC LIGHT SOCKET; Tonjes August Carl Both, Malden, Mass. App. filed April 16, 1912. Mechanical movement adapted for universal application.

1,214,647. BATTERY CELL; Campbell C. Carpenter and Roy J. Ellis, Niagara Falls, N. Y. App. filed April 6, 1916. The cover being so designed as to effectually cover and seal the jar.

1,214,652. LIGHTNING-ROD STRUCTURE; John E. Curti, Omaha, Neb. App. filed April 3, 1916. For connecting the standard with the horizontal cable.

1,214,655. WIRELESS-TELEPHONE APPARATUS; Burr V. Deitz, Slingerlands, N. J. App. filed Oct. 15, 1913. For changing alternating to a direct current.

1,214,663. MOTOR-CONTROLLER; Clarence T. Evans, Milwaukee, Wis. App. filed May 2, 1914. Improved circuit arrangement.

1,214,669. BATTERY CELL; Julius M. Gauss, Niagara Falls, N. Y. App. filed April 8, 1916. Liability of adding too much liquid is minimized.

1,214,686. SUPERVISORY SYSTEM; Alexander E. Keith, Chicago, Ill. App. filed May 14, 1907. Automatic or semi-automatic telephone exchange systems.

1,214,694. TELEPHONE SYSTEM; Albion D. T. Libby, Elyria, Ohio. App. filed Jan. 9, 1911. Telephone meter systems.

1,214,718. OVERLOAD CIRCUIT OPENER; Edmund O. Schweitzer, Chicago, Ill. App. filed April 21, 1913. Improvement.

1,214,721. SIGNAL; William Sparks, Jackson, Mich. App. filed Oct. 8, 1915. Cam actuated diaphragm type.

1,214,722. SIGNAL; William Sparks, Jackson, Mich. App. filed Nov. 18, 1915. Diaphragm signals.

Record of Electrical Patents

Notes on United States Patents issued on Feb. 6, 1917.

1,214,745. HOIST BLOCK; Clement E. Beard, Columbiana, and Walter G. Stephan, Cleveland, Ohio. App. renewed June 29, 1915. Weight indicating or measuring means.

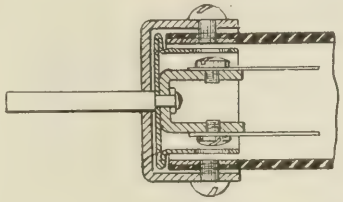
1,214,752. ELECTRIC SWITCH; Harry R. Canfield, Ohio. App. filed Feb. 9, 1911. Magnetically operated.

1,214,757. ELECTRIC WATER HEATER AND AUTOMATIC CONTROL; Dudley B. Clark, Bemus Point, N. Y. App. filed May 9, 1916. Combined hydraulic electrical control.

1,214,763. ELECTRICALLY HEATED STEEL FURNACE; Joseph Lawton Dixon, Detroit, Mich. Improvements.

1,214,764. ELECTRIC STEEL FURNACE; Joseph Lawton Dixon, Detroit, Mich. App. filed Oct. 14, 1916. Regulation of the positions of the electrodes, either automatically or by hand may be rendered more simple and certain.

1,214,770. PROCESS OF MAKING CYANOGEN COMPOUNDS; Hans Foersterling and Herbert Philipp, Perth Amboy, N. J. App. Renewed June 21, 1916. Vaporizing a metal capable of forming cyanogen compounds and reacting the vaporized metal with nitrogenous and carbonaceous matter.



1,214,903. Fuse.

1,214,775. ELECTROLYTIC APPARATUS; William E. Greenawalt, Denver, Col. App. filed Aug. 18, 1913. Electrode bell.

1,214,779. ELECTRIC SWITCH; Jay H. Hall, Cleveland, Ohio. App. filed Feb. 2, 1913. Magnetically operated.

1,214,808. METHOD OF REDUCING METALS; Robert J. McNitt, Niagara Falls, N. Y. App. filed May 12, 1915. From compounds containing the same.

1,214,816. ELECTRIC LAMP; Moses Solomon Okun, New York, N. Y. App. Renewed June 22, 1916. Great percentage of electric energy is transferred into light.

1,214,817. MEANS FOR EFFECTING MAGNETIC OR INDUCTIVE SEPARATION OF SUBSTANCES; Samuel W. Osgood, Chicago, Ill. App. Renewed June 30, 1916. Improvements.

1,214,830. MOISTURE-PROOF SWITCHBOARD CORD; William L. Runzel, Chicago, Ill. App. filed May 24, 1915. Improved interconnecting cord.

1,214,836. BATTERY PACKAGE; John Smith, Brooklyn, N. Y. App. filed May 1, 1916. Provides a combined dry cell set and container which will be both waterproof and heat insulating.

1,214,841. ELECTRIC FURNACE FOR FUSING METALS; John Thomson, New York, N. Y. App. filed Jan. 28, 1916. High thermal economy, rapidity, convenience and metallurgical efficiency.

1,214,842. ELECTRIC ZINC-DISTILLING FURNACE AND CONDENSER FOR PRODUCING BLUE POWDER; John Thomson, New York, N. Y. App. filed Jan. 28, 1916. Increase the purity and effectiveness of the said material at a minimum cost of production.

1,214,857. TRAIN-COUPLING FOR ELECTRICAL CONDUCTORS; Walter C. White, Los Angeles, Cal. To retain the terminals of the electrical conductors within the coupler heads.

1,214,879. ELECTRIC-CIRCUIT-PROTECTING FUSE; Sydney N. Baruch, San Francisco, Cal. App. filed Aug. 25, 1915. Fusible element.

1,214,883. ALTERNATING-CURRENT MOTOR; Donald M. Bliss, West Orange, N. J. App. filed March 13, 1911. Adapted to be operated from a single-phase alternating-current circuit.

1,214,900. SOCKET FOR ELECTRIC LAMPS; John Cuthbert, Chicago, Ill. App. filed Dec. 2, 1915. Easily wired.

1,214,903. FUSE; Louis W. Downes and Ralph Clifton Patton, Providence, R. I. App. filed Oct. 23, 1915. Designed to open the circuit when an excessive current passes through the line.

1,214,915. SERVICE-BOX AND SWITCH; Morton Havens, Jr., and Francis R. Meginniss, Albany, N. Y. App. filed Aug. 18, 1913. For preventing the removal of a burnt-out fuse without first operating the switch to break the circuit.

1,214,920. ELECTRIC SWITCH; Newman H. Holland, West Orange, N. J. App. filed Feb. 16, 1914. Contacts normally spaced apart.

1,214,934. ELECTROLYTIC GAS GENERATOR; Isaac H. Levin, New York, N. Y. App. filed Dec. 20, 1915. To produce hydrogen and oxygen gases.

1,214,956. INSULATOR; Charles W. Rogers, Exeter, N. H. App. filed June 5, 1914. For insulating swaying electric wires from trees.

1,214,959. ILLUMINATED FOUNTAIN PEN; Edmund O. Schaffer, Derby, Conn. App. filed June 27, 1916. The lamp not interfering in any way with ordinary use of the pen.

1,214,969. MEASURED-SERVICE TELEPHONE SYSTEM; Samuel S. Stolp, Chicago, Ill. App. filed Feb. 29, 1912. Improvement.

1,214,980. ALTERNATING-CURRENT MOTOR; Hans Weichsel, St. Louis, Mo. App. filed April 12, 1915. Single-phase asynchronous induction motors having a shunt characteristic.

1,214,982. AUTOMATIC TELEPHONE SYSTEM; Charles S. Winston, Chicago, Ill. App. filed April 11, 1910. System which is free from ground connection at the subscribers' stations.

1,214,983. METAL-WORKING MACHINE; Edward V. Wurts, Pittsburgh, Pa. App. filed Jan. 28, 1914. Improvements.

1,214,989. AUTOMATIC TELEGRAPHIC OR RADIOTELEGRAPHIC TRANSMITTER; Edouard Belin, Paris, France. Improvements.

1,215,002. TELEPHONE APPARATUS; Eldridge A. Cox, Dayton, Ohio. App. filed March 6, 1916. May be connected with, or disconnected from, the central station without touching the receiver.

1,215,004. BATTERY CONNECTOR; Spencer M. Decker, Malden, Mass. App. filed April 21, 1916. Plurality of dry cells may be connected together.

1,215,037. SIGNAL FOR AUTOMOBILES; David J. Lanehart, Baltimore, Md. App. filed May 16, 1916. Readily observable both by night and day.

1,215,038. TELEPHONE-CIRCUIT ARRANGEMENTS; Charles D. Lanning, Boston, and Stephen C. Drew, Brookline, Mass. App. filed Aug. 2, 1911. Concerned wih the relation of two voice current circuits inductively connected.

1,215,042. AUTOMATIC SIGNAL DEVICE; George C. Martin, Los Angeles, Cal. App. filed April 2, 1913. Useful in connection with railway crossings and the like.

1,215,060. TELEPHONE HEAD-GEAR; Thomas Rhodus, Chicago, Ill. App. filed Oct. 7, 1915. Holder is formed of semicircular spring bands.

1,215,070. STREET CAR AND RAILWAY INDICATOR; Ernest H. Stacy, Atlanta, Ga. App. filed April 12, 1916. Improvements.

1,215,074. INSULATING GAS-TIGHT SEAL; William E. Story, Jr., Schenectady, N. Y. App. filed Sept. 19, 1914. Construction of vacuum-tight insulating seals.

1,215,077. MACHINE FOR WATERPROOFING FIBROUS MATERIALS; Alfred O. Tate, Montreal, Quebec, Canada. App. filed Feb. 20, 1915. For producing waterproofed paper.

1,215,079. CANDELABRUM SOCKET; George B. Thomas, Bridgeport, Conn. App. filed Feb. 16, 1916. Lining for the socket.

1,215,088. END RING FOR SQUIRREL-CAGE WINDINGS; Francis M. Whitney, San Diego, Cal. App. filed May 28, 1914. Method of applying.

1,215,094. SYSTEM OF SHIP PROPULSION; Ernst F. W. Alexanderson, Schenectady, N. Y. App. filed April 26, 1913. Propellers are driven by induction motors supplied with alternating current from a polyphase alternator.

1,215,095. SYSTEM OF SHIP PROPULSION; Ernst F. W. Alexanderson, Schenectady, N. Y. App. filed Oct. 13, 1916. In which the ship's propellers are driven by electric motors.

1,211,116. X-Ray Apparatus. William D Coolidge, Schenectady, N. Y. App renewed Oct. 24, 1916. Increased capacity is provided by rotating the tube as a whole and deflecting the cathode beam out of line with the axis of rotation.

1,211,118. Electric Lamp. Albert Dow Cox, Wilmerville, N. C. App. filed Dec. 21, 1915. Two separate resistance or heating circuits.

1,211,141. Electric Lamp Socket. George W. Goodridge, Bridgeport, Conn. App. filed Sept. 14, 1916. Improved construction of the insulating body.

1,211,142. Arc Lamp. Cromwell A. B. Halvorson, Jr., Seattle, and Walter L. Harraden, Lynn, Mass. App. filed March 1, 1915. Mounted upon a standard or other support.

1,211,150. Electrical Testing Apparatus; Allan B. Hendrick, Jr., Fitchburg, Mass. App. filed April 9, 1915. Oils and other liquids.

1,215,156. Automobile Signal; Charles McKeon Hosford, Brooklyn, N. Y. App. filed May 4, 1915. Automatically operated by a steering wheel.

1,125,169. Signaling Device; George John Kloepfer and Carl F. Kloepfer, Springfield, Ohio. App. filed July 26, 1916. For use with motor vehicles.

1,210,040. Cathode Ray Tube. H. E. R. Rukop and W. K. M. Schlossmith, Berlin, Germany. App. filed Oct. 28, 1915; issued Jan. 2, 1917. A high-vacuum hot cathode tube of the audion type, in which the relative positions of the grid and plate electrodes are fixed by insulating members and which has a glowing filament in a plane perpendicular to those of the grid and plate.

1,210,678. Thermionic Amplifier. A. McL. Nicolson, New York, N. Y. App. filed May 19, 1915; issued Jan. 2, 1917. An amplifier of the audion type, in which the electronic stream is augmented by providing auxiliary cathodes which are heated by bombardment of electrons from the filament and which give off additional electrons.

1,211,754. Crystal Rectifier; P. C. Rawls, Des Moines, Iowa. Original app. filed July 6, 1914; divided Dec. 30, 1914; issued Jan. 9, 1917. Details of mounting for crystal detector, in which two springs oppose each other, the second being capable of applying a lateral tension to the crystal contact. Shows a flat-polished crystal surface with regular projections produced by cross grooves.

1,211,770. Micromagnetic Detector; F. G. Simpson, Seattle, Wash. Original app. filed Nov. 1, 1912; divided April 23, 1913; issued Jan. 9, 1917. Group tuned magnetic detector, in which the effect of incoming wave trains is directly to produce movement in a pair of tuned vibrating wires. The motions so set up are caused to affect a microphonic contact connected in series with a battery and indicating instrument.

1,211,863. Apparatus for and Method of Producing High-Frequency Currents of Electricity; D. G. McCaa, Lancaster, Pa. App. filed Sept. 24, 1913; issued Jan. 9, 1917. Generator of substantially sustained, or high-group frequency, waves for radiotelephony or the like, in which the primary oscillatory circuit contains a large capacity series condenser to prevent arcing at the quenched spark gap.

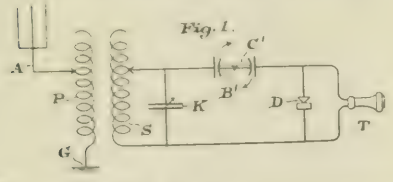


Fig. 1—Proctor's Receiver for Undamped Waves

1,211,963. Radio Receiving Apparatus; J. A. Proctor, Revere, Mass. App. filed June 29, 1914; issued Jan. 9, 1917. Receiver for continuous oscillations, in which either a tuning or a blocking condenser is varied in capacity periodically, so as to produce oscillation variations corresponding to the desired tone frequency.

1,212,163. Relay for Undulatory Currents; E. M. C. Tiegerstedt, Copenhagen, Denmark. App. filed Oct. 19, 1916; issued Jan. 9, 1917. An audion-type amplifier in which a central filament is surrounded by a perforated cylindrical "auxiliary anode" or grid electrode, which in turn lies within a spiral anode or plate electrode. The whole is inclosed by a magnetic and static shielding case.

1,212,202. Submarine, Subterranean and Aerial Telephone; R. A. Fessenden, Brookline, Mass. App. filed May 12, 1916; issued Jan. 16, 1917. A radio-frequency alternator, a magnetic amplifier output circuit, a rectifier and the control coil of a large "oscillator" or powerful telephone receiver are serially connected so that voice vibrations acting through the magnetic amplifier will produce intense corresponding vibrations of the "oscillator" diaphragm. These are used for acoustic transmission to comparatively long distance through the air, earth or water.

1,213,066. Wireless Automatic Railway Registering System; C. L. Bopp, Waterloo, Iowa. App. filed Feb. 24, 1913; issued Jan. 16, 1917. Wireless telegraph apparatus using coherers and relays, controlled by the passage of a train over predetermined portions of track. This device is used in train and block-signal systems, in conjunction with wire telegraphs.

Recent Radio Patents

Notes and Comments on United States Patents on Radio Signaling and allied topics issued during January, 1916.

1,213,250. Means for Receiving Intelligence Communicated by Electric Waves; G. W. Pickard, Amesbury, Mass. Original app. filed Aug. 30, 1906; divided Nov. 8, 1906; issued Jan. 23, 1917. Receiver in which are combined an antenna system, a high-resistance good-contact rectifier, a direct-current indicating device and a shunting condenser for the purpose of leading oscillation current groups to the rectifier and around the indicator.

1,213,869. Inductance Coil; D. R. Price, Winthrop, Mass. App. filed April 24, 1914; issued Jan. 23, 1917. An inductance coil for radio-telegraph or wire circuits, in which the resistance to fluctuating currents is minimized by compensating for the varying impedance effects produced by inequalities in length of the insulated strands of wire used in winding.

1,214,022. Apparatus for Wireless Telegraphy and the Like; P. E. Edelman, Minneapolis, Minn. App. filed Aug. 19, 1912; issued Jan. 30, 1917. Details of apparatus for selective transmission of radio messages, dependent upon successive choice of wave and group frequencies or upon intervals between impulses, or combinations of these. Includes various forms of receiving tuning apparatus, a multi-contact crystal detector, etc.

1,214,214. Generator of High-Frequency Currents; P. O. Pedersen and V. Poulsen, Frederiksberg, Denmark. App. filed Jan. 6, 1913; issued Jan. 30, 1917. System of paralleling arc generators for production of high-power oscillations. The usual phase difficulties of parallel arcs are avoided by dividing the oscillation circuit and placing a series condenser and inductance in each branch.

1,214,265. Detector for Wireless Systems; M. Berel and L. Funke, New York, N. Y. App. filed March 11, 1916; issued Jan. 30, 1917. A crystal detector which is hermetically sealed after proper adjustment of contact is effected, so as to permit indefinitely long use without readjustment.

1,214,283. Wireless Telegraphy; L. deForest, Palo Alto, Cal. App. filed Sept. 24, 1912; issued Jan. 30, 1917. The capacity of a fan antenna is increased by locating near it a supplementary horizontal antenna, directly grounded, with the object of permitting greater energy storage without reduction of radiation resistance.

DISCUSSION

The new year begins with the issue during January, of fifteen patents having to do with radio signaling. This is in strong contrast to the three which were published in December, 1916, but of course cannot be taken as true index of inventive activity for the reason that the application dates may be from a few months to a dozen years earlier than the dates of patenting. In this month's group the Tigerstedt patent, applied for only last October, may be contrasted with the Pickard patent bearing application date of August, 1906, in order to note specific examples of the large variation in complexity presented by the work of the Patent Office.

An interesting device is shown in Fig. 2, which is reproduced from the drawings of Nicolson's patent, No. 1,211,678. This is an audion amplifier bulb of special construction, and is designed to increase the cathode stream over that which would be obtained from a simple filament. In the figure there is shown a straight-wire vertical filament 14, which may be of tungsten coated with a mixture of strontium and barium oxides. It is heated to incandescence, and thus emits a stream of electrons which are caused to bombard the "equipotential cathode" 13. This second cathode is a similarly coated tube of thin sheet platinum or tungsten, and is held at a potential positive with respect to the filament 14 by means of a special battery. The bombardment results in making the tube electrode 13 give off a powerful stream of electrons, by reason of its large surface, and so increases the energy output of the tube. The electron stream passing from the cathodes to the anode 11 is controlled by the electrostatic field of the grid or input electrode 12, which is connected in any of the usual amplifying or generating circuits. Another form of the bulb in which there are several successively larger concentric tubular cathodes is shown; in this more complex bulb each cathode bombards that next outside it, so building up the electron stream to the maximum output of the largest and outermost cathode tube.

Fig. 1 shows the circuit arrangement proposed by J. A. Proctor, in patent No. 1,211,963, for the reception of continuous or sustained waves. The antenna circuit comprises the aerial itself, *A*, the primary coil with variable contact, *P*, and the earth connection *G*. The secondary *S* has connected across its terminals the tuning condenser *K*, and this in turn is shunted by the circuit containing the detector *D*, telephones *T* and variable condenser *C'* as shown. If the condenser *C'* were set at some particular value and allowed to remain in that condition, the receiver would correspond closely to the apparatus ordinarily used for reception of groups of damped waves. In the proposed arrangement, however, the rotating element of *C'* is mounted on a shaft *B'* and is rapidly revolved so as to change the capacity smoothly from minimum to maximum at the rate of from 200 to 500 times per second. When the capacity is near zero it is obvious that oscillations cannot pass effectively from the secondary to the detector, and that, consequently, no energy can reach the telephone. When the capacity is at its maximum, however, the transfer of energy from the secondary condenser *K* to the telephone and detector combination is necessarily quite rapid. Thus there is obtained a sort of "chopper" effect which is similar to that secured by inserting an interrupter in the receiving circuit of a wireless station working with sustained waves. Because the change of capacity is gradual, and so is quite different from the sudden action of a contact device, the arrangement of Fig. 1 is said to produce a better musical note than does the simple "chopper." In operation it is desirable to adjust the speed of the condenser variations so that the tone produced corresponds in frequency to the natural period of the receiving telephone.

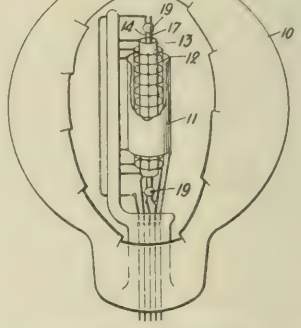


Fig. 2—Nicolson's Double-Cathode Amplifier

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Thinking Straight on the Electric Vehicle

SUBMERGED in the public mind by wave on wave of publicity for the gas car, the electric vehicle still survives and grows in numbers each year. On another page we quote from a recent meeting of the Electric Vehicle Section of the National Electric Light Association, a group of carefully prepared statistics. To most persons the totals will be surprising. There must be a vital reason for this tenacity of life. The electric started off on the wrong foot as a competitor of the gas car for all purposes. As a result it is still walking through life with blackened eyes. It is not and never can be a competitor of the gas car for speed and distance in the present state of the art of electricity. Until recently speed and distance, without regard to cost and comfort and durability, were the only yardstick by which both pleasure and commercial cars were measured. Now, a change has set in. Pleasure cars are being bought for style and comfort. Car bodies as well as engines are in the public eye. Utility driving as well as touring are weighed in the purchaser's scale. As a consequence the electric pleasure car has each year a wider and more intelligent buying clientele.

Similarly, in the commercial field, business men are thinking not of substituting a motor wagon for a horse but of overhauling their transportation methods. Transportation engineering, in which the vehicle is only one part of the problem of handling goods, is the new calling. With these newer and saner standards of values the electric truck has not only a fair chance, but in many cases much the better of the argument. One cannot ride in an electric taxicab in Detroit and learn that each car is netting something like $3,000 a year to its owners, without being more certain of the electric vehicle's present opportunity. When the president of a great express company says electric trucks are a paying investment, when the sales records of a vehicle company show eighteen cars sold in a small town in one season, when we learn that the great utilities in Chicago and New York are in the midst of plans for constructive local development of their vehicle business we know that our faith in the fundamental values of the electric car for both pleasure and commercial purposes is not misplaced and that the electric is coming into its own. Practice shows that the electric vehicle is best for certain conditions of city work. The transportation engineer who thinks in terms of cost and results has not lost sight of these facts, in the mass of confusing general evidence for supposed gas car superiority. Every central station seeking to widen its commercial business ought to ask car and battery manufacturers how it can take advantage of present conditions now.

The Lucky Power Purchaser

CUSTOM leads us to look at the man who sells as a doer of great things. It is this man who tells with pride how he has closed a contract for a goodly quantity of power. With the mere buyer we have no concern. He was only the molded clay in the hands of the skillful salesman. The deal was made, not because the buyer cleverly drew the seller into his meshes, but because the trained salesman made out a case for his product which was so logical that the consumer had no alternative but to write his name on the dotted line. But when conditions change and the seller finds that the buyer has a shade the best of the arrangement his respect for the buyer rises. And it is the turn of the buyer to pat himself on the back for his extraordinary foresight.

This illustration tells the story of what has been happening in the case of some central station contracts for stand-by service to owners of isolated plants. Coal shortage is throwing the burden of the requirements of the isolated plant owner upon the busy central station. Added to record-breaking demands from regular consumers the extra calls for service are a serious tax upon capacity. The shoe is on the foot of the man who has a long-time low-rate contract for the purchase of power.

Standards of Public Policy for the N. E. L. A.

THE public policy committee of the National Electric Light Association has put before the representative membership of that organization an epoch-marking plan for enlarging its work. It is not the plan of novices. It is the careful, deliberate result of a systematic survey of the conditions before the central station industry. It promises large returns. With its execution the association will wield a powerful influence in the fair settlement of public policy questions. In the past it has settled many problems, it has led many companies. In the future extensive organization, abundant funds and the sense of greater responsibility will fit it to do much more.

In considering the importance of the new work, members will do well to recall that the committee foresightedly indorsed regulation when that policy was in its infancy. In other respects, too, it has led development. Accustomed to looking ahead, the committee decides that the time is ripe for continuing on a much greater scale, for continuing intensively the shaping of broad policies. The commercial central station industry cannot afford to disregard the questions of the committee. Only the skeleton of its idea is presented in the letter to members; perhaps this is all that could be said until the plans are carried further. But it is not neces-

sary to read far between the lines to understand that the vital topics are on the list. Data on commission rulings, valuation terminology, methods in valuation, rate-making and rate-data, municipal ownership and operation, water power regulation and legislation, regulations on inductive interference in transmission lines are only the announced subjects. That the committee will, as it indicates, find other matters to occupy its attention is certain.

Larger work and income mean larger responsibility. In taking up duties that potentially have the greatest possibilities for the commercial central station industry the committee will not seek to evade the accompanying responsibilities. Holding these responsibilities before it, the N. E. L. A. should be able to form virtual standards of public policy. If it can show a company that its rates are above the line of fairness, that it is foolishly or needlessly antagonizing the public, that in running counter to public opinion it is endangering its position as a "beneficent monopoly" the association will clear up situations which jeopardize the industry. And at other times its proper function will be to combat unjust public demands. Information, research, is the basis of the proposed work. Action will follow. The plan has in it so much that is of promise and value that its hearty indorsement and support by the membership are to be expected. There certainly is need for constructive work in the directions indicated.

Iron Wire Transmission Lines

THE enormous price of copper has put a heavy burden on power transmission circuits, even those on which the load is comparatively dense. When it comes to extended networks carrying relatively light loads the cost of conductor has become outrageously and forbiddingly high. We have published data from time to time on the use of iron wire as a substitute for costly copper, a subject which came to the front in Germany very soon after the outbreak of the war and was considerably discussed. The transmission line which M. D. Leslie described in a recent issue is of particular interest as being rather the most extensive as yet tried, at least in this country. The situation is one common enough on transmission lines, namely, the desire to supply small towns with the necessary light and power from an existing network. To do this on a sound economic basis demands a low investment, and with copper at the rate of 40 cents a pound or thereabouts something radical had to be done. The distance to be covered was about 30 miles and the total load which could be reasonably expected in the two communities reached only 75 kw., barely two-thirds of this being touched by the present peak. The solution of the economic problem was found in using a three-phase circuit of No. 6 galvanized iron wires carried on steel poles set in concrete with a span of 300 ft. The voltage of transmission is 22,000.

The great tensile strength of high-grade iron wire enabling the use of long spans is a very important feature of its utility and the use of steel poles gives a substantial and permanent line free from risk of fire and with relatively little danger from lightning. It is rather interesting to note that the steel poles used were actually of less strength against a pull at the top than the wooden poles customarily used, but yet were amply strong to meet all the requirements with a suitable factor of safety. The result is a strong and reliable line at very modest cost, indeed, enabling service to be rendered to communities which would otherwise have to be without it at least until the price of copper resumes its normal course.

The regulation of this iron wire transmission line, as Mr. Leslie has indicated, has to be watched somewhat carefully, and for heavy varying loads would undoubtedly prove inconvenient. Iron can hardly be considered a general substitute for copper as a conductor, yet its low cost in construction may often, as in the case before us, quite overcome the minor operative disadvantages attending its use. Three months' service on this line have shown only two cases of failure due to defects in the wire, which is doing very well considering the length of circuit. If the price of copper keeps up some little time, as now seems very probable, a good many branch lines are likely to be constructed of iron.

For anything save very small amounts of energy stranded wire will undoubtedly be used, and when properly put up should give a very cheap and reliable system, even in cases involving considerably more energy than that handled in the case mentioned. With a substation equipment automatic regulation of the terminal voltage is entirely feasible, so that with reasonable judgment in design and installation there seems to be no reason whatever why iron may not be employed on a considerable scale between the limiting variations of operation and service that have been outlined.

Selling Aluminum at a Profit

CENTRAL stations are not trading companies; if they merchandise household appliances they do it as only an incident in their larger function. They do not build up elaborate physical equipment in order to dismantle it part by part, to sell as there is opportunity. Even if they get a tempting offer they prefer to keep apparatus until the end of its usefulness for their operations. But times and unprecedented situations alter policies in this as well as in other directions. The high price of aluminum offers a profit which arouses the trading instinct. A company which has aluminum transmission line is not justified in overlooking the chance to scrap it and to substitute copper. It has a commercial interest in analyzing the comparative value of the two metals. Several properties have made substantial profits by dismantling aluminum lines, which after all were not giving the service expected, and reverting to the red metal. The example which is described elsewhere in this issue is but one of several conspicuous instances which have been reported in the historic thirty months just past.

The Analysis of Load

THE unattainable ideal of every central station is the 100 per cent load factor stretching uniformly through the twenty-four hours without peaks and without hollows. The nearest point to its realization could perhaps be reached by a plant dealing with some electrochemical industries, but in general service no such good fortune could be expected. Mr. Leffler in a most instructive paper indicates some of the methods which may be applied to the analysis of load growth to ascertain its commercial desirability. Obviously an added load which is piled upon the peak cannot be assured of a warm welcome from the central station, while if it is devoted to filling up a conspicuous hollow in the existing load curve it is greeted like a long-lost brother. A chart showing merely the increase of load from year to year conveys only a very imperfect idea as to what is actually happening in the business considered as a paying enterprise.

Mr. Leffler in his article very properly divides the growth of load into two separate factors: first, the natural increase which comes from the ordinary process of a growth in the community and the appreciation of advantages of electrical service; and second, the artificial growth stimulated by careful salesmanship which is devoted to new uses for electrical energy and to building up service which will tend to improve the load factor, and hence lower the cost of production and ultimately render lower prices feasible. It is this controlable artificial growth of load which is the most important factor in station economics and it is from the summation of the various items which go to make up this factor of load that the greatest information of economic value can be obtained.

For instance, Mr. Leffler's curves show that the normal growth of load differs very little in its character from year to year as regards the distribution throughout the twenty-four hours. In the territory in which his studies were carried on the normal peak during the period investigated is at about 6 p. m. and it is clearly shown that the natural growth of load does not shift the peak appreciably from this period and hence does not improve to any sensible degree the load factor. There is always a period of considerable growth in the morning at just about the time when the industrial load comes on with the effect of rather exaggerating the variations of load than diminishing them. Following the same subject a little further it is found for the particular territory investigated that the electric range load corresponds so closely to the conditions of normal growth that it adds seriously to the peaks already formed, a condition which certainly does not exist in some other localities. On the contrary, the effort made to develop the water heating load, quite negligible in most central stations, tends to call for energy at a later period than the range load proper and hence to improve the load factor by increasing the off-peak consumption. The same would doubtless be true of ordinary electric heating which offers considerable possibilities in moderate climates.

Now each class of service considered involves a different ratio of service expense to receipts, so that the mere summation of increase in load tells very little about the net results to the station. The subdivision of the increase into its separate factors, however, gives opportunity for testing the relation of each class of service to gross and net profits. It is only by such analysis that it becomes possible to direct the selling efforts of the supply company's force so as to produce the most efficient results. If a salesman's efforts are aimed merely at getting as many kilowatts connected as possible, he may be doing admirable service to his company, or he may actually be depleting its treasury. This is a point not often appreciated by the solicitors of central station companies and very frequently lost sight of by managers in charge of properties.

The most skillful kind of team work is necessary in developing load for maximum results, and the organization of this work demands just this sort of intimate analysis that Mr. Leffler here explains. All this has a very direct bearing on the relations between the supply companies and the public service commissions with which they almost universally have to deal. Before the commissions can get any adequate idea of the real commercial status of the companies, over whose fortunes they have large powers, they must be brought to understand the relation between the various classes of service undertaken and the profits that accrue therefrom. Mere increase of output, however impressive the showing of proportionate growth may be, does not imply large reductions in the cost of service and may indeed connote upon an ever-decreasing scale of profits. The equities of the situation demand that keen attention shall be paid not to the growth of the load alone, but to the discordant items which go to make up this growth.

The Coming Issues

AS usual the next issue of the ELECTRICAL WORLD will be devoted to matters of public policy and the broader phase of problems in the management of public service properties. In the second issue of next month, dated March 10, a leading article will discuss the nature of sleet troubles on transmission lines and methods used to prevent these troubles as developed by the Pennsylvania Water & Power Company. Other engineering articles of that number will take up particularly station and operating problems. In the third issue of March, another section of Prof. Alfred Still's article started in the Feb. 17 issue bearing the title of "Insulation of High Voltage Transformers" will be presented. The issue dated March 24 will as usual take up commercial problems and phases of central station commercial business. In the fifth issue of March a leading article will deal with the electrical layout and operating features of a large New England cotton mill. Other articles in this number will discuss engineering features of industrial installations and their operating problems. ELECTRICAL MERCHANDISING for March will be issued on the 15th of the month and feature selling plans and methods of timely interest.

The Possibilities of the Lighting Load

How Increases in Lamp Efficiency May Serve to Retain and to Materially Strengthen the Present Position of Lighting as the Major Producer Among Central Station Services

By William A. Durgin

THE prophecy that electric lighting is doomed to continually decreasing importance has gained some considerable acceptance during the last few years among central station men. Prominent executives have referred to lighting sometimes as a future by-product. Certain sales managers have given this portion of the business merely perfunctory attention, and lighting salesmen have felt that their effort at best could gain recognition only as a routine contribution to income.

Assuming for the moment that lighting is in grave danger, should we not all the more concentrate our attention upon means for strengthening its position? Is not this the time to reanalyze the entire question; to get a clear view of the reasons for the failure of interest among the salesmen; to investigate the possibilities of revivifying the enthusiasm which formed such a large factor in the tremendous electric lighting advance during the last decades of the nineteenth century?

Increases in Efficiency

The greatest influence toward the central station attitude, of course, has been the enormous increase in the efficiency of light production, achieved by the graphitized, and vacuum-tungsten and gas-filled tungsten lamps. With a viewpoint founded on the older carbon incandescent lamp, with an organization developed to handle the rather expensive light which it produced, even the increase from 3.1 to 2.5 watts per candle, as realized in the graphitized lamp caused some central station managers to question the future. To many, 25 per cent increase in efficiency meant only 25 per cent decrease in the amount of electricity consumed. But when this advance was quickly followed by the vacuum tungsten, two and one-half times as efficient as the carbon, the case became critical.

To be sure, the development produced a wonderful selling argument. "Nearly three times the same amount of light for the same money" could be used to retain some of the business. Still it was predicted that many customers would decide that two and one-half times the original lighting was altogether too much. Far worse, many lighting men, educated in the practice of 3.1-watt lighting, fully believed that a watt-for-watt replacement with the new lamps was excessive. Curves similar to that shown in Fig. 1 were used to some extent to impress the increased purchasing power of the dollar, but most central station men saw in imagination the inverse curve, as in Fig. 2. In place of the optimistic rise of the selling curve they dwelt upon consumption dropping rapidly and when the gas-filled tungsten, with five or six times the carbon lamp's light output appeared, the falling curve seemed to approach zero.

There is no disputing the fact of decreased consumption. The gas-filled lamps, even in the small 100-watt size, consume but 25 per cent as much electricity for a given light output as did the 3.1-watt carbon lamps. If lighting practice during the carbon period was more than in the first stages of development, if the prevailing assumption that lighting installations were satisfactory with the older lamps is even approximately true, there seems little hope of striking achievement in the lighting field. It is the purpose of these articles, however, to show that such assumptions are fundamentally wrong, that the older artificial lighting was the merest makeshift and that the development in incandescent lamps, properly interpreted, opens a future for lighting which may well enable it not only to retain but to materially strengthen its present position of major producer among central station services.

Over-Emphasis on Power Business

The pronounced tendency to consider lighting application as already standardized and hence as possessing a most restricted field for the man of originality and initiative, has added weight to the over-emphasis on power applications. The possibilities in power have been so large. Electrification of steam roads, enlargement of electrochemical industries, adaptation of individual motor drive to an almost infinite number of machines, present opportunity for all grades of ingenuity. Power contracts, too, generally represent a sizable increment of income from a single transaction. On a commission basis this adds considerably to the salesman's interest.

At the same time these large increments impress executives, both because of increased return and on account of the apparently simple changes in the transmission, accounting and supervision systems sufficing to care properly for the new business. Power has been so much more spectacular than lighting that it has gained prominence at the expense of the older portion of the business and to many it has seemed to promise income several times that which could ever be secured from lighting alone.

The Public-Relations Value of Lighting Business

It must not be forgotten, however, that electric lighting is of primary importance quite irrespective of the income resulting. All public service companies depend largely upon the good-will of their community, and this good-will is secured, naturally, through common interest. With all the concentration of the best thought and ability which has been directed toward power, a comparatively small percentage of the total customers of any central station use it. For example, the Commonwealth Edison Company of Chicago, is particularly fortunate in its power business, yet 88 per cent of the consumers know it only as a lighting company and this percentage has increased steadily during the last ten years. Some, of course, use small utensils, but these were added in most cases to an already existing lighting installation and although the utensils are gaining the company many friends, lighting is still the primary bond with the greater portion of the public.

As J. W. Lieb of the New York Edison Company has said: "The incandescent lamp is the principal translating device with which the customer comes into contact and by far the most appealing, revealing as it does at once visually and forcibly any defects as well as the excellences of the service. It is more generally used than any other appliance, and its service being a more prominent and observed feature it commands more attention and consideration from the public than do all other devices combined."

Among our senses the eye stands pre-eminent, especially in modern life, dependent so largely upon

printed matter. Color and form are coming more and more to dominate our amusements. The portion of life spent under artificial lighting is steadily increasing. For a public service company, with the possibility of municipal ownership always lurking, can we overestimate the importance of that portion of the output through which nine-tenths of our customers are made our friends or our enemies; through which the most vital sense of the public at large is pleasantly stimulated to satisfying activity or strained to early exhaustion?

Lighting as an Income Producer

These arguments alone should be more than sufficient to regain attention for lighting, but such aspects seem almost insignificant when a careful analysis is made of the actual present position of lighting as an income producer. For despite the tremendous decrease in the consumption of individual lamps, despite the lessening attention given to the lighting business, the returns from lighting have shown a continual increase. The consumers, the actual users of light, have developed an attitude toward its benefits much more appreciative than the most optimistic lighting men could hope. The improvement secured by a moderate increase of lighting once seen, the larger number of customers have demanded yet more light. The notable growth of our industries has aided in the increase. More efficient light generation has led also to its application in many locations which would not have been considered with the older lamps.

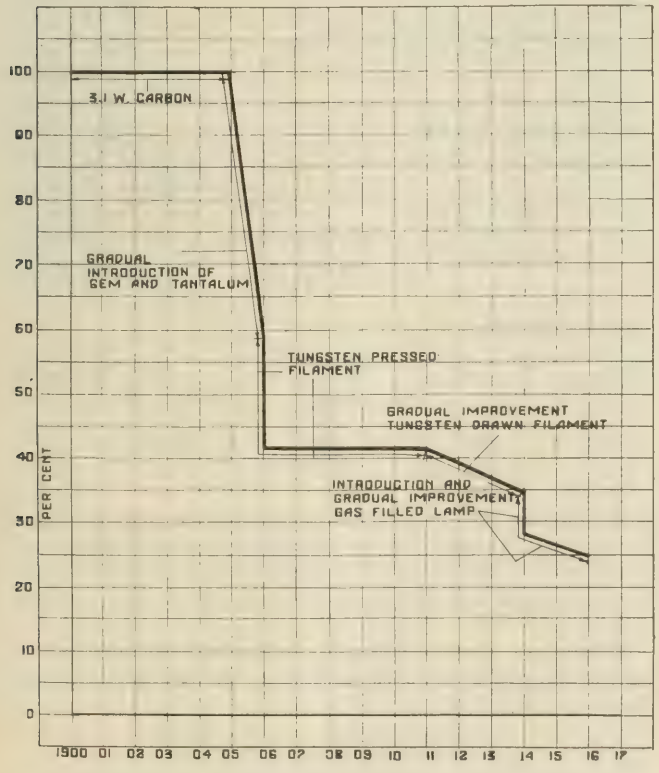
Practically all of this lighting business has been taken on at regular rates. The allowances for off-peak use, for high load factor and for large bulk, which have lowered power rates, rarely apply in lighting and as a consequence the gross income from this business has been and is still a major portion of the total. The power enthusiast still insists, of course, upon attention to net income only, and here he has a somewhat better case. It is believed, however, that an unprejudiced consideration of all expenses in any central station business will materially lessen the burden of plant investment, service costs and overhead previously allotted to lighting and that the importance of lighting once admitted, many of the power rates, in reanalysis, will be seen to be too low, leading sometimes to actual loss. In other words, the prejudice in favor of power has been so extended that frequently lighting has been charged with excessive expense.

Stability of Lighting Business

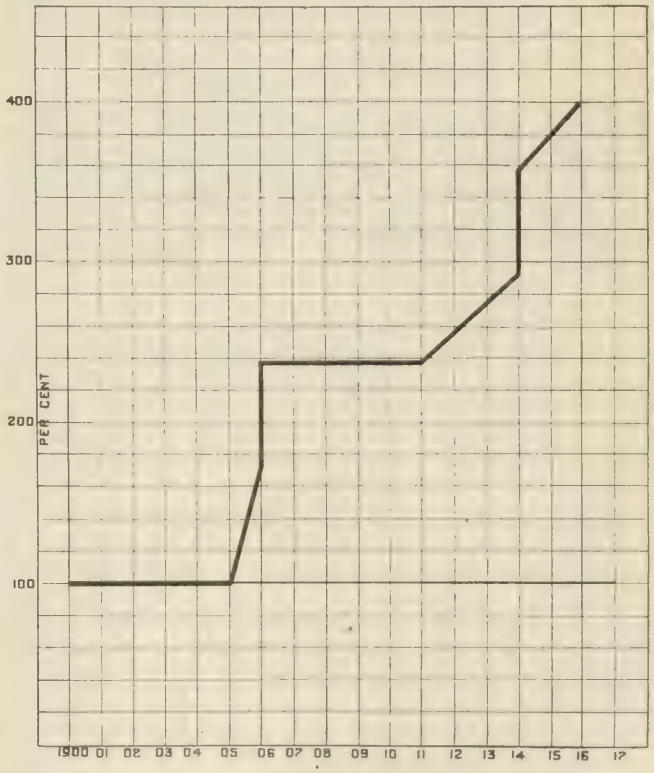
After all fair revisions are made, however, it must be conceded that lighting is more costly to deliver in small quantities than is power in large blocks. The relation of net lighting income to expense can never be as generous as for power, but as long as profit is reasonable, lighting remains most attractive and the value of its predominant gross income is fundamental.

From the standpoint of stability of revenue the arguments in favor of lighting seem final. The return from many power applications depends entirely upon the trend of business. Electrochemical industries, for example, are subject now to abnormally early obsolescence of apparatus and processes. Many industrial undertakings supply a single phase of demand. The very size of the individual power consumers, too, suggests instability, as so much is lost by one failure, and line extensions which figured very low per kilowatt connected, become alarmingly expensive with no load remaining. These considerations apply to lighting to a very much lesser degree. The load is so distributed throughout the community that adverse conditions in one industry affect it slightly. Even in hard times the modern man feels that he must prolong his day, whether in business or at home, well into the hours of darkness and lighting output is reduced but little comparatively by quite extreme depression.

Such factors, it will be noted, are of weight irrespective of increased efficiency of light generation. These form the firm foundation for any development of the business. To this well founded industry now comes the possibility of tremendous enlargement.



ENERGY CONSUMPTION PER CANDLE-POWER OF MEDIUM-SIZED LAMPS IN PER CENT OF ENERGY CONSUMPTION OF 16-CP. CARBON LAMP



LIGHT GENERATED PER UNIT COST OF ELECTRICITY USING MEDIUM-SIZED LAMPS, IN PER CENT OF THAT FOR 16-CP. CARBON LAMP

Light production at five or six times the old efficiency requires an entirely new conception of the possibilities. The older light was something of a luxury. Admittedly, in comparison with former illuminants it was expensive. In consequence electric lighting men in general found themselves obliged to accept as satisfactory the lowest intensity which made seeing at all possible. Higher intensities than this led to excessive cost, dissatified customers and restricted business.

As a necessary corrolary lamps were installed to light a small working space, leaving portions of the room dim and nearly useless. With such installations it was most difficult to protect the eyes of users, and glare has been so common that most people have come to believe that artificial lighting is inevitably a serious strain to the eyes. The light from these older lamps, too, was so costly that it was necessary to use every iota and the color which happened to be generated was accepted without any attempt at filtering. This appeared vital to the general adoption of electric lighting and extended arguments were prepared in the attempt to show that under all circumstances this haphazard color of light was the ideal!

To-day we are dealing no longer with a luxurious commodity. Electric light from the gas-filled lamp is a cheap raw product. In many cities rates are so low that seven times as much light is secured as could be obtained for the same cost ten years ago. We can afford to refine this raw light and throw away adulterating or harmful ingredients in order to improve the economic value of the remainder. We can afford to apply it in quantities hitherto never considered possible, approaching even daylight intensities, and we can afford to install those accessories which give the most effective use, even though the bare physical efficiency is somewhat lower than in the older glaring arrangements.

Artificial lighting is just entering upon an entirely new era, an era of the greatest promise to the user, an era which may be made most profitable to the central station. In succeeding articles it is proposed to amplify three lines of lighting advance, offering an increased load to the service company but giving the customer economic advantage far in excess of increased consumption. These three lines are:

1. The use of enough light.
2. The general installation of proper lighting equipment.
3. The application of "filtered flux."

European Markets for Electrical Products

Conditions in Italy and Russia After the War Will Invite American Manufacturers and Jobbers—Preparations to Be Made

Articles published below give information which is of interest to manufacturers and jobbers who will sell electrical apparatus and supplies in Italy and Russia after the war. Both countries offer large opportunities for American products.

ITALY OFFERS MARKETS FOR OUR MANUFACTURERS

By F. Castiglioni
Electrical Engineer, Milan, Italy

I GLADLY accept your invitation to write a brief article explaining conditions and showing American electrical manufacturers what opportunities exist for them in Italy, for I think that benefits for both countries might result from a better knowledge of these conditions and opportunities.

Before treating the question of applied electricity in Italy it is necessary to touch on the coal question, which the war has put in the limelight in all its gravity. I presume that Americans know that Italy imports its coal mainly from England, a condition of things that does not make for low prices even in normal times; but only a few know that, due to different causes, the actual price of coal in Italy now is about six times the normal one, which brings about a situation that would be unbearable if the patriotic spirit did not dispose everybody to cheerful sacrifices.

To see coal at its former prices is scarcely to be expected, and the remarkable industrial development of modern Italy would be irreparably hampered in its imposing program of future progress if there were not the possibility that an aggressive policy of hydroelectric development will save the situation.

Italy is not only an agricultural land, as some appear to think, otherwise the field of applied electricity would not show the imposing total of over 1,000,000 electrically generated kilowatts. For the immediate future its policy, dictated by sheer necessity, has to be the following: To harness without delay all of the waterfalls of the country and through electrical distribution to make available the 3,000,000 kw. that they represent, thus reducing the yearly import of more than 10,000,000 metric tons of coal and at the same time offering a surplus of cheap power for a greater industrialization of the land, to realize the great project of general railroad electrification, to encourage the introduction of electric ovens and furnaces for metallurgy and the production of fertilizers for agriculture, and finally to increase the use of electricity for light, power and also heating purposes in the home. This program will at once awaken the interest of the American manufacturers of electrical goods. Import figures which are tabulated herewith in metric tons per year show the extent of the progress.

	Motors, Generators and Their Parts			Carbons for Electrodes, Brushes, Lamps, etc.			Apparatus—All Kinds		
Years	Total Imported	Imports from Germany	Imports from America	Total	German	American	Total	German	American
1908	8,744	6,154	556	1,565	1,315	...	480	269	80
1909	7,118	4,591	440	1,309	822	...	618	265	75
1910	6,595	4,271	249	1,384	762	...	878	285	89
1911	5,954	4,231	143	1,532	838	171	1,098	595	56
1912	5,286	3,686	109	1,983	1,107	140	1,154	564	36
1913	4,150	3,704	94	1,799	1,095	122	1,221	944	90

Italy also imports annually about 10,000,000 incandescent lamps, and of these about two-thirds are from Germany and Austria.

Italian Output Larger

Statistics concerning the Italian output are rather difficult to obtain, but it will suffice to say that it is

progressing at a rapid rate, especially for machinery up to medium size and for the most widely used types of apparatus and instruments. It is scarcely to be believed that the home industry will follow the accelerated rate of development imposed by the circumstances.

The tabulation published herewith shows that the bulk of the Italian imports was from Germany, while the United States has a very low percentage. It is not a matter of conjecture to affirm that after this war German goods will not find an easy way to Italian customers through the future custom barriers, and therefore it is up to the American exporter to find his way to replace the German products. Moreover, if one takes the trouble to consider the American export figures by themselves, he will find that as to electrical goods Italy has about 3 per cent of the total, a very low percentage in comparison with the importance of this market, even making due allowance for the distance and the hard competition.

How could the American industry gain its due share in the Italian electrical market?

I am not speaking to my good friends with the great manufacturing companies, for these companies already have their branch offices and factories in Italy, and will know how to take advantage of the next great revival. My only remark for them would be that in Italy there is a good market also for large machinery and apparatus of their standard types, but built on Italian soil and by Italian hands. Moreover, these branch factories ought to extend directly from the main house and be considered as something more than repair shops.

Extending Credit Facilities

To the many other American manufacturers in this line who are not yet in commercial connection with Italy, I would suggest that they consider the importance of this market, principally for special and novel apparatus, for heat for all electrical uses, for lamps, etc. It is not necessary for them to start at once planning a branch office or shop. A good start would be to make arrangements granting some firm selling rights; that alone can justify the trouble and expense of introducing a new brand. When people show the right kind of guarantees and references, the first rule has to be to extend to them the necessary credit, because to stipulate "cash payment against shipping documents" sounds at least funny all over the world, which on the average is not overburdened with riches. It was one of the easy German secrets, that of accepting the commercial usages of the different places, extending all possible credit facilities, and nobody could deny that this method brought commercial success.

There are already a branch of the Bencodi Napoli in New York and one of the National City Bank of New York in Genoa, and others will probably follow, so that all possible information can be had, and sure but reasonable credit arrangements can be agreed upon. There is a good field in Italy for American capital to finance good electrical enterprises, as others have done with profit.

There are many other questions connected with exports, each of which has its importance. For instance, it is advisable, though not necessary, to quote the values, weights and measures of the customer, and possibly c.i.f. his nearest harbor. The buyer would find it difficult to know how many francs the cubic meter of a certain wood would cost c.i.f. Genoa if the quotation was in dollars per cord at St. Paul, and I know some American exporters who overlook all of this.

As to quality according to the samples, careful packing, right terms of delivery, etc., I have too high an esteem of the American manufacturer to hazard any advice.

PREPARATION NEEDED FOR RUSSIAN TRADE

By Sterling H. Bunnell
Chief Engineer R. Martens & Company, New York

At this time, when trans-oceanic traffic is closely limited to the munition requirements of the armies of the warring nations, manufacturers are looking ahead in preparation for export trade in other lines. Current statistics from every European country show the diversion of labor from all other work to the munition factories. The reality of this distortion of production from normal lines can be seen in a day's journey in Canada, where shells are being made in increasing numbers by corporations which are unable to turn out more than a fraction of their usual products. There is not the slightest doubt that extraordinary wear and tear has gone on in all mechanical equipment in the countries at war. Replacements and repairs, to say nothing of extensions, will cause a brisk demand for imported articles in all of those countries.

Unless better and direct connections are provided by American manufacturers now, the export business which follows the war must come through the old, inadequate channels of small export agencies in the foreign countries that have correspondents in America. The names which are familiar to us here are unknown abroad. How many manufacturers in Russia, for instance, have copies of Hendricks's, Thomas's or Sweet's classified lists of manufacturers? How can a Russian house place an order for electric generators, transformers or telephone material of American manufacture, not knowing the names of any of the makers who are so familiar to the readers of this article? And if the names were ascertained by some English-reading member of the organization from an American trade journal, how shall the customary f.o.b. price of the equipment at an American inland shipping point be compared with the delivered and erected price which English, French and German concerns will quote through their local representatives in Russia? Personal contact with the buyer is absolutely necessary for any house that is to compete successfully for business in a foreign country.

Different Ideas and Tastes

The ideas and tastes of those who live in foreign countries are quite different from our own. To do a successful export business it is necessary to become thoroughly familiar with those ideas and tastes. Having become so familiar, it will be possible for the manufacturer to decide whether to make what the foreigner now wants, or to create a demand for the manufactured goods as they are. Often a middle course can be adopted, and the regular products modified somewhat sufficiently to fill the existing demand. But if any course short of copying the articles already on sale in the foreign country is to be adopted, it is very important to have the most accurate knowledge of the purchaser and his fancies. It is not easy for an American counter salesman to determine why his American customer refuses one thing offered and selects another. It is infinitely more difficult to determine what the foreign purchaser will like and buy and what he will leave alone. The investigating traveler ought to be a native and resident of the country which he is studying and familiar to the last degree with the manners, customs and tastes of its people.

If it is decided to go about creating a demand for something new in the country in which it is to be sold, the way in which the article is presented is all-important. We like our own style of advertising matter, with its features of language, illustration and printing. Nothing just like it is found in any foreign country.

The publicity man therefore meets a problem at the very beginning of his work. Will the foreign buyer be most attracted by printed matter on the exact lines conventional in his country, or by American-style printing? Americans, for instance, do not generally fancy the appearance of catalogs printed in England; it is probable that the English do not care particularly for catalogs as they are usually printed in the United States. The force of convention is so strong that sales literature, to have pulling power, must be so nearly in accord with what the reader has been accustomed to expect that he will not be repelled by its form or tone.

American Catalogs Not Suited for Use in Foreign Countries

Most American catalogs are not suited for translation and use in foreign countries. The subject matter is too technical; it goes too deeply into theories of design and construction, and it describes manufacture by special processes, the use of special materials, and other scientific technicalities that interest only engineers and expert constructors. The foreign buyer wants to know what the article will do, and how much better it is in use than competing articles, rather than how it is made. If it is something new to him, he wants to know what it is and how it works. In every case he wants sizes, weights, *cubic measurements*, and prices, and all in his own units of measurements, weight and money.

Illustrations of machinery are most useful in making foreign sales, but they should show the machine set up for operation, not set up for mere show. The operator, if shown in the picture, gives a correct idea of the size and proportions of the machine. The name, size number and description of the machine should appear as a caption. Each picture should be correct in every detail, so that the buyer may know just what he is getting. The background and accessories should be either a scene in the foreign country, so that the machine will appear in familiar surroundings, or else should show unmistakably its use in the country of its manufacture.

When, after preliminary work, inquiries from prospective purchasers begin to arrive, they must be handled in a different manner from domestic inquiries. Information from a foreign prospect is never complete, and yet it must be used in making up a complete reply. Imagination is needed in answering foreign inquiries. If, after an interval of two months or more, the foreign correspondent receives in reply only a catalog and a list of questions from America, he will naturally close with the English or German house whose prices and alternatives have been in hand for a month. If vitally necessary details must be had, they should be cabled for instantly on receiving the inquiry; the fact of cabling, showing the interest of the American, will help to hold the matter open for him. But it is better to assume the conditions and to estimate in several possible ways, writing fully the advantages of each. The inquirer may have no means of deciding on even the fundamentals until the letter arrives.

A Chance for Imagination

For illustration, consider an actual inquiry which was received recently for "all materials for an electric tramway, poles, rails, cars, etc., except power plant, which will be purchased in England." The usual routine sales correspondent in America would throw up his hands, and write or mail a printed list of questions asking gage, weight of rail, voltage of current, and a hundred more questions, none of which could possibly be answered by the foreign promoter, who evidently plans to install a system in some small city and must decide how much capital is needed. A man with imagination will assume everything from voltage to size of cars, write a ten-page letter if necessary, giving present approximate prices, and send illustrations and catalog pages of the articles he mentions. The promoter may have to come back with his details, but the seller has gained for himself an inside hold on the proposition which will be difficult for any competitor to overcome.

Importance of Personal Investigation

Personal investigation of the conditions in a foreign country is of great value to the manufacturer who is planning for export trade; but even more important is the establishment of export service facilities, including banking, shipping and delivering arrangements, so that goods may be quoted to the buyer at his own works and on his own terms of payment. The total amount of the transactions which require the services of an exporting organization is astonishingly great. Only corporations of great resources can carry out the larger projects which will be ready for American manufacturers when peace is declared. Connection with a strong exporting corporation is absolutely necessary for the manufacturer who is not in a position to make large investments abroad and desires to keep his working capital active in his own factory. There is plenty of work for able salesmen in connection with the activities of the exporting house.

Whether the salesmen working in the interests of a particular manufacturer receive their compensation from him or from the exporting house is a matter of mere detail. The cost of their services must be paid out of the profits of the foreign sales. It makes no difference at all whether the necessary percentage for maintaining the salesmen is provided out of the manufacturer's gross profit, or out of an increased commission (or profit in the final selling price) of the exporter.

Foreign trade is going to be a large item in the future prosperity of American manufacturers. The wise manager will make his foreign connections now, and with the aid of a responsible and capable exporting corporation will study the possibilities of foreign business and get the necessary information in time to be ahead of the competition which is sure to come when the war trade barriers are down.

Hartford, Pioneer City in Battery Service for Trucks, Now Has in Operation 400 Electric Passenger Cars

Although Hartford, Conn., is a pioneer city in battery service for trucks, some 400 pleasure cars of the electric type are now in operation, and the popularity of these machines is rapidly increasing. Four prominent makes of electrics are exhibiting this week at the Hartford Automobile Show, and one dealer informed a representative of the Electrical World that one new car a week of his type is being purchased, apart from the sales of competitors. Electric garage service at a flat rate of $35 per month for each pleasure car stabled is rapidly developing, and a garage with seventy-five cars in its care will shortly move into new quarters capable of accommodating probably 300 electrics. At the Hartford Automobile Show the pleasure electrics were located close together, giving a cumulative effect which was well worth while, and in finish and appointments these cars compared well with the best gasoline-driven motor cars. Lower prices for closed electrics are bearing fruit in increased orders. "Hartford is the best electric pleasure car city in proportion to its size east of Buffalo," said one representative at the show, and the multiplying of these units on the local streets bears out the truth of the remark.

Analyzing Growth of Central-Station Load

Studying Past Progress and Load-Factor Conditions as a Guide to Effective Future Commercial Effort for Load-Curve Improvement

BY W. S. LEFFLER
San Francisco, Cal.

IN the annual report of the central station company the popular form of "step" chart, with each step a year and their proportionate heights indicating annual growth, serves admirably to convey to the technically disinterested stockholder the fact that some consumers were added. Perhaps a chart like Fig. 1 may further aid, if the scales are properly chosen, in showing that the load also grew.

But the step chart does not discriminate between the 2000-kw. twenty-four-hour pumping consumer and the dollar-a-month, move-six-times-a-year domestic fly-by-night, nor does an analysis such as Fig. 1 indicate the good and bad load characteristics of the connected load which the past year's effort has placed upon the lines. That is, such a chart as Fig. 1 does not discriminate between quantity and quality growth, and a study of it does not indicate the danger points or unbalances that may be creeping into the growth due to the commercial effort being concentrated upon a particular class of service whose peaks may be adding to the peaks already occurring in the normal growth.

To the central station operator and executive the

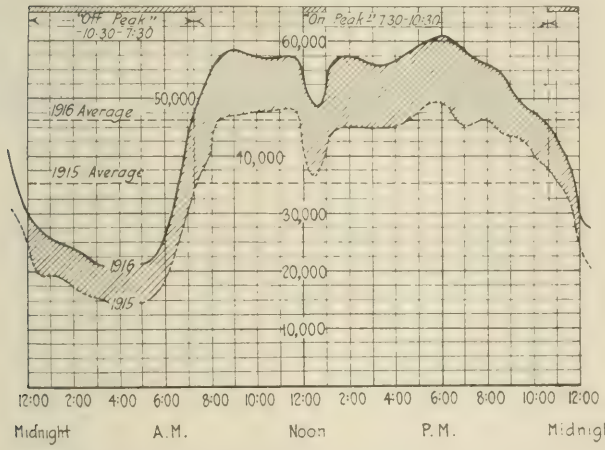


FIG. 1—AVERAGE OF DECEMBER LOAD CURVES FOR 1915 AND 1916 SHOWING, BY SHADED AREA, GROWTH OF LOAD FOR EACH HOUR OF THE DAY

popular analyses do not express a definite relation between load increase, the cost of that load increase, and the nature of the commercial effort necessary to most effectively counter the unbalances which, unwatched, finally grow into serious peaks. Hence the presentation of this method, which is based upon facts which are self-evident.

It will be immediately conceded that all central station growth is the result of one of two agencies: First, the natural increase of load resulting from the business which comes unsolicited due to the *natural* increase in population, general education, and the relative progressiveness of the community, which kind of growth, for the purpose of this discussion, we will call the "natural growth."

The second and only other agency producing central station increases is the active solicitation and aggressive campaigning which is carried on by and at the expense of the central station and its allied commercial organizations. The growth produced by this commercial effort we may call the "made load."

It is equally apparent that the business which comes unsolicited would have certain definite load characteristics, depending upon the dominant feature of the greatest part of the central station's custom. The peaks of the load curve of the "natural growth" might or might not coincide with the station peak, but since each year's "natural growth" is but an increment of the total station

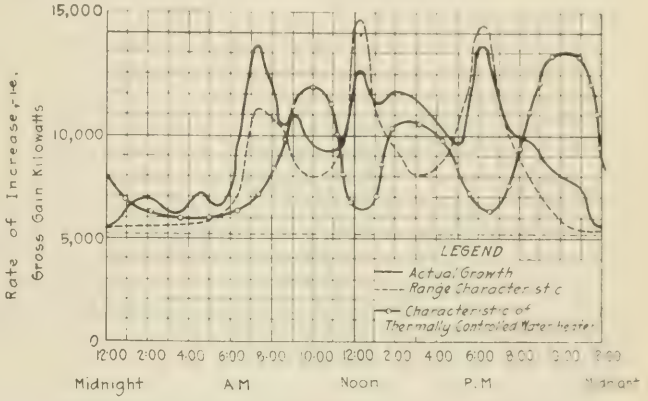


FIG. 2—CURVE OF ACTUAL GROWTH IN LOAD FOR EACH HOUR OF DAY, COMPARED WITH HOURLY LOAD CHARACTERISTICS OF ELECTRIC-RANGES AND WATER HEATING CUSTOMERS

business and load, it is reasonable to assume that the peaks of the natural unsolicited growth *will* coincide with the system peak already formed. Further, with respect to this natural growth, since it is unsolicited it is at once evident that the nature of its collective load characteristics and its relation to and effect upon the established peaks cannot be controlled by any power within the central station's reach other than discriminatory rates, which means is indeed a thing of the past.

THE CONTROLLABLE "MADE GROWTH"

On the other hand, the load characteristics of the "made" growth, coming by solicitation and aggressive development work, can be controlled, and the location of its peaks placed at nearly any hour of the active day by concentrating the commercial effort and expense upon the development of those classes of new business load

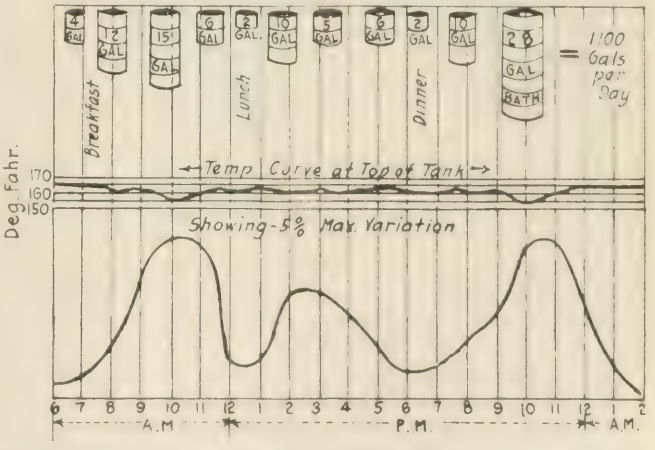


FIG. 3—HOURLY CHARACTERISTICS OF THERMALLY CONTROLLED WATER HEATING LOAD

which have load characteristics tending to produce a cumulative peak at the desired valley hour.

With these thoughts established, it is at once evident that the characteristics of the year's total growth should first be carefully studied and from these characteristics the coming year's commercial effort so laid out that by concentrating upon the proper kind of "made" load the result will be the development of such business as will have load peaks and characteristics which will balance the undesirable characteristics of the natural growth.

Limitation of space permits no attempt at a discussion of the "curing loads" for undesirable natural growth, for they will be different for each central station in terms of the various classes of service available for development and the general characteristics of the majority of the station's consumers. The purpose of this article is, however, to present a brief description of the basic method, together with an example which will show the necessity of some methodic analysis.

The studies herewith presented are typical only of the Western central station, but, again, the method of analysis, which is the central idea, may be applied to any type or series of load curves, and when the basic principles here given are elaborated upon, a comprehensive analysis may be readily developed which will clearly bring out the nature of the load which next year's commercial effort and expense should be concentrated upon in order to most effectively balance the characteristics of the natural growth individual to whatever central station may be under analysis.

Cooking and Water Heating as Examples

Having chosen a typical central station situation, cooking and water heating are taken as examples of "made load," in so far as they have load characteristics directly opposing each other, and further, since amplified domestic service seems to be the target of the greater part of commercial effort put forth by the new-business departments of the various central stations having water power as a main or auxiliary source of energy supply.

Referring to Fig. 1, we have the ordinary graphic presentation of the load curve growth which has been laid down for the years 1915 and 1916 by averaging for each year the thirty-one daily system load curves accruing during the month of December.

For the purpose of this discussion the off-peak period is taken as those hours during which the load curve remains below the mathematical average of the twenty-four hours' load—which leaves the on-peak period to include those hours of the day when the load curve rises above the average.

On a system developing such an appreciable drop at noontime, due to the shutting down of the industrial plants at this hour, it might be well to also include the hour from 12 to 1 as part of the off-peak period when considering the off-peak hours as a whole.

As has already been noted with reference to Fig. 1, it gives very meager information as to the nature of the year's growth other than that the load has more or less increased over the entire twenty-four-hour period. The noon valley in the 1916 curve seems as deep as in the 1915, and the peak still comes at 6 p. m. and the valley load reaches a minimum at 4.30 a. m.—a satisfactory presentation for the lay mind, but an analysis which conveys none of the desired information to the executive.

Fig. 2 presents a detail analysis of the growth, and has been developed by plotting the gross gain in kilowatt-hours on a twenty-four-hour chart with a sufficiently exaggerated vertical scale to definitely locate those periods of the day when the greatest increases in load, both normal and "made" growth, are manifested. As noted in the legend of Fig. 2, the heavy line tells the story of the actual growth, from which it might be noted that the load curve is increasing more rapidly at 6 p. m. than at any other hour of the day.

Referring to Fig. 1, we note that 6 p. m. is the one hour of the day when an increase in load is least desirable, or, expressing it differently, we note that increases at 6 p. m. are more costly to the station than at any other hour of the day. The increase at 12 o'clock noon, however, is developing at a very satisfactory rate, which would be gratifying on all systems where the hour of 12 to 1 is considered off-peak.

The third point of most rapid increase in the normal growth is noted between 7.30 and 8 a. m., and hence new business tending to cause a rapid increase in the load at this hour would warrant less commercial effort on those systems having a large industrial load, due to the fact that between 7.30 and 8 a. m. would come the industrial peak caused by simultaneous motor starting loads in practically every industry on the system.

The curve traced in dashes and superimposed upon Fig. 2 is a typical electric-range load curve taken from cumulative studies made on 1000 ranges.

The heavy dotted curve is a projected curve showing the characteristics of thermally controlled water-heating apparatus, its peaks coming directly following the dish-washing periods, and its greatest peak coming around 10 p. m., due to the coincidence of the evening dish-washing and bathing hot-water demands.

Neither the cooking or water-heating curves are plotted to scale, but they are true with respect to each other and, having such opposite characteristics, serve admirably as examples of this method of analysis, by which the utility operator is shown at a glance the relative value of range, water-heating loads, or any other

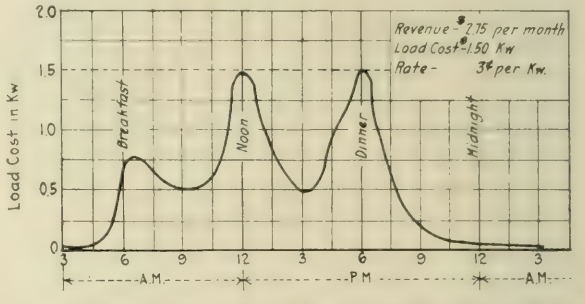


FIG. 4—HOURLY CHARACTERISTICS OF ELECTRIC RANGE LOAD

type of business, after the typical curve of each class of business has been laid down against the growth curve. The relative value of the range and water-heating business to the load shown is too immediately self-evident to warrant discussion, for the peaks of the range load, corresponding at every point with the peaks of the normal growth, indicate that the development of any business having these load characteristics is but adding to the peaks already forming at an alarming rate, whereas the development of any class of service having load characteristics such as are indicated by the thermally controlled water-heater when applied to a system such as shown, would tend to fill up the valleys of the normal growth.

The writer fully appreciates that there are many conditions to be considered other than a purely theoretical analysis of the load. For instance, in a hydro-electric situation, if the system peak was approaching the carrying capacity of the high-tension line, it is apparent that commercial effort might be profitably doubled or even tripled upon the development of loads having the characteristics similar to the thermally controlled water heater. On the other hand, if transmis-

sion capacity were of no particular moment it might be possible that hydroelectric storage capacity would be of prime importance, and in that event the system such as discussed here might well double or triple their commercial effort upon loads having characteristics similar to the range load, in order that limited water storage might not be sacrificed to the lower unit rate which would inherently be earned by the water-heater type of load which would fill up the valleys of the normal growth.

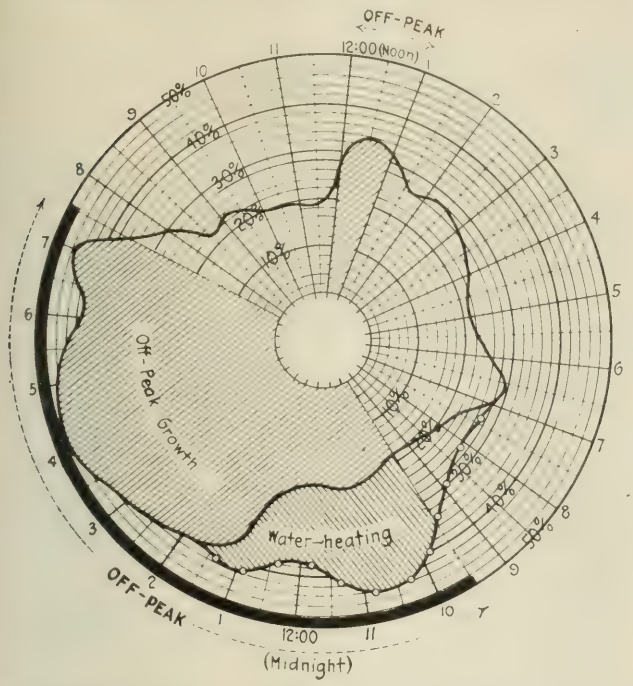


FIG. 5—POLAR CO-ORDINATE DIAGRAM OF PERCENTAGE GROWTHS, SHOWING OFF-PEAK AND ON-PEAK INCREASES—ALSO RESULT TO BE EXPECTED OF SUPERIMPOSING A WATER HEATING LOAD

Whatever the local conditions and limitations may be surrounding the individual situation to which this method of analysis may be applied, it is apparent that when each class of load available for development has been analyzed by superimposing its load characteristics upon Fig. 2, each available source of new business will be shown to have a different value to the central station in terms of the nature of its load characteristics and the location of its peaks with respect to the peaks of Fig. 2. Furthermore, each class of service has a different development cost per kilowatt of load secured, in terms of the amount of pioneering and campaigning it is necessary to undertake and the extent and nature of the competition encountered.

With the relative cost of development known, and, from the application of this analysis, the relative value to the system of each class of service determined, the logical conclusion is, then, the selection of those classes of service which combine the greatest value in load characteristics and the lowest exploitation cost per kilowatt of load secured. With the results of this selection constantly in mind, all commercial effort and expense for the new year should be so directed as to tend toward the development of the most highly desirable classes of service.

Fig. 5 gives a rather novel presentation of the year's growth when analyzed in terms of percentage increase. Since all commercial effort is primarily aimed at the development of the off-peak loads, then when the gross increase plotted in Fig. 2 is reduced to percentage and plotted on a polar-co-ordinate chart and the off-peak period shaded, a presentation is secured which shows the effectiveness of the past year's commercial effort.

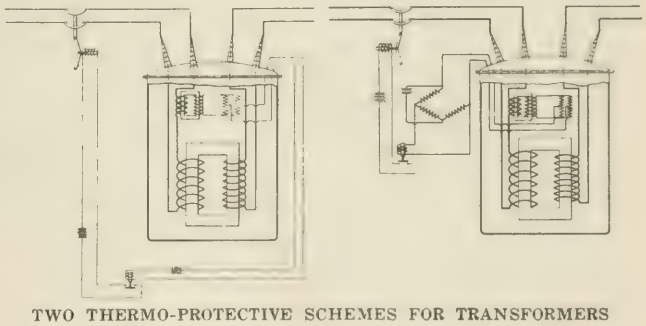
A utility operator producing such a generous increase during the off-peak periods as is shown in Fig. 5 should indeed be gratified.

Referring again to our examples of range and water-heating values, we find that on a system where electric cooking was actively campaigned for we should expect a substantial increase during the noon hour, such as is shown in Fig. 3, between 12 and 1 p. m. And with reference to the thermally controlled water-heating load shown in Fig. 2, if it be conceded that the effect upon the system load of this class of service would result in a peak between 10 and 11 o'clock, we then see that by superimposing a water-heating peak upon the analysis in Fig. 5 it would, in certain stations having characteristics similar to those analyzed here, be possible to maintain a steady increase during the off-peak hours. Such a chart as Fig. 5 might be incorporated in the company's annual report accompanied by a paragraph explaining why the ratio between "off-peak" and "on-peak" growth is the true index of the company's progress and commercial success.

Automatic Thermal Cut-Outs for Transformers

A number of patents have been issued recently for transformer thermo-protective devices designed to be located within the transformer tanks themselves. Inasmuch as transformers are capable of carrying material overloads without injury because of their superior ventilating, radiating and heat-dissipating properties, it is necessary to disconnect them from circuit only when their temperatures reach dangerous or destructive values. Charles Le G. Fortescue of Pittsburgh, and A. W. Copeley of Wilkinsburg, Pa., in patents respectively 1,210,058, and 1,210,049, show methods of controlling circuit interrupters by virtue of change of resistance with the temperature rise in the transformers.

In the Fortescue device a constant potential circuit comprising a battery and an electro-responsive device such as a solenoid switch is connected across equal-potential points of the resistor. When the resistance of the resistor within the transformer changes, because of a change in temperature, the current will vary substantially in accordance with variations in the temperature of the resistor. In the Copeley device, in order to preclude the improper functioning of the electro-responsive switch, a resistor is provided that is heated in accordance with the energy that traverses the transformer. By providing a Wheatstone bridge, one arm of



TWO THERMO-PROTECTIVE SCHEMES FOR TRANSFORMERS

which comprises the resistance of the resistor between equal potential points and a battery across two of the terminals of the Wheatstone bridge and the electro-responsive cut-out switch across the remaining terminals, when the resistor is heated to such a degree that it is advisable to disconnect the transformer, the resistance across the equal-potential points is sufficient to cause the Wheatstone bridge to become unbalanced, thereby de-energizing the electro-responsive switch.

Electric Motor Drive in Paper Mills

Load Conditions and Sizes and Types of Motors for Operating "Jordans," Beaters, Fourdrinier Machines, Calenders, Saws, Barkers, Pumps, Etc., Used in Paper Manufacturing Processes

ELECTRIC MOTOR drive for paper mills has many advantages, and often, to quote the opinion of the manager of a large eastern mill, the possible increased production alone will warrant the expense of the change from mechanical to electric drive. Both individual and group drive are used, but individual drive is especially desirable where variable speeds are required, as in the case of the paper machine.

Woods used for paper manufacture include poplar, fir, pine and hemlock. Mills manufacturing wood-pulp paper may be divided into two general classes, those which make the pulp required and those which purchase the pulp. The manufacture of wood pulp, especially mechanical pulp, involves the use of large amounts of power, and where water power is available it is customary to use it for the grinders and chippers, although electric drive is well adapted to the requirements of these machines, and is rapidly displacing water power.

Before taking up the details of equipment, a brief general outline of the manufacturing processes and a description of the principal machines will be given. Cotton and linen rags can be converted into paper of different grades, depending upon the color and quality of the material. The rags are carefully sorted and all foreign material removed, and then again sorted according to quality and cut up into pieces, and later cut to a finer degree by mechanical cutters and the dust removed by machines. The rags are then boiled with suitable chemicals and are ready for the beginning of the machine processes.

In making wood-pulp paper, fresh green wood is used for mechanical pulp, as it is more easily ground and produces better fiber. Blocks of wood about 18 in. in length are placed in the grinders and held against a grindstone revolving at from 200 to 260 r.p.m. by hydraulic pressure ranging from 30 to 75 lb. By this process the wood is reduced to a pulpy mass, and, during the grinding, the stone is sprayed with a stream of water to prevent burning of the wood. The pulp is then screened and is transferred to the beaters, where it is mixed with other stock that may be desirable, and is then rolled into sheets by wet machines, ready for storage or shipment, or it is transferred to the paper machine direct. Pulp grinders with a 27 by 54-in. stone require from 300 to 600 hp., depending upon the pressure and the size of the pockets. Chemical pulp is made somewhat differently, as the wood is chipped in chippers and treated with chemicals in digesters, where different combinations are employed to secure different grades of pulp.

From this stage the preparation of the raw material and the manufacture of the paper from rags and wood pulp, is in general, similar. The beaters which are used for refining the pulp consist of an oval-shaped tub with a partition half way across the center corresponding with the rectangular section. A heavy roll with knives in the periphery, parallel to the shaft, is rotated between one side of the tub and the partition. This roll is adjusted with reference to a bed plate, which consists of a number of steel plates standing on edge. The adjustment of the roll has to do with the ultimate condition of the fiber, as all of the stock passes between the roll and the bed plate. Clean water is constantly added to the stock while the dirty water is removed. The bleaching process sometimes takes place in the beater by means of adding the required bleaching solutions. From the beater the stock is generally run through a "Jordan engine," which consists of a cone-shaped plug made of hardwood and steel bars, fitted into a hollow concentric cone lined with a filling similar to that of the plug. By regulating the space between the plug and the outer cone the stock is finally reduced to the proper condition for the paper machine.

Sometimes it is desirable to drive the Jordans and beaters by different motors, as in some mills the entire stock is not subjected to the last refining process. Both the Jordan and the beater are operated at constant speed, but the power for operation depends upon the condition of the stock and the adjustment of the machine. When, however, all of the beaters supplying one paper machine are driven by a single motor the load will be practically uniform. Motors with high torque and constant speed characteristics should be used for beaters, and shunt-wound, direct-current motors, squirrel-cage and slip-ring induction motors are all operated on this service.

The power required to drive beaters is a variable quantity, but from tests it has been determined that a good rule to follow is to allow 1 hp. for each inch of width of the beater roll. For work on light stock, such as ground wood, sulphite fiber, old papers, etc., with a moderate peripheral speed not exceeding 1600 or 1700 ft., three-fourths of a horsepower for each inch of roll face will generally be found ample. The starting torque for beaters varies considerably, depending upon the methods of operation. If a beater is shut down full of stock, and started again shortly afterward, with the roll down in its running position, the starting torque will be about the same as the normal running torque. If the roll is lifted before starting, the necessary torque will be reduced and the beater will start comparatively easily. If, however, the stock is allowed to stand for some time with the rolls stationary, as on Sundays, the fiber settles to the bottom, clogging the roll, and requiring more than normal torque to start it, even if the roll has been lifted above its running position. For this reason, slip-ring motors are often recommended for beaters, as they give a better starting torque. Beaters lend themselves to either group or individual drive.

For newspapers and other kinds of paper, as well as rag paper, the Fourdrinier paper machine is in general use. The machine can be conveniently divided into two parts, the constant-speed part consisting of the pump, felt beater, shaker and screen, and the variable-speed part, which includes the wire press rolls, dryers, and calenders. The constant speed requirements are from 25 to 30 per cent of the total machine power requirements. A considerable range of speed variation with fine increments is essential for the variable-speed portion of the machine, and the common method is to employ a shunt-wound, variable-speed, direct-current motor or a constant-speed induction motor in connection with some form of mechanical speed-changing device. Satisfactory results are obtained by the combination of an adjustable-speed interpole motor, the motor having a field rheostat with from 60 to 90 points. The power requirements of a Fourdrinier machine



Electric Motor Drive in Paper Manufacture

The center illustration shows a group of four motor-driven super-calenders operated by the P. H. Glatfelter Company at Spring Grove, Pa. Other applications of motor drive in the paper mill industry are pictured in the upper and lower panels on this page. Electric drive is rapidly replacing other sources of power for operating the grinders and chippers which are used in making wood pulp. The illustrations show the trying conditions under which such motors operate; sawdust does not hinder the induction motor. The pulp is refined in beaters and later reduced in "Jordan engines." Both of these machines are operated at constant speed, the power requirements varying with the adjustment. Motors for beaters must have high-torque with constant-speed characteristics.

vary with the width of the paper and the speed of production. For example, in a test of the variable-speed part of a 152-in. machine, the motor input varied from 87 to 92 hp., depending upon the quality of the paper.

On account of the great variety of paper, the method to be adopted for driving the machines must be studied for each installation. One method is to use a constant-speed motor for driving both the constant and the variable-speed ends of the machine with a mechanical speed changer between the motor and the variable-speed shaft. This is the cheapest as far as electrical equipment is concerned, but does not eliminate the speed changers, which, especially in the case of large machines, prove very troublesome, besides having a first cost that may entirely offset the initial saving in the electrical equipment. In most cases this method is not recommended.

In a second method, a constant-speed motor drives both the constant and the variable-speed end of the machine, the speed variation being obtained by changing the pulleys driving the variable-speed shafts. This gives a low total cost, but does not give any fine speed adjustments, and it requires considerable time to change pulleys, and should be used only in cases where it is expected to run on one grade of paper for a long period. This is also more or less of a makeshift as far as electric drive is concerned.

Another method is to employ a constant-speed motor for driving the constant-speed end of the paper machine and a slip-ring induction motor with regulating resistance to drive the variable-speed end. This method is only applicable when the amount of speed variation is small, on account of the poor speed regulation at low speeds. Such installations have proved successful with as great as 40 per cent reduction below the maximum speed, but it is a safe rule that the largest variation of speed with such an installation should not be below 20 per cent of maximum speed.

Still another method is to use a constant-speed motor for the constant-speed end of the paper machine and an adjustable-speed, direct-current motor with field control on the variable-speed end. Since most paper mills use alternating current for their principal drives, this scheme involves the use of a motor-generator set for supplying the necessary direct current for the adjustable-speed motors. The range of speed which can be obtained by this method is limited by the economical range for which it is possible to obtain adjustable-speed motors. This limiting range is about 4:1, and it is preferable to confine it to 3:1.

In some instances, a method that is used consists of installing a constant-speed motor for the constant-speed end of the machine, with the speed variation of the motor driving the variable-speed end of the machine obtained by voltage control. By this method it is possible to obtain speed ranges of 5:1 or 6:1, and greater, by purely electrical methods. The generator for supplying the direct current for the variable-speed motor is usually driven by an induction motor. It is also possible to omit the motor driving the constant-speed end of the paper machine and drive this from a pulley on the motor-generator set. Another arrangement which has been considered is to use an engine belted to the constant-speed shaft and belted or direct-connected to a generator and exciter, which would furnish power for the motor driving the variable-speed end of the machine.

There is a modification of the voltage-control system which has certain features of superiority, consisting of a combination of a certain amount of field control of the motor driving the variable-speed shaft with voltage control. With this method of voltage and field control, 10:1 speed variation may be obtained.

For driving the calenders, a slow and uniform threading speed is essential, and there must be a gradual acceleration from low to high speed, with ability to slow down and accelerate again. Simplicity of control and operation is also important. Electric drive, for these reasons, is especially adapted to this work, as each weight of paper can be run at the highest operating speed and the operation of the machine is always under instant control. Two-motor drive is well adapted to calenders, one a small squirrel-cage motor with gear reduction for threading the paper through the rolls, and gradually accelerating the speed by means of the larger motor. In a large Eastern mill the 66-in., 72-in., and the 86-in. calenders are equipped with 75-hp. and 15-hp. motors, the former for driving and the latter for threading in.

Power required for presses and trimmers varies from almost nothing to the maximum, and properly proportioned flywheels should be included in the machine equipment. The power requirements of some additional machines used in paper mills are as follows: Water pumps, 10 to 20 hp.; saws and barkers, 10 to 15 hp.; stuff pumps, 5 to 10 hp.; elevators, 3 to 10 hp.; cutters, 5 to 10 hp.; exhaust fans, 5 to 15 hp.



EACH OF THESE ELECTRICALLY-DRIVEN PAPER MACHINES HAS A CAPACITY OF 150 MILES OF WRAPPING PAPER 13 FT. WIDE, PER DAY. THESE MACHINES ARE A PART OF THE MILL EQUIPMENT OF THE UNION BAG & PAPER COMPANY AT HUDSON FALLS, N. Y.

Performance of Two Successful Windmill Generating Plants

Considerations on Which Selection of Equipment Was Based, Features of Arrangements Employed and Results of Tests Showing Ability of Plants to Utilize Wide Range of Wind Velocities

By Frank S. Culver

GENERATION of electricity by wind power is a problem that has been studied by numerous inventors for many years, yet very few of them have compiled data which can be used in the design of small rural lighting plants. Furthermore, most of the arrangements which have been tried out have been abandoned owing to their complexity, inefficiency or cost. Believing that there would be a field for wind-power generators, however, if a simple and durable construction could be developed, the writer installed two experimental plants in Wisconsin and conducted extensive tests to determine the best method of utilizing the wind.

Upon investigation it was found that all previous investigators had one idea in common, namely, that electric power could be generated economically by wind power only through the medium of a storage battery. On all other phases of the subject there were almost as many opinions as experimentors. The first thought of nearly all inventors seems to have been that the variable speed of the windmill is not suitable for charging a storage battery, and must in some manner be brought to a more nearly uniform speed or damage would result to the battery. In attempting to secure speed regulation some used centrifugal governors and brakes, others employed belt drive and permitted slippage, and still others used hydraulic motors operated by water which had been elevated by the wind mill. Each of these arrangements is undesirable, however, the first being wasteful of power, the second self-destructive and the third too complicated and expensive.



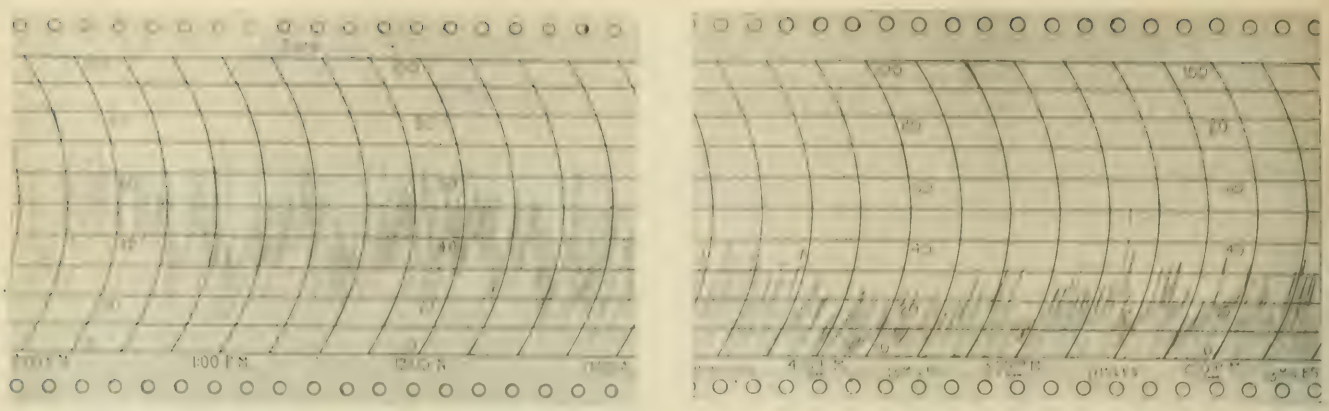
FIG. 1—WINDMILL-OPERATED GENERATING SET IN NORTHERN WISCONSIN WITH GENERATOR ATTACHED TO TURNTABLE

Very little data could be obtained from a careful search of the libraries and little reliable information could be obtained from manufacturers regarding the performance of their mills. About the only data obtained that were usable were secured from the United States Weather Bureau. These showed the annual average wind velocity for Wisconsin to be about 9.9 miles per hour. Since the wind is more active during the day than at night, it was assumed that the average daytime velocity would be about 14 miles per hour. From the Weather Bureau reports it was also found that the lowest wind velocities occur in June, July, August and September—the months with the longest days and therefore the periods requiring the least amount of artificial light.

Having decided to erect an experimental plant on a farm in northern Wisconsin, a rough estimate of the number of lamps that would be required and the number of hours that each would be in use was made and it was decided that a battery of 26 cells with a normal discharge rate of 3 amp. for eight hours would be ample to provide lighting for several nights on one full charge of the battery. For charging the battery, a generator rated at 3 amp. and 65 volts was selected. As the maximum speed of the windmill in heavy winds was somewhat uncertain, the question of generator speed was left for further consideration. From the information obtained on wind velocity it was decided to erect an ordinary pumping-form 12-ft. wind mill on a 50-ft. steel tower. By experimenting, it was found that the speed of the windmill did not exceed 75 r.p.m. in a wind of 30 miles per hour when running without load, due to the regulating features of the windmill. With this speed fixed, it was an easy matter to provide the proper sized pulley for the generator. To assure charging with winds of low velocity, a generator was selected having a normal speed of 900 r.p.m., but having a pulley ratio which made it operate at 1800 r.p.m. with the maximum windmill speed of 75 r.p.m. Heavy charging current at the higher speed was prevented by a differential winding. A study of the accompanying chart will show how well this regulation was cared for.

A waterproof generator was employed, being attached to the turntable of the windmill, below the axis and a little to one side. As shown by the accompanying illustration, it was connected thereto by a sprocket wheel and standard automobile chain. From the generator, wires were conducted down through the hollow center posts of the mill, and terminated in a set of collector rings. Connections were made with the storage battery by means of collecting brushes attached to the stationary frame work of the windmill. This arrangement permitted the windmill to turn in any direction with change of wind without requiring any complicated transmission mechanism.

As this plant was constructed principally for the purpose of gathering information for the design of larger plants, it was connected with a switchboard on which was mounted voltmeters, ammeters, graphic recording ammeters, watt-hour meters and an anemometer for recording wind velocities. The anemometer cups were placed sufficiently above the windmill to be out of the influence of the wheel. By means of an automatic cut-in the generator is connected with the battery



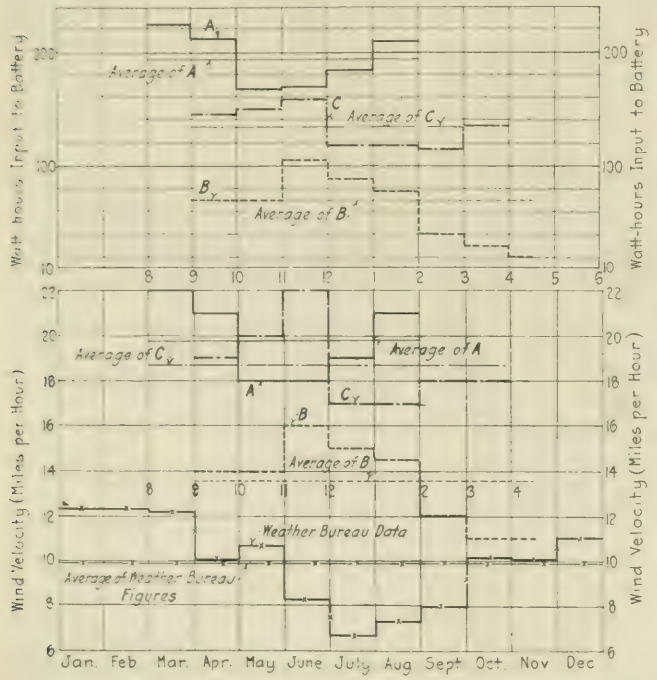
FIGS. 2 AND 3—CHARGING RATE OF CHAIN-DRIVEN GENERATOR AND EFFECT OF AUTOMATIC CUT-OUT DURING LOW WIND VELOCITIES
The curve in Fig. 2 refers to conditions represented by curves A of Fig. 4. Each horizontal line represents 1 amp. As shown by Fig. 3 the generator was automatically cut out about forty times in one hour due to low wind velocity.

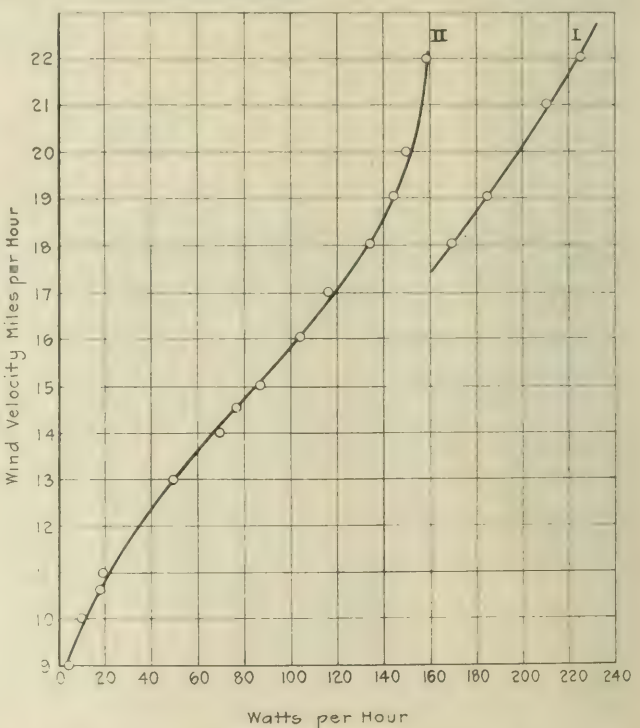
whenever the generator voltage is in excess of the battery voltage and is disconnected just before the current reaches zero value or point of reversal.

Nightly records were made with this plant and the results obtained shown in Fig. 4. It may be noted that with an average wind velocity of 19.8 miles during a six-hour test, the battery was charged only slightly above its normal rate of 3 amp. This is also shown by the graphic recording meter chart, Fig. 2, each horizontal line of which represents 1 amp. The curve in Fig. 6 shows the amount of energy used on the evening of May 25 and is an average of several others taken at various times. This chart shows that lamps were lighted at 7.15 p. m., the load becoming a maximum at 7.45 p. m. This load, which was the normal full load for the battery, continued until about 8.40, when a decrease commenced, the last lamp being extinguished at 10.10 p. m. During this period, 260 watt-hours were drawn from the battery according to the watt-hour meter. Since Figs. 4 and 5 show that the battery was charged at a rate of 193 watt-hours per hour, this shows that the rating of the equipment was properly selected. In this connection, it should be pointed out that one day's charging furnished enough energy for four nights' illumination. During the shortest days of the year, lamps would be required about two hours earlier, but observations of wind movements show that wind velocities are greater at the same time, thus insuring sufficient power for the generation of this extra energy.

Although mounting the generator at the top of the windmill as described affords a very efficient drive, the generator is inaccessible. It was therefore decided to erect another experimental plant in which the generator would be placed in a building at the base of the windmill tower, either on the floor or on a shelf. This arrangement made it necessary to adopt a power type of windmill, but it also permitted the use of an open-type generator and the elimination of sprockets and chains, as well as the collector rings. For these reasons, the cost of the two systems was about the same.

The second plant was erected in southern Wisconsin and consisted of a 12-ft. wheel mounted on a 50-ft. tower driving a 6-amp. 35-volt, 900 r.p.m. generator. The battery used in conjunction with this equipment was rated at 6 amp. and consisted of fourteen cells. A standard windmill with a vertical shaft terminating in a footjack in the lower part of the tower was employed





FIGS. 4 AND 5—ENERGY INPUTS TO BATTERIES AND CORRESPONDING WIND VELOCITIES FOR TWO TYPES OF WINDMILL GENERATOR PLANTS INSTALLED FOR EXPERIMENTAL PURPOSES IN WISCONSIN
Curves marked A and I refer to an outdoor chain-driven windmill generator and curves B, C and II refer to an indoor bevel-gear belt-driven plant. Curves marked with corresponding letters refer to similar conditions.

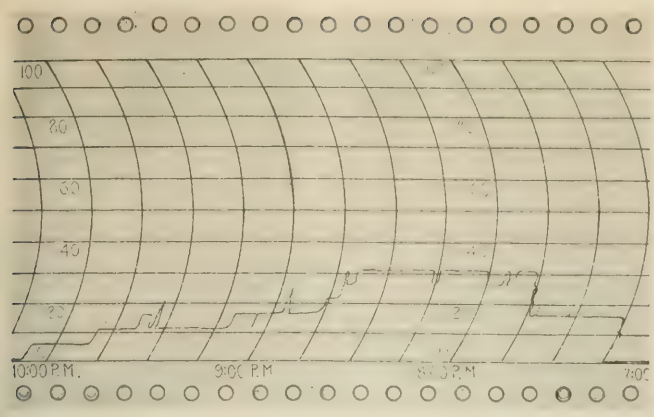


FIG. 6—VARIATION IN LOAD ON GENERATOR ON A TYPICAL SUMMER DAY (MAY 25)

and bevel gears used to transmit power to a horizontal shaft extending into the building. The generator was connected to this shaft by an ordinary pulley and belt.

Results obtained from this plant at different wind velocities are also shown in Figs. 4 and 5. As shown by comparing the figures on the two plants, it can be seen that there is very little difference in efficiency, the cost is the same, but the last plant erected has the advantage of greater simplicity and suggests the possibility of using this system in connection with any power windmill that may be already in use. Since some of these plants have been in operation for six years, furnishing illumination every night, there seems to be no question as to their durability.

The curve in Fig. 3 is interesting, as it shows the action of the outfit when operating at a low wind velocity. In one hour the generator was connected and disconnected about forty times. This performance speaks well for the design of the cut-in and it is very important as this condition may exist for days at a time. Furthermore, it demonstrates that it is possible to fully charge a battery even on days when the wind is gusty and low velocity.

Results of tests on the chain-driven and geared type plants are shown in Fig. 5. From an examination of these curves it will be noted that with a wind velocity of 22 miles per hour, the charging rate of the geared plant had nearly reached a maximum, while with the chain-driven plant the charging current was increasing almost directly with the wind velocity. This action is due to the difference in adjustment of the differential windings of the generators. In the first case, nearly the entire winding was effective, while in the other it was nearly all cut out of circuit. Thus, by adjusting the amount of the differential winding in circuit, the peak charging current can be easily controlled. Another interesting fact is the low wind velocity at which the generator will charge the storage battery, current being furnished with a wind velocity of only 10 miles per hour.

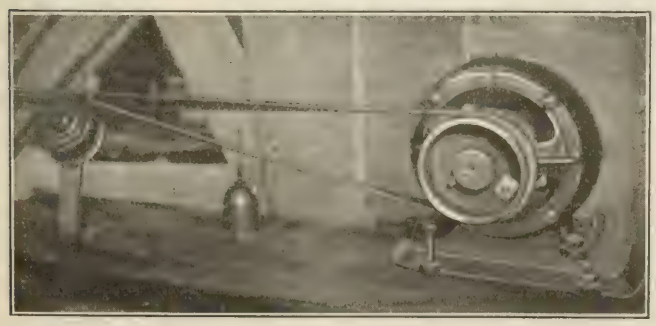
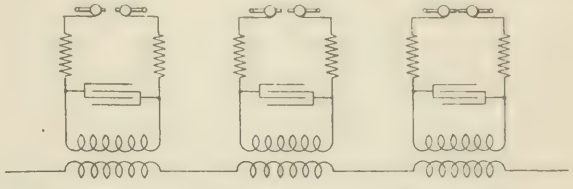


FIG. 7—INDOOR GENERATOR CONNECTED WITH WINDMILL SHAFT BY BELT AND BEVEL GEARS

Scheme for Lightning Arrester

The older forms of lightning arresters have, as the underlying principle, the fact that an inductance or capacitance in a line acts as a reflector for the electrical disturbances impressed thereon. This theory of reflections appears to be due in the main to Oliver Heaviside. With the advent of resonance circuits in wireless telegraphy the decremental energy losses in a spark gap circuit has suggested patent 1,212,128, issued to Alexander Cherynshoff of Swissvale, Pa. This is an application to power circuits which may be subject to high frequency destructive surges set up by whatever cause.

Instead of reflections taking place which heretofore required that the surge energy be either dissipated in the line or be allowed to slowly filter through the protective devices to the machinery one wished to protect, such oscillation circuits act as unreflecting absorbers of the surge energy to the more perfect protection of the line. By connecting a condenser in shunt with the secondary windings of an air core transformer, the transmission



MEANS OF PROTECTION AGAINST STRAINS DUE TO HIGH FREQUENCY CURRENTS

line conductor is instantaneously relieved of high-frequency disturbance, inasmuch as the condenser absorbs the charge by reason of the close inductive interlinkage between the primary winding and the secondary winding when subjected to the high-frequency impulses. When the quantity of electricity absorbed by the condenser raises the potential of the condenser and subjects the spark gap to a sufficiently high voltage to effect discharge, the auxiliary discharge circuit will oscillate at a frequency in excess of the original disturbance because of the low inductance of said auxiliary circuit.

Thus it will be seen that a plurality of protective devices may be inserted in series with each line conductor, each device being so constituted as to dissipate most effectively the energy of disturbances having frequencies and quantities of energy within limited ranges. In this manner, protection may be afforded a system against disturbances of a wide range of frequency and quantities of energy. Moreover, no ground connections or connections between adjacent transmission conductors are required, which condition greatly affects the insulating properties of the line. After the devices have been once installed, it is unnecessary to have frequent inspections, such as are required when electrolytic condensers are used.

Indirect Publicity Considered Effective at Indianapolis

The newspapers and the public of Indianapolis, Ind., have of late been devoting much time to discussing the lack of community interest or civic pride in the Hoosier capital. In order to do its share to restore public interest in city affairs and progress, the Merchants Heat & Light Company of Indianapolis has been publishing a series of indirect advertisements which are taking the form of parodies on some of the Riley poems, telling of the "No-Community Interest that'll git yer, ef you don't watch out." The company has for a long time been a believer in indirect publicity, and has particular faith in the value of this series of advertising.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

A MONTANA ALUMINUM LINE DISMANTLED AT A PROFIT

Load of Two 50,000-Volt Aluminum Transmission Lines 60 Miles Long Now Carried by Steel Tower Copper Line Reinsulated for 100,000 Volts—Salvage of Aluminum About $60,000

Recently advantage has been taken of the high price of aluminum by the Montana Power Company in the reconstruction of transmission lines from its power stations on the Madison River to Butte. Originally three 50,000-volt lines were constructed between these points, two of them using aluminum conductors on wood poles and one No. 0 copper on steel towers. The steel tower copper line has been reinsulated for 100,000 volts and the aluminum lines abandoned. General Manager F. M. Kerr of the Montana Power Company gives the cost of reinsulating the 60 miles of tower line as approximately $17,000, with a salvage on aluminum from the other two lines at 52 cents a pound f.o.b. the Butte railway station, of approximately $60,000.

The aluminum lines were built in 1901 and consisted of a double pole construction 60 miles long. Wood poles 40 ft. tall spaced 180 ft. carried conductors in triangular spacing, on one crossarm with two insulators and an insulator on top of the pole. Pin-type glass insulators of the "Prove" design were used. The conductors were of seven-strand aluminum, each strand being No. 10 B & S gage, making the line equivalent in section to about No. 1 copper. The conductors were originally tied on the side of the glass insulators with No. 4 solid aluminum wire. These ties wore out in the first two or three years and were replaced by ties of No. 8 weatherproof copper. After several years the conductors began to show wear at the contacts with the insulators and after about twelve years of service it was found necessary to reinforce the conductors at every insulator. This was done by taking a short piece of aluminum, about 18 in. long and clamping it to the conductor with two Crosby clamps and again tying the conductor to the insulator.

While these two aluminum lines have been in continuous service fifteen years, Mr. Kerr states that it has been known for the past several years that on account of their condition, the time was rapidly approaching when they must be abandoned. The present high price of aluminum appeared to offer an opportune time to get the largest amount of salvage from the aluminum and hastened the work. The growth of business has made it advisable to change to 110,000 volts. This raised the rating of the tower line to approximately 10,000 kw.

The experience and observations of the Montana Power Company have led its engineers to favor copper over aluminum for long-distance transmission lines for the following reasons: (1) Aluminum is softer and weaker and particularly susceptible to abrasions at points of support. (2) Aluminum has a lower melting point and is easily burned in two and destroyed by arcs. (3) Where the wires are supported on suspension insulators, side swinging to the wind must be considered. Aluminum is at a disadvantage in this respect and on account of its light weight and large area will swing up into close proximity to the crossarms, cutting down the necessary clearance to a dangerous extent. (4) Fire hazards and danger are greater with aluminum on account of its liability to burn in two, drop to the ground and set fire to whatever it touches. The ends of the wire will burn free from the ground and hang down as a menace to human life.

How a Power Company at Niagara Falls Utilizes Trolley Boat to Prevent Ice Jams

BY RAYMOND FRANCES YATES

The trolley boat shown in the accompanying illustration, which has been used for a number of years by one of the large power companies at Niagara, has been found a practical means of preventing ice jams in the intake canal of its power station. For this purpose it is more effective than a steam tug since it can be handled with greater ease and is much faster in its action.



TROLLEY ARRANGEMENT FOR OPERATING ELECTRIC ICE BOAT IN A FOREBAY

The power equipment of the craft consists of a 75-hp., single-phase, 220-volt, 25-cycle railway motor with the ordinary drum controller and grid resistances. The maximum load speed of the motor is 1000 r.p.m., which gives the propeller 240 r.p.m. by means of a single reducing gear with a ratio of 16 to 66. As the motor starts at heavy torque, the boat accelerates very rapidly to full speed which is very desirable in this work. The device at the top of the pole in the illustration is a commutator arrangement that permits the boat to travel in any direction. The purpose of the boat as now used is not to break ice, but to keep it moving in the direction of a small spillway at the end of the canal, where it drops into a perpendicular shaft that discharges into a big tunnel.

The trolley boat shown in the illustration was constructed by the Niagara Falls Power Company and first used in 1912. One of similar construction, however, was built in October, 1905, by the Canadian Niagara Power Company, and has been in service ever since.

How Quarry Pits Were Used to Store Coal Under Water

BY R. I. ELKIN

An ingenious and inexpensive method of storing large quantities of coal under water was utilized last summer by some of the large coal users in Chicago at the time when all large consumers of coal were busy preparing for the threatened railroad strike. Outside the city of Chicago and in close vicinity thereto are a large number of stone quarries about 25 ft. in depth, some of which have been worked out and are nearly full of water. A number of these worked-out limestone quarries on the Chicago & Alton Railroad, to which tracks ran, were filled with coal. The coal in regular hopper cars was run in on the tracks alongside the quarries and flushed into them by water. Most of the coal so stored consisted of screenings. As it filled up the quarries the water was displaced, the coal being dumped in until between 2 ft. to 6 ft. of water remained above the surface, the idea being to protect the coal from spontaneous combustion. Much of this coal still remains in storage although some has been taken out by suitable suction pumps.

Stage Pressure Observations During Turbine Tests

The primary function of a turbine test is to ascertain how many pounds of steam are required to generate a kilowatt-hour. In a great number of the tests important observations which have a bearing on the accuracy of the test results are overlooked, and as few observations as possible aside from weighing the water and recording the electrical load are made. If the test results show that the steam consumption follows a straight line law all is well and good. However, there are tests in which the line of steam consumption shows a deviation from the Willans law, and many times such data as stage pressures will show the probable cause for the difference. If the stage pressures are taken as the tests are made, as is now done in large plants, the results may be compared so as to demonstrate the condition of the nozzles or of the turbine blading. Changes in the pressures will indicate excessive leakage and deterioration.

In Fig. 1 is shown an arrangement for obtaining the

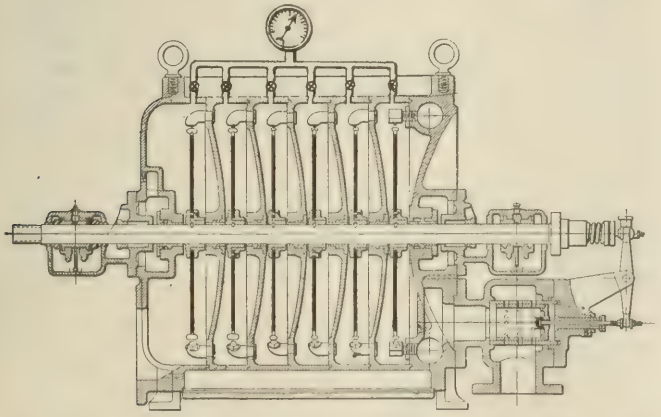


FIG. 1—ARRANGEMENTS FOR OBTAINING STAGE PRESSURES ON MULTISTAGE TURBINE

stage pressures on a small multistage impulse turbine. A 0.25-in. pipe was tapped into each stage and in this short length a valve or cock was placed. The other ends of these pipes terminated in a header to which a steam gage was attached. This provided a permanent method of taking the pressures. If the turbine is used to drive an exciter, the load may be varied by the use of a barrel rheostat, and the steam consumption and pressures taken for different load conditions.

In Fig. 2 is shown the pressures in the various stages plotted against the per cent of rating of an exciter. During this test the steam pressure in the line supply-

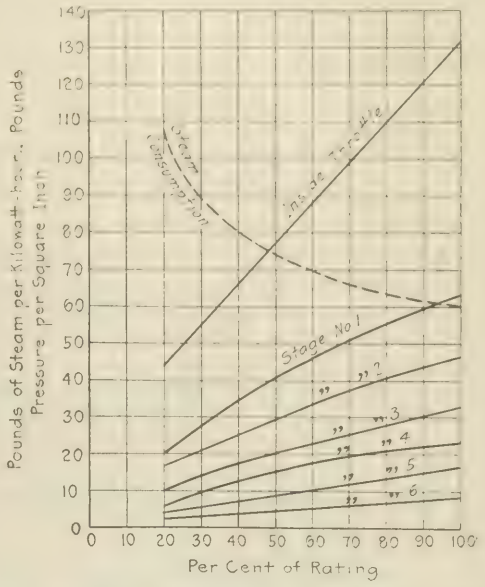


FIG. 2—STAGE PRESSURES AT DIFFERENT LOADS

ing the turbine varied but slightly, so that the line showing the pressure inside of the throttle illustrates the governor action covering variations in the load. The dotted line is the steam consumption in pounds per kilowatt-hour.

The stage pressure lines are practically straight, and show that there was no undue restriction of steam flow and no leakage in any one of the stages.

An Explanation of an Apparent Difference in Acceleration of Two Wound Rotor Induction Motors

BY E. C. PARHAM

The current in the rotor circuit or secondary of an induction motor depends on the impedance of the rotor and on the emf. acting on that impedance. The amount of the emf. that is active in the rotor circuit depends on the rotor slip which is the difference of the speeds of the rotor and of the rotating magnetic field due to the stator. Since the difference of these speeds represents the rate of the relative cutting of the lines of force of the magnetic field and the conductors of the rotor, it is a measure of the voltage generated in those conductors. The speed of induction motors that have wound rotors is controlled by varying the resistance included in the circuit of the rotor. The speed of an induction motor that operates light, is very nearly the same as that of the rotating field; that is, the speed is nearly synchronous. Under this condition a given change in the resistance of the rotor circuit will have but little effect on the rotor speed, compared to what the same resistance change will have when the rotor is driving a load.

An operator at one time complained to the writer that of two similar induction motors that were applied to the same kind of duty, the speed of one responded more decidedly to the advancing of the controller, than did the speed of the other. He was dissatisfied with the speed control of the less responsive machine.

Trial proved that on one outfit each controller notch made a difference of about 2 r.p.m. of the work while

on the other outfit the speed difference per controller notch was about 4 r.p.m. of the work. Investigation disclosed that the motor with the greater speed variation per notch was connected to a much heavier load than was the other motor and that while it started at a comparatively low speed which increased with the advancing of the controller, the more lightly loaded motor attained a comparatively high speed on the first notch so that there was less margin left for variations.

Insulation of Transmission Lines Near Cement Mills

In a number of instances successful service has been maintained on lines serving or passing cement mills by the simple expedient of extra insulation. It has been recommended in the case of 44,000-volt lines that twice the standard number of disks should be used per string and periodically the line should be killed and the insulator disks carefully wiped with a cloth saturated with transil oil. For 60,000-volt lines, in addition to doubling the normal number of disks, duplicate lines have sometimes been constructed in the vicinity of a mill, so that service need not be interrupted when the insulators are being cleaned, as power can be supplied over one branch while the other branch is dead. These methods of using double insulation to safeguard service have proved equally successful in regions where salt deposit is heavy.

How a Peculiar Case of Poor Commutation Was Traced to Frame Vibrations

There are so many well-known possible causes of unsatisfactory commutation, that when a commutation trouble shows up with a machine of admittedly good design, a trouble seeker is likely to direct his attention to eliminating the most common causes before looking for the more uncommon ones. In one particular instance the generator of a motor-generator set that consisted of a continuous current generator driven by an induction motor mounted on the same and rather long base, commutated badly. The sparking was not sufficiently bad to prevent the operating of the set, but as long as it existed, the commutator could never take a polish.

The operator had checked the speed, voltage, load, polarities, air gap, field drops, brush sets, brush tensions, brush alignments, brush shift and also the switchboard instruments and everything appeared to be perfectly regular. The commutator mica appeared to be flush with the bars, but as it is sometimes difficult to tell with certainty whether or not the mica is a little high, it was decided to slightly undercut it as an experiment. At this time a turbine construction man happened along (turbine men usually are very keen for any condition that is likely to produce vibrations) who noticed that oil was breathing out between the bearing cap and the pedestal of the middle bearing. This struck him at once as a case of faulty alignment, with the possibilities and causes of which he was thoroughly familiar.

Two iron wedges were made and driven under the center of the base on opposite sides of the machine. A relief was immediately noticeable and the vibration that before had been evident only to the most skillful observer was missed at once. The sound emitted by the machine and especially by the brushes, became entirely different and all sparking ceased. Investigation disclosed that the base of the machine as originally set was virtually resting on its four corners as far as the distributing of the weight on the foundation was concerned, and had sagged the long span of the base.

Unit Costs for Setting Transmission Line Wood Poles

There seems to be some question in the minds of readers as to the basis for compiling the unit costs of setting wood poles for transmission lines as given in the round-table discussion of the Ohio Electric Light Association published in the Dec. 23 issue of the ELECTRICAL WORLD on page 1252. E. B. Hook, superintendent of construction Georgia Railway & Power Company, makes the following comment:

"Unit construction costs for setting poles were mentioned by members of the transmission and distribution committee of the Ohio Electric Light Association, and one operator stated that it costs $6 to set a pole, and $1.50 additional cost per pole to obtain the data by which he discovered the unit cost to be $6, thus making the cost for setting each pole $7.50. In the same article a representative stated that he recently compiled data on a 600-pole line and found the labor cost to be $12.68 per pole. It would be interesting to know if the above figures represent merely the actual setting of poles or if they include the expense of handling and hauling poles to the desired location, digging holes and after setting, tamping in the poles. The figures seem to be given in a very general way, with no idea of the size or type of pole given, and nothing said about the condition of setting, whether in country or town, class of ground, and the like.

"We have set quite a number of poles in north Georgia during the past few years, and by using a block and tackle method of our own design have been able to set a large number of 50 ft. creosoted poles in a day's time with a minimum number of men at a cost of 60 cents to 75 cents per pole. This figure, of course, does not include anything but actually setting and tamping in the poles. The cost of compiling the figures is negligible, as it required merely the scanning of a few daily field reports selected at random. We have used the block and tackle method referred to for a couple of years and employed a pair of mules and nine or ten men to set poles. Recently a 1.5-ton truck has been substituted for the mules and the services of six or seven men dispensed with. In other words, we are now setting from twenty-five to forty 50-ft. and 60-ft. creosoted poles, weighing approximately 2 tons each, in a day with three men and the truck at a cost which is approximately 33 cents per pole."

As an example of the basis for computing the costs of pole setting, a member of the Ohio Electric Light Association has furnished the following data. The costs given are for two lines built through a hilly country. The poles used are chestnut and vary in length from 45 ft. to 60 ft. The average length of the poles was 48 ft.

Number of poles	328	485
Labor per pole (hauling, trimming, setting and cross-arming)	$18.78	$15.88
Extra teaming (hauling men and material)	2.59	2.86
Miscellaneous	1.10	4.43
Insurance	.95	.78

"It will be noted that the miscellaneous charges in the second column of the table are rather high. This was due to the many causes that happen in the building of any transmission line occasioned by unforeseen difficulties, of damages and other difficulties that impeded construction work. These figures are meaningless to anyone not familiar with the type of construction. Chestnut poles of class 'A' specifications were used, which are nearer sawlogs than they are poles. Each pole was equipped with an angle iron bayonet and with two wood crossarms 4 in. by 5 in. by 8 ft. These in turn were equipped with three strings of suspension insulators five units per string."

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

IMPRESSIVE FIGURES THAT POINT VEHICLE OPPORTUNITIES

Present Investment of $36,000,000 in Electric Commercial Cars Means an Energy Consumption of 90,000,000 Kw.-Hrs. Per Annum

Some interesting figures on the possibilities of development of the electric vehicle were presented by W. P. Kennedy, consulting transportation engineer, New York City, in his address before the conference of central station executives held under the auspices of the Electric Vehicle Section of the N. E. L. A. at New York, Feb. 14.

There are now in daily use, said Mr. Kennedy, approximately 20,000 electric passenger cars (representing $40,000,000 investment) and each yielding a return of at least $100 per year for energy, or a total of $2,000,000. At least 75 per cent of these are used in the large cities where the garages and owners are restricted to the use of off-peak load.

There are in the United States fifty-four cities exceeding 100,000 population, each of which should absorb 100 electrics per annum. There are fifty-nine cities between 50,000 and 100,000 which should each take fifty. There are 133 cities between 25,000 and 50,000 entitled to twenty-five cars each. There are 350 cities from 10,000 to 25,000 which can readily use ten each.

This totals 15,225 cars per annum without including a host of small towns where electrics are gaining a foothold.

A yearly product of 15,000 cars would add $1,500,000 each succeeding year to the previous sale of energy. If this entirely reasonable accomplishment were carried out, the central stations of the country should within seven years receive collectively a total of $10,000,000

TABLE I—VALUE OF COMMERCIAL ELECTRIC VEHICLE EQUIPMENTS IN VARIOUS LINES OF BUSINESS

Brewers	$5 950,000
Department stores	5,927,000
Public service companies	4,171,000
Express and transfer companies	3,460,000
Manufacturers' and merchants' industrial trucks	2,700,000
Industrial manufacturers	1,374,000
*Railroad and steamship companies	1,200,000
Bakers	1,023,000
Packing house organizations	679,000
United States Government service	515,000
General trucking	510,784
Wholesale dry goods	400,000
Municipal apparatus	368 000
Storage warehouses	180,000
Retail grocers	170,972
Wholesale grocers	150,000
Food products	125,220
Coal merchants	120,000
Hospital ambulances	120,000
Hardware	116,000
Publishers	85,787
Glass	75,000
Paper dealers	64,235
Confectioners	63,840
Restaurateurs	60,450
Musical instruments	48,687
Silversmiths	38,550
Ice	30,580
Dairy products	30,220
Clothing—retail	28,545
Silk finishers	21,525
Oriental furnishings	19,080
Soaps	17,250
Carpets	16,840
Other miscellaneous applications	6,134,000
Total value of electric vehicle equipments applied to end of 1916 (approximate)	$36,000,000
Annual energy consumption (approximate) 90,000,000 kw.-hr., at 4 cents	3,600,000

*Including industrial trucks.

TABLE II—PRESENT AND POSSIBLE ELECTRIC VEHICLE LOAD VALUES IN VARIOUS CITIES, A LARGE PORTION OF WHICH MIGHT BE SECURED BY ADEQUATE EXPLOITATION OF THE ELECTRIC.

		Annual Load Value at 4 Cents per Kw-hr
Baltimore:		
35	passenger electrics, at $100	$3,500
140	commercial electrics, at $300	42,000
17,173	horses, at $100	1,717,300
		$1,762 800
Boston:		
287	passenger electrics, at $100	$28,700
314	commercial electrics, at $300	94,200
23,000	horses, at $100	2,300,000
		$2,422,900
Chicago:		
3,000	passenger electrics, at $100	$300,000
1,050	commercial electrics, at $300	315.000
69,320	horses, at $100	6,932,000
		$7,547,000
Cleveland:		
1,750	passenger electrics, at $100	$175,000
115	commercial electrics, at $300	34,500
17,000	horses, at $100	1,700,000
		$1,909.500
Denver:		
750	passenger electrics, at $100	$75,000
43	commercial electrics, at $300	12,900
11,647	horses, at $100	1,164,700
		$1,252,600
Detroit:		
1,500	passenger electrics, at $100	$150,000
175	commercial electrics, at $300	52,500
13,921	horses, at $100	1,392.100
		$1,594,600
Hartford:		
300	passenger electrics, at $100	$30,000
95	commercial electrics, at $300	28,500
3,639	horses, at $100	363,900
		$422,400
Kansas City:		
876	passenger electrics, at $100	$87,600
90	commercial electrics, at $300	27,000
14,324	horses, at $100	1,432,400
		$1,547,000
Newark and Public Service Territory:		
295	passenger electrics, at $100	$29,500
331	commercial electrics, at $300	99,300
23,400	horses, at $100 (In Newark and Jersey City)	2,340,000
		$2,468,800
New York:		
450	passenger electrics, at $100	$45,000
2,800	commercial electrics, at $300	840,000
129,400	horses, at $100	12,940,000
		$13,825,000
Philadelphia:		
300	passenger electrics, at $100	$30,000
510	commercial electrics, at $300	153,000
51,800	horses, at $100	5,180,000
		$5,363,000
Pittsburgh:		
250	passenger electrics at $100	$25,000
49	commercial electrics, at $300	14,700
13,454	horses, at $100	1,345,100
		$1,385,100
St. Louis:		
590	passenger electrics, at $100	$59,000
116	commercial electrics, at $300	34,800
31,362	horses, at $100	3,136,200
		$3,230,000
Washington:		
800	passenger electrics, at $100	$80,000
250	commercial electrics, at $300	75,000
13,374	horses, at $100	1,337,400
		$1,492,400

NOTE: Allowance is made for the present horse population on the basis of an income of $100 per year for each horse displaced by electric transportation

per annum from the sale of energy for electric passenger cars.

There are, however, at present, said Mr. Kennedy, only about four manufacturers of commercial cars and four manufacturers of passenger cars in the business. It is too much to expect that they have any resources which could be employed to do more than maintain their own subsistence.

The central station, therefore, must pass judgment upon the whole matter in an abstract way, placing reliance entirely upon the revenue value of the vehicle itself as a utility in the extension of its business.

There are five classes of energy-consuming apparatus which constitute the load builders of central stations: Lamps, motors, domestic appliances, electric automobiles, and in some cases street car systems.

A little analysis will show that the automobile is the most desirable of these, both from the quantity of energy consumed per unit, and the fact that energy is taken by this device when the others are not generally in use.

The value of the possible automobile load in any city at the present time may be measured by the number of horses in use, or by the number of horses that would be in future use, as required by the increasing business development in each community.

Each horse superseded by electric vehicles has an average revenue value of about $100 per year with energy at 4 cents per kilowatt-hour.

The average or medium size electric vehicle usually supersedes three horses, and is thus equal to $300 per annum at the same rate for energy.

The larger size vehicles consume $500 worth of energy per annum and few of the smallest size consume less than $200 worth per annum at the 4-cent rate.

As a large proportion of the horses in any given city could be superseded by a reasonable amount of exploitation, the load value which could be secured by the central station might therefore be measured by half, or even one-third, of the horses now employed at $100 per horse per annum.

There are very few medium-sized cities in which reasonable effort would not supersede 1000 to 2000 horses, and as this would mean 300 to 600 commercial vehicles, the value of this load may be readily computed at $300 per machine per annum.

In many of the larger cities there is on a possible development of from 30,000,000 to 50,000,000 kw.-hr. per annum, but to secure such an amount some effort of a different character from that already employed would certainly be necessary.

The question to be answered, declared Mr. Kennedy in conclusion, is what amount of effort should each central station expend in building up for itself a load of this character and volume as a new-business development?

Free Appliance Repairs in St. Louis

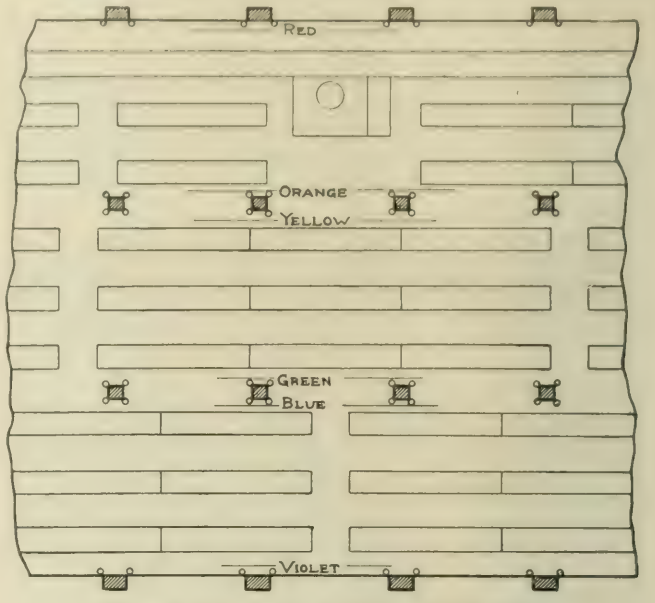
In the future when repairs to electrical appliances, which have been purchased from the Union Electric Light & Power Company of St. Louis and which are in use by the customers of that company, are necessary, it will be possible for the consumer to have the repairs made free of charge. By telephoning to the company's office-sales department, they can secure the services of a special appliance repair man, who will make the necessary repairs to the appliance on the customer's premises if possible. In case the necessary repair is of a more extended character, the appliance will be taken to the company's shop where the trouble will be remedied, after which the appliance will be returned to the customer without charge.

THE SPECIAL LIGHTING FOR THE EDISON DINNER

Ceiling Color Spectrum Projected from Concealed Reflectors—Dipped Lamps Burned at Overvoltage for Short Period

BY A. L. POWELL

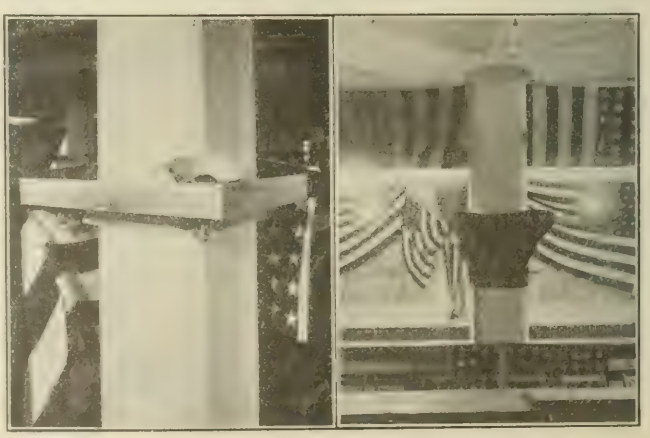
The lighting scheme employed for the dinner tendered to Thomas A. Edison by his employees on the occasion of his seventieth birthday was somewhat novel and warrants description. The gathering was held on the fifth floor of the Edison Storage Battery Company's building at Orange, N. J., the entire north wing and three bays



PLAN OF PORTION OF THE BANQUET HALL

of the east section being utilized to accommodate the large party, which numbered more than 1800.

The festivity of the occasion required that the decorations be in harmony with this spirit. The customary method of decoration is to employ quantities of colored bunting draped on every available point, with innumerable small lamps strung everywhere. Needless to say, the effects thus produced are often garish. In the case of the Edison celebration, however, a carefully planned arrangement of lamps caused the ceiling to take the appearance of a gigantic spectrum, although no colored trim was used save for a few American flags which were employed to hide the details of construction. The strips of white cheesecloth shown in the accompanying picture



DETAILED VIEW SHOWING METHOD OF SUPPORTING LIGHTING UNITS, AND PROVISIONS FOR CONCEALING SPECIAL CONSTRUCTION

were caused to assume an infinite variety of delicate tints, blending one into the other without lines of harsh demarcation.

The illumination was exceptionally uniform, not a lamp was visible, and any shadows which were produced were extremely soft.

The building is of typical mill construction, with concrete pillars supporting a heavy beamed ceiling, and painted a flat white. The main room is three bays wide, posts being spaced 15 by 20 ft. As tables were placed throughout, uniform general lighting was required.

Certain conditions made it necessary to avoid the use of any fixtures suspended from the ceiling.

As it was but 12 ft. to the bottom of the beams, and the permanent outlets for general illumination were quite widely separated, it was decided to neglect these entirely and run special feeders for the decorative lighting.

After preliminary experimentation a totally indirect method of illumination was adopted. Seven feet from the floor a wooden framework, such as pictured in one



NIGHT VIEW SHOWING SPECIAL ILLUMINATION EFFECTS FOR MR. EDISON'S SEVENTIETH BIRTHDAY PARTY

of the illustrations, was provided at each post, and similar equipment on the corresponding pilasters. An angle reflector was placed in each corner of the box thus constructed. This was of steel with matt aluminum finish, 10 in. in diameter, 9½ in. deep, with the holder set at an angle of 45 deg. The general arrangement of these outlets is shown in the floor plan of a portion of the room. An American flag, neatly pinned in place around each framework, effectually concealed the reflectors, connections and construction work.

These groups of two and four units were connected in multiple by lamp cord and then attached to special feeders which were run lengthwise of the room in four pairs. The bushed holes, provided through the ceiling beams by the mill construction, enabled this work to be done neatly and with ease. A three-wire connection was used and the load balanced.

Flat streamers of white cheesecloth 30 in. wide were stretched diagonally from pillar to pillar. These were readily attached to strips of wood tacked around the top of each column. This slight decoration was deemed desirable to partly cover the rough appearance of the ceiling.

One hundred-watt vacuum-type tungsten lamps were adopted as the lighting units. These were superficially colored or dipped. This type of lamp was chosen as it was known that the coloring would not change during a period much greater than the lamps would be in service. As the installation was to be used for only a few hours, it was deemed advisable to burn the lamps over voltage. Accordingly, 100-volt lamps were used, although the circuit was approximately 115 volts. In this manner the light output was increased 60 per cent, which compensated to a great degree for the absorption of the colored dips. The power consumption was about 1.2 watts per square foot of floor area, this rather high wattage being necessitated by the loss of light due to coloring.

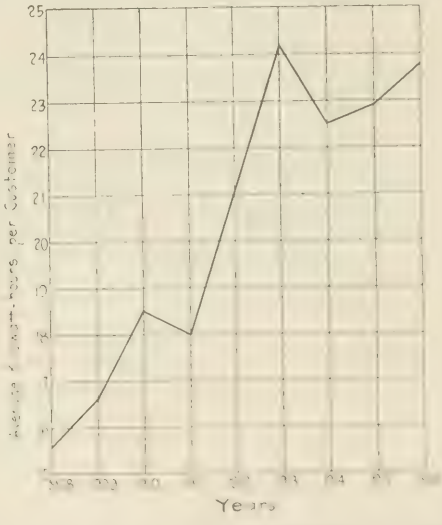
As indicated on the drawing, red, orange, yellow, green, blue and an approximate violet lamps were used in successive rows the entire length of the room. This arrangement made possible the spectrum effect desired. Careful selection was made of the colors used, in order that the most perfect blending might be secured.

The Edison band rendered selections from time to time and a special section of the east wing was provided as a band stand. It was thought desirable to provide a somewhat higher intensity in this area, in order that there might be no question as to the amount of light incident on the music. A white canvas was stretched over the stand and four semi-indirect dishes of dense opal glass, with 250-watt Mazda lamps hung pendant, were used here.

The possibilities of intelligently applied colored lighting are remarkable, the effects produced striking, yet dignified, and it is safe to prophesy that more and more of this work will be done.

Increase of Energy Consumption by Apartment-House Customers

Individual customers of the lighting companies are steadily being educated to use more current. The accompanying curve was plotted from data given by Peter Junkersfeld of the Commonwealth Edison Company in his address at the convention of the Indiana Engineer-



CURVE SHOWING HOW INDIVIDUAL ENERGY CONSUMPTION OF CHICAGO APARTMENT-HOUSE CUSTOMERS HAS INCREASED IN THE LAST EIGHT YEARS

ing Society at Lafayette, Ind., showing the average monthly consumption of apartment-dwelling customers in Chicago. In 1908 the number of apartment-house customers was 25,980, and since that time the number has steadily increased until in 1916 the total reached 168,234.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

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CORONA PHENOMENA

Electric Strength of Air—The Corona in Air and Hydrogen—Applications to Rectification—Abstracts of Recent A. I. E. E. Papers

AT the New York meeting of the American Institute of Electrical Engineers last week two interesting papers were presented on corona phenomena. In one of these J. B. Whitehead and W. S. Brown discussed the electric strength of air. In view of the variation among the values obtained by different observers, the authors have carried out a careful determination of corona-forming voltages for alternating and for positive and negative continuous voltages in the same apparatus and under the same conditions. The principal result is that within the range of wire diameters used corona appears at a lower value when the wire is positive than when it is negative, although the two curves converge for increasing diameters. The maximum excess of negative over positive, as observed, was 6.3 per cent.

The values with alternating voltage coincide with those of negative continuous voltage. Positive continuous voltage, therefore, forms corona at the lowest value.

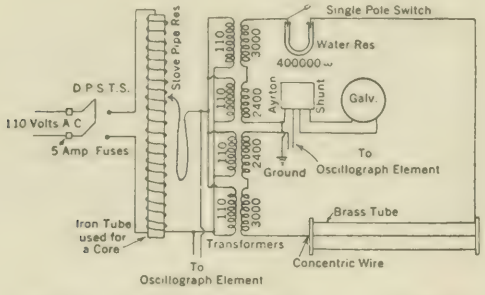


FIG. 1—CIRCUITS AND ARRANGEMENTS OF CONNECTIONS FOR HALF WAVE RECTIFICATION

These results of the present authors are at variance with the recent results of F. W. Peek, Jr., who had found that the alternating and continuous voltages are identical and independent of the polarity of the wire in the case of continuous voltage.

Whitehead and Brown pointed out that the fact that positive corona appears at a lower voltage than negative for the same size wire is in accord with the theory of secondary ionization due to collision, if we assume that the negative ion is the principal ionizing agent. Observations on negative corona give values higher than heretofore obtained. They also describe other experiments which give qualitative indications of the correctness of Townsend's theory of ionization by collision.

The paper by J. W. Davis and C. C. Breese discussed the corona discharge between co-axial cylinders (or between a wire and a concentric cylinder) in an atmosphere of hydrogen. The chief results of the investigation are as follows: The critical intensity for corona in hydrogen follows Peek's law fairly closely as far as changes due to variations in the gas pressure are concerned. The variation of the critical intensity with the radius of the wire is not as yet conclusively proved, either to follow or not to follow Peek's law, but the general character of the results so far obtained seem to indicate that the law may hold.

Hydrogen is different from air in that corona is maintained at voltages considerably lower than the critical voltage while this has not been found to be the case with air. The characteristic curves with the wire positive in hydrogen differ from those with air in that the voltage necessary to maintain a given current depends on whether that value of current has been approached by increasing or decreasing the machine voltage. The characteristic for the wire negative in hydrogen is entirely different from the characteristic obtained with a negative wire in air.

Complete rectification for alternating current is obtained between concentric cylinders when the intervening space is filled with hydrogen and an alternating potential difference sufficiently high to produce negative corona is impressed between the cylinders. This recti-

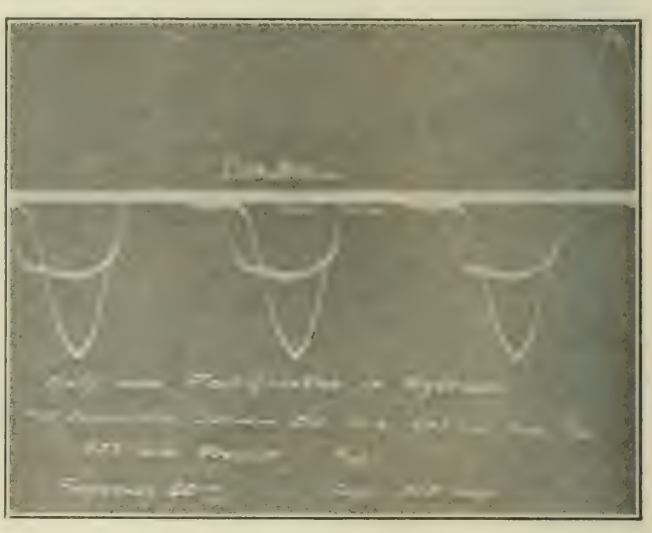


FIG. 2—VOLTAGE AND CURRENT CURVES WHEN ALTERNATING VOLTAGE IS IMPRESSED ACROSS A CORONA TUBE

fication continues after the negative arc has been established, under the proper conditions of pressure, size of wire and size of tube. Direct currents as high as 0.12 amp. have been obtained with alternating voltages of approximately 8000 volts.

The connections for half-wave rectification are shown diagrammatically in Fig. 1, which is self-explanatory. How effective a means of rectification the corona in hydrogen between a wire and a tube is may be seen from Fig. 2, which gives the current and voltage curves when an alternating voltage is employed and impressed across a corona tube.

The curve has both positive and negative lobes in the voltage. The non-symmetrical character of this curve is due to the drop in the resistance in series with the primaries of the transformers. The curve lying mainly below the axis represents the current flowing between the wire and tube. The irregularities in the part of the curve near the zero line seem to be due to the capacity effect and are in no sense characteristic of the corona discharge.

Generators, Motors and Transformers

Calculation of Three-Phase Motors.—KARL METZLER.—A mathematical paper on the stray-flux coefficient and the predetermination of three-phase motors. In the design of three-phase motors both the stray-flux coefficient and the overload capacity are important. The dimensions and the distribution of the windings can be chosen in such a way that the stray-flux coefficient becomes a minimum for a given overload capacity. The author gives a formula for determining the condition under which this takes place, and comments on analogous formulas of Pichelmayer and Hoock.—*Elek. Zeit.*, Dec. 28, 1916 (this is the first issue of *Elek. Zeit.* which has been received in this country for almost a year).

Lamps and Lighting

Lumen as a Measure of Illuminating Power.—An account of a discussion on this subject before the British Illuminating Engineering Society. Prof. J. T. Morris pointed out that the distribution of light from illuminants can now be carried so widely by the use of suitable globes and reflectors that the only proper basis of comparison is in terms of the total light in all directions. It has been suggested that lamps should be rated in terms of mean spherical candle-power, but this would involve giving most lamps a smaller rating than at present, which is inconvenient commercially. In addition, the mean spherical candle-power is an imaginary quantity, somewhat difficult of conception. British makers of electric lamps contemplate adopting the lumen, though it may be necessary also to state candle-power values and to show their relation to lumen values during the transition period. The use of the lumen in connection with illuminating engineering calculations has several advantages. For example, if the lumens in each zone from a lighting unit are tabulated, the addition of these values gives the total output of light; *i.e.*, the total flux of light produced by the unit; this can be compared at once with the corresponding output in lumens of the lamp used in the lighting appliance (globe, reflector, etc.), and the efficiency of the latter readily ascertained. It is also convenient to work with lumens in the usual formulas for determining the average illumination in a room resulting from a given arrangement of lamps, and particularly when the approximate average illumination over an area needs to be quickly determined. It also assists calculation of the illumination derived from extensive illuminated surfaces, such as occur in the case of indirect lighting. F. W. Willcox, who followed, illustrated the diversity in polar curves of light distribution of modern illuminants by a large number of diagrams. He also recommended the adoption of the lumen. Although at first unfamiliar, the general use of this method of rating will ultimately be much more convenient. Besides being the most scientific basis of comparison, the use of the lumen will simplify the formulas used in calculations. The simple equation for determining the number of lamps required to light a given area is the product of the floor area in square feet and illumination in foot-candles divided by the product of "utilization efficiency" as a decimal and lumens per lamp. The utilization efficiency is a factor depending on the arrangement and type of lighting appliance used. It will remove several opportunities for misunderstanding and misrepresentation which arise through statements of the candle-power from lamps in a single direction only.—London *Electrician*, Jan. 26, 1917.

Tungsten Arc Under Pressure.—GEORGE P. LUCKEY.—An account of an experimental investigation carried out at the Nela Research Laboratory. Measurements were made of the temperature of the melting point of tungsten in the electric arc under pressure from 1 to 30 atmospheres. The melting point found at 1 atmosphere was 3623 deg. K., and the apparent melting point decreased to 3564 deg. K. when the pressure was raised to 28 atmospheres. It is doubtful whether this decrease is due to a change in the melting point or merely to an increased absorption of the vapor surrounding the arc. The highest temperatures attainable in the arc were measured, and a large increase in this temperature as the pressures increased was noted. At atmospheric pressure a probable temperature of 4235 deg. K. was found, while at 33 atmospheres the highest temperature in the arc was increased to 5084 deg. K. It is probable that these temperatures represent a value somewhere between the melting and the boiling points of tungsten in each case. The electrical characteristics of the tungsten arc were investigated. The drop in potential across the arc, other conditions being the same, was found to increase with the pressure. At high pressures the voltage dropped as the current increased until values of current of about 5 amp. were reached, after which the voltage rose with increasing current. This latter effect might be ascribed to the tendency of the arc to flare out to one side with larger currents, as well as to the increase of pressure in the tank caused by the heating of the gas.—*Phys. Rev.*, February, 1917.

Generation, Transmission and Distribution

The Future of Water Power in the United States.—CHARLES W. COMSTOCK.—The author gives a careful compilation of figures showing the total fixed installed primary power in the United States and similar figures for total installed water power, at the same time calling attention to the unreliability of statistics in general. With these figures, those compiled by the Commissioner of Corporations are summarized and compared. The geographic distribution of installed water power is considered, and it is pointed out that while the percentage of total central station power generated by water is only 21 and 22 per cent for the New England and the Middle Atlantic States, it is nearly 60 per cent on the Pacific Coast. The three Pacific Coast states, with 4.6 per cent of the population, have 12.3 per cent of all the central station power in the United States. Of this, nearly 60 per cent or 7.2 per cent of all central station power in the country is hydroelectric. In discussing the advantages of water power developed the author points out the fallacy of power development waiting upon demand instead of creating it. The immense field for hydroelectric power which a development of the electrochemical and electrometallurgical industries would create with the success of such industries abroad is cited and an appeal made for a federal policy of encouraging business enterprise instead of obstructing it.—*Proceedings* Amer. Inst. Elec. Engrs., January, 1917.

Traction

Regenerative Breaking.—R. E. HELLMUND.—The author discusses the problems of applying regenerative breaking to electric railways. He discusses three-phase systems, the phase-converter system, the direct-current systems, the alternating-current commutator-motor systems, and the possibilities of regenerative control with a vapor converter system. He thinks that in view of the practical advantages of regeneration for heavy railroad work, it is quite likely that regeneration will in time become one of the factors which will win some railroads, now operated by steam, over to the electric cause.—*Proceedings* Amer. Inst. Elec. Engrs., January, 1917.

Electromobile Experience.—R. BORLASE MATTHEWS.—An account of the experience with electric vehicles of the Hartford Street Motor Company, Ltd., which houses as many as 120 electric vehicles in its garage. The

author discusses the advantages of the electric vehicle, care of batteries, battery life, interchangeability of batteries, value of good discharging, battery ills, overcharging, operating systems, battery details, car particulars, garage arrangement, and costs.—London *Elec. Rev.*, Jan. 19, 1917.

Electrophysics and Magnetism

The Actinium-Uranium Ratio in Colorado Carnotite.—KARL H. FUSSLER.—An account of an experimental investigation in which the ratio of activity of the actinium series to the activity of the uranium associated with it in Colorado carnotite was determined. The results indicate that the quantity of actinium in carnotite is proportional to the quantity of uranium. The value of the ratio is of the same order of magnitude, but somewhat lower than that obtained by Boltwood using North Carolina uraninite. The results are in agreement with the theory that actinium is a branch product of the uranium series.—*Phys. Rev.*, February, 1917.

Units, Measurements and Instruments

International System of Electric and Magnetic Units.—J. H. DELLINGER.—A critical discussion of the present international system of electric and magnetic units and of various proposed changes. The electric units ordinarily used are based upon certain standards defined by international congresses. These units may be considered to form a distinct system. They have been called international units to distinguish them from the corresponding units in the electromagnetic system, of which they are the representatives for the purpose of electrical measurements. The international and the electromagnetic units differ by exceedingly small amounts, and the small differences are determined by absolute electrical measurements made from time to time. The international system takes the international ohm, the international ampere, the centimeter, and the second, as fundamental units. The unit of magnetic pole strength is relegated to a subordinate position, corresponding with its unimportance in practical work. The dimensional expressions of electric and magnetic units in this system have a simplicity and direct applicability lacking in other systems. The system has, however, no such simplicity or utility in the domain of mechanics nor anywhere except in electricity and magnetism. It in no way tends to supplant the classical system based on length, mass and time. Magnetic units have been in a somewhat confused state. The use of the word "gauss" as the name for both the unit of induction and the unit of magnetizing force is one difficulty. The international system furnishes no justification for this double usage. There have been various proposals from time to time to rationalize the electric and magnetic units; that is, to use units such as to redistribute the factor 4π in the equations. In no systems is this factor entirely eliminated. The first proposal, that of Heaviside, had much to recommend it and his units are used in some recent theoretical works. However, all the units are different by some power of 4π from the ordinary units, and their general adoption now seems out of the question. Proposals since Heaviside's for the rationalization of the units have involved less change of existing units, but have all had the disadvantage of incorporating 4π in the values of the permeability and dielectric constant of empty space. A very satisfactory rationalization is effected by the use of the ampere-turn as the unit of magnetomotive force, without recourse to any new units. There are two sets of magnetic units in use, based upon the international electric units. In one set the units correspond in magnitude to the ordinary cgs electromagnetic units. In the other, the ampere-turn and derived units are used. For want of a better name, the units of this set are called ampere-turn units. It has been pointed out that the ampere turn units are rationalized more nearly like the Heaviside units than any of the systems which have been proposed, in that μ_0 retains its value unity. From one standpoint the 4π are even better distributed than in the Heaviside system. It is of interest to find that units actually in use constitute a system which is not at all inferior to the various proposed systems. In conclusion, this study has shown that the international system, based upon and representing the electromagnetic system, is a convenient and satisfactory system of units for the purposes of electric and magnetic measurements. Proposed changes in some or all of the units do not appear to offer advantages such as to justify the inconvenience of changing the units as ordinarily used.—*Scient. Paper, Bureau of Standards*, No. 292, Oct. 11, 1916.

Use of Thermocouples at Temperatures Above the Melting Point of One Constituent.—C. R. DARLING and A. W. GRACE.—A brief abstract of a (British) Physical Society paper on the thermoelectric properties of fused metals. One of the authors has for some time been investigating the possibility of using base metal thermocouples at temperatures above the melting point of one of the constituents. For this purpose it was necessary to determine whether any peculiarities in the thermoelectric behavior of metals occur at fusion. In the case of lead, tin, zinc, and cadmium there is no perceptible break in the continuity of the curves obtained. In couples containing bismuth, however, several cases were noted in which the emf. remained constant for a wide range of temperature after the fusion of the bismuth. This occurs with silver, aluminium, iron or nichrom as the other element. Useful applications of this property are discussed. No attempt was made to construct a thermoelectric diagram from the results, as it would be impossible to obtain correct values of dE/dt at all parts of the curves, many of which show small flexures, without making more accurate measurements in the region of such flexures than was practicable.—London *Electrician*, Dec. 29, 1916.

Miscellaneous

Expiring British Patents.—A list giving the principal British electric patents which will expire during 1917. In an editorial note it is pointed out that the list this year does not include as many patents of general interest as is frequently the case, but, on the other hand, there are some of more than usual importance. Among these may be mentioned No. 322 of 1903, which describes at considerable length the various mechanical details of the Edison accumulator, which have gone a long way towards securing the success which this cell has achieved. Apart from the details the specification does not refer particularly to the electrodes or the chemical actions underlying the electrochemical action of the cell. Patent No. 3704, by Messrs. O. S. Bragstad and J. L. LaCour, describes the well-known motor converter, consisting of a combination of a synchronous machine and a rotary converter mechanically coupled together, the phases of the motor being connected in concatenation with equidistant points of the armature winding of the rotary. The resulting advantages are easy starting with alternate currents and a saving of material. Patent No. 15,599, due to V. Poulsen, describes the well-known development of Duddell's arc by placing it in hydrogen or in a hydrogen compound, so that higher frequencies are obtained, thus enabling the arc to be used for radio-telegraphic work. Lastly, Patent No. 24,305 describes Sir Oliver Lodge's system for the deposition of fog and dust by means of rectified high-tension alternating currents.—London *Electrician*, Jan. 5, 1917.

Book Reviews

LA CHIMIE DES ELEMENTS RADIOACTIFS. By Frederick Soddy. Paris: Gauthier-Villars, et Cie. 174 pages. Illustrated. Price, 5 francs. E. Phillippi, Translator.

This is a good translation from the English original into French of a very interesting text-book on the chemistry of radioactive materials.

Radioactivity is only twenty years old, for it was discovered by Henri Becquerel in 1896. Yet in this relatively short space of time it has profoundly modified human philosophies and the fundamental beliefs of educated mankind. Owing to radioactivity, the conservation of matter is no longer believed in. The old belief has been shelled out of the scientific curriculum by projectiles believed to be but little more massive than the 2000th part of a hydrogen atom.

The book has no chapters but is divided into two sections, the second dealing with the more recent developments of this wonderful subject. The treatment is emphasized from the chemical standpoint, and the physics of the subject are left to a subsidiary category. Tables and diagrams are given of atomic weights of the chemical elements from the radioactive point of view, adopting a modified Mendeljeff tabulation.

Only specialists can hope to be familiar with the details of a subject which specializes specialization; but no intelligent person can claim to be educated to-day who does not know something about the elements of radioactivity, whether he obtains his knowledge from the English; or, in this case, from the French language.

ELECTRICAL ENGINEERING. First Course. By Ernst J. Berg and Walter L. Upson. New York: Mc-Graw-Hill Book Company, Inc. 416 pages. 295 illustrations. Price, $4.

So many good books have been written on electrical engineering and design of machines by so many prominent engineers that the reviewer is at a loss to know just how appropriately to compare one with the other or offer an opinion on the merits of any particular one. Perhaps this thought may be more clearly expressed by saying that the existing widely accepted works appear to the reviewer as different designs of beautiful architecture—different mainly because they are put together differently but all serve the same purpose. From the frank admission of the authors in their preface that no book on electrical engineering can now be produced which does not bear testimony to the pioneer work of such writers as Fleming, Silvanus Thompson, Bedell and Crehore, Steinmetz and McAllister, it is certain that they appreciated this situation when looking for an excuse on which to hinge the offering of the book. Be this as it may, the authors are to be congratulated on the production of another fine piece of work, a text-book that will stand close analysis and be found concise, but comprehensive, devoted to fundamentals but intensely practical and understandable, not a mathematical treatise on theory but a useful textbook or reference. It is another new book of the type that the reviewer believes should be in every well filled, well balanced engineering library, one to refer to for an hour's review of engineering fundamentals with an author who thinks and reasons in the light of the latest research and in the language of the latest standards.

The book contains forty-five chapters. The first twenty-five chapters are devoted to the fundamentals of the magnetic and electric circuit and the design of direct-current machines. The remaining chapters are devoted to discussions of the principles on which alternating-current apparatus is constructed and operates. The entire book is well illustrated with circuit diagrams, curves and vector diagrams with practically no space taken up with pictures of machines that can be secured from manufacturers' catalogs showing all types, forms and styles. The elimination of this character of illustration is altogether wise, since it prevents the student from picturing in his mind a certain form of machine, when discussing the theory on which a group of machines operate, and to which fundamental principles apply equally or slightly modified. We hope this work will receive the attention and study it merits.

GAS ENGINE IGNITION. Prepared by Earle B. Norris, Robert K. Winning and William C. Weaver. New York: McGraw-Hill Book Company, Inc. 174 pages. 209 illustrations. Price, $1.50.

There is considerable information to be found on the subject of gas engine ignition in standard textbooks which take up the operation of the internal combustion engine, however most of these delve into the theory of the subject. The authors of this book have followed a most practical plan by combining the theory of the subject with descriptions, diagrams and illustrations of the different types of commercial devices that make up a complete ignition system. While changes in design of the apparatus shown are sure to come, the features of the devices shown, illustrate principles of operation and therefore aid in securing a thorough understanding of the fundamentals so that any reasons for the refinements in design and operation of modified devices will come easily to the student of the book. On account of this treatment it is not a work that will become antiquated. If for no other reason, the work should appeal to the practical internal combustion engineer by reason of the information on high-tension outfits and batteries. The work is not adapted to the needs of the designer but more especially to those of the student and practical repair man, as will be noted from the headings of the chapters which deal with operating features: The Make and Break System; Jump-Spark Battery System; Non-Vibrating Coils; Batteries; Low-Tension Magnetos; Oscillator Magnetos, Inductor Magnetos; Low-Tension for Jump Spark Ignition; High-Tension Magnetos; Direct-Current Generators; Miscellaneous Ignition Systems.

THE PRINCIPLES OF ELECTRIC WAVE TELEGRAPHY AND TELEPHONY. By J. A. Fleming. New York: Longmans, Green & Company. 912 pages. Illustrated. Price, $10.

This excellent treatise on the principles and apparatus employed in radio-telegraphy and telephony here appears in its third edition.

The chapter which in the preceding editions dealt with the history of the subject has been curtailed, and an interesting new chapter has been added on radio-telegraphic transmission.

There are ten chapters dealing respectively with the following topics: The production of high-frequency currents and electric oscillations, High-frequency electric measurements, Damping and resonance, Stationary electric waves on wires, Electric radiation, Detection and measurement of electric waves, The apparatus of electric-wave telegraphy, Radio-telegraphic stations, Radio-telegraphic transmission, Radio-telephony. They are all particularly strong on the quantitative side.

The book has been carefully revised and brought up to date. It offers to the student of the radio-communication principles what is probably the most complete and comprehensive treatise in the English language.

Manual for Engineers. By Charles E. Ferris. Knoxville, Tenn.: Tennessee University Press. 220 pages. Price, 50 cents.

This manual, now in its twentieth edition, contains many valuable tables and other data for engineers and business men. Area, circumference, squares, cubes, root and logarithm tables are given, as well as tables of especial interest to the electrical, mechanical and civil engineer. The N. E. L. A. instructions for resuscitation from electric shock are also given. This book is not too bulky to carry in the pocket and shows careful work in the selection of data and in its makeup.

Telephone Apparatus. An Introduction to the Development and Theory. By George D. Shepardson. New York: D. Appleton & Company. 338 pages. 115 illustrations. Price (to come).

This is a textbook on telephonic apparatus, and especially on telephonic receiving and transmitting apparatus. It is developed with particular attention to the scientific history and literature of such apparatus. The wealth of references given to the technical literature in discussing the principles and modes of operation of telephone apparatus would justify the publication of this book without any regard to the matter contained in the text. The text is, moreover, well arranged and amply illustrated for the treatment of the subject.

The book is divided into four parts, which deal respectively with speech sounds, signaling equipment, sources of electromotive force and appendices containing mathematical sections.

The book is particularly well adapted for those who desire to acquaint themselves with the behavior of telephone apparatus and with the literature of the same. The mathematics in the text are simple, so that the book can be read by non-mathematical students. As a treatise on the subject it embodies not only experimental contributions and a good exposition, but also a large amount of systematic compilation.

Annuaire Pour l'an 1917. Publié par de Bureau des Longitudes. Paris: Gauthier-Villars & Company. Price, 2 francs.

This little red book has been annually republished by the French Longitude Office for the last 120 years. It is an admirable piece of national work, containing a large amount of information at a very low price. It has gradually grown in size, until since 1905 it has had to be divided, each half appearing successively in alternate years. This year it is the turn of the astronomical, meteorological and metrological half. The tabular data concerning calendars, the solar system, the stars, spectroscopy, metrology and meteorology are particularly developed. All these data are officially recognized among the scientific bureaus and societies of France. Certain astronomical charts of the heavens appear for the first time.

Following the 452 pages of regular text are 190 pages of special appendices. One of these appendices, by M. J. Renaud, is a valuable historical compendium of the actions in France which led last year to the legal adoption of the daylight-saving hour change in clock time. The principal debates and arguments on this subject are amply reported here. This document is of great importance to Americans, in view of the agitation for the same action in the United States this year. Another appendix, by M. M. Hamy, describes the determination of the international meter in wave lengths of cadmium red light. This measurement was first made by Michelson fourteen years ago. A recent redetermination is here reported. It appears that whereas Michelson made the meter 1,553,164.02 of these wave lengths, the redetermination makes it 1,553,164.13 or 1 part extra in some 15,000,000.

Perhaps for the first time the Annuaire contains portraits of two distinguished engineers and scientists.

The geographical section devoted to the geography of France is omitted this year for reasons that are self-suggesting, and in which we sympathize. We hope that at the next date of republication these difficulties shall have been removed.

Principles of Electrical Design. D.C. and A.C. Generators. By Alfred Still. New York; Mc-Graw-Hill Book Company, Inc. 366 pages. 145 illustrations. Price, $3.00.

There are a number of good text-books that discuss the fundamental principles of electrical machine design but few that have been developed from as thoroughly a practical standpoint as the one by Professor Still. The author has confined himself mainly to the design of direct and alternating-current generators devoting about two-thirds of the book to the former and the last third to the latter, the first two chapters being given over to the magnetic circuit and electromagnets. Although this work has been designed primarily as a text for classroom work, the practical viewpoint explained by the author in an elaborate introduction and found throughout the development of the subjects treated, gives a logical reason for the book and sets it apart from the usual run of college texts. He says, "In the method of design as followed in this book, an attempt is made to base all arguments on scientific facts and build up a design in a logical manner from known fundamental principles. This is admittedly different from the method followed by the practical designer, who uses empirical formulas and 'short cuts' justified only by experienced and practical knowledge. It must not, however, be supposed that a commercial machine can be designed without the aid of some rules and formulas which have not been developed from first principles, for the simple reason that the factors involved are either so numerous or abstruse that they cannot be all taken into account when deriving the final formula or equation. In any case the constants used in all formulas, even when developed on strictly scientific lines, are invariably the result of observations made on many actual tests, such as the coefficient of friction, magnetic reluctance and eddy current loss are subject to the variation under conditions which it is difficult to determine. The formulas used in the design are therefore frequently empirical, and they yield results that are often approximations only; but an effort will be made to explain, whenever possible, the scientific basis underlying all formulas used in this book."

This explanation we believe, which the text bears out admirably, removes the book from the strictly college text book class and makes it become at once a practical reference text for the practical electrical engineer and designer who desires an aid in the interpretation of the problems which he meets in his work. The numerical examples and calculations throughout the text help to make it readable. The subjects treated and appear as chapter headings follow: Magnetic circuit-Electromagnets; Design of Electromagnets; Dynamo design—brief outline of the problem; Armature Windings and Slot Insulation; Losses in Armatures—Ventilation, Temperature Rise; Flux Distribution over Armature Surface; Commutation; Design of Field Magnets; Design of Continuous Current Dynamo—Numerical Example; Design of Alternators; Armature Windings, Losses and Temperature Rise; Air-gap Flux Distribution—Wave Shapes; Regulation and Efficiency of Alternators; Example of Alternator Design.

Protecting Cable Sheaths in Manholes

To the Editor of ELECTRICAL WORLD:

SIR: The protection of cable sheaths from external damage is of greater importance to-day than ever. The size of cables and the capacity behind them is increasing, while the impedance to prevent the rush of heavy current is reduced. The congestion of the manholes, the large number of important cables in close proximity to one another all serve to emphasize the need for reliable protection. The matter of protecting cable sheaths is an old one, but the interesting article by Albert F. Hovey in your issue of Nov. 18, 1916, page 1009, raises several points which it seems might be discussed to advantage generally. Cement or asbestos coverings are the most generally used, although shelves of concrete, or split tile made from the duct conduit, are also quite frequently made use of.

There are a number of disadvantages in the use of asbestos in any of its forms however wound and whether used alone or with silicate of soda. Asbestos has not very high mechanical strength, and may for this reason be unfit for its task at the very time it is most needed. Pure asbestos has very high heat-resisting properties, but after lengthy service, especially in dirty, hot and moist locations, such as exist in the majority of manholes in large cities, the asbestos soon becomes affected and its value as a protective coating is greatly reduced, and to such an extent that it is easily torn and ruptured at the slightest provocation. The use of steel tape as a wrapping tends to prevent its injury, but the use of steel, in itself, is undesirable for several reasons.

Apart from its lack of mechanical strength detracting from its value as a protecting covering, asbestos has one further disadvantage, and a very real one. It appears to hasten rather than to mitigate electrolytic corrosion of the lead sheath. This action is very slight, if present at all, in dry localities, but is quite pronounced where there is moisture, and particularly in the presence of stray or vagabond unidirectional currents or direct currents from electric street car tracks and other sources. The exact manner in which the asbestos hastens corrosion does not appear to be known, but is apparently due to decomposition of the asbestos in which is included of course the absorption of the various salts and substances contained in the soil by absorption and cathodic action.

While cement appears to have many advantages over asbestos, it does not appear to be altogether free from corrosive action upon the lead of the cable sheath. Such action while slight has been discovered in several instances. The corrosive action appears to occur only in wet places or damp locations, and when in the presence of electric currents, which is a typical condition in city underground systems. In dry locations it is possible that the cement does actually exert a protective influence against electrolysis, because of its high ohmic resistance when dry. That electrolytic decomposition may be going on under cement coverings is a fairly recent discovery, and as yet no decided theory has been advanced which definitely answers the problem. The most obvious reasoning is that cement contains lime. In the presence of electrolytic action with current flowing from ground to lead these stray currents tend to decompose the lead in the cement until the lime exists in the free state, and next to the lead. When the cable sheath becomes positive, and the direction of current flow is reversed, this lime which existed in the free state has a tendency to dissolve the lead of the sheath. In practice there are always present acids diffused in the cement from the soil, the sewers, the dissolved products of illuminating gas, etc., which undoubtedly tend to hasten electrolytic decomposition.

The use of paraffined cheesecloth, as suggested by Mr. Hovey, would appear to have an added advantage over that mentioned by him, namely, that by inserting it between cable sheath and cement it tends to reduce electrolytic action by reason of its insulating properties and being non-hygroscopic. On the other hand the presence of paraffine and cheesecloth, which make rather a combustible working pair, might also be a real disadvantage in case of manhole fires.

While electrolytic action cannot apparently be avoided altogether, it is possible to reduce it by using cement instead of asbestos. If the cable sheaths are bonded properly and then grounded there appears to be little need for going to the expense of installing cable racks with their rather extravagant space factor, because the circuit through the supports for the cables are always in parallel with the bond wires at all times, and the path for the current through the supports is one of much higher resistance than that through the bond wires because in it are included the resistance of the cement coverings and the brick or cement walls of the manhole.

Bonding cable sheaths not only tends to prevent electrolysis and disintegration of the lead with eventual failure, but doing so also may prevent serious and even disastrous burn-outs. On high-capacity cables an arc may exist without the operators in the station knowing, because the current is limited by the comparatively high-resistance path along the cable sheath, and the overload relays cannot operate. Were the cable sheaths bonded together and grounded this current would reach a value sufficient to operate the relays. A number of very serious fires would have been prevented by judicious bonding of cable sheaths.

GILBERT RUTHERFORD.

Evanston, Ill.

Readers' Views and Comments

A Mistaken Economy

To the Editor of ELECTRICAL WORLD:

SIR: This is essentially an age of big things, big business, big feats, big undertakings and big calamities. There is an old saying that "if we look after the little things the big things will look after themselves," and this surely never applied with greater force than in the operation of our large electrical systems, where the capacities to be controlled are enormous and the factors entering into its distribution complicated in the extreme.

When a large turbo-generator was recently installed in one of the famous power houses, a discussion took place as to which of two types of oil circuit breakers should be installed. The one type was admittedly preferable to the other because of a certain operating mechanism which possessed a safety feature. Its cost was, however, $4 more than the other and less desirable type. Moreover, the circumstances under which the protective device represented by the extra $4 in cost was intended to care for was an abnormal occurrence which, those of economical turn of mind contended, would probably never happen. The result was that eventually it was decided to save that $4 by foregoing that adjunct which might under somewhat remote circumstances be required.

Not long after the turbo-generator and its control apparatus had been placed in service trouble occurred in the generator end of the unit. Instead of the oil switch letting go it remained closed and thus the damage instead of being merely that due to the machine itself was made more extensive and disastrous by the reversal of power from the station bus, which continued until the defective generator could be cleared by hand control instead of automatically, as should of course have been the case.

With the large turbo-generator out of service it was necessary to operate two smaller units in its place until such time as repairs could be executed on the large one, and this machine restored to service. These smaller units required a greater coal and steam consumption per kilowatt-hour, due to lower efficiency of the turbine and generator, the smaller boilers, etc., and the cost due to operating these two smaller units until the large machine could be placed back in service again was $30,000 in excess of what it would have been had the large unit remained in service. To this expense should be added the cost of repairing the large machine, which required gangs of men working night and day as well as the cost of materials. Moreover, while the generator was having the damaged coils replaced, other construction men were taking out the oil circuit breaker and replacing it with the one which cost $4 more. In reality it had cost considerably in excess of $30,000 if labor be included. Assuredly, if the little things are properly attended to the big things may look after themselves.

R. I. ELKIN.

New York City.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

ONE-HUNDRED POINT CONTEST WINNERS

Cleveland Winner in Cities of First Class, Milwaukee in Second Class and Eau Claire in Third Class

Winners in the Jovian Order "One-hundred Point Committee" contest that have been decided to date are for the three cities as classified according to membership. Cleveland, Ohio, is winner in the first class, J. M. Bateman, chairman; Milwaukee, Wis., winner in the second class, Carl Golin, chairman; Eau Claire, Wis., winner in the third class, A. E. Peirce, chairman. The prizes awarded are loving cups of over $100 value. The five winning state chairmen are, Roy M. Van Vleet, Milwaukee, Wis.; J. F. Dostal, Colorado Springs, Col.; O. A. Rofelty, Minneapolis, Minn.; H. E. Musson, Oklahoma City, Okla., and J. E. Taylor, Kansas City, Kan. To these Jovians the prizes awarded are Jovian rings and honorary Vulcan Degrees. The work of deciding the winners of local chairmen and committeemen has not yet been completed.

TO RAISE $50,000 FOR N. E. L. A. PUBLIC POLICY WORK

Plans Developed for Greater Activities Along Directions That Were Followed by Committee During 1916

Plans for greater activities by the public policy committee of the N. E. L. A., W. W. Freeman chairman, have been made and the Class A membership notified of the additional assessment of one-twenty-fifth of 1 per cent of the annual income necessary in order to carry out these plans. No expenditures will be made by the committee until a minimum sum of $50,000 has been assured for this purpose.

During 1916 the committee had under consideration the questions of (1) compiling data on the rulings of commissions in the various states; (2) valuation terminology; (3) proper methods in determining valuation; (4) compilation of rates and rate data; (5) information as to municipal ownership and operation; (6) information as to municipal ordinances and franchises; (7) water-power regulation and legislation; (8) regulations affecting inductive interference in transmission lines. In addition to the above, numerous other matters of importance to the central station business in general.

A conference of Class A members on these subjects was held in New York on Feb. 16 and 17, 1916, when these various matters were fully discussed. It was the consensus of opinion of the executives of the industry in attendance at this meeting that the activities of the association should be enlarged at as early a date as possible to secure the compilation of reliable information upon all of these subjects for the use of the member companies. At the public policy meeting held as an executive session during the Chicago convention of the association in May last the action of the conference held in New York was commended and the committee was definitely authorized and instructed to proceed to establish the necessary organization for meeting the needs of the member companies in connection with any of the matters mentioned or any other matters deemed of sufficient importance by the committee.

Acting upon these instructions, it was necessary to determine how this could best be done, and as the present income of the association is used entirely for the maintenance of its correspondence staff at headquarters, the activities of the various technical committees of the association and the general operations of the annual conventions, the committee states that it is necessary, in order to carry on this enlarged work properly, that the member companies be assessed pro rata, based on their general commercial electric income, excluding merchandise and railway business, on the basis of one-twenty-fifth of 1 per cent of such annual income.

The committee believes that it will take five years to cover the work that should be done.

STILL PROSPECTS OF PASSAGE OF WATER-POWER BILL

House Rescinds Vote to Discharge Conferees, Thus Having Effect of Bringing About Further Conference with Senate Conferees

The House of Representatives has rescinded its action of last week when it voted to discharge its conferees on the general dam bill. The conferees of the House had reported, and the Senate had also reported, last week, a hopeless disagreement on that measure. The Senate reappointed its conferees, and the action of the House, which took place Tuesday, has the effect of bringing about further conferences, with a view to trying again to reach an agreement.

The general dam bill passed both houses of Congress at the last session, in different forms, but the conferees have been unable to get together on it at this session. Representative Adamson, who has had the bill in charge for the House, as the chairman of the conferees, has had frequent conferences with President Wilson, who is strongly urging action on the bill at this session. There is now, therefore, a prospect that the bill will be passed at this session, although how good that prospect is no one in Washington will venture to say.

The Secretary of the Interior has designated, as actual or prospective valuable water-power lands, 750,000 acres along the Colorado River and other streams in Arizona. Practically all of this land is within the limits of national forests, monuments or Indian reservations, and will be affected by the bill in the Senate known as the public lands water-power bill, if that bill passes, although there has not been much prospect of its passage recently.

President Wilson has restored for settlement purposes 60,000 acres of land along the Bill Williams and Santa Maria rivers in Arizona. It had been withdrawn for investigation as to its water-power value but has been found worthless for water-power purposes.

PROPOSED CHANGES IN NATIONAL ELECTRICAL CODE

Recommendations of Electrical Committee of National Fire Protection Association on Code Changes to Be Considered at March Meeting in New York City

The important suggested changes in the National Electrical Code which were formulated by the National Fire Protection Association electrical committee and which will be considered at its meeting on March 28 and 29 in New York City are abstracted in what follows here. The reports refer to such matters as have been brought to the attention of the various committees and which were considered of sufficient importance to require special investigation and report.

Wiring of Power and Substations

2. *Conductors.*

Sec. a.—Conductors installed in conduit or ducts where exposed to moisture must be lead sheathed and the sheathing must be grounded. Except for low potential systems the insulation of the several conductors where leaving the metal sheath of cables must be thoroughly protected from moisture and mechanical injury by means of a pothead or some equivalent method.

5. *Lightning Arresters.*

Sec. c.—Ground wires must not be attached to gas pipes within the buildings nor to be run inside of iron pipes unless electrically connected to both ends of such pipes.

Sec. b.—Arresters on circuits of over 7500 volts must be well isolated from all other equipment and if of the oil immersed type must be located outside or in a fireproof room or compartment on the premises.

11. *Transformers.*

Sec. a.—For oil cooled transformers used in stepping voltage up or down before distribution, a separate fireproof building, room or compartment is usually required, cut off from the plant proper, provided with not less than 6-in. non-combustible sill at doorway and with floor drained to some convenient point outside the building. Transformers of the air cooled type should be isolated from all other equipment and if of air blast type should be supplied with air through fireproof ducts.

Induction Motors

8. *Motors.*

Sec. b.—Add: Except where exposed to moisture a metal sheath need not be provided over splices, but the ends of the sheaths must be belled out and sheaths must be bonded around splices by No. 6 B. & S. gage copper wire and approved ground clamps. Where the starter when in the running position opens automatically under overload it may serve also as a circuit breaker.

Sec. b.—The insulation of the several conductors, where leaving the metal sheath of cables, must be thoroughly protected from moisture and mechanical injury by means of potheads or some similar method.

Except where exposed to moisture a metal sheath need not be provided over splices, but the ends of the sheaths must be belled out and sheaths must be bonded around splices by No. 6 B. & S. gage copper wire and approved ground clamps.

Grounding

15A. *Method of Grounding, When Protective Grounding is Required.*

This is a new rule divided into eighteen sections, and is to be classed under Class C—Inside Work, and takes into consideration direct current systems, alternating-current systems, ground conductors, and ground connection.

26. *Wires.*

A new section is added.

Sec. a. (After July 1, 1917.)—The neutral conductor on all three-wire circuits and one conductor on all two-wire circuits must have an identifying insulating covering, readily distinguishing it from other wires. This wire must be run without transposition throughout the entire installation.

23. *Automatic Cut-Outs (Fuses and Circuit-Breakers).*

Sec. d.—The fuses in the branch cut-outs protecting circuits of 660 watts or less shall not have a rated capacity greater than that given in the following table:

125 volts or less	10 amp.
125 to 250 volts	6 amp.

Fuses, Switches and Meter Installations

23. *Automatic Cut-Outs (Fuses and Circuit-Breakers).*

Sec. a.—Where service switch, service fuses and meter are combined in a single self-contained unit device having no exposed wiring or live parts and no parts unprotected by fuses except potential coils of the meter, such potential coils may be connected on the supply side of the service fuses. Departure from the provisions of the above rule may be authorized only under special permission in writing.

Theater and Moving Picture Wiring

A new rule, 38A, is recommended to be adopted regarding moving picture factories and studios.

Switch and Cut-Out

67. *Cut-Outs.*

The Cut-Out Section of the Associated Manufacturers of Electrical Supplies, in conference with the Underwriters' Laboratories, have prepared a revision of this rule, as given below. The matter has been reviewed by the switch and cut-out committee, who recommend that Rule 67 be amended and rearranged as indicated.

68. *Fuses.*

The switch and cut-out committee and Underwriters' Laboratories, to whom was referred the matter of revised specifications for link fuse cut-outs and link fuses, have not yet been able to carry out the necessary investigation and tests, but desire to report progress. It is expected that this work will be under way during the coming year.

68. *Fuses.*

Sec. d.—The switch and cut-out committee has continued its investigation and study of the subject of refillable fuses, and reports the following committee opinion:

"The evidence presented to or obtained by the committee does not warrant it in recommending any change in Rule 68d."

68. *Fuses.*

A revision of the specifications in this rule, including a detailed procedure for tests, was prepared and has been reviewed by the switch and cut-out committee, who recommend that Rule 68 be amended and rearranged. This revision takes into consideration Sec. d, e, f, h, i, j and k of inclosed fuses—plug and cartridge type.

Sec. j.—Short-Circuit Test.—When only one fuse is blown at a time on a system of the voltage for which the fuse is rated and under circuit conditions outlined below, the fuse must open the circuit without emitting sufficient flame or molten metal to ignite easily inflammable material entirely surrounding the cartridge and covering the vents, the cartridge to remain intact.

The normal capacity of the system must be in excess of the load on it just previous to the test by at least five times the rated capacity of the fuse under test.

The resistance of the circuit up to the cut-out terminals must be as follows:

For 125 volt fuses	0.0125 ohm
For 250 volt fuses	0.024 ohm
For 600 volt fuses	0.06 ohm

CIRCUIT BREAKERS

66. Oil Break Type (Not over 3500 Volts A. C.)

Sec. 1.—Tests.—The oil circuit breaker to be connected to a load of rated voltage, equivalent in all electrical characteristics to that of a squirrel cage induction motor of the rating of the circuit breaker with rotor blocked, current to be adjusted by means of external reactance (if necessary), limit the starting current from 6 to 8 times the normal rated current of the circuit breaker.

Under these conditions the circuit breaker must successfully close and open the circuit 30 consecutive times with one minute interval on each open position without incapacitating the circuit breaker.

CABINETS

The committee on cabinets recommends slight changes to be made to Rule 59. Outlet Junction and Flush Switch Boxes, Sec. A, and adds a new section. Rule 70 on cabinets and cut-out boxes has five new sections recommended.

The committees on transformers, electric signs and wireless telegraph apparatus recommended slight changes in the subjects they considered, and a large number of miscellaneous suggestions were brought up for consideration.

SOUTHERN CALIFORNIA EDISON TO SELL $5,000,000 STOCK

California Railroad Commission Authorizes Issues Dependent on Granting Application to Purchase Pacific Light & Power Company

The California Railroad Commission has issued an order authorizing the Southern California Edison Company to sell $5,000,000 of common capital stock at not less than 91.5, the proceeds to be expended from time to time under the commission's order, as follows: Not exceeding $4,000,000 to pay for $5,000,000 face value of bonds, issued by the Pacific Light and Power Corporation. This issue is dependent on the granting of the Edison company's application to buy the properties of the Pacific corporation, which application is now pending before the commission; not exceeding $2,480,405 to discharge notes of the Pacific Light and Power Corporation, this also being dependent on the merger; to pay part of proposed additions and betterments during 1917 and 1918, the amount contemplated being $7,992,000.

In July, 1913, the Edison company was authorized to issue $3,000,000 of common capital stock at 80 per cent of par, to retire indebtedness and make additions and betterments. The order provided that if $2,000,000 of the stock were underwritten at 80 per cent., $2.50 a share commission might be paid, and later the selling price of the stock was raised to 82.5 per cent, and the commission to $5 a share. In March, 1915, the Edison company was authorized to issue $2,750,000 stock to refund an issue of five year 6 per cent debentures.

At the present time the company has out $4,000,000 of first preferred stock, $12,500,000 of second preferred stock and $10,411,00 of common stock.

PUBLIC INTEREST AND LOW STOCK PRICES INCONSISTENT

Massachusetts Commission Increases Prices of Tenney Companies' Securities Over Those Petitioned, Scaling Down Value of Rights

In three decisions dated Feb. 16 the Massachusetts Gas and Electric Light Commission approved the issue of additional capital stock by the Fitchburg Gas & Electric Light Company, the Haverhill Electric Company and the Springfield Gas Light Company to the extent of 6543 shares. The board ruled, however, that the prices fixed by the respective boards of directors in the petitions for security increase were in each case materially lower than will insure a ready market for the stock, and so low as to be inconsistent with the public interest. On this account the commission fixed the prices of the shares above those named by the petitioners at points representing a total difference of $173,855 between the board and the companies. In scaling down the value of rights the board pointed out that in the case of each company recent sales show that the outstanding capital stock commanded prices considerably in excess of the prices fixed by the directors. The following table summarizes the action of the commission:

	Price Fixed by					Difference in Prices Petitioned and Fixed	
	Directors	Commission	Recent Sales	Par	No. Shares Authorized	Per Share	Total
Fitchburg	$85	$100	$115	$50	2,400	$15	$36,000
Haverhill	130	275	210	100	1,714	45	77,130
Springfield	200	225	260	100	2,429	25	60,725
Total					6,543		$173,855

The proceeds of these new securities are to be devoted to paying floating debts incurred in extensions, improvements, etc. In the case of the Fitchburg company, dividends have been paid regularly for seven years at the rate of 10 per cent. The Haverhill company has paid 10 per cent regularly for four years and the Springfield company has paid regular dividends at the rate of 12 per cent for nine years.

MEETING OF SALESMEN'S HANDBOOK COMMITTEE CALLED

Advisability of Separating Sections so That Members with Particular Interests Will Receive These Sections Only to Be Discussed

A meeting of the Salesmen's Handbook Committee of the Commercial Section, N. E. L. A., will be held on Feb. 27, at headquarters in New York City, for the purpose of discussing the committee's report and for further discussion on methods of taking care of the increased size of the handbook and on increasing the use of the handbook. There will also be discussed the advisability of separating the different sections of the handbook so that members interested in particular sections will obtain those sections only.

The electric vehicle section will be completely revised by a sub-committee of the Electric Vehicle Section of the association. The following is an outline of the data to be included in the revision: *General*—comparison with other forms of vehicles; *revenue for central stations*—value of load; *passenger*—description, uses and advantages; *commercial load*—description, uses and advantages, cost of operation; *industrial*—description, uses and advantages, cost of operation; *miscella-*

neous equipment—batteries, tires, charging apparatus and operation.

Efforts are being made to secure for manufacturers data on types of reflectors and their application for the lighting section, and a report will be submitted at this meeting.

The final draft of the section on "Air Handling" in the poorer section has been made up, and is now practically ready for the printers. This section is intended to include data on all forms of air handling, showing the application of the different forms of apparatus for furnishing air. This ought to be ready for circulation inside of the next few weeks. The article on "Refrigeration" is being revised by C. J. Carlsen, and should be ready for the printers by March 1. The general data on "Power" and on "Isolated Plants" is in the hands of the power sales bureau, and will be presented to the committee for publication. Very little has been done on the preparation of short articles, descriptive of each class of industry, and the committee feels that it should take some active steps to get this work completed as soon as possible.

For the electric heating section data are to be included on "Electric Ranges," "Industrial Heating," and typical installations. Manufacturers are to furnish data on their equipments applicable to all domestic and industrial heating. R. H. Tillman is chairman of this committee.

EXTRA SESSION OF CONGRESS NOW DEEMED IMPROBABLE

Democrats and Republicans Refuse to Bargain with Independents for Committee Chairmanships, a Number of Which Are of Importance to Electrical Industry

Unless some unforeseen event in connection with the international situation should arise which might make it advisable, it seems improbable, according to the latest information obtainable in Washington, that there will be an extra session of Congress in the near future. This is indicated in reports at Washington that President Wilson does not even intend to conform to custom and call the Senate in extraordinary session for the purpose of confirming appointees. The President is credited with believing that his cabinet officers have already been confirmed—most of them four years ago, when he first took office—and that there is no necessity for him to again lay their names before the Senate for confirmation.

Some well-informed Washingtonians believe that President Wilson does not need any power from Congress to deal with international events which may arise. They instance the fact that he dispatched the Atlantic fleet to Mexico without first consulting Congress, and that under the Constitution President Jefferson dispatched an American squadron to Tripolitan waters to protect American commerce without consulting Congress. In some quarters it is believed that the presence of Congress in Washington in the near future might be a handicap to President Wilson rather than an aid.

In this situation there is no probability that the Republicans will organize the House of Representatives as a Republican body in the near future. As the situation stands, there are 214 Republican members and 214 Democratic members of the next House, with five independents apparently holding the balance of power. The latest reports are that overtures from these five independents to one side or the other for important committee chairmanships in return for support have met with repulses from both Democratic and Republican members of the House, who say they will not be led into bargaining for some of the most important committee chairmanships, among which a number are of importance to the electrical industry, such as Judge Adamson's seat, which has control of water powers in navigable streams; Judge Flood's seat on the committee on foreign relations, which has control of Niagara water-power matters; the patent committee chairmanship, etc.

OUR DELAY IN DEVELOPING THE NITRATE INDUSTRY

California Commission Compares Highly Developed Field Abroad with Failure to Utilize Hydroelectric Power in This Country

The attention now being directed toward the use of hydroelectric power in the manufacture of nitrates has led the State Water Problems Conference appointed by the Governor of California to devote considerable space to this subject in its recent report, an extract of which appeared in the ELECTRICAL WORLD for Feb. 3, 1917. In order to emphasize the latent possibilities in this field in the United States, comparisons are drawn with the nitrate industry in foreign countries. The following has been taken from the report:

Europe uses per acre of cultivated land 200 lb. of fertilizer; the United States uses 28 lb. Germany, in twenty years, by the use of fertilizer, has increased the average yield of all crops grown three and one-half times as much per acre as America. The German Agricultural Department reports show that by feeding the soil with 2,000,000 tons of nitrate there was secured an increase in crops of 63,000,000 tons. In Germany intelligent effort has been directed to replace the nitrogenous compounds extracted from the soil by crop growth; in the United States the average agriculturist has seen his land yield steadily decreasing crops without attempting adequate remedy.

The average yield per acre in bushels for various crops in the United States and in Europe is as follows:

	Wheat	Oats	Barley	Rye	Potatoes
Europe	32	47	38	30	158
United States	15	29	25	16	96

"As a measure of preparedness in event of war the United States has been attempting to accumulate a reserve stock of 32,500 tons of Chilean nitrate. Her army and navy use annually in peace 3000 tons. The reserve stock contemplated would make enough explosives to last possibly a week in a modern war, and at the end of that time the nation would be powerless unless her navy were strong enough to enable her to commandeer a supply from Chile, against the efforts of her enemy and possibly the wishes of the world. A cheerful outlook for a nation whose foreign relations are becoming complicated!"

A country with great natural water-power resources can by the proper use thereof make itself independent of the foreign supply of nitrates. Nitrates can be readily extracted from the air by hydroelectric power, and where there is a general distribution of the necessary rock deposits used in these processes, which is the case throughout the West, it may be considered that 1.5 hp. of hydroelectric energy will produce a ton of sodium nitrate per year. The method of manufacturing fertilizer from Chilean deposits produces a composition of 12 per cent active fertilizer and 88 per cent useless material on which freight must be paid, while the electro fertilizer product contains 60 per cent of fertilizing material.

The United States is importing from Chile annually 625,000 tons of nitrate, valued before the war at $23,000,000 (including the Chilean export duty of nearly

$8,000,000), but now worth $37,500,000. That entire amount of nitrate could be manufactured in California by utilizing 1,000,000 hp. of its unused water-power resources. California itself is using about 50,000 tons of Chilean nitrate annually at a cost before the war of nearly $2,000,000, increased now to $3,000,000. Many times this amount should now be used annually in that State, and this will doubtless come in time. A 75,000 hp. hydroelectric plant would supply the nitrates now used in California.

ANNUAL MEETING A. M. E. S. SCHEDULED FOR MARCH 15

February Meetings of All Sections of the Association Are Postponed to the Week Commencing March 12

The annual meeting of the Associated Manufacturers of Electrical Supplies will be held on March 15, at Delmonico's, New York City. The association has made remarkable progress during the past year, and it is anticipated that the annual meeting will be largely attended, and will be an interesting and enthusiastic one. The meeting will be followed by a banquet in the evening.

The board of governors of the association held its regular meeting on Feb. 21 at the offices of the association.

The regular meetings of all sections of the association scheduled to take place in February have been postponed to the week commencing March 12. This change was made to meet the convenience of out-of-town members desiring to attend the annual meeting and banquet.

The following schedule of meetings has been arranged:

March 13.

Fan motor section, offices of the association, 10.30 a. m.
Knife switch section, offices of the association, 10.00 a. m.
Panelboard and switchboard, offices of the association, 2.00 p. m.
Snap switch section, offices of the association, 2.00 p. m.
Lighting fixture section, Hotel Biltmore, 10.00 a. m.
Outlet box section, Hotel Biltmore, 2.00 p. m.
Lamp receptacle and socket, offices of the association, 9.30 a. m.
Fuse section, offices of the association, 2.00 p. m.
Attachment plug section, offices of the association, 4.00 p. m.
Committee on inclosed fuses, offices of the association, 9.30 a. m.
Moulded or formed insulation section, Hotel Biltmore, 10.00 a. m.
Line material section, Hotel Biltmore, 2.00 p. m.
Porcelain section, Hotel Biltmore, 10.00 a. m.

NOMINATIONS FOR FEDERAL TRADE BOARD VACANCIES

President Wilson Sends Names of Former Governor Fort of New Jersey and William B. Colver of St. Paul to Senate for Confirmation

President Wilson has sent to the Senate the nominations of former Governor Franklin Fort of New Jersey and William B. Colver of St. Paul, Minn., for the vacancies on the Federal Trade Commission created by the retirement of Edward N. Hurley and the fact that the Senate refused to confirm Commissioner Rublee, who has served for some time as a recess appointee, but who will not be nominated again. Mr. Rublee was recently appointed a member of the commission to observe the working of the so-called eight-hour railroad labor law.

Mr. Fort is a Republican, and resides at South Orange, N. J. He was born in that State in 1852, and is a graduate of Albany Law School, Rutgers College and New York University. From 1878 until the time he became Governor of New Jersey in 1908, in which position he served until 1911, Mr. Fort served on the judicial bench of New Jersey in various positions, ending with service on the Supreme Bench of that State.

Mr. Colver is a newspaper man, and in a statement made public in connection with his appointment he is described as "a man of very unusual familiarity with economic, social and political questions." He is a Democrat, forty-six years of age. For many years he was associated either as editor or publisher with the Scripps-McRae League of newspapers, the Newspaper Enterprise Association, etc. In recent years he has been a resident of St. Paul, Minn., actively engaged in the management of the publications known as the Clover Leaf Association.

The positions pay $7,500 a year. Mr. Colver is appointed to fill out Mr. Hurley's unexpired term and Mr. Fort is appointed for a term of six years.

It is not known whether the appointments will be confirmed by the Senate without opposition. The single objection of Senator Gallinger of New Hampshire to Mr. Rublee served to keep the latter from being confirmed. Mr. Gallinger's only objection to Mr. Rublee was that Mr. Rublee was "personally obnoxious" to Senator Gallinger. Under the rule of Senatorial courtesy this served to prevent Mr. Rublee's confirmation.

NEW ENGLAND ELECTRICAL MEN VISIT PROVIDENCE

Inspection Made of Property of Narragansett Electric Lighting Company Followed by "Get Together" Luncheon

Over 100 central station and affiliated electrical men convened at Providence, R. I., Feb. 15, upon the initiative of M. R. Griffith of the General Electric Company, Boston, Mass., and under the general auspices of the New England Section of the N. E. L. A., to inspect the property of the Narragansett Electric Lighting Company and hold a "get-together" meeting at the Crown Hotel. A special car attached to the 10.05 a. m. train out of Boston carried about sixty, and upon arrival in Providence the offices and electric shop of the Providence company in the Turk's Head Building were visited. This was followed by a luncheon, at which E. R. Davenport, sales manager of the Narragansett company, presided. Among the speakers were R. S. Hale, chairman of the N. E. L. A. committee on wiring; C. E. Greenwood, Boston Edison company; A. H. Allcott, in charge of the Narragansett company's electric shop; F. A. Gallagher, head of the company's lighting department; Franklin Hall, auditor, and J. A. Gibson, in charge of electric sign campaigning. The film "The King of the Rails" was shown at the close of the speaking.

Mr. Hale outlined the methods of the wiring committee in working toward unification of plug and receptacle designs through conferences among manufacturers. It is hoped to secure one standard plug for the "socket end" of flat-iron and other appliance cords, and it would be a notable gain if a similar standardization could be attained on the appliance end of the cord. Nothing is forced upon the manufacturing interests, but through conferences the reduction of diversified types of plugs has been materially promoted. Mr. Davenport suggested that central stations specifying that an appliance must be equipped with a standard attachment plug would help this development.

The success of the Narragansett company's electric

shop, located on the ground floor front of one of the finest office buildings in the city, was the principal topic of discussion at the meeting. Operated purely on merchandising principles, with the idea that every transaction should carry its legitimate cost to the consumer, this shop cleared $6,500 in 1916, after all rental, advertising and operating costs were covered. Mr. Allcott presented a paper dealing with the electric shop policies in condensed form, emphasizing the importance of purchasing goods advantageously and effecting substantial savings by anticipating requirements, placing orders with factories for goods for future delivery which could be made up during the dull season. Under the sale of portable lamps, Mr. Allcott pointed out that 1400 were sold last year, frequently two or more per customer. Inquiry developed their use for decorative purposes, and an attractive field for expansion appears open here.

Promptness in repairing appliances has been secured by a repair shop located in the basement of the store, and every effort is made to render twenty-four-hour service, except where appliances have to be renickeled. Last year the company received over $1,000 from customers as charges for repairs, and no difficulty whatever was experienced in collecting these charges when the repairs were made necessary by the ordinary wear and tear and not covered by a guarantee, or due to a defect. The electric shop in Providence did a gross business in 1916 of $150,000, of which $74,000 was in electric appliances and the remainder in tungsten lamps. January, 1917, showed a gain of 168 per cent over January, 1916.

Mr. Gibson discussed the spread of electric sign business on the basis of a campaign in which the company assumed the selling expense, thereby gaining lower prices from the manufacturers. In eleven weeks twenty-eight signs of 48 kw. connected load were added.

WEBB EXPORT TRADE BILL REPORTED FAVORABLY

Believed That Amendments Suggested by Senate Committee Will Be Agreed to by House Conferees so That Bill May Become Law at Present Session

Senator Pomerene has reported to the Senate from the Committee on Interstate Commerce the so-called Webb bill which would permit combinations of exporters engaged in foreign trade. It is recommended that the bill be passed. The measure, known as H. R. 17,350, has already passed the House, and it is believed in Washington that certain amendments suggested by the Senate Committee would be agreed to by House conferees, and that the bill may become a law at this session.

The report on the bill points out that the Federal Trade Commission has found that European nations with great liberality permit organizations or combinations in respect to their foreign trade, and states that since the beginning of the European war the Allies have organized buying agencies for the benefit of their governments and their peoples.

"Our merchants and manufacturers," the report states, "must meet this situation. Very few of them can compete single-handed with these great combinations. Our belief is that it is necessary to permit our business men to form similar organizations or associations, so as to enable them to meet foreign competitors on a more equal footing. In this way they will be able to reduce selling costs."

The important Senate committee amendments have, it is stated in the report, the following objects:

"The authority thereby conferred should not result in the restraint of trade within the United States, which is clearly prohibited by the Sherman Law.

"While the purpose of the bill is to increase our foreign trade it should not result in destroying the business of other companies, associations or individuals who may be engaged in the foreign trade.

"The purpose is to increase and improve this trade —not to injure it.

"While we realize that any sales in foreign commerce may incidentally and temporarily result in the increase in prices of the same article to home consumers these associations should not be permitted to so conduct their affairs as to artificially or intentionally and unduly enhance prices of the commodities in which they are dealing to a home consumer."

One of the Senate Committee amendments places the power and responsibility for enforcing and supervising the act upon the Federal Trade Commission.

EMERGENCY FLOOD-LIGHTING OF NEW YORK BRIDGES

How City Engineers and Lighting Companies Are Co-operating to Flood-Light the Bridges Over the East River

New York City central station companies are now cooperating with the municipal engineers to flood-light all the bridges over the East River. Projectors have been placed under the arches of the bridges, along the waterfront and around the stone piers as a precautionary measure and to assist the militiamen in watching over the vital sections. The fall of the Brooklyn or Manhattan Bridges would cut off the navy yard from the main ship channel, while the fall of the Williamsburg, Queensboro and the inter-connecting railway bridges would block the internal lines of traffic. Ninety guardsmen are stationed on each bridge and machine guns and three-pounders are located under the bridges.

On Saturday, Feb. 3 at 4 p. m. an order was issued to increase the illumination of all bridges, including anchorage points of suspension bridges, bases of piers, and the underside of bridge flooring by the use of flood-lamps, arc lamps and search-lamps. On Sunday night the three lower bridges on the East river were illuminated; on Monday the Queensboro bridge, and on Tuesday the inter-communicating bridge was illuminated. As there were but few lamps available for this purpose a man was sent to Lynn, Mass., for a carload of suitable types. About 300 employees of the city and of the lighting companies were required to install these lamps at the time set. All work is of a temporary nature and lamps are fed from the nearest source of supply in each instance. Some lines were tapped from cables on bridges, some from street lighting circuits and from other sources. The New York Edison Company, the Edison Electric Illuminating Company of Brooklyn and the New York & Queens Electric Light & Power Company furnish the energy for this purpose.

About 100 flood-lamps rated for 500 and 750 watts, more than 200 Type C lamps and a large number of 100-watt Mazda lamps are used. Several large search-lamps are also kept in action continually, while small naval boats with search-lamps cover the piers and bases of the bridges. Danger signs to keep boats away from the bridges have been posted and are illuminated. In addition as a matter of safety a 50-ft. deadline has been ordered around the pier of each bridge.

This work has been carried out under the direction of David F. Atkins, chief engineer of the department of water supply, gas and electricity, and Samuel G. Rhodes of the New York Edison Company.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public-utility companies.

Where Burden of Proof Showing No Negligence Rests with Light Company.—In an action for death due to unsafe condition of an electric transformer used to step down from 2300 volts to 110 volts, where a young man was killed in attempting to turn out an electric lamp by means of a wall switch, it was held by the Supreme Court of Pennsylvania, in Seeherman vs. Wilkes-Barre Company (99 A. 174), that the result speaks for itself, and that the law imposed on the defendant the burden of showing that it was not negligent.

Extent of Right of Power Company.—An act forbidding the exercise of the power of eminent domain by any water company thereafter incorporated as to the appropriations of streams, rivers, or the land covered thereby, does not forbid a water company from taking land outside the limits of a stream for the purposes of a reservoir, it was held by the Supreme Court of Pennsylvania (98 A. 1032) in Brumbaugh vs. Raystown Water Power Company.

Statute Regarding Height of Wires.—A statute providing that all wires strung upon poles should not be less than 24 ft. above the ground at all crossings and not less than 14 ft. above the ground at other places did not apply to a light and power company in the construction of its line over a bridge having a wire only 22 ft. 2 in. above the floor of the bridge attached to poles on each side at a height of more than 24 ft. where the wire at the place of discharge was 32 ft. above the ground, it was held by the Supreme Court of Wisconsin in Vannatta vs. Lancaster Light & Power Company (159 N. W. 940).

Liability for Damages Caused by Excavation.—A company excavating in a street to repair its own conduits, though authorized to do so by the city, is liable to the owner of a stock of goods damaged by water seepage due to the excavation, regardless of its negligence it was held by the Appellate Division of the Supreme Court of New York, in May vs. New York Edison Company (161 N. Y. S. 886).

Salesman Inspecting Installation of Machinery Regarded as Employed in Manufacture Thereof Under Compensation Law.—A salesman of a manufacturer of machinery whose duties require him to inspect the apparatus generally, and who does inspect it after it is set up and in operation, during which inspection he is injured by the fall of a piece of it, may be regarded, according to the Court of Appeals of New York, in Benton vs. Fraser (114 N. E. 43), as employed in the manufacture of machinery under the workmen's compensation law.

Company Has No Right to Discontinue Service Upon Tender of Payment.—Notwithstanding the contract of an electric company provided for discontinuance of service, without notice, upon non-payment of consumer's bill within ten days from its date, the Supreme Court of Arkansas held, in Little Rock Railway & Electric Company vs. Leader Company (188 S. W. 1182) that the company had no right to discontinue service after the tender of the proper amount by the consumer, although he was in arrears, for the consumer should have notice and reasonable opportunity to pay before enforcing forfeiture of the contract, forfeitures not being favored.

Contract vs. Approved Sketch.—That the terms of a contract do not necessarily hold when not in accordance with an approved sketch or drawing was in substance the decision of the Supreme Court of New York in American Sign Company vs. Rundback (161 N. Y. S. 228). A written contract was made for an electric sign specifying 359 lamp sockets. The approved sketch, however, called for 319 lamp sockets and showed where each socket was to be placed, the sketch going so far as to enumerate the number of sockets for each part of the sign. The defendant refused to accept and pay for the sign, claiming that the terms of the contract had not been fulfilled, but the court held that where the design not only showed the number and position of the lamp sockets if counted, but plainly shows in a conspicuous position the number provided, it must be held that the defendant agreed to pay for the sign shaped in that design and containing the number of lamp sockets pictured on the design and also stated thereon.

Public Utility Monopoly.—A party, complaining of an order of the State Public Utilities Commission, permitting one telephone company to purchase a controlling interest in another and insolvent company, who shows no special damage resulting to him from the purchase by the first company of the stock and bonds of the other company from persons other than himself, cannot raise the question whether the purchase violates the federal anti-trust law, enforcement of which is committed to the attorney-general of the United States, except where an individual can show some special damage to himself from a violation of the act, it was held by the Supreme Court of Illinois (114 N. E. 190). Where a commission authorized a foreign telephone company to purchase a controlling interest in an insolvent domestic company, the order of the commission expressly preserving the integrity of the domestic company and its franchise rights there was no violation of the State public utilities act providing that no franchise, license, permit or right to own, operate, manage, or control any public utility, except common carriers in interstate commerce shall be granted or transferred to any grantee or transferee other than a corporation duly incorporated under the laws of the State, as the term "public utility" means the plant operated by a public utility, and not the corporation.

Commission Rulings

Important Decisions of Various State Bodies Involving or Affecting Electric Light and Power Utility Operation and Practice.

New Rates Supercede Old Ones.—In a complaint to the Pennsylvania Public Service Commission alleging an overcharge by the Duquesne Light Company of $110.67 for energy furnished between July 1, 1914, and April 1, 1916, it was brought out that the contract for supply was entered into in March, 1913, at a minimum charge of $30 per month. On July 1, 1914, however, the company filed with the commission a schedule under which the minimum rate for this class of service was $26.

The commission held that the complainant was entitled to reparation to the amount by which his payments under the $30 minimum had exceeded the amount he would have been required to pay under the $26 minimum, and an order awarding reparation in the amount of $72 was entered.

Reproduction Costs Modified to Basis Under Normal or Average Conditions.—In a hearing before the Public Utilities Commission of Colorado concerning the rates of the Mountain States Telephone & Telegraph Company, the commission stated that "in arriving at the value of the property by the method of the cost of reproducing the property as the term is understood, the term is not used in its strict sense, but is so modified and altered as to bring before the commission the cost of reproducing the property under normal or average conditions, due regard being given to the conditions under which the property has been actually constructed and the prices paid for labor and materials.

"It can be readily seen that in reproducing a property to assume the prices of to-day would bring about an improper result, as would the prices during a period of financial depression."

Confidence of Public Secured Only by Full and Frank Publicity.—In its annual report for the year ended June 30 last, the Idaho Public Utilities Commission made the following statement: "We believe that the people of Idaho are willing to pay rates that will insure to the utilities serving them a reasonable return on the value of the property used and useful in the public service, but they object to paying returns on promoters' profits or watered stock. Utilities can secure and retain the confidence of the public only by doing business in the open, giving full and frank publicity to all their operations affecting service to the public. We believe that the public utilities of our State realize that full publicity is the wisest and best policy for them to pursue, and are pleased to state that none of them has shown a disposition to hide from the Commission any of its operations."

Missouri Commission Report.—The fourth annual report of the Public Service Commission of Missouri for the eleven months ended Nov. 30, 1916, has recently been published.

Electric Pumping Costs Less Than by Steam.—A recent report by the superintendent of the city water works of Faribault, Minn., shows that the cost of pumping water by electricity during the past nine months has been $2.55 per million gallons less than the average cost of pumping by steam, which method was used during the previous four years. The electric pumping load is served by the Northern States Power Company, which company was instrumental in inducing the city officials to test the efficacy and economy of pumping by electricity.

May Sell Municipal Plant.—Mayor George Puchta of Cincinnati, Ohio, said recently that he would call a meeting of the Board of Control to discuss the advisability of selling the municipal light plant at Madisonville, now a part of the city. The plant has been unprofitable, although the rate has been 9.5 cents per kilowatt-hour. Under the circumstances, the plant could not operate at 8.5 cents, the new rate to be charged by the Union Gas & Electric Company, but the Mayor has promised customers that the company will extend the new rate to them after the municipal plant is sold.

Regulations for Electric Concessions in Panama.—The Government of Panama has decreed that only the executive may grant concessions for the use of land and water for the production and distribution of electric light and power. The law as published in the *Gaceta Oficial* stipulates that concessionaries, in return for specified exemptions, must agree to grant the Government a part of their gross proceeds from electric service, and to furnish electricity for public purposes at a reduction of not less than 25 per cent from the rates charged private consumers. Companies installing electric light in a city of at least 45,000 inhabitants must transmit their current underground. Contracts executed by the executive in conformity with this law will not require legislative approval.

Rules and Regulations of Pacific Gas & Electric to Be Revised.—After an all-day session before officials of the Railroad Commission of California, it was unofficially stated that "all of the rules and regulations of the Pacific Gas & Electric Company regarding its relations with consumers are to be revised, rewritten, and generally made less liable to arbitrary action by employees of the company." During the hearing Max Thelen, president of the commission, stated that he thought more satisfactory rules could be drawn. He thought that the existing rules were "of drastic and mandatory character" and left too much to the discretion of company employees. It is understood that the revision is to be done by experts of the railroad commission working in conjunction with the gas company's experts.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Recommends that Municipal Plant Be Built in Coal Fields.—It is said that Light and Heat Commissioner W. E. Davis of Cleveland, Ohio, will recommend in a report to be presented to Council shortly that a large station be built by the city on coal lands to be leased or purchased outright. He estimates that energy may be transmitted from this plant to Cleveland and sold at 3 cents per kilowatt-hour for lighting and 1 cent for heating. He will not recommend hauling coal to operate such a plant located in the city.

A Companion to the Famous Mills Bill in Ohio.—Senator H. H. Timby has introduced a bill in the Ohio Legislature which provides that municipalities may issue general credit bonds to purchase, acquire by condemnation, or construct municipal telephone plants. The Mills bill, introduced at two different sessions in the past, and defeated both times, gave the right to municipalities to issue general credit bonds for the acquirement of all kinds of public utilities. The last measure is very radical, and contains a complete code governing the operation of municipal telephone plants. It limits the length of the lines outside the city to 10 miles. Plants are to be free of all taxes, but taxes may be levied in a general way to pay the interest on and provide a sinking fund for bonds during construction. It thus places the interest charge on users and non-users of the service alike for this period, and provides a further authority for issuing bonds, aside from the limitations prescribed by the Longworth act.

Wisconsin Power Properties Purchased.—L. E. Myers, of the L. Myers Company, contractors, Chicago, has purchased the Ironwood (Mich.) & Bessemer Railway & Light Company, including the Gogebic & Iron Counties Railway & Light Company, the Ashland (Wis.) Light, Power & Street Railway, the Ashland Power Company; Hurley (Wis.) Water Company and Ironwood Water Works Company, the Big Falls, Tylersfork, Brownstone Falls, Copper Falls and Superior Falls power developments on the Montreal, Flambeau and Tylersfork Rivers are also included in the transfer. Upon the completion of the work that is now under way these properties will comprise about 40,000 hp. in water power and steam auxiliaries. About 9000 hp. in steam plants is under construction. The consideration involved in the sale was about $3,500,000. L. E. Myers has been elected president of the several companies and L. N. Bosen, of the Myers company, was elected vice-president. The present local managements will be continued.

Electrical Output of American Gas Company Increased 27 Per Cent.—The annual report for 1916 of the American Gas Company, which operates both gas and electric properties, stated that the electrical business generally had grown rapidly during the year, there being an increase in the kilowatt-hours sold of about 27 per cent. The cubic feet of gas sold during the year increased only about 14 per cent. The report showed gross earnings of $4,491,817.73, which is an increase of $512,203.32 for 1916.

Bill to Impose Additional Tax of $1 per Horsepower on Generating Companies.—A bill has been introduced into the New York State Legislature, amending sections 192 and 197, and adding new section 189-a, tax law, by imposing on every corporation, joint stock company, or association, generating electricity by water power within the State, or transmitting to the State electricity so generated elsewhere, an additional annual franchise tax of $1 per unit of horsepower based on the average daily amount of electricity so generated or transmitted, and requiring such corporation to report to the tax commission annually on or before Nov. 15.

The Provincial Electric Supply Committee of Great Britain.—This committee has been formed with the principal object of providing a central and representative body to afford a ready means of co-operation in protecting and furthering the financial, commercial and legislative interests of English provincial electric light or power companies, working under provisional orders. The committee proposes to direct particular attention to the following matters: (1) To organize and arrange for united action, in protecting common interests as and when occasion arises and such united action is necessary and desirable. (2) To afford the readiest means for considering such questions as rating, income tax, assessments, excess profits tax, emergency and other legislation, rates for supply, fiscal and other matters generally affecting the companies' interests. (3) To prepare, collect and distribute among the members statistics or other information of common interest, and to print and issue other literary matters for the use of members desiring to avail themselves of the facilities offered. (4) To afford facilities for intercourse between the directors of the companies represented on the committee with a view to the consideration of any questions affecting the common interests. (5) To watch over the interests of the companies and take any steps expedient with a view to correcting misstatements that may appear in the public press. (6) To assist in the compilation of official statistics and information on a uniform basis where such is desirable, and to the benefit of the companies. (7) To appoint sub-committees to deal with any special matters arising, and generally to initiate, organize, and carry out any work having for its object the protection or furtherance of the interests of the companies.

Causes of Prosperity and Depression.—At the 182nd meeting of the Schenectady section of the A. I. E. E. held Feb. 2, George E. MacIlwain delivered an address on the topic, "The Real Causes of Prosperity and Depression."

Worcester Polytechnic Institute Branch, A. I. E. E.—The fifth regular meeting of the branch was held on Feb. 23. W. H. Blood, Jr., of Stone & Webster, spoke on "Grounding of Alternating Current Secondary Distribution Systems."

Automobile Head Lighting Practice.—The February meeting of the New England Section of the Illuminating Engineering Society was held on the sixteenth at Boston. S. Carleton Rogers spoke on "Present Practice in Autumobile Headlighting."

Automatic Telegraphy.—C. E. Davies, traffic superintendent of the Great Northwestern Telegraph Company, spoke before the Toronto section of the American Institute of Electrical Engineers on Feb. 16, on the subject, "Automatic Telegraphy." In addition the members of the Institute took a trip to the telegraph exchange.

The Electric Development and Jovian League of San Francisco.—At the Feb. 7 meeting of this organization, H. F. Jackson, president of the Sierra & San Francisco Power Company, outlined the plans and purposes of the new Pacific Coast Section of the National Electric Light Association, which was recently formed, and which will hold its first meeting in southern California within a few weeks.

New Jovian League.—The Stark County, Ohio, Jovian League was organized at a recent meeting held at Massillon, Ohio, by members of the electrical industry from several cities, and a prospective membership of 100 is anticipated. The officers elected at the meeting are O. A. Acuff, Massillon, president; H. F. Heyman, Alliance, vice-president; Robert E. Lane, Canton, secretary; Messrs. Steele, Vincent, Cope and Horner, executive committee.

Louisiana Engineering Society.—At the annual meeting of the society, Jan. 13, the following officers were elected to serve for the ensuing year: President, A. T. Dusenbury; vice-president, John Klorer; secretary, W. T. Hogg; treasurer, Ole K. Olsen; director, John Riess. The other members of the board holding over are Rufus S. Manley and Samuel Young. L. P. Breckenridge, professor mechanical engineering, Yale University, spoke on "The Engineer, His Opportunity and His Obligation."

Illinois State Electric Association.—At the reorganization of the Illinois State Electric Association the by-laws were amended to include associate members. The associate members will consist of salesmen and representatives of electrical manufacturers. The associate members of this association will have all the advantages of the meetings of the association that the regular members have, with the exception that they have no voting power and are not present at the executive sessions, if any, and do not hold office.

Associations and Societies

A complete Directory of Electrical Associations is regularly printed in the first issue of each month on the next to-last text page

New York Electrical Credit Association. The adjourned 1916 annual meeting will be held at headquarters, 120 Broadway, during the afternoon of Feb. 28.

Lighting Practice.—At the second bimonthly meeting of the Texas branch of the American Institute of Electrical Engineers on Jan. 26, L. M. Krausse read a paper on "Illumination." This was followed by an illustrated lecture by Prof. J. M. Bryant of the Electrical Engineering School of the University of Texas, on "Street Lighting."

Portland (Ore.) Section A. I. E. E. and N. E. L. A.—At the regular monthly meeting of the sections on Feb. 6, at the Multnomah Hotel, William Conger Morgan, professor of chemistry at Reed College, spoke on the subject, "The Newest Chemical Element — Electricity." Stereopticon slides illustrated the address. The meeting was under the auspices of the N. E. L. A., J. C. Henkle, chairman.

Meeting of Iron and Steel Electrical Engineers. — The regular monthly meeting of the Association of Iron and Steel Electrical Engineers was held on Feb. 17, at the Fort Pitt Hotel, Pittsburgh, Pa. Papers on "General Safety Movement and Accident Prevention" were presented by the safety committee, of which H. A. Schultz is chairman. The March meeting of the Pittsburgh section will be held on March 17 at the Fort Pitt Hotel, under the auspices of the electrical development committee, of which Stewart Coey is chairman. The Philadelphia section will hold its March meeting on March 3, at which time the speaker will be C. T. Henderson of the Cutler-Hammer Manufacturing Company. The eleventh annual convention of the association will be held in Philadelphia.

Series of Evening Meetings for Louisville Jovians.—An interesting series of evening meetings is projected by the Louisville Jovian League. An evening meeting will be held each month. On Feb. 26 a supper meeting, with the ladies present, will adjourn to a moving picture theater, to see electric pictures and safety-first pictures; in March there is to be a dinner dance meeting; in April a lecture meeting, for which an out-of-town speaker will be provided; May is to see production of an amateur theatrical by the members of the league, and June will bring the annual river excursion. These evening meetings are proposed in order that the members of the organization who cannot get out to the noonday meetings will have some interest in their membership. One noon meeting will be held each month.

American Institute of Consulting Engineers, Inc. — At the council meeting on Feb. 6, the following officers were elected for the year 1917: President, George Gibbs; vice-president, Lewis B. Stillwell; secretary and treasurer, F. A. Molitor.

Address on Criminality at Buffalo.—The February meeting of the Buffalo section N. E. L. A. was held on Feb. 13, in the amphitheater of the Electric Building. After a moving picture entertainment, Henry J. Girvin, chief of detectives of Buffalo Police Department, addressed the meeting on the subject of "Criminality." Following this address, the meeting was given over for a short time to an amusing Valentine party, in which many appropriate souvenirs were distributed and considerable interest manifested, after which the meeting adjourned to the floor below for refreshments.

Plans for Civic Activities Outlined to St. Louis Jovians.—At what proved to be its largest and most enthusiastic meeting of the year, the St. Louis Jovian League listened to an outline of plans for civic activities, on Feb. 13. The speaker was J. Lionberger Davis, the newly-elected president of the St. Louis Chamber of Commerce. Mr. Davis laid particular stress on the great value of co-operation between civic and commercial bodies, in the work of developing and improving the city. He made a splendid plea for the support of the Jovian League for several movements being inaugurated by the Chamber of Commerce.

Fire Hazard of Electricity.—At the regular monthly meeting of the New York companies section of the N. E. L. A., held on Tuesday evening, Joseph C. Forsythe of the New York Board of Fire Underwriters spoke on "Electrical Fire Hazards." Last year 124 fires in New York City were found to have been caused by electricity with a fire loss of $91,549. In 1915, 30,000 fires from electrical causes were reported in the United States or about 5 per cent of the total number of fires. Mr. Forsythe pointed out the rapidly growing fire hazard of the electric flatiron. Following Mr. Forsythe, Mr. Roberts, a newspaper correspondent, spoke on some of his personal experiences with Francisco Villa, the Mexican revolutionist.

Meeting of Philadelphia Illuminating Engineers.—The regular monthly meeting, Philadelphia section, Illuminating Engineering Society, was held at the Engineers' Club on Feb. 16. The speaker of the evening was L. C. Porter of Harrison, N. J., who presented a paper on the subject of "Flood-Lighting," amply illustrated by lantern slides. Preceding the reading of the paper, F. H. Gilpin combined the twenty-minute talk on the "Fundamentals of Illumination" with the discussion of "Illumination" and "Brightness." Botn parts of the meeting were fully discussed. Following the meeting, the members and their friends visited the City Hall to inspect the flood-lighting equipment of the tower.



E. G. ROBINSON

Men of the Industry

Changes in Personnel and Position— Biographical Notes

E. G. Robinson has resigned from the management of the Washington Coast Utilities Company, Arlington, Wash., successor to the Jim Creek Water, Light & Power Company, and has purchased the entire stock of the Molalla Electric Company at Canby, Ore., of which he becomes president and general manager. The Molalla Electric Company furnishes electric service to Canby, Barlow, Aurora, Hubbard, and Donald, and operates a water-power plant of 225 kw., located on the Molalla River. Mr. Robinson is a past-president of the Northwest Electric Light & Power Association, and has been very active in association work in the Pacific Northwest. He is a graduate of the electrical engineering course at Leland Stanford University, and after spending four years in electrical and steam engineering work in the Klondike, Yukon Territory, and at Dawson, he returned to Seattle, Wash., later becoming superintendent of the Ballard Electric Company, which had taken over a defunct municipal plant. This plant Mr. Robinson rebuilt and put on a sound financial footing, but resigned his position to become superintendent of the Skagit Improvement Company of Sedro-Woolley, Wash. Eighteen months later he went to Arlington, Wash., as manager and engineer of the Jim Creek Water, Light & Power Company.

L. H. Hartstock, manager of the Pacific Gas & Electric Company's system in Colusa, has resigned to assume the position of assistant manager of the Grass Valley and Nevada interests of the Pacific company.

H. L. Beach, for the past two years general manager of the Utah Light & Power Company, Salt Lake City, has resigned his position and will return to the East. His successor has not yet been named. Mr. Beach is to be associated with the same interests in the East.

A. L. Scott, who has been sales manager for the Edison Electric Illuminating Company at Lebanon, Pa., for several years, has been transferred by the Reading Transit & Light Company to undertake special work for President West. His duties will include those of general sales manager, also.

Charles O. Murphy has been appointed assistant general manager of the American Public Utilities Company, with office at Grand Rapids, Mich.

L. B. Andrus has been appointed chief engineer of the American Public Utilities Company, with headquarters at Grand Rapids, Mich, succeeding B. T. Gifford.

M. B. Wheeler will be appointed commercial agent of the American Public Utilities Company, effective March 1, 1917, with office at Grand Rapids, Mich.

Donald McDonald, manager of the Louisville (Ky.) Gas & Electric Company, was elected vice-president of the Louisville Industrial Foundation at the last annual meeting of the stockholders.

Eben F. Putnam has been appointed superintendent of the Greenwich, Conn., district of the United Electric Light & Water Company. Mr. Putnam was formerly commercial agent for the same company at Waterbury.

W. R. Waggoner, superintendent for the Salina (Kan.) Light, Power & Gas Company, operated by Henry L. Doherty & Company, goes to the Montgomery (Ala.) Light & Water Power Company in a similar capacity.

J. W. Murdock, who has been manager of the Ithaca Gas & Electric Corporation, Ithaca, N. Y., has been appointed general superintendent of the Associated Gas & Electric Company's properties in New York State.

W. A. Schoel of Vancouver, Wash., has been appointed manager of the North Coast Power Company at Chehalis, Wash., to succeed Otto Frank, who resigned to accept a position with the Twin City Auto Company of Chehalis.

G. H. Losey, who was superintendent of maintenance of way of the railway electrical department of the Indiana Railways & Light Company, has been made electrical engineer in charge of the company's railway and lighting department.

W. E. O'Neil, who for the past ten years has been superintendent of the Norwich (N. Y.) Gas & Electric Company, has been appointed superintendent of the Ithaca (N. Y.) Gas & Electric Corporation, succeeding J. W. Murdock, who has been appointed general superintendent of the Associated Gas & Electric Company's properties in New York State. P. R. Chambers, formerly manager of the Manatee Electric Company of Bradentown, Fla., succeeds Mr. O'Neil as superintendent of the Norwich Gas & Electric Company.



C. F. HARDING

Charles Francis Harding, the president-elect of the Indiana Engineering Society, is professor of electrical engineering and director of the engineering laboratory at Purdue University, LaFayette, Ind. Professor Harding is a graduate of Worcester Polytechnic Institute, and after testing work with the General Electric Company at Schenectady became electrical engineer for the Worcester-Southbridge Railway Company. In 1905 he was appointed engineer for the D. & W. Fuse Company at Providence, R. I., and in 1906 he served as assistant professor of electrical engineering at Cornell University. For two years thereafter he was a member of the Stone & Webster electrical engineering staff, responsible for planning and superintending the installation of electrical equipment for many of the electric light and railway companies operated by that corporation. Since coming to Purdue, in March, 1908, Professor Harding has continued in part his appraisal and consulting engineering work, having been called into consultation by various Indiana utility companies. Professor Harding is the author of the standard text-book, "Electric Railway Engineering." He is a Fellow of the A. I. E. E.

H. N. Eastman, of Portsmouth, N. H., has been appointed manager of the commercial department of the Rutland Railway, Light & Power Company.

Obituary

John J. Burleigh, vice-president of the Public Service Corporation of New Jersey, died on Feb. 18, at his home at Merchantville, N. J., a suburb of Camden. He was born in 1855 and was a telegraph operator when fourteen years old. Four years later he was made chief operator of the Pennsylvania Railroad between New York and Philadelphia. Mr. Burleigh built the first telephone system of South Jersey, which in 1880 was sold to the Bell system. He built the first electric street railway in the State at Camden in 1890, and organized the Camden Light & Heating Company, which was taken over by the Public Service Corporation.

REVIEW OF TRADE AND MARKET CONDITIONS

Notes of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

LICENSEES UNDER TUNGSTEN INCANDESCENT LAMP PATENT

Fifteen Domestic Manufacturers and Four Importers Have Now Signed Agreements and Paid Back Damages

In accordance with the plan announced late last fall and reported in the Oct. 28 issue of the ELECTRICAL WORLD, a number of independent lamp manufacturers have been licensed under the Just & Hanaman patent, owned by the General Electric Company, to manufacture tungsten incandescent lamps. To date the number of domestic manufacturers that have signed license agreements is fifteen. Four importers of tungsten lamps have also signed licenses. In all cases the licensees have paid back damages for infringement of the patent for all tungsten lamps sold from date of issuance of patent, Feb. 27, 1912. Domestic manufacturers are licensed to continue the manufacture of tungsten incandescent lamps. The importers are licensed to sell only such lamps of foreign manufacture as they now have in stock. This action automatically prevents the further importation of tungsten incandescent lamps.

A number of other manufacturers are seeking licenses, which it is expected will be issued as soon as the necessary details have been satisfactorily arranged. Manufacturers that have signed the tungsten lamp license agreement to date:

Acton Lamp Company, New York, N. Y.
Davis Tungsten Lamp Company, Union Hill, N. J.
Domestic Tungsten Lamp Company, West New York, N. J.
Hygrade Lamp Company, Salem, Mass.
Kentucky Electric Company, Owensboro, Ky.
Lux Manufacturing Company, Hoboken, N. J.
M. & W. Company, Springfield, Mass.
Re-New Lamp Company, Boston, Mass.
Triumph Lamp Works, Union Hill, N. J.
U. S. Incandescent Lamp Company, St. Louis, Mo.
Vacuu-Rite Lamp Company, Chicago, Ill.
V. & D. Electric Company, Franklin, Ohio.
Vosburgh Miniature Lamp Company, West Orange, N. J.
Weehawken (N. J.) Tungsten Lamp Company.
Whitelite Electric Company, New York City.

Importers who have signed the tungsten lamp license agreement to date:

Laco-Philips Company, New York, N. Y.
Morimura Brothers, New York, N. Y.
C. D. Wood Electric Company, New York, N. Y.
Szel Import & Export Company, New York, N. Y.

FREIGHT CONGESTION NOT IMMEDIATELY HURT

Curtailment in Production of Raw Materials, However, Likely to Prove Future Handicap to Industry

Although the present freight congestion and consequent shortage of freight cars is the most acute ever experienced there is little evidence of any added hardships being felt so far by Eastern manufacturers. Freight deliveries are slow and rather uncertain, of course, but they have been in this condition now for the past year.

The real effect of the tie-up, however, will undoubtedly be felt by the electrical manufacturers some months from now. At present they are for the most part well supplied with raw materials, but this freight congestion has so handicapped raw material manufacturers that it is very evident that expected spring and early summer deliveries will be further delayed.

Iron and steel men have been particularly affected. Iron production is now less than capacity by a considerable amount, although there are sufficient orders on hand to run plants to the limit into 1918. Iron and steel plays such an important part in the manufacture of electrical products that it is apparent that the effects of the embargoes, while not now felt, will make a very real impression on the market later.

There are many reasons put forth why the situation has become so serious. One factor is the lack of sufficient bottoms to carry away the vast stores of material now awaiting export at Eastern ports. It is probable, however, that the fundamental cause for the tie-up lies with the manufacturers. Large production has become so necessary that space formerly provided for storage facilities has been cut down with the result that the freight cars in many instances became the only available storage space. This has held up many cars that otherwise would have been rolling.

IMPORTS OF ELECTRICAL MERCHANDISE INTO CUBA

Official Statistics Classified by Year and Products According to the Country in Which They Were Manufactured

Statistics follow showing the relative importance of American-made electrical goods in the Cuban market. During the two years prior to the war it will be noticed American goods led in machinery and wire imports, but were second to Germany in the imports of incandescent lamps. Since the war started, of course, the importation of German goods has fallen off to a large extent. In the other markets the demand for American goods lead other makes.

Articles and Countries Supplying Them	1912-13		1913-14		1914-15	
	Quantity	Value	Quantity	Value	Quantity	Value
	Number		*Number*		*Number*	
Electric lamps:						
Austria	6,915	$2,352	16	$6	14,658	$2,075
Belgium	9,111	2,640	9,350	1,852	.....	.....
France	4,653	615	6,175	715	571	127
Germany	354,720	70,278	513,487	83,527	120,505	29,202
Netherlands	71,729	10,567	28,585	5,492	71,802	14,002
Spain	11,532	2,392	9,255	1,400	4,860	789
United Kingdom	592	229	1,000	450	775	295
United States	255,996	50,937	126,467	25,547	397,665	67,750
Total	715,248	140,010	694,335	118,989	610,836	114,240
	Kilos		*Kilos*		*Kilos*	
Copperwire:						
Austria	277	102	2,365	1,344	2,547	943
Belgium	.....	.....	529	161	2,016	854
France	.....	.....	361	122	331	185
Germany	33,188	12,823	153,212	27,167	784	490
Spain	2,848	65	489	224	.....	.....
United Kingdom	9,087	4,706	20,648	9,057	6,803	3,772
United States	1,030,193	370,885	1,271,315	442,083	764,452	240,837
Total	1,075,593	388,581	1,448,919	480,158	776,933	247,081
Electrical machinery:						
Belgium	.....	.....	.....	.....	22,227	5,178
France	176	211	3,737	1,111	10	11
Germany	41,711	15,877	100,929	21,931	9,535	5,853
Spain	.....	.....	193	168	42	35
United Kingdom	3,177	2,041	14,890	6,277	18,057	6,919
United States	275,177	123,890	230,931	98,273	211,773	89,348
Total	320,241	142,019	350,680	127,760	261,644	107,344

EXPORTS OF COMMERCIAL ELECTRIC VEHICLES GROWING

High Price of Gasoline Abroad and Lack of Gasoline Cars, Owing to War Needs, Help Create Demand for Electrics

Conducted entirely by correspondence, the sale of American-made electric trucks abroad is increasing at a greater rate than domestic sales. From one factory alone, the domestic agency sales of which increased 50 per cent in 1916, as compared with 1915, the sales for export increased by 154 per cent. Although foreign sales are growing faster than domestic sales, there is less effort by far expended in this field than at home. There is no personal representation abroad, the business being conducted by local agents. These agents develop the business, bearing the entire expense of obtaining it, and when orders are received trucks are ordered from the manufacturer. The foreign agent pays on delivery at the dock in New York, the same price and with the same discount, it is understood, as the domestic agent.

It has been noticed that the foreign agent is more aggressive than the domestic agent in selling commercial electrics. To a certain extent, of course, the foreign field naturally lends itself to the sale of electrics. The governments at war have practically commandeered every gasoline car that would run, and have made untiring efforts to buy up all the cars they could in neutral countries. There is, therefore, not only a dearth of gasoline cars, but also what is practically a closed market for them. Also, gasoline abroad has advanced to a much higher price than is to be found in this country, while the vehicle-charging rate abroad is usually lower than that found in the United States. The foreign agent, therefore, can sell on the basis of operating cost.

With the exception of England, the bulk of the foreign sales have been for industrial service. In England, however, the municipalities have purchased a number of trucks. Furthermore, there seems to be a decided tendency in the foreign sales towards the large capacities.

Sales have been heavy in Australia and Africa, and especially so in India. Sales to Canada are light, it is understood, due to the very large duty.

PROPOSED STANDARDIZATION OF APPLIANCE PLUGS

Meeting of Manufacturers Called by Wiring Committee of N. E. L. A. to Discuss Situation Broadly

Standardization of electrical fittings, devices and attachments is in the air. Already considerable has been done on this account by the manufacturers on both their own initiative and that of the trade and central station industry.

One of the latest directions in which this force is working is that of appliance plugs. Appliance manufacturers have been invited by the wiring committee of the N. E. L. A., R. S. Hale, chairman, to attend a meeting at the Engineering Societies Building, New York City, to frankly discuss the matter of standardizing on attachment plugs. Neither prices nor license arrangements will be discussed and no definite action except perhaps to appoint subcommittees.

While the wiring committee understands that in the event of plug standardization many manufacturers will be put to great expense in changing their designs, tools, etc., that it may not be possible to decide at once on the best design, and that there may be or are patents claiming to cover some or all of the possible construction, it is firmly convinced that some time in the future there will be a standard form of connection so that a cord will fit the flat iron of different manufacturers, and also will fit percolators, toasters, etc., of different manufacturers. It believes this development is as sure for the future as the present standardization of the Edison screw base for lamps.

It is expected that as a result of the discussion and interchange of experience practically all of the manufacturers may agree on one or more designs which can be standardized.

CONDITIONS GOOD IN NEW ENGLAND SWITCH FACTORIES

No Appreciable Slackening in Demand for Electrical Products Anticipated Should United States Enter the War

Improvement in the labor situation and better deliveries are features of note in the switch manufacturing field of New England. The release of workers from some of the munition plants, following completion of orders, is benefiting the switch factories, some of which are now operating with nearly their full complement of more contented labor. Twenty per cent better deliveries than two months ago are being guaranteed by one large switch maker and yet few signs of a recession in orders appear among representative concerns. It is the opinion of competent executives that even if this country enters the war, there will be no slackening of the demand for electrical products in any way applicable to general power and lighting uses.

Raw materials are still difficult to obtain in part, notably brass, and some delays in freight service are encountered. Collections are on the whole good with respect to large jobbers, but some small jobbers overstocked their shelves in apprehension of further price increases in the fall and early winter, and consequently are somewhat pressed for ready money. No further increases in prices are in sight at this writing. In some cases the shortage in toolmakers has held back development work, and the scarcity of certain raw materials, notably sheet steel, has somewhat retarded advances in switch-box design, but new products are in sight which will add to the safety features of modern wiring installations as soon as raw materials sufficient for mass production can be procured. Relations with jobbers at this time appear excellent, and the outlook is attractive.

LARGE SALE OF COPPER AT TOP NOTCH PRICES

Trade Surprised That So Much of the Red Metal Was Available for First Half Year Delivery

High prices of copper have brought to light supplies of the red metal that were not known to exist. It had been generally supposed that practically all of the first half copper had been contracted for by consumers. However, it is reliably reported that sales last week totaled between 25,000,000 and 30,000,000 lb., mostly in large lots. Several sales of small lots were reported at prices a cent or two above market quotations.

Buyers are still disinclined to anticipate their needs very far in advance. Most of the buying now is for early summer delivery.

Market quotations on Tuesday for electrolytic were as follows, showing a slight increase over last week: February, 36.25 cents; March, 36.25 cents; second quarter, 34.5 cents; third quarter, 31.5 cents; fourth quarter, 30.25 cents.

NEW YORK METAL MARKET PRICES

	Feb. 13 Selling Price Bid	Asked	Feb. 19 Selling Price Bid	Asked
Copper	£ s d		£ s d	
London standard spot	138 0 0		140 0 0	
Prime Lake	33.00	to 34.00†	35.00	to 35.50†
Electrolytic	34.00	to 35.00†	36.00	to 36.50†
Casting	30.50	to 31.50†	32.50	to 33.50†
Copper wire base	40.50	to 41.50†	41.50	to 42.50†
Lead	8.50		8.50	
Nickel	50.00		50.00	
Sheet zinc, f.o.b. smelter	21.00		21.00	
Spelter, spot	10.42½	to 10.67½†	10.55	to 10.67½†
Tin, straits	53.25†		49.00†	
Aluminum, 98 to 99 per cent.	51.00	to 53.00†	51.00	to 53.00†

OLD METALS

Heavy copper and wire	26.00	to 27.00†	26.00	to 27.50†
Brass, heavy	15.50	to 16.00†	16.00	to 17.00†
Brass, light	12.00	to 13.00†	13.00	to 13.50†
Lead, heavy	7.50	to 7.75†	7.50	to 7.75†
Zinc, scrap	7.50	to 7.75†	7.50	to 7.75†

COPPER EXPORTS

Total tons to Feb. 19 . . . . . 6,[illegible]

†Nominal

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Automatic Temperature Controllers

The Bristol Company, of Waterbury, Conn., has developed a line of automatic temperature controllers for gas and oil fired and electrically heated furnaces.

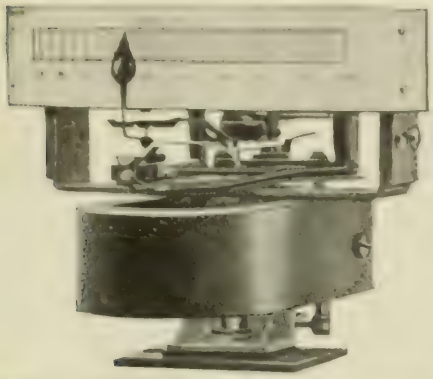


FIG. 1—INTERIOR VIEW OF CONTROLLING ELEMENT OF THERMO-ELECTRIC TYPE

The principle of operation of these temperature controllers is to use three elements: a measuring element, a contacting element and an operating element.

The measuring element consists of a number of different types of Bristol electric pyrometers and thermometers; notably the Bristol thermo-electric pyrometer with Weston millivoltmeter movement and patent Bristol separable couples, also the Bristol vapor-filled type of thermometer, which is very extensively used for recording temperatures. The controlling element is combined with the measuring element and consists primarily of a patented electrical contact closing device, which operates at predetermined high and low temperatures, and by means of this electrical circuits are closed or opened, thus energizing or disconnecting the operating element.

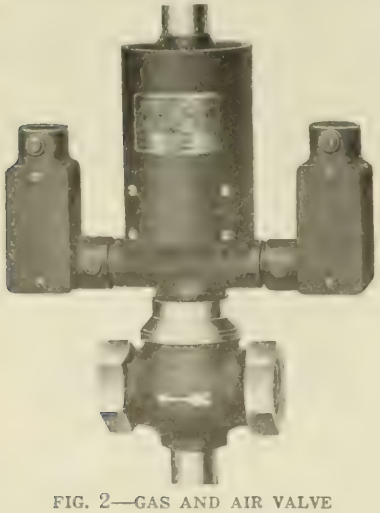


FIG. 2—GAS AND AIR VALVE

The operating element consists of the device which actually regulates the heat supply in the furnace; as for instance, in the case of a gas-fired furnace, a pair of electrically operated gas and air valves, and in the case of an electric furnace it consists of a special relay switch, opening and closing the circuits of the heating element of the furnace.

An interior view of the controlling element of the thermo-electric type is shown in Fig. 1, from which it may be seen that the indicating arm is completely insulated from the operating circuits. The contacting device is absolutely frictionless. These Bristol thermo-electric temperature controllers can be furnished for all temperatures up to 3000 deg. F., and with high-resistance movements for use either with base or precious metal couples.

In Fig. 2 is shown one of the special gas and air valves, two of which are used in connection with gas furnaces if air is supplied at a pressure, and both gas and air valves are operated simultaneously so as to insure having the proper mixture at all times. An interior view of a vapor type Bristol thermometer-thermostat is shown in Fig. 3. Both the high and low contacts are shown in this illustration, but with the Bristol automatic electrical controlling valves for both gas and air supply, only one contact is required.

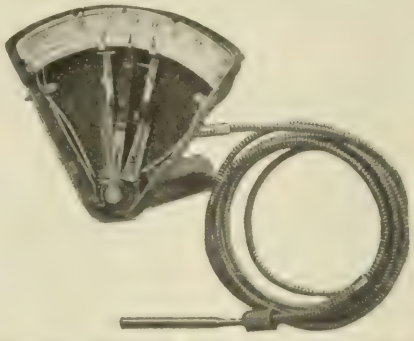


FIG. 3—INTERIOR VIEW OF VAPOR TYPE THERMOMETER-THERMOSTAT

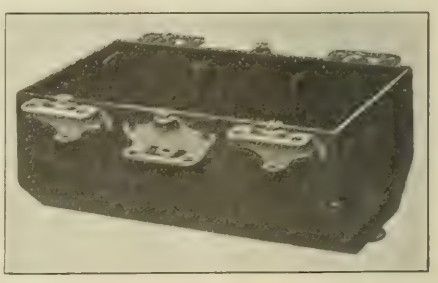
Commutator Cleaner

The Dyno Utilities Manufacturing Company, 608 South Dearborn Street, Chicago, is marketing a commutator cleaner in paste form. This cleaner is put up in tin boxes of 1-oz. size, which are packed in cartons containing six boxes. It is claimed that it will remove all the dirt, oil and grease from a commutator and clear itself from the surface at the same time, leaving nothing on the face of the commutator to increase the contact drop at the brushes. It is therefore offered as a substitute for sand paper as a commutator cleaner. The manufacturer makes the particular claim that this product is not a lubricant, and is not a commutator compound, and contends that modern machines with proper brushes do not require the use of lubricants if they are properly cleaned.

Screwless Switch Boxes

A screwless switch box which the manufacturer, the A. B. Wilson Company of Cleveland, Ohio, claims provides for all the requirements of the contractor's work, is shown in the accompanying illustration. This box can be used for old or new work by reversing the ear from the up to the down position, which provides a correct position of the box. When the ear is up so that the box can be used in old work the lug which holds the switch screw for the other position is bent back with a pair of pliers, thus eliminating the necessity for cutting away any of the fastening-screw space in the wall and leaving a perfect clearance for the box into the opening. The small rivet or burr which holds the ear in position is offset at the two ends so that only one wood screw in each end will lock the ear securely and hold the box rigid.

The boxes may be ganged up to any length with a perfect register of the switches on the plate. The boxes come together and lock securely and there is no wall between to interfere with the passage of the wires from one switch to the next. When the boxes are ganged and placed in position on the wall the holding screws, even if only used in the end boxes, provide against any box in the gang losing its position, but a further safeguard against this is provided in the manner in which the lug of one box passes through the opening in another and makes possible riveting the boxes together at this point by a few taps with a hammer.



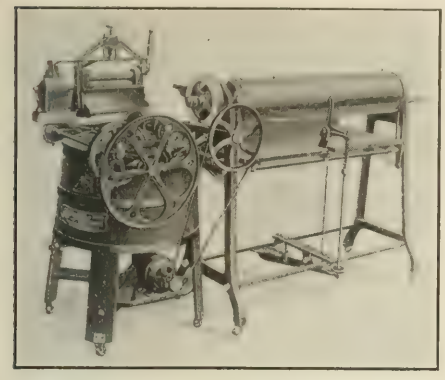
SWITCH BOXES FOR OLD OR NEW WORK

These boxes are sold two ways—

either complete with two side walls, or as spacers only without side walls, this effecting considerable saving when boxes are used in gangs. They are all furnished so that the knockouts are removed from the inside of the box.

Motor-Driven Ironing Machine

The Horton Manufacturing Company of Fort Wayne Ind., has placed on the market a motor-driven, gas-heated, household-type ironing machine, which



HOUSEHOLD TYPE OF IRONING MACHINE

provides an ironing surface 42 in. wide, making the machine capable of handling large pieces as well as small ones. The entire machine occupies a floor space about 5 ft. long by 2 ft. wide and stands about 4 ft. over all, above the floor. The chief features claimed for the machine are that it is noiseless; it is rapid in operation; its ironing surface retains heat; it has a wide space between the ironing shoe and the roll to prevent burning the goods; it is operated by a foot lever; and the tension regulator is conveniently located.

Electric Heating Pad

The pad shown in the accompanying illustration is composed of coils of asbestos-covered wire and equipped with two thermostats which control the heat and keep it at an even temperature. It is covered with eiderdown and is flex-



EIDERDOWN COVERED HEATING PAD

ible, enabling it to be applied to any part of the body. The pad is 9 in. by 12 in., equipped with 10 ft. of cord and a Hubbell attachment plug. The Standard Electrical Appliance Company of Beverly, N. J., is the maker of this appliance.

Oil Drying and Purifying Outfit

Both moisture and impurities, it is claimed, may be effectively and economically removed by passing transformer oil through the oil-drying and purifying outfit shown in the accompanying illustration. In this outfit, the oil to be purified is forced through several layers of specially prepared filter paper. The sediment is strained out by the first layer of paper and moisture is taken up by the capillary action of the paper.

The complete outfit consists of filter press, motor, pump, oil strainer, pressure gage, and piping. The filter press proper is made up of a series of flat cast-iron plates and frames assembled alternately, with the filter papers between them, as shown in Fig. 2. By means of a screw and lever and a movable cast-iron end block, the plates, frames and papers are forced tightly together. Except for a carefully machined rim around the edge, which serves to form a joint to prevent the



FIG. 2—ASSEMBLY OF ONE FILTER-PRESS PLATE AND ONE FILTER-PRESS FRAME

escape of the oil, the plates are cast with small pyramids on both surfaces.

The plates and frames are cast with holes *A* and *B* in two of the corners. When the plates and frames, with the filter papers between them, are assembled, the holes *A* and *B* form respectively the inlet and outlet for the oil. Cored openings *a* and *b* connect respectively with the holes *A* in the frames and the holes *B* in the plates.

The oil entering under pressure at the top corner through the inlet formed by holes *A* in the frames, plates and filter papers enters by means of the opening a in the frames and fills each of the chambers formed between each set of two filter packs. From these chambers there is no outlet opening and the oil is consequently forced through the filter papers that form the sides of the chambers. The filter paper thus takes up all the moisture and screens out all sediment from the oil. After passing through the filter paper, the oil flows along the grooves formed



FIG. 3—ELECTRIC DRYING OVEN, OPEN

by the pyramid surface to the opening *b* in the corner of the plates and thence out through the outlet *B*. The pyramid surface is well adapted for its purpose, it is said, as the tops of the pyramids, being flush with the rim of the plates and spaced close together, support the filter paper against the working pressure, and the grooves readily permit the oil to pass through. This outfit is made by the Westinghouse Electric and Manufacturing Company.

A Westinghouse electric oven for drying the filter paper before use in the filter press is shown in Fig. 3. The oven is substantially built of sheet-iron with double walls. Adjustable slides are provided in the top of the oven for regulating the temperature and the circulation of air through the oven. The filter papers are held in a vertical position in a rack and supported by rods through the holes in the corners of the papers. When the door in the front of the oven is opened, the rack may be withdrawn and the filter paper conveniently inserted or withdrawn. The paper should be dried for about twenty-four hours before being used, but this time can be decreased, depending upon the condition of the paper and degree of heat.

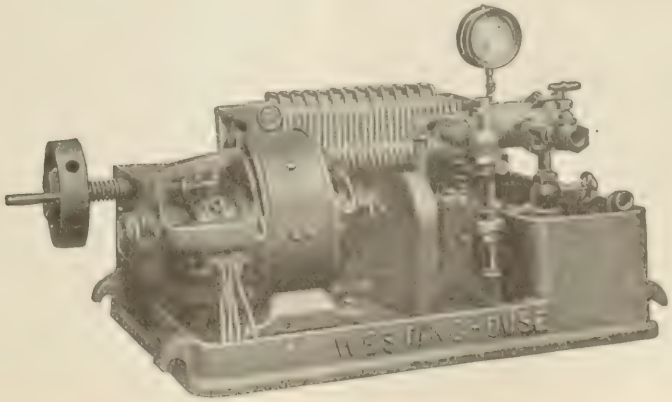


FIG. 1—OIL DRYING AND PURIFYING OUTFIT

Trade Notes

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has put an end to the removal of the San Francisco office into a suite of offices in the First National Bank Building of that city. C. E. Heise is district manager. The offices of the Westinghouse Lamp Company are also located.

E. H. BARKER has resigned as general sales manager of the B & K Manufacturing Company and has joined the sales organization of the Western Electric Company at the Philadelphia office.

THE HENRICH REFLECTOR COMPANY, INC., has just moved into new quarters at 147 West Thirty-first Street, New York. This company makes a specialty of corrugated mirror glass reflectors for cove lighting, bank screen lighting, and window and show case lighting.

E. A. GARRETT, who for the past four years has been publicity manager for the Busch Sulzer Brothers Diesel Engine Company of St. Louis, has resigned to accept a position with the Boston (Mass.) Belting Company. Prior to his connection with the Diesel Engine Company Mr. Garrett was manager of the Twinplex Sales Company.

PEABODY, RICE & WILSON, electrical engineers, Johannesburg, announce that Philip Herd of Johannesburg, having now entered into partnership with them, they shall henceforth cease to trade under the name of Peabody, Rice & Wilson. The title of the new firm will be: Rice, Wilson & Herd. Mr. Herd has been associated with the South African interests of the British Thomson-Houston Company, Ltd., of Rugby, and the General Electric Company of Schenectady, N. Y.

C. R. MESTON resigned as first vice-president of the Emerson Electric Company at a meeting of the directors held on Feb. 6. He resigned as an officer of the company because he intends to devote his entire time to other business interests. He will remain on the board of directors of the company. The directors re-elected H. L. Parker president. The following were elected vice-presidents: T. M. Meston, L. L. Whittemore, H. I. Finch and E. L. Barkhouse.

WILLIAM J. HAMMER, consulting electrical engineer, announces the removal of his office to 55 Liberty Street, New York City—suite 2510, Liberty Tower Building.

THE HESS-BRIGHT MANUFACTURING COMPANY announces the opening of two branch sales offices—one for the eastern portion of the country at 1974 Broadway, New York, and one for the central section at 1036 Guardian Building, Cleveland, Ohio. H. E. Brunner is in charge of the New York office. The Cleveland office is under the direction of R. E. Clingan.

FARNHAM YARDLEY, son-in-law of the late Alfred B. Jenkins, and formerly vice-president of Jenkins Bros., has been elected president of the company to fill the vacancy caused by the death of Mr. Jenkins. Frank T. Swain, general manager of the company, was elected vice-president. Samuel Laird, manager of the Philadelphia business, has been elected a director to fill the vacancy in the board.

P. & B. MANUFACTURING COMPANY, Milwaukee, Wis., had its main plant destroyed by fire on Feb. 5 with a loss of about $35,000. Arrangements are being made, the company announces, to build a new plant, 80 ft. by 300 ft. The company expects to have the new plant in operation within sixty days.

VAN DORN & DUTTON COMPANY, Cleveland, Ohio, recently moved into its new factory. The main factory building is constructed of two sections, the front section, 50 ft. by 250 ft. and two stories high, and the rear section 80 ft. by 250 ft., built on one floor. At the rear of this section is a large sub-story room which it is intended to incorporate in the next section of the factory to be built. It is the intention of the company to add sections in this manner until the extent of the building has been reached.

UNION METAL MANUFACTURING COMPANY, Canton, Ohio, at its recent annual meeting granted a bonus of approximately 6 per cent of their year's wages to the employees who have been in the service five years or more. In addition to the regular dividend, the company declared an extra cash dividend which represents the largest dividend ever made by the company. The annual report showed a greatly expanded business during 1916.

AMERICAN MANUFACTURERS AGENCY, INC., has taken the agency for soldering paste manufactured by the Seifert Electric Company, Evansville, Ind., and are introducing it to jobbers and dealers.

METAL STATISTICS for 1917, published by the *American Metal Market* and the *Daily Iron and Steel Report* is now ready for distribution. The volume shows output and prices for all the main industrial metals as far back as authentic records go.

DELCO PLANT SALES. At the annual meeting of the Domestic Engineering Company of Dayton, Ohio, manufacturing the "Delco" lighting system, it was reported that 10,000 "Delco" plants were sold during the year and that estimated sales for 1917 are 20,000.

WILFRED LUMLEY and HECKERT L. PARKER announce the organization of a new firm, the Conneaut (Ohio) Metal Works. Mr. Lumley leaves the position of general superintendent of the Ivanhoe Metal Works of the General Electric Company to manage the designing and production ends of the new firm. Mr. Parker, who is the business manager for the new firm, has been associated with the electrical industry for fifteen years.

Trade Publications

MOTORS.—"Manager Wise" is the title of a collection of advertisements and data on small motors and their uses recently issued by the Westinghouse Electric & Manufacturing Company as an edition of a publication issued by that company under the title "Small Motors." This pamphlet, which is profusely illustrated, brings out the advantages of small alternating-current and direct-current motors, describing the application and construction of each.

STARTERS.—Auto starters for induction motors embodying the latest developments are thoroughly explained and illustrated in leaflet 1610, just issued by the Westinghouse Electric & Manufacturing Company. The particular features of construction are brought out and illustrated, and a view of the auto starter installed is shown.

CONTROLLERS.—Leaflet 3956, issued by the Westinghouse Electric & Manufacturing Company, covers direct-current magnetic controllers for steel mill and crane service. Uses of this type of controller, together with diagrams of connections and illustrations of the controllers, are given.

RANGES.—The Westinghouse Electric & Manufacturing Company has just issued a number of leaflets, Nos. 3928, 3929, 3932, 3935 and 3942, covering the automatic and non-automatic electric ranges built by this company. The particular features of construction and operation are given, together with photographs showing the range in operation.

RAILWAY ACCESSORIES.—Accessories for use on railways, including circuit-breakers, fuse boxes, resistors, connectors, receptacles and plugs are described and illustrated in Catalog 5-B, just issued by the Westinghouse Electric & Manufacturing Company as a section of its General Supply Catalog. In addition to these accessories, illustrations are also given of the Rico Coasting Time Recorder, which records the actual number of minutes that an electric car or train is operated while coasting, without the use of power or brakes.

PIPE FITTINGS.—The Selah Manufacturing Company of Newark, N. J., is distributing additional leaves Nos. 6, 6A, 7, 10, 11, 11A and 12 and a new price list and discount sheet to supersede those now in the present catalog. These leaves are descriptive of this company's pipe fittings.

SWITCHBOARD.—The Stone Base & Panel Company, Columbus, Ohio, has prepared a leaflet descriptive of its "Stonol," which is a substitute for slate or marble.

MOTORS.—The Universal Motor Company of Oshkosh, Wis., has prepared an attractive calendar. This company makes marine motors and small lighting plants.

FANS.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is distributing catalog 8-A, descriptive of its fans for the season of 1917.

FANS.—The Crucet Manufacturing Company, 256 West Twenty-eighth street, New York City, is distributing an illustrated folder descriptive of the Crucet fan stands in period designs suitable for city or country homes.

SWITCHES.—Bulletin No. 45 has been issued by the Detroit (Mich.) Fuse & Manufacturing Company, describing its "Square D" steel inclosed motor starting switches.

New Incorporations

THE ATLANTA ELECTRICAL LEAGUE of Atlanta, Ga., has been incorporated with a capital stock of $5,000 (maximum) by L. L. Shivers, G. Russell and W. R. Collier. The company proposes to conduct electrical shows and exhibitions.

THE ALAMO LIGHT PLANT & BATTERY COMPANY of Bozeman, Mont., has been incorporated by F. G. Roedell of Billings, D. H. Budd of Bozeman and A. E. McCune of Bozeman. The company is capitalized at $25,000 and proposes to manufacture and restore illuminating plants and apparatus for various buildings and equipment, etc.

THE K & B ELECTRICAL EQUIPMENT COMPANY of New York, N. Y., has been incorporated with a capital stock of $25,000 to manufacture surgical apparatus, instruments, etc. The incorporators are: L. Kotraschek, W. W. Mowry of Corona, and H. Brodsky, 148 East Sixty-third Street, New York, N. Y.

THE HOLLAND MACHINE COMPANY has filed articles of incorporation under the laws of the State of Delaware for the purpose of manufacturing electric motors and electric machinery of all kinds. The incorporators are: Leonard L. Wetmore, Frank W. Walton and Alexander H. Jackson, all of New York, N. Y.

THE FRIENDSHIP (N. Y.) LIGHTING CORPORATION has been incorporated by M. A. White, J. P. Hopson and G. Wishart, 101 Park Avenue, New York, N. Y. The company is capitalized at $50,000 and proposes to supply electricity for lamps, heaters and motors.

THE BUFFALO ELECTRIC COMPANY of Bellefonte, Pa., has been incorporated with a capital stock of $5,000 to operate in Perry County. A. J. Musser of Clearfield, Pa., is treasurer.

THE LIVERPOOL ELECTRIC COMPANY of Bellefonte, Pa., has been incorporated with a capital stock of $5,000, to operate in Perry County. A. J. Musser of Clearfield is treasurer.

THE LIVERPOOL TOWNSHIP ELECTRIC COMPANY of Bellefonte, Pa., has been granted a charter with a capital stock of $5,000. A. J. Musser of Clearfield is treasurer.

THE SIXTH CITY LIGHT COMPANY of Loraine, Ohio, has been incorporated with a capital stock of $5,000 by Joseph Morgenstein, S. Salz, Aaron Hesnik, A. Lertzman and J. Spielman.

THE KOSSE (TEX.) LIGHT & POWER COMPANY has been incorporated by L. T. Gibbs, W. D. Allen and W. E. Allen, all of Kosse. The company is capitalized at $12,000.

THE LA CENTER (KY.) LIGHT & POWER COMPANY has been organized to operate an electric plant in La Center. S. T. Payne is president.

THE LA CROSSE (IND.) ELECTRIC COMPANY has been organized with a capital stock of $5,000 by Charles Kimble of La Crosse.

THE HEBRON (IND.) LIGHT & SERVICE COMPANY has been incorporated with a capital stock of $25,000 by George W. Giddley, J. F. Cole and George A. Harrop.

THE HARTSVILLE (TENN.) LIGHT & ICE COMPANY has been chartered with a capital stock of $10,000 by C. M. Gwinn, L. T. Littleton and others.

THE CAMBRIA (ILL.) LIGHT, HEAT & POWER COMPANY has been chartered with a capital stock of $2,500 to supply electrical service in Cambria. J. J. Thomas is manager of the company.

THE GEIER MANUFACTURING COMPANY of Cleveland, Ohio, has been incorporated by Ralph W. Edwards, Corinne Altshouse, William J. Coughlin and others. The company is capitalized at $25,000 and proposed to manufacture and deal in electrical appliances.

THE FAIRBANKS STORAGE BATTERY COMPANY of Bridgeport, Conn., has been incorporated with a capital stock of $25,000 to do a general electrical business. The incorporators are: Joseph S. Fairbanks, E. F. Meyer and Thomas P. Thompson, all of Stamford, Conn.

THE ECONOMY APPLIANCE COMPANY of Marlboro, Mass., has been incorporated with a capital stock of $50,000 to manufacture and deal in gas and electrical appliances. The officers are: Benjamin E. Larned, president; Joseph W. Matthews, treasurer, and Thomas A. McAvoy, clerk, all of Worcester, Mass.

New England

CHICOPEE, MASS.—Bids will be received by John C. Gray, superintendent of schools, Chicopee, Mass., until March 6 for erection of high school building, including plumbing, heating and electric work. A deposit of $50 will be required for general plans and $15 for plumbing, heating and electric plans, respectively, which may be obtained at the office of the superintendent of schools.

WHITINSVILLE, MASS. — The Paul Whitin Manufacturing Company has awarded a contract to the Worcester Suburban Electric Company of Uxbridge to install electric lamps in 160 of its tenements.

MIDDLETOWN, CONN.—The Franklin Electric Company has recently purchased property adjoining its plant on Hamlin Street and contemplates extensions which will double the output of the plant.

Middle Atlantic

BINGHAMTON, N. Y.—Plans are being revived for the construction of an electric railway from Binghamton to Utica. Franchises granted in 1907 have been renewed. The plans provide for the construction of a large power plant at Whitney's Point. Thomas McBride of Clinton is interested.

BROOKLYN, N. Y.—Bids will be receied at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Feb. 27 for furnishing at the navy yard, Brooklyn, N. Y., telephone switchboards, mechanical telegraphs and telephones. Blank proposals may be obtained upon application to the navy pay office or the above bureau.

GENEVA, N. Y.—The City Council has appointed a committee to make investigations relative to the installation of a municipal electric-light plant in Geneva.

NEWBURGH, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until March 7 for plumbing repairs, conduit and wiring system, lighting fixtures, etc., for the United States Post Office at Newburgh, N. Y. For details see proposal columns.

NEWPORT, N. Y.—The Newport Electric Light & Power Company, it is reported, contemplates extensions to its transmission lines. George T. Woodin is treasurer.

NEW YORK, N. Y.—Bids will be received by Col. J. M. Carson, depot quartermaster, U. S. A., New York City, until Feb. 26 for cable, coils, conduit, electric switches, etc. For further information apply to the above office.

NEW YORK, N. Y.—The property at 77 and 79 Murray Street has recently been purchased by the Interborough Rapid Transit Company, on which will be erected a substation, to be used jointly by the Interborough company and the Brooklyn Rapid Transit Company to supply energy to operate the new subway lines and the present elevated railway lines.

SARANAC LAKE, N. Y.—The Paul Smith Electric Light, Power & Railroad Company has petitioned the Public Service Commission for permission to exercise a franchise to erect and operate an electric distributing system in Jay.

WALDEN, N. Y.—The Wallkill Valley Electric Light & Power Company has petitioned the Public Service Commission for permission to erect electric transmission lines in the towns of Montgomery and Crawford and the exercise of rights and privileges under franchises granted by those towns.

AMBLER, PA.—The Borough Council is considering improvements to the street-lighting system. The present contract expires March 4.

BRADFORD, PA.—The Bradford Electric Light & Power Company has been awarded a contract to install a new lighting system in the business district. Nitrogen-filled lamps of 400 cp. will be used.

MARS, PA.—Bids will be received by the board of school directors, Mars, until March 1 for construction of high school building. Separate bids to be submitted for heating, plumbing and wiring. W. G. Eckles of New Castle is architect.

OSTERBURG, PA.—Notice has been given that application will be made for a charter for the Osterburg Light & Power Company, which proposes to construct a power plant to supply electricity in St. Clairsville, Osterburg, Imler, King, Claysburg, Sarah Furnace, Sprowl and surrounding territory in Bedford and Blair Counties. W. H. Rohm, John H. Zinn and others are interested.

PHILADELPHIA, PA.—The branch line of the Pennsylvania Railroad from Seward to Gallitzin, it is reported, will be equipped for electrical operation, the same system as on the Paoli line to be used.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

PHILADELPHIA, PA.—Charles Christos, 2821 Helen Street, is contemplating the construction of a power plant to operate his new textile mill, to be erected at Hunting Park Avenue and Stockley Street.

WAYNESBORO, PA.—Notice has been given that application will be made to the Public Service Commission soon by the Antrim Township Electric Company, the Guilford Township Electric Company, the Quincy Township Electric Company, the Washington Township Electric Company and the Waynesboro Electric Light & Power Company for a certificate of public convenience and for approval of the commission to merger and consolidate their properties, franchises, etc., into a corporation to be known as the Waynesboro Electric Company.

YORK HAVEN, PA.—The York Haven Water & Power Company is contemplating the construction of a dam across the eastern channel of the Susquehanna River near the present dam to increase the water power facilities.

ABSECON, N. J.—Steps have been taken by local business men to establish an electric-light plant in Absecon. If the contract for lighting the new Absecon-Atlantic City Boulevard can be obtained, it is said, the proposition is assured.

BAYONNE, N. J.—The Public Service Electric Company has acquired a site at Thirty-sixth Street and Broadway on which it will erect a new building, to cost about $75,000.

CLAYTON, N. J.—The local electric-light plant, we are informed, was not purchased by the South Jersey Gas Company, as stated in the issue of Feb. 10. The plant has been purchased by the Electric Company of New Jersey and has been made a part of its system. The general office of the Electric Company is at Pitman. The company is a subsidiary of the American Railways Company of Philadelphia, Pa.

JERSEY CITY, N. J.—Extensive additions will be made to the power plant of the Union Terminal Cold Storage Company on Twelfth Street, and also improvements to the present power station, in connection with the erection of a new eight-story (100 ft. by 100 ft.) cold storage plant. T. Adams is president.

NEWARK, N. J.—The alms committee of the City Council is planning to install new boilers at the power house of the Ivy Hill Alms Institution.

NEWARK, N. J.—The installation of electric-lighting fixtures in the new addition to the City Hospital at once has been recommended by Neil J. Convery, 665 Broad Street, architect. The Council, it is understood, will authorize the work.

NORTH BERGEN, N. J.—Bids will be received by the township committee of North Bergen, Township Hall, Boulevard and Main Street, North Bergen, until March 1 for lighting the streets, fire houses, township hall and public places in the township. Patrick A. Brady is township clerk.

MILFORD, DEL.—Extensions and improvements to the municipal electric-light plant, water-works and sewer system are under consideration by the Board of Light and Water Commissioners.

NEWARK, DEL.—The City Council contemplates extensions and improvements to the municipal electric-lighting plant and water-works system, to cost about $15,000.

OCEAN CITY, MD.—The construction of an electric railway, 10 miles long, is under consideration by the Isle of Wight Land Company. C. Edward is secretary.

RONCEVERTE, W. VA.—The contract for the engineering and construction work in connection of the new steam power plant for the Virginia-Western Power Company of Clifton Forge, Va., has been awarded to the J. G. White Engineering Company of New York, N. Y. Plans for the initial installation provide for 5000 kw. with provision for an ultimate capacity of approximately 30,000 kw. The erection of a short transmission line will connect this new station with the existing transmission lines of the Virginia-Western Power Company, which now operates 114 miles of transmission lines in the territory between Lexington, Va., and Hinton, W. Va.

WASHINGTON, D. C.—Bids will be received at the office of the superintendent, United States Coast and Geodetic Survey, 26 New Jersey Avenue, southeast, Washington, D. C., until March 3 for two electric deck winches for the U. S. Coast and Geodetic Survey steamer Surveyor. For details see proposal columns.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: F.o.b. works, Schedule 731—7500 or 33,000 lb. rotating copper bands, Brooklyn, N. Y., Schedule 742—40,000 ft. interior communication cable, 4300 ft. galvanized steel conduit, 140 telephone jacks, 21,000 single conductor wire, 20,000 ft. twin conductor wire; Schedule 741—5000 admiralty metal condenser tubes, Philadelphia, Pa., Schedule 742—3000 ft. galvanized steel conduit; Schedule 741—miscellaneous chronium nickel resistance wire; Schedule 729—miscellaneous seamless steel tubing, Boston, Mass., Schedule 742—120,000 ft. insulated antennae wire, Charleston, S. C., Schedule 733—two centrifugal flushing pumps, Mare Island, Cal., Schedule 747—miscellaneous seamless steel tubing. Applications for proposal blanks should designate the schedule desired by number.

North Central

ANN ARBOR, MICH.—Bids will be received at the office of the county clerk of Washtenaw County, addressed to John Lawson, chairman of the building committee, Ann Arbor, until March 8, for construction of a county infirmary, including mechanical equipment, for Washtenaw County. Bids will be taken for the entire work and also on separate contracts. Further information may be obtained upon application to Rupert W. Koch, architect, Ann Arbor.

LOWELL, MICH.—The contract for the engineering work for the new municipal power plant, to replace the one which fell into the river, has been awarded to Gardner S. Williams of Ann Arbor, consulting engineer. The new plant will have an output of 600 kw. and will operate on a 15-ft. head. The contract also includes the rehabilitation of the waterworks system.

MASON, MICH.—The City Council is considering a proposal submitted by the Commonwealth Power, Railway & Light Company of Jackson offering to take over the municipal distribution system and lighting business for $15,000. An election will soon be called to submit to the voters the proposal as to whether the proposition of the Commonwealth company shall be accepted or a new plant installed.

NILES, MICH.—The City Council has authorized the Board of Public Works to purchase an oil engine for the municipal electric-light plant.

PONTIAC, MICH.—Bids will be received by the Board of Education, City Hall, Pontiac, until March 8 for construction of the proposed additions to the High School, the Central School and the Wilson School Buildings. Separate proposal to be submitted for heating and ventilating apparatus and plumbing. Separate bids will be received for electric wiring on additions to the Wilson and Central Schools only. Plans and specifications may be obtained upon application to Perkins, Fellows & Hamilton, architects, 6 North Clark Street, Chicago, Ill., or to Fisher Brothers, architects, Pontiac, upon receipt of $5 for each set of plans for the High School addition and $3 for each set of plans for the Wilson or Central School—$11 for three sets complete, which will be retained by the architects to cover costs.

ALLIANCE, OHIO.—The capital stock of the Alliance Gas & Power Company has been increased from $550,000 to $1,550,000, the proceeds to be used for extensions and improvements to the generating plants and distribution systems.

CLEVELAND, OHIO.—The City Council has adopted a resolution authorizing the Cleveland Railway Company to expend $300,000 for a new substation.

CLEVELAND, OHIO.—The Cleveland Railway Company has awarded contract for construction of a substation at 2162 Ashland Road to the W. I. Thompson & Son Company, 6110 Euclid Avenue, to cost about $60,000.

CLEVELAND OHIO.—Bids will be received at the office of commissioner of purchases and supplies, City Hall, Cleveland, Ohio, until March 6 for cedar poles for the division of light and heat. Specifications may be obtained at the office of the division of light and heat, room 204, new City Hall.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleve-

coal, etc. March 8 for steam heaters and appurtenances for the division of light and heat. Specifications may be obtained at the office of the division of light and heat, room 700 City Hall.

CLEVELAND, OHIO. The Cleveland Electric Light & Power Company is contemplating enlarging its distribution lines and soon the erection of about 12 miles of transmission lines to supply the and other villages in this vicinity with electric service. Electricity will also be supplied to residences along the transmission line. W. S. Arter & Company, First National Bank Building, Milwaukee, are owners of the property.

COLUMBUS, OHIO. Plans for extensive improvements have been prepared by the Columbus Railway, Power & Light Company which include the construction of a large central station on the Hocking Valley Railroad, a mile south of the city, to cost about $1,000,000. The proposed work depends upon the consent of the Public Service Commission to the issue of $1,610,319 of new securities. The erection of the proposed station will mean the abandonment of the Third and Spring Street stations. The company has secured 15 acres of land for the station, plans have been completed, and the right of way for the transmission lines has been secured.

LANCASTER, OHIO. The State Legislature has increased the appropriation proposed for the Boys' Industrial School at Lancaster from $53,500 to $100,000, to provide funds to build a new power house at the institution.

LEIPSIC, OHIO.—The Northwestern Ohio Light Company is planning to erect a new power plant in Leipsic, to cost about $30,000, on which work will begin soon. Electrical service will be supplied to Hamler and Oakwood from the local plant.

LORAIN, OHIO.—Preparations are being made by the Lorain County Electric Company for the construction of a large electric power plant on the former Baltimore & Ohio property in the rear of the Wickens Company's block. The Lorain company, it is reported, contemplates extending its service to various cities and towns in this section of the state.

MADISONVILLE, OHIO. — Plans are being considered by city officials to abandon the municipal electric-light plant, which is being operated at a loss.

PIQUA, OHIO.—The Bell Telephone Company is planning to remodel an old building for use as its Piqua headquarters, including offices and exchanges, at a cost of about $35,000. Plans are being prepared for placing all wires underground during the year, at a cost of about $135,000.

ST. BERNARD, OHIO.—Plans are being prepared for extensions to the municipal electric power plant, including the installation of new equipment and water softening plant, for which $90,000 in bonds were recently voted. Edgar P. Kay, P. O. Box 151, Cincinnati, Ohio, is engineer. Through error this appeared under St. Bernard, Ala., in the issue of Feb. 17.

TROY, OHIO.—The Dayton Power & Light Company has submitted a proposal to the City Council offering to supply electricity to operate the municipal waterworks system in Troy from its Piqua plant.

YOUNGSTOWN, OHIO.—The Youngstown & Sharon Street Railway Company is contemplating the construction of an electric plant in Youngstown.

MONTICELLO, KY. — The Monticello Electric Light & Power Company has purchased the old mill site and water rights, about 2 miles from Monticello, where it proposes to construct a hydroelectric power plant. Continuous service will be established and flat rates discontinued. Meters will be installed.

BLOOMFIELD, IND.—The Public Service Commission has granted the Indiana Power & Water Company of Bloomfield permission to issue and sell for not less than 80 per cent. par value, $119,000 in capital stock and $569,000 in bonds, for extensions and improvement to its properties.

COLUMBUS, IND.—The city of Columbus has recently purchased a 300-kva. Westinghouse, turbine-driven generator, to cost about $16,000. Not yet installed. J. C. Rush is general manager.

FORT WAYNE, IND.—Improvements, involving an expenditure of about $100,000, are contemplated to the municipal electric-light plant during the coming year, which will include the installation of a 5000-kw. steam turbine, condenser and auxiliary equipment and also a 750-hp. boiler. Underground conduits for electric wires will also be installed in the fire limit district of the city, at a cost of about $15,000. Frank J. Dix is superintendent.

KOKOMO, IND.—The directors of the Indiana Railways & Light Company have approved of an appropriation of $300,000 to be used for extension to street railway system and enlarging power plant in Kokomo.

SOUTH BEND, IND.—The Public Service Company has granted the Farmers & Merchants Light & Power Company of South Bend, recently organized, authority to issue and sell $100,000 in capital stock the proceeds to be used to purchase two water power sites in northern Indiana and to construct and operate electric-light and power plants. The cost of the proposed plants is estimated at $410,139.

BLOOMINGTON, WIS.—The Bloomington Electric Light & Power Company, it is reported, contemplates the installation of a 10-kw. generator and a 60-hp. engine.

JANESVILLE, WIS.—Plans are being prepared by A. Arthur Guilbert, architect, Racine, Wis., for construction of a new factory and power plant for the George S. Parker Pen Company, to cost about $75,000. The main factory will be 75 ft. by 150 ft., two stories, with a separate engine and boiler house.

LANCASTER, WIS.—The Lancaster Light & Power Company has been awarded a contract for lighting the streets of the city for a period of five years. The new contract provides for the installation of new lamps.

MILWAUKEE, WIS.—The Electric Steel Casting Company has purchased a site at West Allis and is preparing plans for the first unit of its plant, which provide for the erection of a foundry, power house, pattern shop, laboratory and office building, at a cost of about $100,000. A three-ton electric furnace will be installed in the foundry. Chauncey Yockey of Milwaukee is secretary of the company.

OSCEOLA, WIS.—Plans have been completed for the construction of a hydroelectric power plant for the Osceola Mill & Elevator Company. The plans provide for power house, 2000 lin. ft. of wood stave pipe; also the installation of generator, water wheel to develop 200 hp. under 130-ft. head, switchboard, head works, etc. Bids, it is understood, will soon be asked for. The Power Engineering Company, Corn Exchange, Minneapolis, Minn., has charge of the engineering work.

WHITEWATER, WIS. — Improvements and extensions involving an expenditure of $25,000, it is reported, are contemplated by the Whitewater Electric Light Company during the coming year.

EMMONS, MINN.—Plans are being considered for the installation of a municipal electric-light plant in Emmons. Earl D. Jackson, Capitol Bank Building, St. Paul, Minn., is consulting engineer.

EVELETH, MINN.—The Minnesota Utilities Company, which owns and operates the electric light, power and central steam heating properties serving the communities of Chisholm, Eveleth, Coleraine, Bovey, Taconite, Marble, Calumet, Spina and Kinney, contemplates a water power development to generate electricity for transmission to towns and cities in the Mesaba Range country of Northern Minnesota. Neil Brown, Walter Alexander and others of Wausau, Wis., are interested in the company.

CUMBERLAND, IOWA.—At an election held recently the proposal to issue bonds for the installation of a municipal electric-light plant was carried.

FAIRFIELD, IOWA.—At an election held recently the proposal to grant the Iowa Railway & Light Company of Cedar Rapids a franchise to supply electricity in Fairfield was carried.

GRINNELL, IOWA.—Plans are being prepared by the Pillsbury Engineering Company, Metropolitan Building, Minneapolis, Minn., for an addition to the power plant at Grinnell College. H. W. Somers is secretary and business manager.

MOUNT VERNON, IOWA.—The Wapsie Power & Light Company of Mount Vernon has recently completed 22 miles of 6600-volt transmission lines and will serve the town of West Branch with energy in bulk, and also will furnish electricity to about 50 farmers along the line. The company also contemplates extending its transmission line to Downey, Centerdale and Springdale. Kenneth Lindsay is manager.

OSKALOOSA, IOWA.—Bids will be received at the office of L. T. Shangle, Secretary Board of Education, Oskaloosa, until March 16, for addition to and alterations in the present high school building. Separate bids to be submitted for heating and plumbing and electric wiring. Plans may be obtained at the office of Proudfoot, Bird & Rawson, architects, 810 Hubbell Building, Des Moines, Iowa.

OSKALOOSA, IOWA.—Bids will be received by the general building committee of the Penn College, Oskaloosa, until Feb. 28 for construction of the women's dormitory building, to be located on the new Penn College Campus. Separate bids will also be received at the same time for heating, ventilating and automatic control of the main group building now in course of erection also for automatic inter-communicating telephone system for the main group building, and clock system, bell and program system; also for vacuum sweeper system for main group building, electric conduit and electric wiring and accessory electrical work, and for plumbing. A deposit of $25 will be required for plans of women's dormitory, and $14 for each set of plans for heating, plumbing and electric wiring. In each case one half of the amount of the deposit will be returned. A. T. Simmons, First National Bank Building, Bloomington, Ill., is architect.

GRANDVIEW, MO.—The town has voted to grant L. K. Green & Sons of Pleasant Hill a franchise to supply electricity in Grandview for commercial purposes.

JOPLIN, MO.—At an election to be held March 1 the proposal to issue $135,000 in bonds for improvements and extensions to the municipal electric-light plant will be submitted to the voters.

KANSAS CITY, MO.—Plans are being prepared, it is reported, for a new electric generating plant for the Kansas City Light & Power Company. John H. Lucas is president.

MARSHALL, MO.—Plans are being considered for the installation of a municipal electric-light plant in Marshall, to cost about $75,000. Henrici, Kent & Lowry, 222 Commerce Building, Kansas City, Mo., are engineers.

MIDDLETOWN, MO. — The installation of an electric-light plant in Middletown is under consideration. Messrs. Roberts & Clarke of Mexico are reported interested in the project.

ST. LOUIS, MO.—The Public Service Commission has granted the Union Electric, Light & Power Company permission to absorb the Missouri Electric Light & Power Company, which has been operating in St. Louis County and other sections of the State.

CROSBY, N. D.—Bids will be received at the office of the county auditor of Divide County, Crosby, N. D., until March 14 for construction of a court house and jail and sheriff's residence, separate bids to be submitted on vault doors and shutters, cell and jail work, heating apparatus, plumbing and electrical work. Plans and specifications may be seen at the above office and at the office of Buechner & Orth, architects, 500 Shubert Building, St. Paul, Minn.

BRUCE, S. D.—The city of Bruce has recently sold a bond issue of $7,000, the proceeds to be used for the installation of an electric-lighting system.

BLUE RAPIDS, KAN.—The Marshall County Power & Light Company of Blue Rapids is negotiating with the town of Irving, 4½ miles distant, to extend its service there. Benjamin F. Eyer is general manager.

INDEPENDENCE, KAN.—Plans are being considered by the Kansas Gas & Electric Company for the erection of a 10,000-kw. electric plant, to cost about $1,000,000. W. F. Morrow is local manager.

OSAGE CITY, KAN.—The towns of Allen and Admira are contemplating the erection of an electric transmission line to connect with the local municipal electric-light plant for electrical service in those towns.

YATES CENTER, KAN.—The proposal to issue $30,000 in bonds for the installation of a municipal electric-light plant will soon be submitted to the voters.

Southern States

PILOT MOUNTAIN, N. C.—The installation of an electric-light plant and waterworks system in Pilot Mountain is under consideration. C. M. Bernard is interested.

WARSAW, N. C.—The City Council is considering the installation of an electric-light plant, water-works and sewer system, to cost about $30,000.

ATLANTA, GA.—Plans are being prepared by the Georgia Railway & Electric Company of Atlanta for the erection of four new substations, in order to carry more evenly the increased city arc-lamp lighting load. The changes will call for the revision of all of the 38 arc-lamp circuits, which will require new wires and poles, etc.

NORMAN PARK, GA.—The electric-light plant of the Norman Park Institute was recently destroyed by fire. Arrangements, it is reported, have been made for the installation of a new plant at once, to cost about $4,000.

CLARKSVILLE, TENN.—A resolution has been introduced in the City Council providing that application be made by the city

to the State Legislature asking for permission to issue bonds to establish a municipal electric plant in Clarksville. It is proposed to issue $100,000 in bonds. Electrical service is now supplied by the Clarksville Electric Company, which secures energy from the Hopkinsville plant of the Kentucky Public Service Company.

BIRMINGHAM, ALA.—The court has ruled that the city of Birmingham might issue $500,000 in bonds for extensions to the municipal electric-light plant, as authorized by the election last spring.

DUMAS, ARK.—The City Council has awarded the contract for the construction of an electric-light plant to the J. L. V. Grenier Company.

LECOMPTE, LA.—The town of Lecompte has recently appropriated funds for the erection of an electric-light and power plant in connection with the municipal waterworks system. It is proposed to install a 2300-volt 60-cycle, three-phase, alternating-current system with a low tension distribution of 115 volts; about 15 miles of net work will be erected. Bids for construction of plant will be received within the next 30 days. F. Pythais Joseph of Glenmora is consulting engineer.

ARDMORE, OKLA.—At an election held Jan. 30 the proposal to issue $40,000 in bonds for the installation of a new fire-alarm system was carried.

BARTLESVILLE, OKLA. — The Midco Gasoline Company is building a large electric plant to supply electricity for lamps and motors for the oil fields in this section. The cost of the plant and other improvements is estimated at about $2,000,000.

HASKELL, OKLA.—Preparations are being made for the installation of a municipal electric-light plant, for which $20,000 in bonds were recently voted. The equipment will include two 120-hp. engines, two 75-kw. generators, etc. A. H. Jones, Haskell, is engineer.

LAWTON, OKLA.—The Night & Day Oil Company, it is reported, will rebuild its power plant and pumping station, recently destroyed by fire.

LINDSAY, OKLA.—An ordinance has been adopted by the City Council authorizing an issue of $6,000 in bonds, for improvements to the municipal electric-light plant and water-works system.

NORMAN, OKLA.—The local electric-light plant and ice factory has been purchased by the Oklahoma (Okla.) Gas & Electric Company.

STRONG CITY, OKLA.—The contract for the installation of the municipal electric-light plant is reported to have been awarded to Francis Walker.

WAURIKA, OKLA.—The Council has granted M. Griffin O'Neal a franchise to furnish electricity in Waurika for commercial purposes.

ATLANTA, TEX.—The Gulf Public Service Company, recently organized with a capital stock of $125,000, is planning to construct an electric-light plant and waterworks system to supply electrical service and water in Atlanta, Bloomberg, Queen City and Orange. Edward S. Ellis of McAlester, Okla.; J. C. O'Connelly of Port Arthur, and O. C. Oden of Atlanta are interested in the company.

FORT WORTH, TEX.—The contract for the construction of the new county jail building has been awarded to the Taylor Building Company of Fort Worth, at $228,400. The company was also awarded the contract for plumbing, heating and electric wiring of the building, at a total cost of $56,514.

LUBBOCK, TEX.—Bids will be received by the board of directors of the Ponton Sanitarium at Lubbock until March 7, for construction of the Ponton Sanitaroum, to be erected in Lubbock. Separate bids to be submitted on heating apparatus, cooler, electric elevator, kitchen and laundry equipments. A deposit of $25 will be required for general plans and $10 for heating apparatus, electric elevator, etc. Plans and specifications may be obtained at the office of Dr. O. F. Peebler of Lubbock and at the office of Rose & Peterson, Kansas City, Kan.

Pacific States

PORT ORCHARD, WASH.—The Mason County Power Company has applied to the Board of County Commissioners for permission to erect and maintain electric transmission lines to supply electricity in various towns and villages in Kitsap County. The company has a power plant on the North Fork of the Snohomis River, near Hoodsport on Hoods Canal.

RITZVILLE, WASH.—The Pacific Power & Light Company of Portland, Ore., is negotiating with the Commissioners of Adams County for the right of way for electric transmission lines from the southern border of Adams County to Lind.

SEATTLE, WASH.—Bids will be received by the Board of Public Works, Seattle, until March 16 for auxiliary steam plant to be erected as an adjunct to the municipal electric plant at Lake Union. The equipment will cost $300,000 and will double the output of the plant. Bids will be received on the entire installation or on the following units: (1) boiler feed pump and service pumps; (2) steam turbo-generator, reactance coils, exciter, etc.; (3) high vacuum set condenser, air and water pumps, etc. J. D. Ross is superintendent of lighting.

SEATTLE, WASH.—Announcement has been made by the officials of the Great Northern Railway Company that work on the hydroelectric power project on the Chelan River would begin at once. The plans provide for the installation of a 150,000-hp. plant to operate the company's lines from Spokane to Seattle. It is also proposed to equip the coast lines of the Great Northern Railway between Vancouver, B. C., and Portland, Ore., covering more than 500 miles of railroad, much of it double-tracked. Work will begin this spring on the construction of the dam and power station, the former at the foot of Lake Chelan and the latter on the Chelan River. The power plant will be built in the basalt side hills in the canyon of the Columbia River. The cost of the work is estimated at about $20,000,000.

SEDRO WOOLLEY, WASH.—The City Council is negotiating with the Pacific Northwest Traction Company of Mount Vernon for a new street-lighting contract to cover a period of five years. Considerable changes will be made in the street-lighting system if the contract is made.

SPOKANE, WASH.—A bill has been passed by the State Legislature authorizing the raising of the water along the fort target range for the development of a large power project by the Spokane Valley Power Company.

TACOMA, WASH.—The City Council has authorized H. F. Gronen, city light commissioner, to employ a special engineer to investigate plans for increasing the output of the municipal electric-lighting plant, at a cost of $300,000; also to purchase at once two new lighting-feed panels and equipment for substation switchboards, to cost $17,000.

TACOMA, WASH.—The Washington Irrigation & Development Company, it is stated, will build a hydroelectric plant about 9 miles from Beverly. It is estimated that 500,000 hp. can be developed at a cost of from $25,000,000 to $30,000,000. The company, through its consulting engineer, M. O. Leighton, Washington, D. C., is co-operating with the state and federal government geological surveys in the matter. G. L. Parker is district engineer of the U. S. Geological Survey.

BEND, ORE.—The Bend Water, Light & Power Company contemplates the establishment of an auxiliary pumping station soon, to serve in emergencies, for fire protection, etc.

PORTLAND, ORE.—Bids will be received by the Columbia River Interstate Bridge Commission, Multnomah County Court House, Portland, Ore., until March 6 for furnishing material and installing the roadway lighting system for the Columbia River Interstate Bridge and approaches across the Columbia River, between Portland, Ore., and Vancouver, Wash. Plans and specifications may be obtained at the above office.

PORTLAND, ORE.—Preparations are being made by the Portland Railway, Light & Power Company to supply additional electrical energy to the Southern Pacific Company to operate its trains from Whiteson to Cornvallis. The erection of an electric transmission line from the power station on the Clackamus River to Salem is now under way from Mount Angel, so that it may carry higher voltage, and greater facilities for distribution of power from Salem are being provided. The cost of the work is estimated at between $50,000 and $60,000.

ALTURAS, CAL.—The State Railroad Commission has granted the Alturas Electric Light & Power Company permission to issue $100,000 in bonds.

CHICO, CAL.—Plans and specifications prepared by C. M. Burleson, consulting engineer, 785 Market Street, San Francisco, for a municipal electric-light and power plant will be submitted to the Board of City Trustees and to the Business Men's Association. The data prepared include estimates for a power site on Deer Creek, owned by Dennis Murphy. The cost is estimated at $577,536.

FONTANA, CAL.—The State Railroad Commission has approved an issue of $350,000 in bonds by the Fontana Power Company, recently organized, to develop a water power in the mountains to supply electricity in Fontana and vicinity.

SAN FRANCISCO, CAL.—The Sierra & San Francisco Power Company, 38 Sutter Street, is contemplating extending its transmission lines into Modesto. The cost is estimated at about $36,000.

STOCKTON, CAL.—The Railroad Commission has authorized the Western States Gas & Electric Company to extend its electric transmission and distribution lines in Trinity County to the lines of the Northern California Power Company, near Weaverville, to erect distribution lines in the neighborhood of Junction City, Douglas City, North Fork, Hayfork and territory adjacent thereto to furnish electrical service.

WEAVERVILLE, CAL.—The machine shop and electric plant of the Lagrange Mine, near Weaverville, were recently destroyed by fire, causing a loss of about $10,000.

ANACONDA, MONT.—The City Council has passed a resolution creating a special improvement district for the purpose of lighting the full length of Third Street, using 153 lamps of 80 cp. The cost is estimated at $19,000.

HELENA, MONT.—Extensive improvements are contemplated by the Helena Light & Railway Company this year, involving an expenditure of between $60,000 and $80,000. The work will include the erection of an electric transmission line to the Scratch Gravel district to supply electricity to the various mining companies operating in that section; also rebuilding the upper Broadwater railway and the installation of new ties and heavier rails on the East Helena line and the purchase of several new cars.

COLORADO SPRINGS, COL.—Plans are being prepared for the installation of ornamental lighting system on Pikes Peak Avenue, from Nevada Avenue to the Santa Fé station.

STEAMBOAT SPRINGS, COL.—The Steamboat Service Company is contemplating the erection of a five or ten-ton ice plant to be operated in conjunction with the power plant, work on which will begin about May 1. The company also makes a specialty of storage battery repair work and also of charging batteries. W. L. Carver is manager.

Canada

EDMONTON, ALTA.—The Delta Copper Company, 703 Tegler Block, Edmonton, it is reported, contemplates the construction of an aerial railway, 3½ miles long, and also a power plant at Skeena Crossing, B. C.

DELAWARE, ONT.—The ratepayers have approved a by-law authorizing the installation of a hydroelectric system, to cost about $5,000.

PORT ARTHUR, ONT.—The by-law authorizing an expenditure of $2,500,000 for power development by the Ontario Hydro-Electric Power Commission of Toronto, has been passed by the ratepayers. F. A. Gaby is chief engineer.

WOLESLEY, SASK.—Improvements and extensions, involving an expenditure of $10,000, are contemplated to the municipal electric-light plant.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until March 3 for furnishing structural steel, boiler punches, watt-hour meters, rheostats, etc. Blanks and further information relating to this circular (No. 1125) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y., and 614 Whitney-Central Building, New Orleans, La.

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until March 10 for miscellaneous auxiliary equipment for extension to Gatun hydroelectric station and Gatun substation, including oil switches, cable, conduit fittings, copper lugs, copper bar and rod, current transformers, disconnecting switches, end bells, insulators, potential transformers, fuses and fuse supports, doors and miscellaneous material. Blanks and further information relating to this circular (No. 1124) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

1,214,432. Explosive Gas Protection; Charles H. Adams, Glendale, Cal. App. filed April 26, 1916. Unobjectionable.

1,214,444. Telephone Test System; Henry M. Dawson, Lambertville, N. J. App. filed Sept. 30, 1915. Controlling a signal by relays responsive to currents of different characteristics both of which relays will be energized to complete the normal signal circuit only when the subscriber line is terminated in the approved manner.

1,214,448. Telegraphy and Telegraph Relay, Joseph H. Curtis, Hoboken, N. J. App. filed Aug. 10, 1912. Uses third wire insulated from the two others and in circuit with an independent source of current.

1,215,174. Designing Printing-Plate and the Making of Master Same; William S. Lucas, Sag Harbor, N. Y. App. filed May 3, 1915. Process of intaglio printing plate or surface the ink composed of a solid homogeneous body of iron or other refractorious material having a smooth surface and having under surface printing lines therein, formed through electro-deposition.

1,215,356. Automatic Pressure-Regulator for Electric Machines; Max Fuss, Berlin, Germany. App. filed March 21, 1911. For separately excited electrical generators, the exciting dynamo being provided with a variable shunt resistance in its field.

1,215,361. Electrical Potential Regulator; Max Fuss, Berlin, Germany. App. filed Dec. 8, 1913. Maintain the constancy of the generator voltage under all loads and to generally improve the aforesaid structure.

1,215,365. Cable Armor; Henry R. Gilson, Baden, Pa. App. filed Oct. 2, 1914. Formed of two helically coiled superposed strips of metal arranged to interlock with each other.

1,215,366. Armored-Cable Connector; Henry R. Gilson, Baden, Pa. App. filed Jan. 28, 1916. Connector for attaching armored cables to electrical fixtures.

1,215,377. Sanitary Telephone Mouthpiece; Ed. M. Jenkins, Italy, Tex. App. filed Jan. 19, 1915. Improvements.

1,215,378. Telephone Exchange System; Lewis H. Johnson, Bloomfield, N. J. App. filed July 29, 1916. System having link circuits which may be employed for indiscriminately interconnecting common battery and magneto or local battery telephone lines terminating at a central office.

1,215,389. Signal-Gauntlet; Francis E. Lauray, Detroit, Mich. App. filed Feb. 28, 1916. Provided with and bodily carries an electric cell, an electric bulb, and a finger controlled circuit.

1,215,393. Trolley-Controlled Apparatus; James F. McElroy, Albany, N. Y. App. filed June 1, 1912. Improvements.

1,215,401. Magnetic Reciprocator for Electric Generators; Elbert R. O'Keeffe, Omaha, Neb. App. filed Oct. 13, 1915. Providing means for longitudinal reciprocation of the commutator and its shaft, to permit uniformity in the wear of the surface of the commutator from the contacting brushes.

1,215,421. Block-Signal System; Robert H. Souder and Howell W. Souder, Tamaqua, Pa. App. filed Nov. 18, 1915. For use on electrically operated street railways or interurban roads, although its application is not limited to such use.

1,215,422. Current-Limiter; Charles H. Spangler, Reading, Pa. App. filed Feb. 4, 1915. Current is automatically interrupted when a determined maximum flow is exceeded.

1,215,423. Current-Limiter; Charles H. Spangler, Reading, Pa. App. filed Aug. 16, 1915. As in a residence where a certain number of lamps or other translating devices have been contracted for.

1,215,425. Plotting-Indicator; Elmer A. Sperry, Brooklyn, N. Y. App. filed Dec. 18, 1914. For use on war vessels to indicate to the plotting room the bearings of the target.

1,215,429. Coil Structure for Electromagnetic Devices; Chester H. Thordarson, Chicago, Ill. App. filed June 30, 1913. Improved means for insulating the several turns of the coil one from the other.

1,215,430. Insulated Terminal for Transformers and the Like; Chester H. Thordarson, Chicago, Ill. App. filed Feb. 10, 1915. Withstand heavy electrical stresses, and which is also so constructed as to withstand mechanical and thermal stresses without danger of breakage.

1,215,432. Process of Producing Articles of Quartz Glass; Otto C. Trautmann, New York, N. Y. App. filed Aug. 10, 1916. Quartz glass tubes.

Record of Electrical Patents

Notes on United States Patents issued on Feb. 13, 1917

1,215,443. Process of Producing Articles of Quartz Glass; Otto C. Trautmann, New York, N. Y. App. filed Aug. 10, 1916. Particularly quartz glass vessels.

1,215,447. Electric Circuit-Controller; Theodore Varney, Pittsburgh, Pa. App. filed May 27, 1912. Covers polyphase alternating current motors.

1,215,453. Starting Mechanism for Automobiles; Charles E. Wilson, Wilkinsburg, Pa. App. filed Jan. 3, 1913. Controlling the operative connection of starting motors to the shafts of internal-combustion engines.

1,215,485. Thermostatic Fire-Alarm; César Joseph Cld, Quebec, Quebec, Canada. App. filed Jan. 28, 1916. Sound a series of alarms for indicating a sudden or excessive rise in temperature.

1,215,487. Telephone System; Henry P. Clausen, Mount Vernon, N. Y. App. filed Sept. 2, 1916. Plurality of telephones are connected to a single subscriber's line circuit.

1,215,491. Fuse or Like Device; Nicholas J. Conrad, Chicago, Ill. App. filed April 19, 1913. Present no live parts which may be touched by an operator, and in which all the metallic parts are inclosed by insulating material.

1,215,492. Switch; Elmer E. Cook, Chicago, Ill. App. filed March 23, 1914. Controlled by a combination lock.

1,215,508. Electromagnetic Device; Charles W. Dunham, Swissvale, Pa. App. filed Sept. 12, 1914. Improvements.

1,215,515. Non-Interference Successive Signal Box; Robert J. Gaskill, Fort Wayne, Ind. App. filed July 3, 1916. Fire-alarm.

1,215,522. Railway Signaling; Henry W. Griffin, New York, N. Y. Opp. filed July 24, 1913. For stretches of single track over which traffic moves in both directions.

1,215,524. Safety Device for Elevators; Edward A. Hanff, Wilkinsburg, Pa. App. filed July 30, 1914. Improvement.

1,215,540. Lightning-Arrester; Ray P. Jackson, Edgewood Park, Pa. App. filed Sept. 6, 1910. Protection of very high-voltage electrical apparatus and circuits.

1,215,549. Electric-Conductor-Insulating Support; John A. Koontz, Jr., Palo Alto, Cal. App. filed July 26, 1916. Series of interconnected units.

1,215,566. Circuit-Controller; Ray H. Manson, Elyria, Ohio. App. filed July 13, 1914. Telephone switchboards.

1,215,590. Electric Switch; Harrison G. Thompson, Glen Ridge, N. J. App. filed Nov. 12, 1909. Automatically open and close an electric circuit under predetermined conditions.

1,215,595. Self-Locking Junction-Box Coupling; Alvin W. Weikert and James Pettibone, Washington, D. C. App. filed Aug. 13, 1915. Improvements.

1,215,604. Automatic Printer; George M. Yorke, New York, N. Y. App. filed April 26, 1915. Receiving apparatus of printing telegraph systems.

1,215,605. Means of Synchronizing Rotary Devices; George M. Yorke, New York, N. Y., and George B. Benjamin, Jersey City, N. J. App. filed Aug. 21, 1915. Synchronous telegraph or signaling systems.

1,215,610. Electric Heating-Pad; Harvey E. Bloomer, Milwaukee, Wis. App. filed Nov. 15, 1915. Thermostatic controller.

1,215,621. Pneumatic Governor; Herbert W. Cheney, Milwaukee, Wis. App. filed April 27, 1910. For fluid pressure systems.

1,215,635. Sintering and Smelting Ore; Arthur S. Dwight, New York, N. Y. App. filed June 15, 1916. Particularly those which are susceptible of a desulfurizing or kindred treatment and a sintering treatment, either simultaneously or successively, and of being subsequently reduced by smelting or a similar operation.

1,215,639. Starting and Stopping Mechanism for Engines; Austin D. Eberly, Spokane, Wash. App. filed March 4, 1916. Automatically start the motor at a predetermined temperature and also stop the same automatically at a predetermined increased temperature.

1,215,658. Signaling System; Richard M. Hopkins, New York, N. Y. App. filed June 28, 1916. Call box type.

1,215,665. Spring Arrangement Especially for Contact Devices; Heinrich Landis, Zug, Switzerland. App. filed April 5, 1915. Quick or jerky motion of an organ may be obtained by means of a slow moving driving organ.

1,215,670. Automatic Railway-Crossing Danger Signal; Jay H. Lanker, Charlotte, N. C. App. filed Feb. 28, 1914. Positively operate to signal persons at the crossing when a train is approaching.

1,215,693. Electric Soldering-Iron; Harry A. Orme, Washington, D. C. App. filed Nov. 20, 1916. Electrical self-feeding soldering iron.

1,215,700. Carbon Electrode and Method of Manufacturing Same; Robert D. Pike, San Francisco, Cal. App. filed March 13, 1916. Lamp black refuse derived from the manufacture of illuminating gas from petroleum.

1,215,701. Fuse-Plug; Clarence D. Platt, Bridgeport, Conn. App. filed July 14, 1914. Clearly indicate a "blown" or "dead" fuse.

1,215,702. Loading Duplex or Multiplex Telephone-Lines; Henning Bernhard, Mathias Pleijel and Axel Herman Olsson, Stockholm, Sweden. App. filed April 27, 1914. Improvements.

1,215,703. Liquid-Heater; Fred Poole, Jewell, Kan. App. filed Feb. 2, 1915. Instantaneous.

1,215,704. Automatic Electric Regulator with Stop-Charge Relay; Harry H. Powell, London, England. App. filed Oct. 9, 1912. For car lighting systems.

1,215,722. Circuit-Protecting Device; Edmund O. Schweitzer and Nicholas J. Conrad, Chicago, Ill. App. filed May 22, 1911. For use upon circuits having very high potential and coming from very high capacity generators.

1,215,734. Telegraph-Call; Charles Spiro, New York, N. Y. App. filed April 6, 1916. Call is automatically transmitted by mechanical means and may be repeated.

1,215,748. Electric Heater; Weeden B. Underwood, Rochester, N. Y. App. filed Dec. 14, 1915. For heating water or other fluids.

1,215,757. Flash-Light; William L. White, Birmingham, Ala. App. filed June 13, 1916. When not in use will automatically become extinguished.

1,215,772. Headlight; Frank Buchanan, Syracuse, N. Y. App. filed April 24, 1911. Efficient means for supporting the electrodes and lamp mechanism of the headlight.

1,215,774. Primary Battery; Edwin F. Callender, Galesburg, Ill. App. filed May 29, 1916. Improvements.

1,215,786. Means for Preventing Sparking in Direct-Current Machines; Alois Fahrmbacher, Charlottenburg, Germany. App. filed Oct. 22, 1912. Improvements.

1,215,787. Means for Preventing Sparking in Direct-Current Machines; Alois Fahrmbacher, Berlin-Charlottenburg, Germany. App. filed Jan. 21, 1915. Obtain a commutating field which is as favorable as possible with a wide range of speed.

1,215,795. Elevator-Signal; Robert H. Gaylord, Pasadena, Cal. App. filed Aug. 12, 1915. Single announcing telephone receiver.

1,215,800. Combination Electric Lock-Switch; Robert O. Hammond, Paterson, N. J. App. filed Jan. 28, 1916. Permit the prompt change in said combination any number of times, if so desired.

1,215,807. Electric-Switch; Edward S. Huff, Detroit, Mich. App. filed Nov. 14, 1914. Not liable to deteriorate.

1,215,813. Combination Piano and Organ-Player Mechanism; Richard S. Irvine, San Francisco, Cal. App. filed Sept. 14, 1915. Electrically controlled contact.

1,215,814. Switch for Automatic Telephone Systems; William Kaisling, Chicago, Ill. App. filed April 27, 1910. Selector or connector switches.

1,215,815. Electric Signaling System; Paul Kaminski, Spandau, and Otto Schneider, Schoneberg, near Berlin, Germany. App. filed June 24, 1913. For range finding.

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The United Engineering Societies Council

SPECIALISM has its advantages and its disadvantages. This is only another way of saying that no human institution can be perfect, or possess all the good things to the exclusion of the bad. An advantage of specialism is that by confining attention of each individual or group of individuals to a particular group of activities, greater effectiveness and greater efficiency can be secured in all directions. A disadvantage of specialism is that the associations, views and habits of the individual necessarily become relatively delimited and narrowed.

Engineering as a profession is, in a broad sense, a great field of endeavor in which the basic principles are everywhere the same. Mathematics, physics, chemistry and various other branches of science are applied to the business of the world through economics, direction and discipline, so as to secure the maximum of joint constructive production with the minimum of inconvenience, expense and delay. According to any such broad interpretation of the nature and purposes of engineering, one might suppose that all engineering was essentially the same, and called for the services of one and the same group of technically trained men. We all know, however, that the field of engineering is so large that no one man can possibly possess the knowledge and experience necessary for efficiently conducting work in all of its departments. In order to give good engineering service, specialism is necessary, and there are to-day half a dozen main branches of engineering, each branch having perhaps half a dozen distinct sub-branches.

This necessary specialism in engineering divides engineers as a body into a number of groups, so distinct one from another that the technical language of one may hardly be understood in another. It is like the case of the dog, which is generally admitted to be a quadruped of the genus *canis*, but as existing in nearly a hundred different species, some among which differ so profoundly in qualities and dimensions as to make it difficult to believe that the single term "dog" applies alike to all.

The subdivision of breeds among engineers makes it very difficult for them to make common cause in any joint effort for the benefit of the community. The totems they follow are so different as almost to amount to castes in exclusiveness. This is a real misfortune, both for the engineers and for the country they serve. They may be particularly well qualified to express opinions, or to suggest courses of action in grave emergencies, owing to their training and experience, and yet, owing to their multiple-cursedness, they are prevented from giving adequate expression either to opinions or to suggestions.

It is stated that a movement is on foot to co-ordinate the disjunctions among American engineers by forming a United Engineering Societies Council, for the purposes of collective utterance and action, when occasion may demand. If this movement is effected logically and automatically, it may be a great boon for the engineers and also for America. If the movement is made unfortunately, the last state of the engineers may be worse than the first. We wish the movement every success. There is need for it.

Recognition of Good Management

AS regulation by state public utility commissions in this country has progressed, it has become more and more evident that incentive for good service and economical management which would produce a rate of return on the investment in excess of that generally allowed by commissions thus far would soon be destroyed unless the regulatory bodies gave recognition to the better managed properties by allowing an increased rate of return. Indeed, some managements have begun to feel that efforts to reduce operating expenses so that the investment would show more than a certain rate of return are a waste of energy, and this also applies to the installation of more economical apparatus involving additional investment. The State Public Utilities Commission of Illinois has evidently felt this danger. In its decision in the Lincoln Water & Light Company case recently announced the commission states that once it has fixed a reasonable rate of return in a rate case it is agreeable, at any future date, to consider an increase in the rate of return, based on exceptional operating performances. In other words, the commission is willing "to reproportion savings made by the utility's management between increased profits to the stockholders and reduced rates to the consumers, rather than to declare that all such further savings should accrue solely to the public." While this expression from the commission is a promise for the future, it is nevertheless very encouraging as a pronunciamento from a regulatory body. It is, of course, not altogether easy to determine how much increased profits are due to conditions beyond the control of the management and how much of it is the result of skillful operation. However, this problem is no more difficult for a well-organized commission to solve than establishing the fair rate of return upon the investment or promulgating standards of good service. The mere fact that the question is being considered is satisfying.

Connecticut Transmission Systems

THE system of the Connecticut Power Company, described in this issue, is of more than usual interest to the engineer on account of the fact that it is thoroughly typical of conditions which exist in many parts of the country, where useful water powers of moderate size are linked up with steam stations, existing or new, to form an interconnected system capable of utilizing the full value of the hydraulic resources. The main plant of the company is at Falls Village on the Housatonic River, with a subsidiary plant higher up on this stream at Canaan. The installation at Falls Village consists of three 3000-kw. units, that at Canaan of two 300 kw., with a small steam auxiliary. The scheme of development has been to build the Falls Village plant for the production of an exceptionally large proportion of the available power, thereby utilizing the privilege as fully as feasible. The Canaan plant in itself is small and comparatively unimportant, but it bears a very significant relation to the main plant in that its storage area 6 miles above Falls Village is great, bringing the total for the system to 42,000,000 cu. ft. The acquisition of this smaller plant therefore enabled the larger one to be brought to a fuller development and defended it against being seriously incommoded by the storage of water at some of the mills on the stream. At times of high water the Canaan plant is almost out of business, but at low water it can operate at its full head, which is only 12 ft., and run its comparatively large flowage through to the higher head of the main plant below. Here again is an advantageous union of two hydraulic privileges, one of them so small as to be unpromising by itself, but working admirably in conjunction with the other.

To the engineer the chief interest of the Falls Village plant is the thorough investigation that was made of the hydraulic situation before the system was finally constructed. The head is at a maximum of 110 ft., but distributed over two natural falls, and five separate schemes for the combined utilization of the head were exhaustively studied before the final plan was completed. This involved a small sacrifice of head, but made it possible to use a considerable stretch of an old dry masonry canal built on this site more than sixty years ago. With its walls built up and the whole lined with reinforced concrete, it became possible to convey the water so as to dispense with the extremely long pipe lines, which would have been necessary to the other schemes. The final penstocks have been kept down to 400 ft. in length, thereby both lowering the cost and improving the regulation. Of the main hydraulic plant itself little need be said except to call attention to the fact that it is rather unusually simple in its switchboard design. The power is generated at 6600 volts and the main transmission is of the now usual type, with steel towers and suspension insulators, at 66,000 volts. This main line to Bristol is a double-circuit one, 40 miles long, fitted with a ground wire above the towers. From Bristol to Berlin, 13.5 miles, more similar towers are used but as yet carrying only a single circuit. This transmission is connected with both Hartford and New Britain. These secondary lines, however, are on wooden poles 40 to 45 ft. long, and spaced 180 ft. apart, showing thereby the modern tendency to departure from the old short spacings which are a hand-me-down from slender telegraph and telephone poles carrying a great mass of wires. These poles are equipped with suspension insulators, four disks in series, and at frequent intervals are guyed in two directions. The connected steam systems are provided by the stations of the Torrington Electric Company, the Bristol & Plainville Tramway Company, the United Electric & Water Company and the Hartford Electric Light Company, from any or all of which power can be drawn when necessary. A further extension is now under way which will unite this system with the Middletown steam station of the Connecticut Power Company.

The Importance of Lighting Load

AT every increase in the efficiency of electrical illuminants there have been dire predictions that the lighting end of the electricity supply business was going to the dogs, and the only hope of continued prosperity lay in a large increase of motor service. In point of solemn fact, every increase in the efficiency of illuminants has encouraged more and better lighting, and in the long run the lighting load has steadily risen through the entire period of improvement. The fundamental fact in the situation is that artificial lighting is, on the whole, still so far from natural lighting in measure of intensity that the inevitable tendency of the former must be upward. It is true that one can see to read or write with 2 or 3 foot-candles of illumination. It is equally true that one is used to working with five or ten times this amount through the hours of daylight, and consequently a certain wrench is felt in passing from natural to artificial light. Eventually the eyes accommodate themselves to the new conditions and, considering what they are, they perform remarkably well. Yet there is little doubt that the period of this passage is one of relative inefficiency, which would be obviated if the intensities before and after the change were more commensurate. It is in response to this mental, rather than physical, condition that there has been a steady rise in the illumination demanded by popular consent, so soon as increased efficiency of the illuminants themselves has made better lighting economical and feasible.

Mr. Durgin in his article last week called attention to the strenuous efforts which have been made to increase the motor and miscellaneous load, attractive to the central station by reason of the comparative simplicity of the service. To one attempting to analyze the real situation, however, it becomes apparent that full advantage has not yet been taken of the economic possibilities of the lighting load. The cost of service is undeniably greater in this class of work, but whether the increased profits do not more than justify the costs is quite another matter. There is little doubt that numerous central stations are supplying the preferred

class of motor customers at a price dangerously near to cost. The desire to obtain all the practicable load, thereby increasing station capacity and decreasing station costs, is a perfectly natural and proper one. It must not be forgotten, however, that the generating costs eventually tend to become asymptotic. In other words, there is a certain capacity beyond which costs diminish slowly if at all, and any increase of load above this point makes very little impression on the net profits obtained from any class of customers. It may therefore happen that a very large increase of railway or motor load, producing most impressive results on the total output, really implies a comparatively small net profit, much smaller than would be obtained, from that critical point on, by a similar access of lighting load. The obvious reason for extremely low power rates is to increase the load factor and thus diminish the cost of generation. The fact that this diminution is not continuous sets a limit to the profit-bearing qualities of such loads.

Another feature of the situation to which Mr. Durgin very properly called attention is the importance of increase of lighting service from the standpoint of public affairs. The humble householder using electric lighting in his flat has a vote which is just as valuable in determining public policies as that of the captain of industry who takes 10,000 hp. from the central station at a price barely yielding a living profit. In fact the former personage invariably exercises his right to vote, while the latter is more likely to do something else and usually takes no active interest in ordinary civic affairs at all. We are not disposed to echo the biblical advice to "Make to yourselves friends of the mammon of unrighteousness," but it is a fact that the company which looks carefully and sympathetically after the interests of its small consumers is likely to have a great many friends in time of need, while if it is solicitous about the interests of big business only it acquires a fund of somewhat justly imputed distrust and is looked upon by the general consumer as an advocate of the "public be damned" policy. It is for this very practical reason that many important lighting companies make so much of their illuminating engineering or lighting service work. This represents an endeavor, primarily to encourage the lighting consumer to a higher standard of illumination, and better results, and secondarily, a determination to make friends with every man who is a patron of the company whether his bill is $1 a month or $500. The wisdom of the policy ought to be sufficiently obvious.

Industrial Controllers

IN the early days of the direct-current shunt motor, of say 1-kw. size, the starting of the machine was an undertaking calling for fitting ceremonies and auspicious convocation. The chief starter called his assistants to attention, refreshed his memory by inspecting anew the printed list of directions, and, having ascertained that the armature circuit was safely open, he uttered an incantation and closed the shunt-field switch on the mains. An assistant then took a bunch of keys, or a handy wrench, and proceeded to demontrate by optical and muscular observation that the field poles were duly and truly magnetized. A sigh of relief having been given, minute care was then devoted to the rocker arm and brushes on the commutator, to make sure that the brushes themselves rested firmly on the neutral point.

The assistant having this delicate matter in charge reported all correct to the assistant having charge of the rheostat in the armature circuit, who, having satisfied himself that the resistance was all in, reported to the chief starter, who after shouting "look out," closed the armature switch on the mains. With fireworks at the brushes, the armature would begin to rotate, and the assistant at the brushes would manipulate the brush rocker arm with the gestures of a despairing man. The assistant at the rheostat proceeded to cut out resistance steps with bated breath. When the machine safely reached full speed, and all the rheostat was cut out, with the brushes in fairly good order, all hands would shout a *Te Deum;* while the starting staff mopped their foreheads.

As a contrast with the foregoing technique from ancient history, reference may be taken to the paper by H. D. James, read at the recent mid-winter New York convention of the American Institute of Electrical Engineers. An abstract of the paper appears elsewhere in this number. The paper shows that the regular process of starting and accelerating shunt motors of 10-kw. or 15-kw. capacity, with only one or two steps of starting resistance, is conducted automatically after the mere closing of a main switch. The process takes effect so smoothly that it takes an oscillograph to make the steps significant.

Nevertheless, in spite of the great strides that have been made in motors and motor starting during the last thirty years, the paper points out that there is still much room for investigation, improvement and design in the application of the motor controller to industrial practice.

The Coming Issues

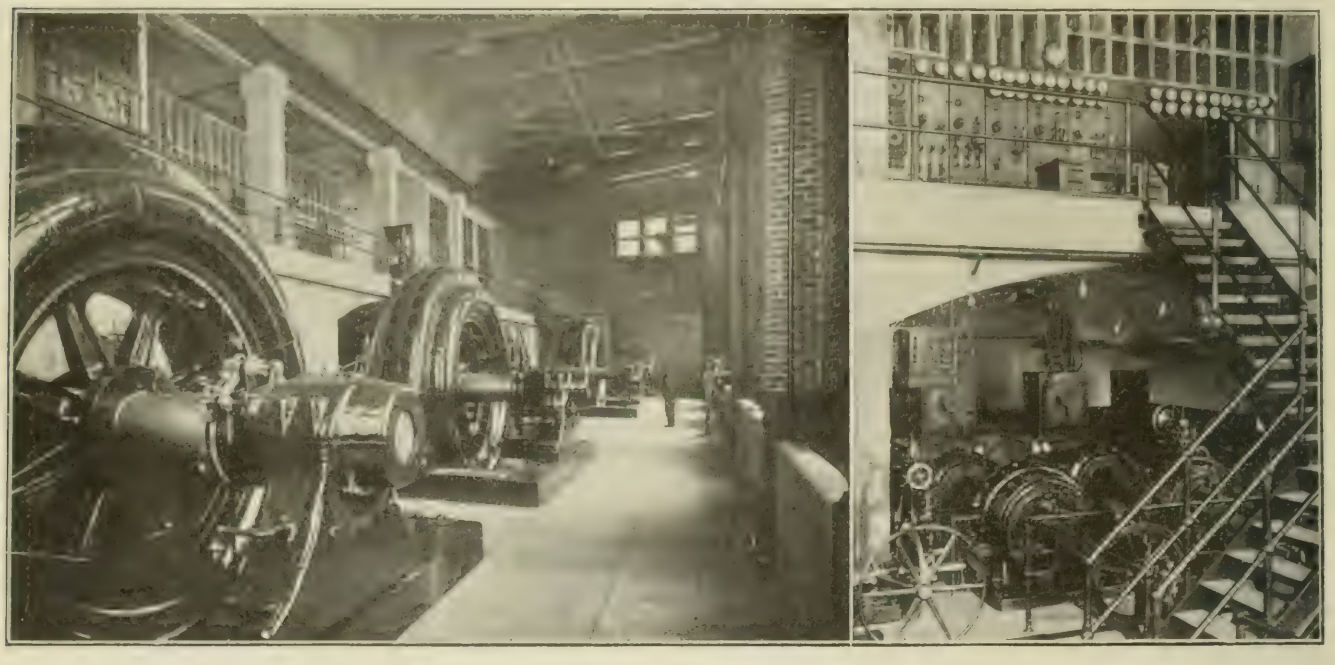
SLEET troubles on transmission lines and methods of preventing them on the Pennsylvania Water & Power Company's lines will be discussed in a leading article of the next issue, dated March 10. Other station and operating problems will also be taken up in that issue. In the third number of March will appear another section of Prof. Alfred Still's article on "The Design of High-Voltage Transformer Insulation," the first part of which was published in the Feb. 17 issue. Articles discussing commercial problems of special interest to central-station managers will be published in the March 24 issue. The fifth issue of March will contain a description of the electrical layout and operating features of a large New England cotton mill. Engineering features of other industrial installations and their operating problems will be discussed in the same issue. ELECTRICAL MERCHANDISING, which will be issued the fifteenth of March, will feature selling plans and methods of timely interest.

Construction and Operation of a Connecticut Hydroelectric System

Features of a 20,000-Hp. Station of the Connecticut Power Company at Falls Village Having Transmission Facilities for Supplying Energy to Connecticut Utilities and Exchanging Energy with Hartford Electric Company

THE Falls Village hydroelectric plant of The Connecticut Power Company, which is located in northwestern Connecticut on the Housatonic River, furnishes an interesting example of how irregular stream flow can be utilized economically by operating in conjunction with steam plants. In this case, however, the hydroelectric plant was developed as an entirely independent source of energy, arrangements being made later with neighboring systems for interchange of surplus energy. Reduced to a basis of horsepower per square mile of drainage the Falls Village plant is very highly developed, but the rating is justified in view of the auxiliary sources of energy connecting with the system. Energy is supplied to 6600-volt transmission lines reaching the towns of Millerton, N. Y., and Canaan, Norfolk, Lime Rock, Falls Village and Sharon, Conn., while 66,000-volt steel-tower lines run to Torrington, Thomaston, Bristol, New Britain and Hartford, Conn. Connections will eventually be made with the Middletown steam station of The Connecticut Power Company thereby tieing together the Housatonic and Middletown divisions of this company and affording the advantages of diversity in load and interchange of energy. The lines to Torrington, Bristol, New Britain and Hartford also furnish auxiliary sources of energy, since they connect with steam stations of the Torrington Electric Light Company, the Bristol & Plainville Tramway Company, the United Electric & Water Company and the Hartford Electric Light Company. Through the two last-mentioned companies, connections are virtually maintained with the Housatonic Power Company and many flourishing industrial communities of central Connecticut. To include all sources of energy connected to the system it should be pointed out that a small hydroelectric plant, also on the Housatonic River, is located at Canaan. This was formerly the generating station of the Berkshire Power Company, but is now the property of The Connecticut Power Company.

Falls Village was selected as the site of the hydroelectric plant because the contour of the Housatonic River was particularly desirable at this point, two falls, Little Falls and Great Falls, giving a hydraulic drop of 110 ft. Attempts had been made as early as 1850 to utilize the natural head thus available by building dry-masonry canals, but due evidently to the seepage of water they were abandoned without ever being used. One of these canals was, however, utilized in the present plant, and extends from Great Falls about 2000 ft. downstream, having an overflow spillway near the headworks and also at its lower end.



FIGS. 1 AND 2—GENERATOR ROOM AND SECTION OF SWITCHING GALLERY OVERLOOKING GENERATOR ROOM

In laying out the present plant several schemes of utilizing the Housatonic River were considered. The one adopted required cutting a channel through Little Falls barrier and constructing a dam at Great Falls with its crest at the elevation of the Little Falls barrier. In addition the old canal was utilized with the addition of a reinforced concrete lining and walls raised approximately 4.5 ft. Extending the walls of the canal to any higher elevation by building on the old wall was considered unsafe, consequently the crest of the dam is 9 ft. higher than the canal spillway and the level of the water in the canal is controlled by motor-operated regulating gates, which may be controlled at will of the switchboard operator either by hand or by an automatic float located in the canal.

Two methods of conveying the water from the canal to the power house were considered. One involved penstocks approximately 800 ft. long, utilizing the maxi-

mum natural load; the other, which was adopted, uses penstocks approximately 400 ft. long, and required excavating the channel of the river for the tailrace in order to utilize part of the 4 ft. additional drop in the rapids below the power-house location. The selection of the power-house site was based on comparison of the costs of the two schemes and a study of the comparative regulation of the two lengths of penstocks.

The drainage area above Great Falls is 644 square miles and the pondage about 21,000,000 cu. ft., equivalent to about 243 second-feet for twenty-four hours. Although there are several small pondages above Falls Village, the largest is that of the Canaan plant, 6 miles up the river. Since the control of this pondage is essential to the successful operation of the Falls Village

HYDRAULIC DATA FOR HOUSATONIC RIVER AT FALLS VILLAGE

Month	Year	Discharge (Cu. Ft.-Sec.)			Rainfall (In.)	Ratio Run-off to Rainfall (per cent)
		Max.	Min.	Mean		
January	1913	3020	1290	2300	4.02	102.3
	1914	1600	200	513	2.51	36.7
	1915	2690	35	1114	5.77	34.5
February	1913	1770	588	1248	2.28	88.5
	1914	1800	350	721	2.35	49.9
	1915	5850	840	2026	5.54	59.2
March	1913	8110	825	2705	6.05	80.0
	1914	8520	400	2390	4.23	101.2
	1915	2760	512	884	0.12	...
April	1913	4410	1050	2416	4.02	104.0
	1914	5680	2750	3825	3.65	179.6
	1915	3120	432	1114	2.56	75.4
May	1913	1970	440	915	4.13	39.8
	1914	3430	480	1830	3.25	99.0
	1915	920	356	614	2.9	38.0
June	1913	1250	178	536	1.81	51.4
	1914	696	220	407	2.87	23.9
	1915	560	154	332	4.65	12.5
July	1912	440	145	275	2.90	11.4
	1913	328	80	193	1.45	23.4
	1914	570	208	306	3.10	17.7
	1915	4480	339	1427	7.97	32.0
August	1912	803	169	321	4.27	13.3
	1913	214	80	157	4.59	6.1
	1914	392	190	255	2.48	18.5
	1915	3320	529	1320	7.41	31.8
September	1912	576	182	316	3.08	17.8
	1913	297	72	181	3.74	8.3
	1914	252	136	196	0.55	61.8
	1915	1090	350	605	3.74	28.1
October	1912	2960	91	591	4.51	23.3
	1913	4510	154	726	8.88	14.7
	1914	169	24	122	2.23	9.9
	1915	725	193	450	1.96	41.3
November	1912	2800	632	1179	3.69	55.3
	1913	2020	538	988	3.23	52.6
	1914	160	29	117	2.37	8.4
	1915	855	193	440	2.07	36.7
December	1912	1990	91	1408	4.86	51.9
	1913	1550	619	912	2.54	64.2
	1914	157	86	131	2.58	8.9
	1915	5670	220	1735	8.89	35.0

plant, this property was acquired by The Connecticut Power Company in 1912. The acquisition added enough pondage to that already available at Falls Village to make a total of about 42,000,000 cu. ft., or the equivalent of 486 second-feet for twenty-four hours. With this large pondage the flow may be utilized so that the minimum output of the development is not affected by the low Sunday flow caused by the shutting down and storing of water by the mills located on the river above Great Falls.

The normal head at the Canaan plant is approximately 12 ft., but during extreme high water is reduced to only a few inches. A 250-hp. steam auxiliary has therefore been installed in this station for use during periods of extreme high and low water, arrangements being made as described on page 1251 of the Dec. 23, 1916, issue of the ELECTRICAL WORLD for operating the waterwheels at reduced head. As an auxiliary to the Falls Village station the Canaan plant will not be required at times of high water, and at times of low water it will operate under maximum head at its highest efficiency and materially increase the output of the system.

The dam at Great Falls is 14 ft. high and 320 ft. long. Next to the headworks is a skimming gate through which large pieces of ice and floating material

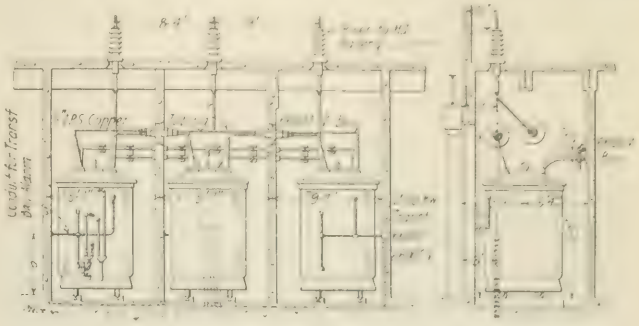


FIG. 3—ARRANGEMENT OF BANK OF TRANSFORMERS IN SEPARATED FIREPROOF COMPARTMENTS

may be diverted by a floating boom anchored to large boulders. Four gates are provided for admitting water to the canal, these being electrically operated and remotely controlled. The amount of gate movement is indicated at the station by the arrangements described on page 1007 of the Nov. 18, 1916, issue of the ELECTRICAL WORLD. Entrance to the gates is protected by 1.75 by 5.75-in. wooden bars spaced 6 in. center to center and extending up only to the water level. On account of the presence of the skimming gate, boom protection and submerged screen and consequent con-

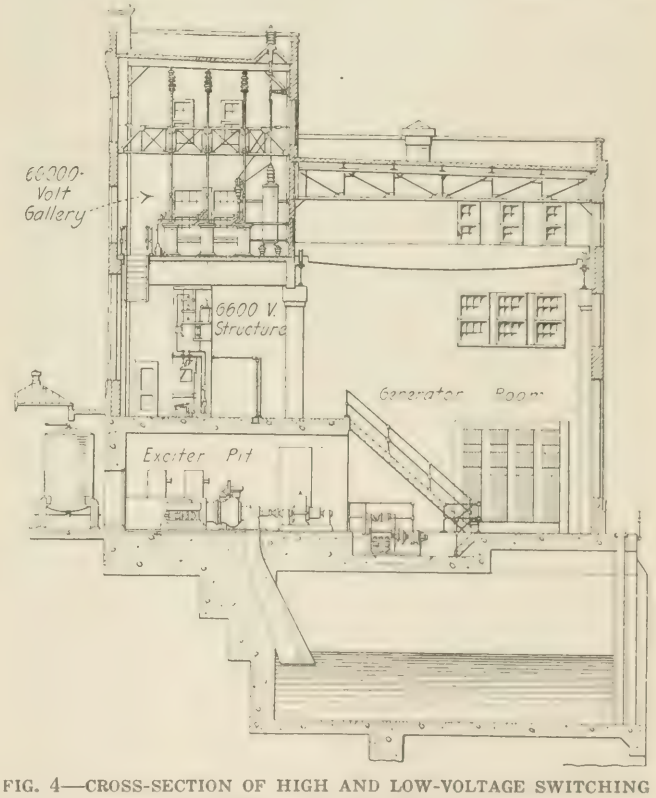


FIG. 4—CROSS-SECTION OF HIGH AND LOW-VOLTAGE SWITCHING GALLERIES AND EXCITER PIT

siderable depth of water above the headworks no serious ice trouble is experienced from the pond.

Directly below the headworks in the canal wall is a 260-ft. spillway, the crest of which is 9 ft. below that of the dam and 3 ft. below the top of the canal wall. The existing spillway was used to avoid the extensive excavation which would be required to bring it to the

proper level in case it were located in the main dam. To prevent water flowing over the spillway except in emergencies particular care is taken by the station operator to regulate the amount of water admitted to the canal, its level, within certain limits, being indicated by lamps attached to electrodes immersed in the canal. Details of this scheme are also described in the Nov. 18, 1916, issue of ELECTRICAL WORLD, page 1007.

The canal was constructed by excavating the old

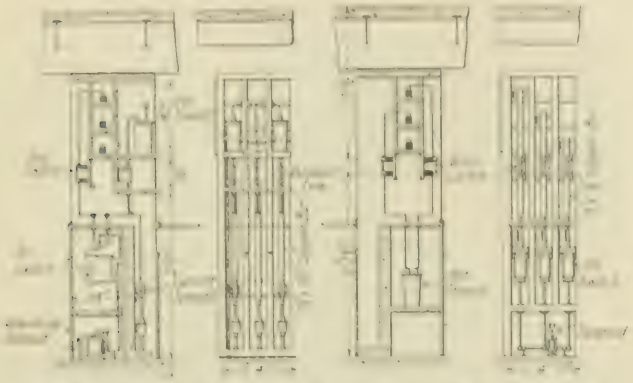


FIG. 5—SWITCH AND BUS-TIE SECTIONS OF 6600-VOLT BUS STRUCTURE

canal, utilizing the old rock walls for supporting one side of the canal, and lining it with reinforced concrete. Its minimum area of cross-section is 400 sq. ft., which permits a flow of 2500 second-feet with a maximum velocity of 6.25 ft. per second. The loss of head is only a few inches. The canal approaches the penstock almost at right angles, and at the end of the canal is a spillway, skimming gate and mudgate. Owing to ice which forms in the canal breaking and massing around the penstock entrances, arrangements were made during the past summer for diverting it over the spillway and discharging it through a long wasteway into the river.

The forebay head block contains four main penstock gates which have hand-operated hoists, with provision for future motor drive. Screens similar to those at the headworks are provided. Considerable difficulty has been experienced in the operation of small waterwheels in the Housatonic River on account of the migration of eels, so double fine mesh screens are placed at the entrance to the exciter penstocks. Three 9-ft. penstocks suitable for 5000-hp. waterwheels and two 3-ft. penstocks for 250-hp. exciter waterwheels are installed and provision made for one more main penstock. These dimensions will give a maximum velocity of 8.5 ft. per second in the main penstocks and 4.9 ft. per second in the exciter penstocks.

General Arrangements Inside Station

The station, which is located on the bank of the river just below the forebay, is arranged as shown in the accompanying plan and cross-section. In the middle bay on the main floor are the turbine-driven exciters, governor oil pumps, oil-storage tanks and heating plant. Mounted directly over each exciter are chain-operated rheostats actuated from the switchboard above. Space is provided on each side of the central bay for two 5000-hp. water turbine-driven generators with their corresponding governor mechanism, but only three units are installed so far. Since the turbines are horizontal-shaft, end-entrance units, rear-bearing inspection chambers are provided at the penstock ends.

Extending the whole length of the generator room along the penstock side is a gallery on the central portion of which, over the exciter pit, are the main switchboard and 6600-volt switch and bus structure. A telephone booth is so located at one end of the switchboard that an operator using the telephone can see every instrument and switch on the board. At each end of the gallery are separate fireproof compartments with metal doors for the transformers. Back of these is space for a machine shop, office, station-service equipment, storeroom and the like. All of the high-tension equipment—that is, the 66,000-volt apparatus, including oil switches, busbars, lightning arresters and disconnecting switches—is installed in a room over the gallery. The horn-gaps, however, are installed on a roof structure supporting the outgoing lines and are operated from within the station by pipe mechanisms.

EQUIPMENT USED IN FALLS VILLAGE STATION

Falls Village—Three 5000-hp. double-runner Wellman-Seaver-Morgan waterwheels directly connected with 3000-kw 60-cycle 6600-volt Allis-Chalmers generators running at 300 r.p.m. Lombard type-governors with automatically controlled oil pumps driven through magnetic clutches by constantly running induction motors. Two 250-hp. single-runner waterwheels directly connected with 150 kw. 125-volt exciters operating at 600 r.p.m. Two banks of water-cooled 6600/66,000-volt tranformers, each consisting of three 2500-kva. Allis-Chalmers transformers connected delta-delta.

The electrical connections are very simple, sectionalized buses with no duplications, loops, or transfer buses being used for both the 6600-volt and 66,000-volt circuits. Provisions are made for connecting one outgoing 6600-volt circuit, one bank of transformers and two generators to each half of the 6600-volt bus, so they may be operated in parallel or in two groups by closing or opening the bus-tie switch; however, only one of the outgoing circuits is connected so far. The 66,000-volt bus is similarly sectionalized, but two outgoing circuits are connected. All of the 66,000-volt oil switches are Westinghouse type E-3 while the 6600-volt switches are type GA. Four-cell type A electrolytic lightning arresters are connected with the 66,000-volt outgoing lines, and inverse time-limit relays are used with the outgoing line switches.

The transformers of each bank are installed in adjacent but separated concrete compartments with floors which are depressed and drained so oil will be carried away in case of transformer explosion and fire. Since the transformers are connected delta-delta simple ring-type buses can be used to join them. The 6600-volt bus-

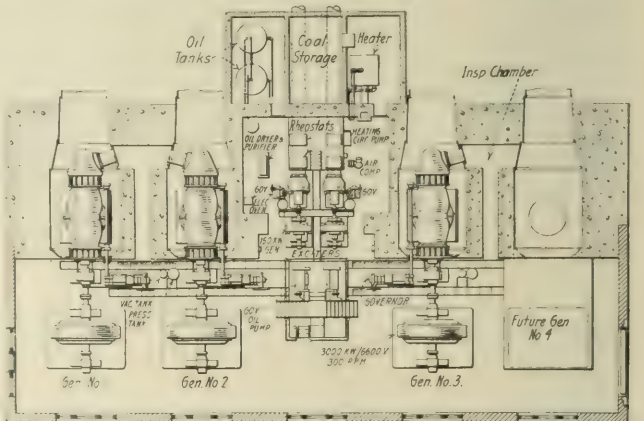


FIG. 6—LAYOUT OF TURBINE-DRIVEN GENERATORS, EXCITERS AND AUXILIARIES

bars consist of 1,000,000-circ. mil cable supported on Electrical Engineers Equipment Company's insulators No. 1886, and carried through the barriers in 14-in. Thomas wall bushings No. 7460. One-half inch copper tubing is used for the 66,000-volt connections being run through the compartment barriers in Thomas wall bushings No. 8403. From the low-tension bus cables run

down the wall through conduit and thence through the floor to the 6600-volt bus and switch structure. The 66,000-volt busbars, however, are connected with the high-tension buses on the floor above by copper tubing carried through Thomas floor bushings No. 8016. Thermometers, water-flow and oil-level alarm circuits on each transformer are inclosed in conduit, each branch of which terminates in a Crouse-Hinds condulet E-22. Between the conduits and the wall boxes (Burns No. 172), ¾-in. flexible conduit is used. The transformers are mounted on trucks and all piping and connections arranged so that the units can be easily withdrawn.

The 6600-volt bus and switch structure is built of concrete, the compartments on the side nearest the generator room being devoted to cable terminals, current transformers, potential transformers and their protecting fuses. The other side contains the oil switches, busbars and disconnecting switches. The arrangement of this apparatus is shown in elevations and cross-sections of the structure. A bus-tie section occupies the central portion of the structure, while the transformer, generators and feeder sections occupy about the same relative position that the corresponding apparatus occupies in the station. All the cable terminals are Electrical Engineers Equipment Company's type 50A potheads, while the current transformers are Westinghouse type KA.

As shown, the solenoids operating the oil switches are all mounted on the floor, permitting the oil switches to be placed above where they can be simply connected with their respective circuits. The busbars consist of two 3 by ¼-in. copper bars laid on edge on General Electric vertical insulators No. 42. Openings in the

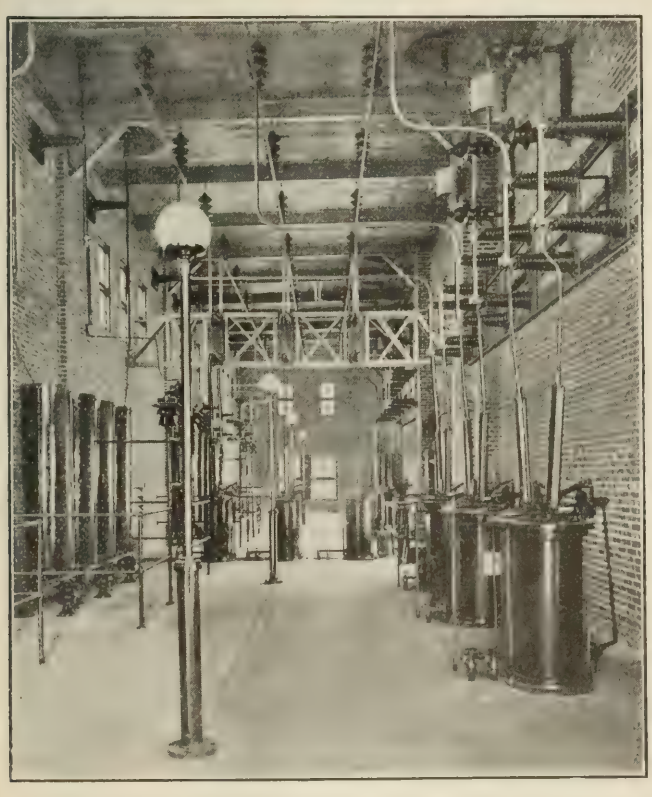


FIG. 7—HIGH-TENSION GALLERY SHOWING LINE SWITCHES, BUS-TIE SWITCHES, LIGHTING ARRESTERS AND OVERHEAD BUS

structure at the ends of the busbars are covered with asbestos lumber doors held in place by expansion bolts.

Symmetry of arrangement has also been carried out in the high-tension room. The busbars run along the ceiling, being sectionalized in the middle and brought down to bus-tie switches arranged across the room. Along the river side of the room are the lightning arrester tanks, fuses and risers leading to the roof bushings, operating rods for the horn-gaps on the roof, and risers from the transformers leading to the busbars with their disconnecting switches. Along the land side are line oil switches with their disconnecting switches and protecting choke coils.

The busbars, which consist of 1¼-in. iron pipe, are

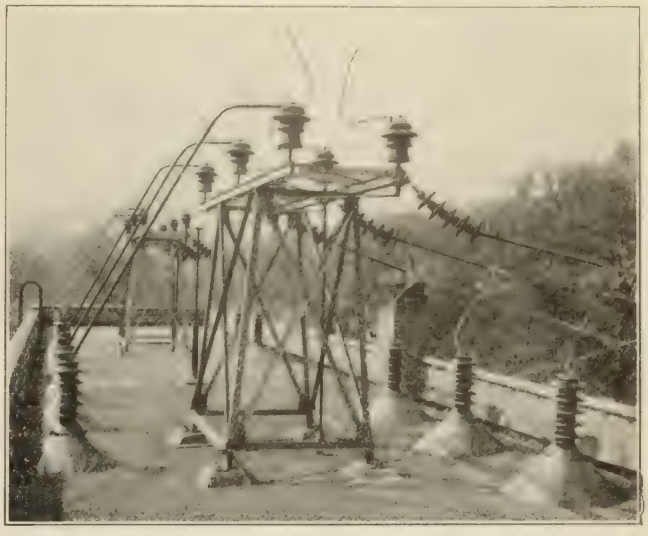


FIG. 8—ROOF STRUCTURES DEAD-ENDING OUTGOING LINES

supported by four-disk Pittsburgh suspension insulators No. 232 equipped with special hangers. The bus-tie disconnecting switches, which are equipped with post-type insulators like all the high-tension disconnecting switches, are attached to a truss directly over the bus-tie switches. The insulators supporting the transformer disconnecting switches as well as the posts insulating the lightning arrester risers and choke coils are attached directly to the brick walls, but the line disconnecting switches are attached to channels. It may be pointed out that all of the high-tension oil switches as well as the transformers are connected with oil-storage tanks and a filter press on the main floor, so the oil can be dried and cleaned without taking the apparatus out of service. The solenoids operating the switches are mounted on the floor, all wiring being run in conduit.

At the south end of the high-tension room is the lightning arrester equipment for the outgoing 6600-volt line. This consists of a choke coil in each phase and General Electric multigap arrester between each line and ground. The outgoing 6600-volt lines pass through Locke wall bushings No. 661 and connect with lines dead-ended to the building with Pittsburgh No. 232 insulators by means of Ohio Brass clamps No. 10,755.

Connections between the 66,000-volt lightning arresters and horn gaps and between the line switches and lines deadended on the roof structure pass through Thomas roof bushings No. 8016. The roof structure carrying the horngaps with the method of deadending the lines are shown in an accompanying illustration. It may be pointed out that arcing horns are attached to the 66,000-volt dead-end insulators.

This system was constructed under the plans and supervision of the Stone & Webster Engineering Corporation and is operated by the Stone & Webster Management Association. M. L. Sperry is district manager of The Connecticut Power Company, Henry E. Lyles is division manager of the Housatonic division and J. K. Mackie is superintendent of the Falls Village plant.

Features of the transmission system and an explanation of how the steam and water power stations are operated in parallel to the best advantage will be described in a later issue of the ELECTRICAL WORLD.

Entering an Age of Greater Electric Service

Defending Its Rates, the Union Electric Light & Power Company of St. Louis Shows That Development of New and Diverse Uses Is Costly, but Carries the Possibility of Further Economies in Unit Production Cost

DEFENDING its rates in a proceeding before the Public Service Commission of Missouri the Union Electric Light & Power Company of St. Louis expresses the belief "that we are entering upon an age of electric service." It "has voluntarily reduced its charges at frequent intervals to assist the greatest possible development in the use of electric service. It realizes that such development of new and diverse services is costly, but carries with it the possibility of further economies in unit production cost. It believes it is furthering both its own interest and the interest of the public in promoting such new uses and economies." It has followed this policy, notwithstanding its showing that its returns, all deductions properly considered, are lower than the percentage allowed by the same commission in a case affecting another company.

The proceeding which the company is contending follows a complaint made by the Engineers' Incitation Club, a voluntary organization of engineers engaged in the operation of steam plants, and others. The charge was made that the residence rate was "unreasonably high" and the power rate "unreasonably low," and that the rates were "ostensibly and colorably" affected by the contract for water power service with the Electric Company of Missouri. The commission was asked particularly to investigate the agreement for Keokuk power.

Value of the Property

On valuation the answer directs attention to the findings of the commission engineers on appraisal of the physical property of the Union Electric Light & Power Company, deducting property not used, being $22,599,195 cost of reproduction and $21,474,307 cost of reproduction less depreciation. These figures relate only to physical property and do not include cost of organization, development cost, going value or working capital, all elements of value which have been considered by the commission in other cases. A valuation made by the company in accordance with the order of the commission shows $24,974,638 for cost of reproduction of the physical property and $24,202,080 cost of reproduction new depreciated. The engineers of the commission have not yet submitted an appraisal of the property of the National Subway Company of Missouri or the Electric Company of Missouri, used and useful for St. Louis service. The valuation made by the company shows the following estimated costs of reproduction: Electric Company of Missouri, $1,532,708; National Subway Company, $446,601.

Accountants for the commission reported that the net profit on operations of the Union Electric Light & Power Company for the year ended Dec. 31, 1915, was $1,428,986. This amount, however, the accountants stated, was subject to adjustment by a proper allowance for reserves for insurance, relief and pensions, injuries and damages, law expenses, public service commission expense, amortization of intangible items and depreciation of plant and equipment, automobiles, horses and wagons. The accountants reported, furthermore, that in considering the amount of revenue which the company should receive from the public, the commission should allow, in addition to operating expenses, depreciation and return on investment, an amount sufficient to cover amortization of funded debt discount and expense. The accountants show that only $306,833 was reserved for depreciation in 1915, whereas in prior years the reservation was as much as $635,623. Engineers of the commission reported an estimated annual allowance of $783,828 to cover depreciation, and this did not include an amount necessary for the amortization of intangible items representing cash necessarily invested in the conduct of the business but not physical values. The amount sufficient to cover amortization of funded debt discount and expense was reported at $53,254.

The maximum rate in 1912 was 12 cents per kilowatt-hour. It was reduced until in June, 1916, the rate was 8.5 cents, and since the date of the report there has been a further reduction to 8 cents.

Net profits from operation for 1915, without the allowances and reductions indicated, were as stated, for the Union Electric Light & Power Company, $1,428,986; for the Electric Company of Missouri (water-power division), $265,872; National Subway Company of Missouri, $13,131; total, $1,707,989. Deducting only the loss in revenue which would have resulted in 1915 because of reduction in rates of the Electric Company of Missouri to the United Railways Company of $68,750, and the reduction in maximum rates from 10 cents prevailing until Dec. 15, 1915, to 8 cents now, conservatively estimated at $160,500, if applied to 1915 business, the net profits from operation would be reduced to $1,578,739.

The original cost as found by Price, Waterhouse & Company, accountants, prior to 1904, which is corroborated by the adjudicated value of the United States Court of Appeals in the Morgan Jones case, and as found by this commission's accountants since 1904, was as published in the accompanying statement:

	Original Cost For		Total
	Tangible Property	Intangible Property	
Union Electric Light & Power Co. Prior to 1904	$11,623,850	$4,104,429	$15,728,279
1904 to 1915	11,936,982	2,726,858	14,663,840
	$23,560,832	$6,831,287	$30,392,119
Electric Company of Missouri (water power division)	1,052,891	.....	1,052,891
National Subway Company of Missouri	561,161	.....	561,161
	$25,174,884	$6,831,287	$32,006,171

Return on the Values

Upon the total original cost the net profits from operations available for proper additional reserves as pointed out by the commission's accountants, for contingencies and surplus and for revenue adjustments because of rate reductions subsequent to 1915, were 5.336 per cent. Deducting the estimated amount of such rate reductions the net profits were 4.932 per cent of original cost.

Upon the cash investment in physical property, neglecting expenditures necessary and reasonable in the conduct of the business and of benefit to customers, the net profits available for all of the purposes enumerated were 6.784 per cent before deducting the effect of rate reductions since 1915 and 6.271 per cent after such deduction.

Costs of reproduction of the physical property, as found by the commission engineers for the Union Com-

pany, and as found by the company for the Electric Company of Missouri and the National Subway Company, and used in the absence of such report by the commission engineers were: Union Company, $22,599,195; Electric Company (water-power division), $1,532,708; National Subway Company, $446,601; total $24,578,504. Upon such costs, without adding any appraisal of cost of organization, going value, development cost or working capital, the net profit was 6.949 per cent before deducting the effect of rate reductions since 1915 and 6.423 per cent after such deduction.

Effect of Suggested Rate

In lieu of the present alleged discriminatory rates the complainants suggested "a uniform rate of not over 5 cents per kilowatt-hour for the first 120 hours' use per month of installed capacity, and all use in excess thereof at 2.5 cents per kilowatt-hour." The average rate in 1915 was 7.67 cents, in 1916 6.61 cents, and at present it is estimated conservatively at 6.12 cents. The maximum rate applies to less than thirteen hours' use of the installed capacity, and a rate of 3 cents gross per kilowatt-hour is earned after less than twenty-five hours' use per month of the installed capacity. To charge 5 cents per kilowatt-hour for 120 hours' use of the installed capacity would penalize every user of domestic appliances. While it would result in a small reduction from residence customers for lighting only, it would do so at the expense of an increase in the monthly bill of a residence customer using an electric flat-iron and range of over 39 per cent. "The proposed rate in the complaint," the company adds, "could not have been more advantageously designed had its purpose been to promote a 'cook with gas' campaign."

A separate report was made by the commission accountants upon the rates applied to isolated plants, the low charges to which were the basis of the complaint. Their report on Union Company accounts showed the following results of operation of isolated plants for the year ended Dec. 31, 1915: Sales of electric energy and steam, $424,621; expenses, $287,481; net profit, $137,140. The accountants added to the actual cost of operating the plants themselves an amount representing cost of the energy furnished from the main lines to consumers in isolated plants figured at the cost of production, 0.533 cent per kilowatt-hour. To this figure, they said, should be added a portion of the cost of transmission and transformation, distribution, commercial and new business, general and other expenses, which they were unable to pro rate. The company concludes: "It is apparent that the net profit of $137,140 is sufficient to pay operating costs and fixed charges of over $1,000,000 of investment," and "that no such investment is used and useful in supplying such isolated plants."

Classification Necessary for Divergent Uses

The readiness of the company to support its rate-making is expressed as follows: "We are prepared to substantiate on hearing, should such prove necessary, that the rates charged by the defendant company are not discriminatory; that the classification adopted is reasonable and places in each of the separate classes all the customers served alike and contemporaneously and under the same or substantially similar conditions; that such classification is necessary to care for the divergent uses and character of electric service demand and for the greatest development of such use; that such classification is far simpler than that obtaining in other large cities in the United States serving a similarly diversified character of business; that the rates resulting from such classification reasonably reflect the difference in cost incurred in serving such separate classes and do not result in any unreasonable prejudice or disadvantage to any particular class; that a single classification such as proposed by complainant of 5 cents per kilowatt-hour for the first 120 hours' used per month of installed capacity would do irreparable injury to the business in that it would increase rates for low-tension power service over 60 per cent, would increase charges for high-tension power service over 300 per cent, would increase charges for municipal street lighting service over 28 per cent, and would increase charges for direct-current lighting service, confined to the business section of the city, over 40 per cent, and would force such customers to use other and less satisfactory forms of lighting, power and heating; that such a schedule, or one similarly designed, would obliterate all of defendant company's efforts to bring the benefits of electric service with its labor-saving devices to the home and the workshop, and put an effective damper upon the movement, in which the company is now taking a large part, for making St. Louis a cleaner and brighter city; that such a rate schedule as that proposed would obliterate all possibilities of achieving that further economy in the conduct of the business which has come from longer hour use, more extensive and diversified use and large scale production, and which has resulted in such a cheapening in the charges in the past."

Water Power Contract

The contention that power had been obtained through an intermediary or intermediaries, and that savings and benefits in the price of energy were diverted from the beneficiaries intended by Congress was disposed of by the returns actually earned, in which the accounts of the associated companies were included. Since then the Union Company has acquired the Electric Company of Missouri. Engineers of the commission, however, stated, after analysis of the cost of water-power energy under the contracts, that the effect thereof was to increase the cost of energy to the Union Company $412,818 in 1914 and $441,882 in 1915. "It appears, however," they add in their report, "from an examination of the Union Company's operating expenses for 1914 and 1915 that the company and not the consumer carried the burden of the water power contract."

These estimates of cost are based on a comparison of steam generation and water-power purchase prices, and the company is prepared to substantiate on hearing that they fail to take into consideration important elements, such as that imported power permitted delay in investments in equipment that would otherwise have been required. Through improvements in the art, equipment now being installed more nearly approaches ultimate efficiency and consequently has a much longer economical life in service with lower annual replacement costs.

On Dec. 31, 1915, the company had spent $45,207 in preparing the inventory of its physical properties in accordance with the commission order in this case. About $22,973 of this total is estimated as the value of permanent office records resulting from such inventory. The State has also incurred substantial expense.

Estimates of values by the engineers and accountants of the commission were accepted by the company only for the purpose of its motion that the complaint be dismissed. The company does not admit that the estimates are the full or true value of its properties.

Hearings to Proceed

St. Louis advices say that the petition filed by the company with the Public Service Commission of Missouri to dismiss the complaint of the Engineers' Incitation Club was denied upon the representation of the attorney for the complainant. He stated that the complainant's case had not yet been presented. The first hearing on the original complaint was set for March 19 at the request of the Union company.

Results of 1916 Light and Power Operations

Central Station Income from Energy Sales More Than $415,000,000, Output Considerably in Excess of 23,000,000,000 Kw.-Hr.

IN what was undoubtedly the largest industrial year on record the central stations of the United States increased their income from light and power sales by 15 per cent and delivered 22.5 per cent more energy to consumers. The earnings for 1916, according to the returns received by the ELECTRICAL WORLD, were more than $415,000,000 while the output was considerably in excess of 23,000,000,000 kw.-hr. The 1916 earnings were greater than those of 1915 by $54,000,000, and the increase in output was 4,265,000,000 kw.-hr.

December returns show the earnings in the last month of the year to have reached $41,000,000. The output was 2,190,000,000 kw.-hr. The increase in income over December, 1915, was 15 per cent, and in output 20.8 per cent. December established a record both for income and output.

In New England and the Middle West the December percentages of growth were somewhat less than those for the previous months. In the remainder of the country the percentages were greater. In the Middle West the income and output of one company were seriously curtailed owing to an accident at the power house. Such local conditions together with the fact that December, 1915, was a large month in the East and Middle West

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE-MONTH PERIOD

	Percentage of Industry Represented	Income from the Sale of Energy			Kw.-Hr Output		
		1916	1915	Per Cent Increase	1916	1915	Per Cent Increase
Jan.	65	25,286,000	22,352,000	13.2	1,200,672,000	984,205,000	22.0
Feb.	65	22,133,000	19,175,000	15.3	1,121,452,000	869,537,000	29.1
March	65	22,027,000	18,722,000	17.8	1,212,363,000	969,888,000	25.2
April	64	21,206,000	18,375,000	15.5	1,137,602,000	920,464,000	23.1
May	64	20,345,000	17,559,000	16.0	1,170,143,000	944,681,000	24.0
June	64	20,254,000	17,551,000	15.4	1,170,679,000	968,724,000	21.0
July	64	19,760,000	17,301,000	14.2	1,174,374,000	976,704,000	24.4
Aug.	64	20,502,000	17,861,000	15.0	1,262,575,000	1,015,805,000	22.4
Sept.	64	21,432,000	18,600,000	15.2	1,268,339,000	1,037,976,000	21.2
Oct.	64	22,882,000	20,164,000	13.5	1,347,502,000	1,125,132,000	19.9
Nov.	63	24,305,000	21,277,000	14.6	1,377,487,000	1,131,012,000	22.0
Dec.	55	22,579,000	19,614,000	15.0	1,207,713,000	999,323,000	20.8

TABLE III—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR UNITED STATES—CITIES GROUPED BY SIZE

	Mch	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
INCOME:										
Group 1	16.0	13.9	14.4	14.9	13.8	13.9	15.0	11.6	13.2	10.9
Group 2	18.5	17.0	17.5	17.7	16.8	15.7	20.4	19.2	17.7	16.5
Group 3	28.1	24.7	26.2	21.8	19.5	20.9	18.4	18.5	18.2	15.2
Group 4	17.3	17.4	15.1	11.0	9.0	9.5	11.3	13.5	12.8	13.8
Group 5	26.5	16.1	24.0	15.3	12.2	14.9	13.3	16.0	15.8	7.7
OUTPUT:										
Group 1	22.0	20.0	21.3	18.7	18.1	21.4	18.5	16.6	18.2	17.9
Group 2	28.1	25.5	18.0	17.5	22.9	33.0	32.9	31.1	27.2	22.0
Group 3	39.0	37.7	40.0	21.8	27.8	31.1	19.3	24.0	32.0	28.4
Group 4	18.2	22.7	23.0	19.3	16.1	23.0	26.0	20.4	19.7	25.0
Group 5	29.9	32.0	33.2	19.0	11.6	16.8	15.3	18.3	32.0	24.8

TABLE IV—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR NEW ENGLAND STATES—CITIES GROUPED ACCORDING TO SIZE

	Mch.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
INCOME:										
Group 1	21.5	16.0	17.0	16.4	12.6	9.6	16.5	12.1	13.5	12.5
Group 2	19.0	21.2	19.5	19.8	20.6	15.1	25.5	21.3	20.0	14.5
Group 3	38.7	15.5	24.0	18.2	21.2	15.0	20.5	18.0	19.4	16.0
Group 4	18.1	13.2	13.5	7.2	6.2	11.1	10.5	15.4	16.0	15.9
Group 5	54.5	27.6	27.0	21.7	14.9	17.5	18.3	18.2	16.3	11.0
OUTPUT:										
Group 1	30.9	25.0	28.2	30.0	19.2	31.3	34.9	17.5	18.0	10.8
Group 2	27.8	31.4	33.2	26.3	14.1	32.0	37.7	35.0	24.7	17.5
Group 3	49.0	38.1	43.0	15.0	31.4	45.5	32.4	42.6	35.9	19.8
Group 4	17.4	36.1	30.0	21.0	26.6	39.4	32.9	48.9	40.0	55.4
Group 5	58.7	71.8	54.4	31.7	13.5	21.3	27.4	22.0	44.4	43.0

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	Percentage of Industry Represented	New England States			Percentage of Industry Represented	Atlantic States			Percentage of Industry Represented	Central States (Illinois Excluded)			Percentage of Industry Represented	Pacific and Mountain States		
			1916	1915	Per Cent Increase		1916	1915	Per Cent Increase		1916	1915	Per Cent Increase		1916	1915	Per Cent Increase
INCOME	January	66	2,819,000	2,432,000	15.0	67	9,589,000	8,564,000	12.0	57	7,834,000	6,717,000	16.6	88	4,182,000	3,823,000	9.4
	February	66	2,599,000	2,185,000	18.8	67	8,978,000	7,854,000	14.3	57	6,660,000	5,568,000	19.7	88	3,761,000	3,443,000	9.3
	March	66	2,595,000	2,122,000	22.0	67	8,998,000	7,660,000	17.5	57	6,470,000	5,394,000	20.1	88	3,787,000	3,386,000	11.9
	April	64	2,221,000	1,898,000	17.0	67	8,794,000	7,596,000	15.8	56	6,289,000	5,292,000	19.0	88	3,825,000	3,520,000	8.8
	May	65	2,103,000	1,788,000	17.0	67	8,226,000	7,131,000	15.4	56	6,085,000	5,123,000	18.7	88	3,874,000	3,469,000	11.6
	June	65	2,208,000	1,906,000	16.0	67	8,045,000	6,905,000	16.5	56	6,007,000	5,143,000	16.9	88	4,017,000	3,539,000	13.5
	July	65	2,130,000	1,875,000	13.7	67	7,832,000	6,621,000	16.4	56	5,926,000	5,095,000	16.3	88	3,755,000	3,493,000	7.6
	August	65	2,203,000	1,935,000	13.7	66	8,090,000	6,875,000	16.4	56	6,195,000	5,266,000	17.7	88	3,883,000	3,582,000	8.4
	September	65	2,315,000	1,982,000	16.8	66	8,631,000	7,445,000	16.0	56	6,505,000	5,537,000	17.8	88	3,979,000	3,644,000	9.2
	October	65	2,684,000	2,331,000	15.2	65	8,887,000	7,930,000	12.1	56	6,968,000	5,895,000	18.2	87	4,213,000	3,889,000	8.3
	November	65	2,904,000	2,511,000	15.7	65	9,821,000	8,634,000	14.4	55	7,170,000	6,088,000	17.8	86	4,234,000	3,937,000	7.5
	December	65	2,957,000	2,605,000	13.7	58	9,479,000	7,992,000	18.5	50	7,304,000	6,448,000	13.3	68	2,680,000	2,429,000	10.2
			1916	1915			1916	1915			1916	1915			1916	1915	
KW.-HR. OUTPUT	January	66	97,072,000	77,029,000	26.2	67	431,201,000	356,809,000	20.8	57	362,121,000	284,407,000	27.5	88	301,645,000	253,982,000	16.5
	February	66	92,855,000	68,982,000	34.8	67	411,715,000	320,924,000	28.1	57	339,326,000	252,816,000	34.1	88	268,653,000	220,662,000	22.1
	March	66	97,321,000	74,958,000	29.9	67	439,660,000	349,347,000	26.0	57	360,872,000	282,179,000	28.0	88	304,327,000	255,450,000	19.3
	April	64	84,769,000	64,816,000	30.8	67	403,223,000	326,574,000	23.4	56	344,866,000	273,367,000	26.4	88	302,386,000	253,778,000	19.2
	May	65	84,719,000	64,318,000	31.8	67	409,529,000	333,585,000	22.0	56	345,860,000	275,328,000	25.6	88	328,793,000	266,599,000	23.2
	June	65	87,829,000	69,506,000	27.6	67	396,630,000	327,541,000	21.2	56	350,015,000	288,982,000	21.2	88	328,996,000	277,915,000	18.6
	July	65	85,317,000	71,160,000	19.8	67	401,179,000	333,771,000	20.3	56	350,708,000	287,407,000	22.2	88	325,647,000	279,285,000	17.4
	August	65	97,197,000	72,900,000	33.4	66	433,129,000	344,730,000	25.7	56	374,327,000	295,866,000	26.5	88	333,468,000	279,976,000	19.1
	September	65	98,350,000	73,343,000	34.2	66	446,534,000	369,815,000	20.8	56	387,626,000	307,485,000	26.2	88	335,817,000	288,332,000	16.4
	October	65	107,756,000	83,705,000	28.8	65	426,151,000	373,705,000	14.2	56	408,364,000	324,509,000	25.9	87	355,014,000	306,828,000	15.8
	November	65	111,615,000	88,901,000	25.6	65	522,390,000	414,757,000	26.0	55	407,733,000	327,078,000	25.0	86	346,675,000	293,378,000	18.2
	December	65	109,524,000	90,952,000	20.5	58	459,947,000	390,792,000	28.0	50	400,711,000	333,080,000	20.2	68	226,437,000	175,635,000	29.0

TABLE V—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR ATLANTIC STATES—CITIES GROUPED BY SIZE

	Mch.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
INCOME:										
Group 1.....	16.7	15.1	14.5	16 4	16.8	16.1	16 2	10.7	13.7	19 0
Group 2.....	21.2	81.5	21.7	21 9	18.5	21.6	19.0	21.0	22.5	21.7
Group 3.....	20.5	15.3	17.7	12.0	14.2	15.0	14.0	14.6	13 0	13.2
Group 4.....	17.9	19.5	14.0	15.4	10.0	14.4	9.8	13.5	13 1	16.4
Group 5.....	12.2	15.6	13.0	15.2	13.0	19.4	8.9	14.3	16 0	14.3
OUTPUT:										
Group 1.....	29.2	26.1	25.5	13.1	23.4	28.5	23.6	19.2	21.2	17.7
Group 2.....	25 6	35.6	11.3	31 8	27.4	32.5	26.7	33.0	31 9	28.2
Group 3.....	16.0	13.7	18.0	13.2	11.5	16.0	24.7	4.5	19.0	14.9
Group 4.....	20 9	19.0	12.6	19.7	16.3	29.5	18.6	17.5	14 6	17.6
Group 5.....	13 1	8.9	35.0	11.1	13.5	20.4	1.3	1.5	5.8	6.9

TABLE VI—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR CENTRAL STATES—CITIES GROUPED BY SIZE

	Mch.	April	May	June	July	Aug.	Sept	Oct.	Nov.	Dec.
INCOME:										
Group 1.....	19.3	18.2	18.0	16.4	15.8	16.5	16.6	18.0	16.5	13.5
Group 2.....	19.1	18.0	17.4	17.5	17.3	21.8	21.5	21.0	17 0	16.4
Group 3.....	23.0	26 7	27.2	20.5	18.6	18.4	13.4	10.9	13.0	1.4
Group 4.....	22.9	22.8	24.1	17.5	17.5	10.7	20.0	19.7	16.8	17.0
Group 5.....	14.4	9.4	21.3	12.6	6.1	11.8	11.0	18.4	14.3	....
OUTPUT:										
Group 1.....	25.2	24.7	25.0	23.8	21.0	24.3	22.3	24.9	24.8	22.4
Group 2.....	32.3	23.9	19.5	12.3	25.7	36.4	40.0	31.7	29.7	21.9
Group 3.....	40.6	43.5	41.0	31.8	26.0	25.7	20.7	17.3	19.7	0.3
Group 4.....	31.9	39.2	38.5	34.3	21.1	23.0	33.8	26.1	21.2	21.7
Group 5.....	19.1	10.1	14.7	4.0	8.6	6.1	13.7	28.2	16.8	9.9

TABLE VII—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR PACIFIC AND MOUNTAIN STATES—CITIES GROUPED ACCORDING TO SIZE

	Mch	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
INCOME:										
Group 1.....	8.5	3.9	7.2	7.5	4.7	5.5	6.2	4.2	3.8	4.7
Group 2.....	18.7	3.5*	2.3	1.2	0.6*	0.7	4.9	1.3	3.0	3.6
Group 3.....	28.1	40 0	39.0	39.5	28.3	32.5	28.5	32.4	31.0	30.0
Group 4.....	17.5	11.7	13.8	3.6	1.0	0.5	11.5	7.2	0.4	0.9*
Group 5.....	26.3	12.0	19.1	12.8	13.2	13.0	11.7	13.5	17.1	11.1
OUTPUT:										
Group 1.....	22.7	8.0	12.0	8.0	10.0	6.3	7.1	5.2	7.7	12.0
Group 2.....	28.3	3.6*	2.2	1.0	2.0	6.5	7.8	9.7	11.4	8.7
Group 3.....	39.0	80.0	79.0	74.5	56.1	57.5	60.0	63.7	61.3	48.0
Group 4.....	18.6	10,3	21.8	10.0	4.0	7.5	12.0	*0.5	4.2	6.1
Group 5.....	30.0	11.7	17.5	16.0	10.8	16.5	7.0	14.7	42.3	5.4

*Decrease. †Results omitted owing to insufficient returns.

are in a large measure accountable for smaller percentages of growth in December, 1916.

The growth is still largely due to an increased power load. A very appreciable factor in this connection has been the scarcity of coal. Many isolated plants were threatened with complete shutdown unless they accepted central station service. Practically every section of the country seems to have felt this shortage. In some cases the central stations viewed the diminishing coal pile with no little fear. Many stations that had contracts covering a long period were forced to go into the open market and buy whatever they could at the prevailing prices.

This was but one of the increases in operating expense of central stations in 1916. Labor supplies and repairs were considerably more costly in 1916 than in previous years. Therefore in spite of the large gain in gross income, as shown by the accompanying figures, it is doubtful if there will be much if any gain shown in the figures for net income.

The growth of the industry from an output of 1,500,-

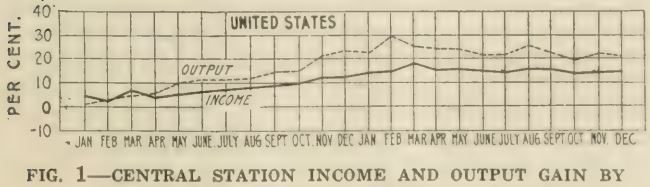
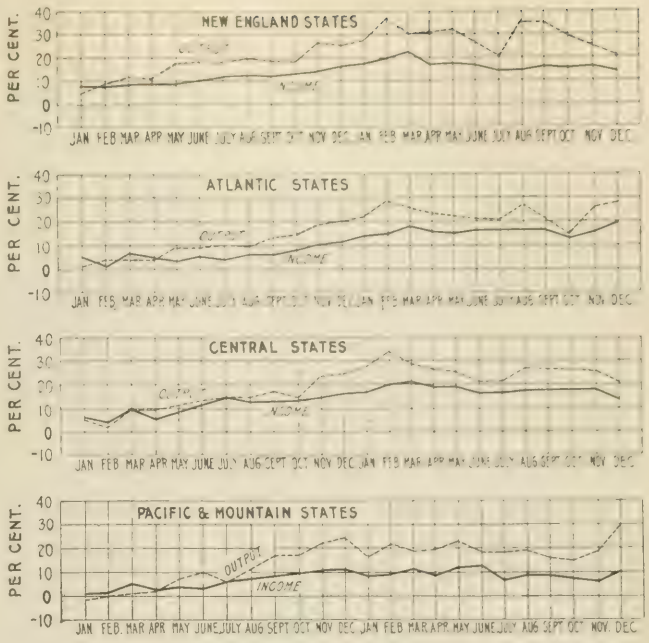


FIG. 1—CENTRAL STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT FOR UNITED STATES



FIGS. 2 TO 5—CENTRAL STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT SECTIONALLY

000,000 kw.-hr. in January, 1915, to one of 2,200,000,000 kw.-hr. in December, 1916, shows how well the industry has kept step with industrial progress. A glance at the accompanying curve showing the monthly income and

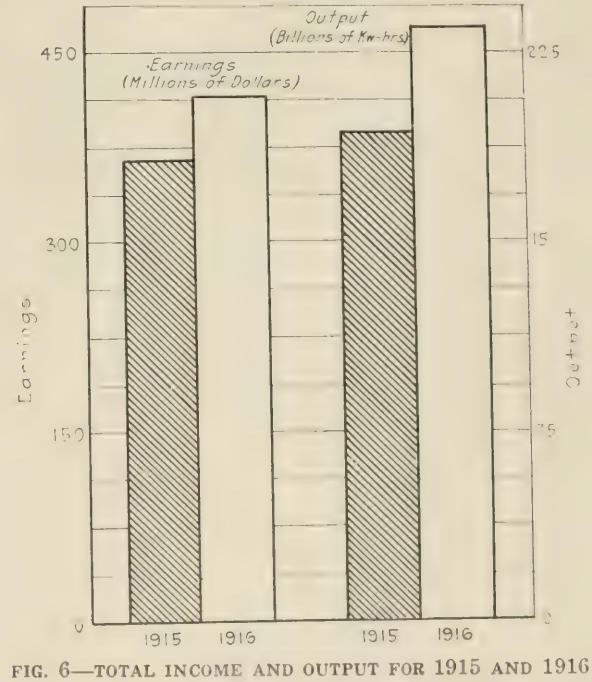


FIG. 6—TOTAL INCOME AND OUTPUT FOR 1915 AND 1916

output for 1915 and 1916 will show how the demand for light and power kept step with the demand for manufactured products. In 1915 there was a tremendous growth in monthly output. In 1916 the monthly output

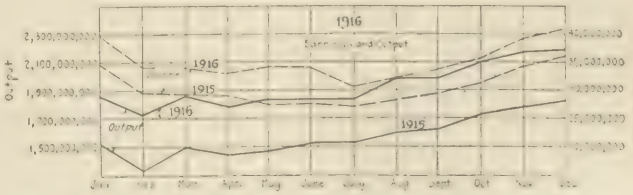


FIG. 7—VARIATION IN MONTHLY INCOME AND OUTPUT FOR 1915 AND 1916

was about the same until the last quarter when a part was taken.

The accompanying curves, Nos. 1-5, show graphically the percentages of growth in income and output as contained in Tables I and II. The remaining tables show the percentages of growth in income and output for companies grouped according to the size of the community served. Group 1 contains those companies operating in cities of more than 100,000 inhabitants, group 2 in cities with a population between 50,000 and 100,000; group 3, between 25,000 and 50,000; group 4, between 10,000 and 25,000 and group 5 between 5000 and 10,000. Fig. 6 shows graphically the total income and output for 1915 and 1916. Fig. 7 shows the variation in the monthly income and output for 1915 and 1916.

DATA ON THE DESIGN OF IRON-WIRE RHEOSTATS

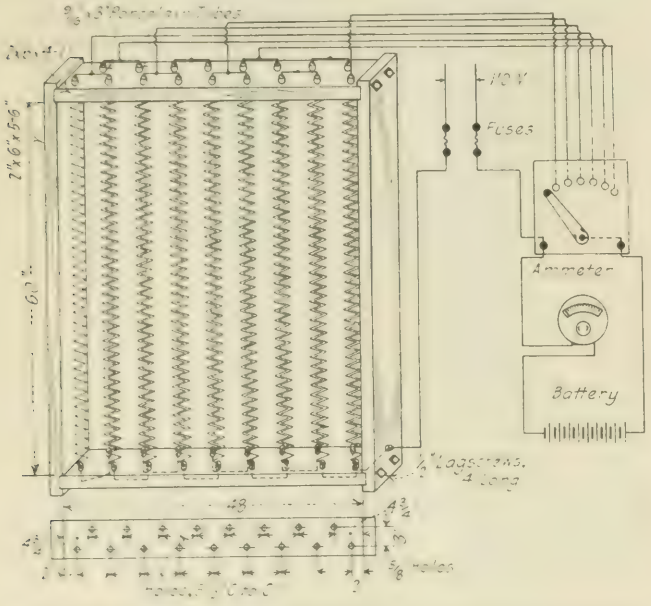
Considerations Involved in Designing and Constructing a Rheostat and Data That Facilitate Calculations

BY G. E. RUDOLPH
Electrical Construction Engineer, Custar, Ohio

The writer has recently designed a simple and inexpensive rheostat for use when charging storage batteries, the resistance elements of which are made of iron wire. The size of wire to use was determined by means of the formula

$$d = 3\sqrt{\left(\frac{I_m}{.014}\right)}$$

where d is the diameter of the wire in mils, and I_m the maximum allowable current. Calculations made therewith apply to iron wire only and permit a maximum temperature of 100 deg. C. Since 10 amp. was the maximum charging current to be allowed in the particular case referred to, the minimum diameter of wire which could be used, according to the formula, was 79.9 mils.



CONSTRUCTION OF IRON-WIRE RHEOSTAT FOR BATTERY CHARGING

This corresponds to No. 14 Roebling or American Steel & Wire Company's gage.

The total resistance required was computed by Ohm's law, $R = \frac{E}{I}$, E being the difference between the applied voltage and the back emf. of the battery; and I the minimum charging current or finishing rate which is allowed. For the case being considered the applied voltage was 110 volts and the back emf. about 18 volts, so the potential drop E across the rheostat had to be 92 volts. Since 4 amp. was to be the finishing rate of charging, the total resistance calculated by Ohm's law was 23 ohms. Since No. 14 iron wire runs about 81.38 ft. per ohm, and weighs 0.01697 lb. per foot, about 1872 ft. or 32 lb. were required for the complete rheostat.

For convenience in spacing the coils it was decided to use seventeen coils as an odd number can be arranged

TABLE I—DATA FOR USE IN DESIGNING IRON-WIRE RHEOSTATS

No. Roebling Gage	Diameter in Inches	Safe Capacity in Amperes	Pounds per Foot	Feet per Ohm at 100 deg. Centigrade	Ohms per in. of Spiral Wound on 1-in. Gas Pipe
4	.2753	47.35	.1346	645.40	.0023586
5	.2070	41.70	.1136	544.83	.0030409
6	.1920	37.25	.09877	468.73	.0038108
7	.1770	32.96	.08307	398.35	.0048642
8	.1620	28.87	.06961	333.70	.0063869
9	.1483	25.29	.05832	279.64	.0082698
10	.1350	21.96	.04832	231.73	.010963
11	.1205	18.52	.03850	184.63	.015771
12	.1055	15.17	.02951	141.52	.022971
13	.0915	12.25	.02220	106.45	.035209
14	.0800	10.02	.01697	81.38	.052678
15	.0720	8.55	.01375	65.91	.072265
16	.0625	6.92	.01036	49.67	.11048
17	.0549	5.55	.007732	37.08	.17129
18	.0475	4.58	.005982	28.69	.25166
19	.0410	3.68	.004457	21.37	.39146
20	.0348	2.87	.003211	15.40	.63994

better than an even number. One hundred and ten feet of wire were therefore required per coil. Winding of the coils was facilitated by chucking a 3-ft. piece of 1-in. gas pipe in a lathe and turning it slowly so the wire could be wound on it evenly and closely. To obviate actually measuring the wire for each coil the space which would be occupied on the pipe by the correct amount of wire closely wound was computed in advance.

Since the temperature of resistance wires computed by the foregoing method will not exceed 100 deg. C. a wooden frame constructed as shown was employed for supporting the coils. Five-eighth inch holes were bored as shown in the top and bottom of the frame and bushed with 9/16 in. by 3 in. porcelain tubes to receive the ends of the resistance coils. By thus stretching the 26-in. coils to 60 in. the adjacent turns were separated sufficiently to prevent short-circuit. The ends of the coils protruding through the bushings were bent over and soldered to the corresponding terminal of the adjacent coil. Perhaps connecting diagonally opposite coils would have been better as in that way the maximum voltage between coils would only be about 11 volts whereas with the connections used it was almost the full voltage applied across the rheostat.

Where vibration is considerable or enough to cause the coils to short-circuit the mid points of each side of the frame can be joined by a 0.25-in. rod passing between the two rows of coils and covered with porcelain tubes. The coils can then be tied to the tubes.

The switch used in conjunction with this rheostat consisted of the slate top, switch blade and contacts of an old burnt-out motor starter. The points at which to connect the rheostat were found by experiment, it being the intention to make each change in the switch position allow two amperes change in current.

By means of the accompanying table, rheostats for any loads up to 50 amp. may be readily designed. For instance the size of wire can be obtained by comparing columns 1 and 3; the total resistance as explained before by Ohm's law; the total weight by multiplying the latter figures by the product of columns 4 and 5 and the length of spirals wound on 1-in. iron pipe by multiplying column 6 by the total resistance divided by the number of coils to be made.

Able Management—How to Get and Reward It*

A Company, the Public and the State Regulating Commission May Co-operate Wisely to Encourage Public Utility Efficiency and Stimulate Lower Rates by Increasing the Return as Charges Decline

By Samuel W. Fleming, Jr.,
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A SECTION of the Pennsylvania public service company law states that it shall be lawful for every public service company to establish, with the consent of the commission, a scale of charges, subject to automatic adjustment, in relation to the dividends to be paid to the stockholders of such company; also to participate, to such extent as may be permitted by the commission and deemed wise by the commission, for the purpose of encouraging economies, efficiencies, or improvements in methods or service, in the additional profits which will be afforded by such economies, efficiencies, or improvements.

The Pennsylvania law thus definitely offers a way for rewarding ably managed utilities. A company that believes that it is entitled to recognition and reward for efficiency can go to the commission with a plan—for example, a sliding scale. The way is opened by law for the company to take the initiative.

Other states have similar clauses in their public service laws, such as Arizona, California, Idaho, Maryland, New York, Ohio and Wisconsin. Massachusetts also, through a special act, allows a sliding scale in the case of the Boston Consolidated Gas Company.

From the states mentioned it can be seen how widely the idea of rewarding ably managed utilities has found expression. Of these states Arizona, Idaho, California and Wisconsin say specifically that their commissions have the right to revoke at any time any plan of this character, even though the plan has been approved by them for a fixed period. In New York and Ohio, when a plan has been approved, the commissions apparently have not clearly the right to revoke such a plan till the end of the period for which it has been set. However, even where the right to revoke is not definitely incorporated in the law, it is not unlikely that a way would be found whereby the commission would revoke if it saw fit to do so.

Good Faith of Commission

The protection for a utility whose plan had been approved lies in the good faith of the commission in carrying out its agreement, and this in the writer's opinion is a real protection. It cannot be assumed that a company and a commission would have settled hastily upon any such plan or agreed to it until their best thought and careful analysis had been given to it. The good judgment, as well as the good faith of a commission, could be seriously questioned if, after giving approval to run for a certain period, it should revoke this approval before the end of the period. Commissions were created for the protection both of public service companies and the public and it is doubtful if reasonable men on either side of a controversy really question the good intentions or impartiality of commissions.

Where a method to reward ably managed utilities is not incorporated in the law of a state it is implied, generally speaking, for every utility is entitled by law to a just and reasonable return for service rendered, and it would be proper for a commission to recommend, if necessary, an amendment to an existing act permitting the adoption of a plan to reward able management, which was the purpose of the application for a trial period of the so-called London sliding scale to the Boston Consolidated Gas Company.

Of course able management, in the eyes of the public and interpreted by commissions, means lower rates and improved service, which are proper if no injustice is worked on the company. The latter is expected to take the initiative and present the plan whereby its ability to lower rates and give good service may be rewarded equitably through its state commission. In this event the company co-operates with the commission to lower rates. In other words, the interested parties would always work for the same ends instead of sometimes trying to block each other.

It was in 1906 that a special committee, consisting of the Board of Gas and Electric Light Commissioners and two others appointed by the Governor, was created by the Legislature of Massachusetts to study the London sliding scale. As a result the Legislature passed a law, although the commission did not agree, allowing this plan to be applied to the Boston Consolidated Gas Company. Apparently one of the reasons why the Massachusetts commission was loath to approve the act was on account of the interference with its regular functions, for during the existence of the ten-year period the regulation of the Boston company has been carried out in accordance with the special law, putting it out of the ordinary control of the commission.

The procedure in the case of the other states noted above is much simpler, for the laws creating their commissions provide a definite method. The company may work out a system of rates subject to automatic adjustment in relation to dividends, or, if desired, another plan whereby the company may be allowed to participate in the economies and efficiencies which able management effects. A way is opened for a company that has confidence in its management; if, for example, it believes that a new power plant or new lines will improve service and lower costs it can go to the commission and ask that it be permitted to share in the economies anticipated from this expenditure. To be sure, the company is taking risks by assuming heavier obligations. Under present conditions of regulation the company, generally speaking, will be no better off than it is at present, for if higher dividends were earned their payment would not be permitted.

The stockholders of a utility and the consumers may be considered as partners; and as partners both should share in reasonable proportion in the results of the brains and achievements of the executives of the utility. One company may be able to sell energy for lighting service at an average of 6 cents per kilowatt-hour, while a nearby company operating under similar circumstances will be forced to sell for 7 cents. In the case of the former company such a difference might easily be due to better service, lower costs, more business and other matters, largely managerial, enabling it to offer lower rates. The company selling for 7 cents could very likely effect the same results and offer the 6-cent rate if the stockholders felt it worth while to procure a first-class manager and back him up by spending money for rehabilitation. But they argue.

*This is the second article by the author on this subject. The first article was published in the Electrical World for Nov. 4, 1916, page 902.

"We are getting 6 per cent on our investment as it is, so why take chances by adding to our obligations when at best we will not be able to pay higher dividends and will be no better off than at present; at worst there may be miscalculation in design or estimates of future costs and we will be out of pocket."

With little stretch of the imagination the company which is able to sell for 6 cents per kilowatt-hour could be considered under existing regulation as having reached the limit of its possible expenditure from its viewpoint. This company might also go further in the way of improvements and reduction of rates, but, like the company now selling at 7 cents, it is not willing to run the risks of further investment when the present investment pays 6 per cent. Likewise the stockholders cannot see the advantage of adding to their obligations when their net returns will not increase and, due to miscalculations and errors in judgment or to increased costs of materials and labor, it may be that net earnings will be less.

Would an individual knowingly add to his obligations when such action would neither increase his net income nor add to his security?

In states where the way is open for a utility to present a plan to the commission for paying higher dividends as a reward for economies it might be advisable in many cases to take advantage of this opportunity with the view of not only adding to its net income, but also of stabilizing its public relations for a fixed period. As pointed out in a recent editorial in the ELECTRICAL WORLD, this is reason enough to find favor with operating men.

WHERE NEW INVESTMENT INCREASES PROFITS

The writer is familiar with the operation of a small electric company serving about 10,000 people. The cost of generating is approximately 1.5 cents per kilowatt-hour, the total business running not over 300,000 kw.-hr. There has never been an active campaign for new business, although there are splendid possibilities. The average rate for all energy is about 5 cents per kilowatt-hour and the company pays 5 per cent dividends.

If this property would spend $75,000 for a good power plant and distributing system, adding about one-third to the investment, it could cut costs and losses to such an extent that dividends of 7 per cent could be paid on the basis of the present output. Then by lowering rates and going hard after new business the output could be doubled within a year and 10 per cent net earned.

This is entirely possible, and careful estimates have checked it closely, but the owners of the property are conservative. They say frankly that they are afraid regulation will force a reduction in rates and they will not make an additional investment; further that they are getting some return on the investment, even though it is low, and they are not going to gamble on spending money. Who suffers? Primarily the members of the community, who might be getting better service at less cost; secondarily, the stockholders of the company, who might be getting a higher return on the investment.

This situation, which is a common one with utilities, brings the company to the point where it should present a "reward for able management plan" to the commission. In this event the utility and commission would work toward the same end—lower rates. If the utility, as at present, will not assume the financing to attain the results, neither it nor the public is benefited.

At present the Dallas Electric Company is taking up with the people of Dallas a new franchise offering rates based on a sliding scale. Likewise the Peoples Gas Light & Coke Company of Chicago is conferring with the city on a plan whereby consumers and stockholders will share in the profits. These are additional indications that the idea of rewarding able management is gaining recognition. If these companies and municipalities get together it is to be hoped that the state commissions will give their approval, assuming that the plans as submitted are sound, which, to judge from descriptions in magazines, they undoubtedly are.

Should not a commission be disposed to co-operate with a company to serve the public in this way?

In public hearings the good name and good intentions of a company are apt to be questioned, no matter how cleanly it may be managed, so that naturally utilities are usually unwilling to present any new plan to a public body involving such a radical change in rates as a sliding scale system. However, situations are arising where it would be timely to bring forward such a plan.

For example, in face of a threatened rate case it would be more economical for the public, the company and the commission to settle it without a long fight. A sound scheme presented at such a time, whereby a certain reduction in rates would be granted provided further reductions should permit higher dividends, might end the case in short order and promise stable relations for a term of years.

Again, a company might have passed very recently through a rate controversy, which always proves costly to the contestants. To stabilize future relations, a point which would be much appreciated, particularly at such a time, the company could present a plan to share with the public in future economies.

A third situation for timely action would be, as pointed out above, when the utility is reaching the limit of its power plant and distributing system, or have adequate though inefficient plant and distribution. In both instances the possible economies in operating costs, due to new investment, could be estimated closely. The public would benefit by lowered rates and the company by higher dividends, allowable if earned.

Within certain limits the benefits of a plan as suggested are cumulative. The more business a company acquires the lower the rates will likely be, both company and consumers working together. Industrial plants and individuals alike that contract for central station service can feel that by so doing they are benefiting the entire community, and that they in turn will benefit as additional business is acquired. This is somewhat like the situation in St. Louis and Milwaukee, where the electric companies are offering lower rates as the number of consumers increases.

DEFINITE ADVANTAGES

To summarize the advantages of a reward for able management plan, to the public, to the commission and to the utility:

1. The advantages to the public.
   a. Lower rates by a definite program.
   b. Better service.
   c. Less agitation and unrest in its relation with the company.
   d. Lessened need for expensive professional services necessary in contests with utilities before commissions.
2. The advantages to the company.
   a. Stable public relations for a fixed period.
   b. Co-operation with the commission instead of antagonism.
   c. Higher dividends allowed if earned.
3. The advantages to the commission.
   a. A definite policy.
   b. Tangible relations with the utility.
   c. The actual accomplishment of results for its clients—the public and the utility.
   d. Co-operation instead of antagonism on the part of the utility.

RECORDING WATTS AND VOLT-AMPERES SIMULTANEOUSLY

Construction and Operation of a Combined Graphic Wattmeter and Volt-Ampere Meter Developed in the Meter Department of a Central Station

BY HENRY H. LYON
Buffalo General Electric Company

A motor-driven, graphic-recording meter designed to give simultaneous graphic records of both watts and volt-amperes in a polyphase circuit has been developed by the writer and built in the meter department of the Buffalo General Electric Company. In general, the apparatus consists of a wattmeter, a reactive-component meter, a record sheet and a pulley-driven shaft connected through bevel gears with another shaft, each of which carries two magnetically operated friction clutches that drive worm screws. A 1/20-hp. induction motor, belted to the driving pulley, furnishes all the power required.

The electrical measuring elements are of the Kelvin balance type (Westinghouse graphic meter parts being used) so connected to the circuit through transformers

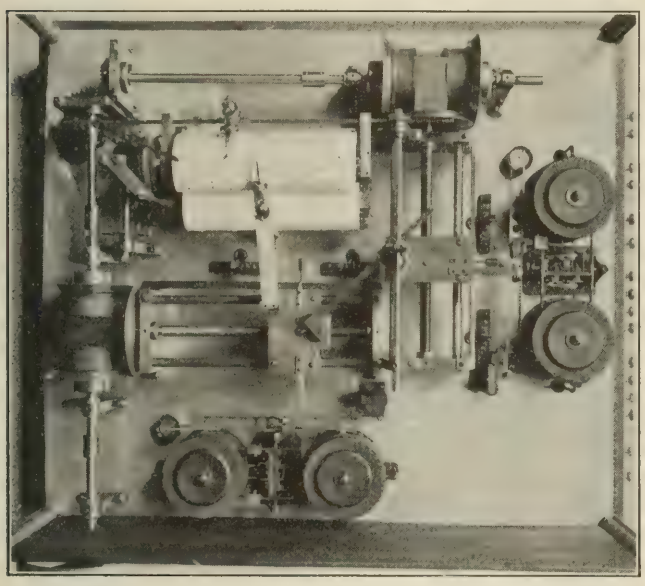


FIG. 1—TOP VIEW OF COMBINED WATTMETER AND VOLT-AMPERE METER

as to be actuated in accordance with the true watts and the reactive component of the power circuit.

Referring to Fig. 1, the shaft shown at the left and the one at the top rotate continuously driving the beveled disks which are rigidly mounted on the shafts. When one of the electromagnets is energized the corresponding disk is drawn into contact with the disk mounted at right angles to it on the end of the worm-screw shaft, and rolling friction between the disks causes the screw shaft to rotate, the direction depending on which disks are in contact. The electromagnets on the left-hand shaft are energized by a contactor on the wattmeter which is at the bottom and the magnets on the top shaft by the reactive-component meter at the right.

Each worm shaft slides a brass carriage along guide rods. Attached to each carriage is an arm which moves a rolling weight along a small channel iron connected to the movable coil of its respective meter. Thus the carriage will assume a position where the rolling weight balances the torque of the meter, as under this condition the contacts are opened and the magnets de-energized. Screwed on the rod connecting the rolling weight with the arm is a smaller weight which is used to calibrate the meter.

Since the carriage at the left travels a distance proportional to the true watts in the circuit and the other carriage travels at right angles to this, a distance proportional to the reactive component in the circuit, the distance between certain fixed points on the carriages

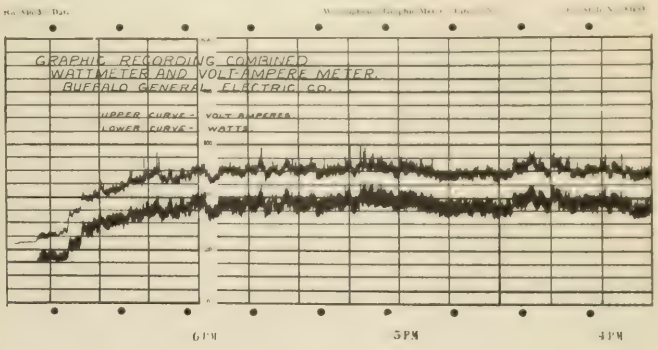


FIG. 2—GRAPHIC RECORD FROM THE METER

will be the hypotenuse of a right triangle and proportional to the volt-amperes in the circuit. A graphic record of this distance is obtained as follows: On the carriage at the left is mounted a non-rotatable pinion and on the other carriage is mounted a freely rotatable pinion. Held in mesh with the pinions, as shown, is a toothed rack. On the same shaft with the rotatable pinion and rigidly connected to it is a bevel gear which meshes with another bevel gear mounted on a square shaft so that it will slide along it as the right-hand carriage moves. The square shaft drives a toothed rack, carrying a pen which records the volt-amperes on the chart.

As the carriages move apart the rotatable pinion will be rotated by the toothed rack and turned a distance equal to the distance between the centers of the two pinions. Through the interconnected gearing the toothed rack is driven forward, a distance equal to the hypotenuse of the right triangle and therefore the pen attached travels across the chart a distance proportional to the volt-amperes in the circuit. A similar pen, mounted on the left-hand carriage, at the same time travels over the chart a distance proportional to the true watts. Circuit breakers are arranged to open the control magnet circuits, and prevent excessive travel of the carriages due to overload or other causes. One circuit breaker is arranged to open two control circuit magnets, and limit the travel of the upper pen, as this could be driven over the edge of the scale without either

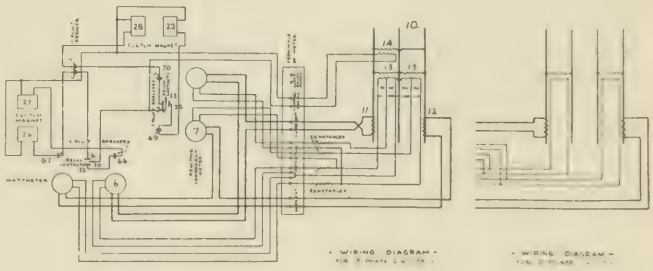


FIG. 3—DIAGRAMS FOR TWO-PHASE AND THREE-PHASE CIRCUITS

carriage having reached its limit of travel. The paper drum and the rewind roll is driven by the shaft at the extreme left. A relay operated by a contact-making clock causes an arm to punch small holes at the edge of the chart at regular intervals of time, thus giving an accurate indication of the time of the record and a check on the speed of the motor.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

SELECTION OF INSULATORS

How Problems in Transmission Line Economics Are Being Analyzed for Operating Conditions in Minnesota

BY LINCOLN NISSLEY
Constructing Engineer, H. M. Byllesby & Company

One of the principal problems in transmission-line design is the selection of insulators for a particular service. Cheapness in first cost should not be the governing factor as maintenance and renewals, and the results of interruptions to service from insulator breakdown may more than offset any saving made in the initial investment. On the other hand it is usually advisable to pay the limit in initial cost of insulation for important lines of a system, rather than insulate only for normal conditions, as these are often exceeded. Conditions which may be given a numerical value may be taken into account in determining the relative values of insulators by the following formula:

$$Y_n' = \frac{(C - C_l)\, d_l\, W_n + (C - C_a)\, d_a\, (W_n' - W_n)}{A_n' + Cr + O + M}.$$

Where A = fractional life at the end of period of service
n = number of whole years
n' = period of service
L = life of insulator
C = first cost of insulator
C_a = salvage value at age A
C_l = salvage value at end of life
d_a = annual deposit in sinking fund to redeem \$1 at the end of A years
d_l = annual deposit in sinking fund to redeem \$1 at the end of L years
W_n = present worth of \$1 per year for n years
W_n' = present worth of \$1 per year for n' years
A_n' = annuity produced for n' years \$1 principal
r = ratio of yearly interest and other fixed charges to first cost
O = yearly cost of operation
M = yearly cost of maintenance

Other data have a recognized bearing on the economic selection of insulators, but these cannot be expressed in dollars and cents. They are obtained by analyzing the performance of existing lines or studying the service given by different types of insulators installed to operate under similar conditions. Among the factors which should be considered are the causes of insulators failing, effect of ground wires, possibility of direction of line affecting insulator requirement, changes of stresses with weather conditions, probability of direct and indirect disturbance from lightning strokes, etc.

Although ground wires are in disfavor with some engineers the Byllesby companies still adhere to using them since experience in Minnesota has proved that they afford some protection. In that state, due to level topography, the clouds float relatively low, so the lightning discharges to earth are much shorter than in hilly or mountainous country. From over 2000 observations made in the districts covered by the Byllesby system, the storm clouds were about 800 ft. above the ground. Owing to the low elevation above sea level (700 ft.), corona problems could be neglected since the loss therefrom is relatively small as compared with that in higher altitudes. By more than 1000 observations on right-of-ways and according to the law of probabilities the percentage of direct lightning strokes on the line was found to be very small—less than one-fifth of 1 per cent. Where lightning has been the cause of interruptions to service, it has usually been found that the lightning struck 400 to 500 ft. away and that the line disturbance was caused by induction. Studies are now being made to determine why one of the transmission lines running 35 miles north and south is practically free from interruptions while other lines constructed in the same manner but running east and west and southwest give more trouble. It is peculiar to note that the line giving the least trouble runs across glacial moraines and attains the highest elevations of any of the circuits operated by the company.

Possible Serious Results When Fuses Fail to Blow

BY E. C. PARHAM

If the fuses of an induction motor are too heavy, they will afford no protection against the abuse of protracted overload. If they are too light, they will blow so often as to interfere with production, because appreciable time is required to tell which fuse or which fuses, of several, are blown in order to replace the blown ones and to again place the motor into operation. Where only fuses are used, their rating should be such that they will blow if the compensator is very carelessly handled. This means that their rating should be selected to suit the load that the motor actually handles and not the load that it could handle. Assuming that the minimum convenient rating of a fuse has been experimentally determined for existing load conditions, then if the load should increase on account of hot boxes, of tight belts or of rubbing rotor, there is more probability that an increase in the frequency of the fuse blowings would suggest an irregularity which could be sought and removed before serious damage could result. If an operator knows that a fuse will blow when he fails to give the motor a fair chance on the starting side of the compensator, he is more apt than otherwise to give it a fair chance.

In one case a three-phase, 20-hp., 220-volt induction motor had its rotor down on the stator three times in three months on account of hot bearings due to the use of an inferior quality of oil. After the third failure, it was necessary to rewind the stator because the rotor had ground through the stator teeth into the stator coils. The point of interest here is that in none of the failures had a fuse blown until the rotor was actually stalled by the friction between itself and the stator. This was indicated by the fact that in each case the inertia of the connected machine, had peeled the belt almost off at the time that the fuse acted.

An investigation disclosed that the operator had become tired of paying for protection in the form of standard fuses and had adopted the practice of refilling the old cartridges with copper wire of any size that happened to be available, provided that it was heavy enough. He stated that the original fuses were a nuisance because one or more of them would blow every three or four days. It is probable that the fuses were a little light for his conditions, for the voltage was about 15 per cent high; but if he had increased their

capacity, a few amperes instead of a few hundred amperes, the chances are that the more frequent blowings that would have characterized the increased load condition due to heated bearings, would have been a warning that something was wrong. Then, if he was unable to find out what was wrong, it would have been in order to call for some one who could.

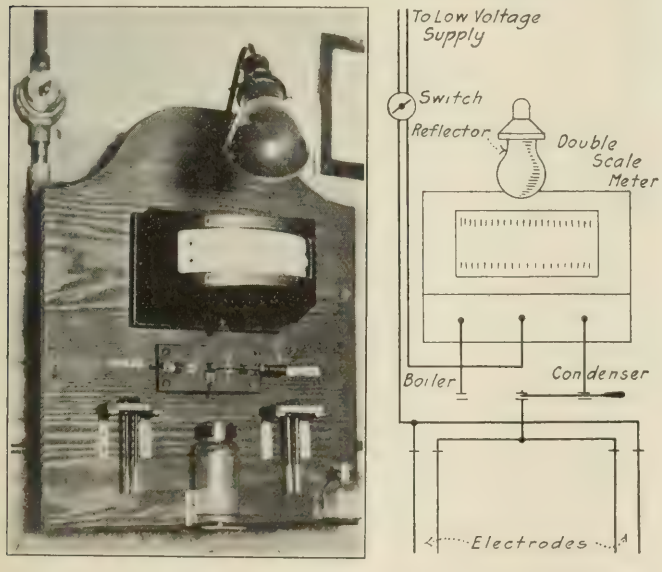
CHECKING CONDENSERS FOR SALT LEAKS AND BOILERS FOR CHANGING WATER

Electrical Method of Determining Density of Condensate and Boiler Water and Frequency of Emptying, Filling and Blowing Boilers

BY CLAUDE CHARLES BROWN

Whenever sea water is used as a cooling medium in condensers there is usually difficulty in keeping the condensers free from leaks that allow the salt water to get into the condensate. Should this impure water get into boiler feed water in any great quantities corrosion with its dangerous results may occur and dense scale may be deposited. These evils are especially liable to be emphasized if the boilers operate at overrating. As titration and chromate tests for leakage have not been found satisfactory at the Station A of the Pacific Gas & Electric Company, San Francisco, where Charles A. Eastwood is superintendent, an electrical test has been developed whereby the amount of salt in condensate, feedwater and boiler water can be found exactly and quickly.

The apparatus consists of a sample measure, test bottle and two sets of electrodes connected in series with a double-scale milliammeter by a single-pole double-throw switch. One set of electrodes is for testing boiler water and the other for condensate. The upper scale of the milliammeter used in testing the condensate has a range of 0 to 6 grains of salt per gallon while the lower scale



FIGS. 1 AND 2—APPARATUS FOR TESTING SALINITY OF BOILER WATER WITH DIAGRAM OF ELECTRICAL CONNECTIONS

used in conjunction with the boiler-water electrodes has a range of 6 grains per gallon to the density of sea water.

To test boiler water, the small measuring bottle is filled with a sample and emptied into the test bottle which is then brought up under the boiler-water electrodes until they touch the bottom. The single-pole switch is thrown to the left position marked "boiler" and the lower scale of the meter read. Condensate is tested similarly but with the "condenser" electrodes, and the switch reversed so as to read the upper scale.

Over the range of conditions tested—0 to 300 grains of salt per gallon—the meter reading is approximately proportional to the salinity of the sample provided the same immersion of the electrodes and the same voltage across the terminals of the apparatus is assured. The

PACIFIC GAS AND ELECTRIC CO.
CONDENSER SATURATION REPORT

STATION "A" DATE.....

GRAINS SALT PER GALLON

TIME	No 5	No 6	No 7	EXCITER	REMARKS
1 A. M.					
2					
3					
4					
5					
6					
7					
8					

FIG. 3—FORM ON WHICH RESULTS OF TEST ARE RECORDED

latter condition is assured as mentioned previously by placing a definite quantity of the sample in the test bottle. Since the scales were calibrated by means of solutions whose density had been tested chemically, the instrument will give readings within 5 per cent of accurate. Tests by this method have compared so favorably with chemical tests that all other tests have been abandoned.

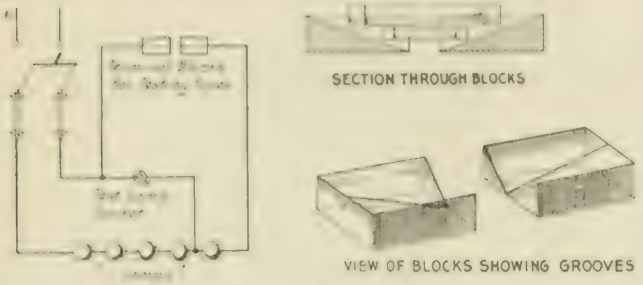
Beneficial effects have been noticed in several ways since the adoption of this method of testing. In the first place quantitative measurements instead of mere qualitative indications are obtained. As a result the boilers to empty, refill and blow down can be selected on a scientific basis instead of as before when two boilers were emptied and filled in rotation regardless of water density. Under present conditions the two boilers containing the densest water are emptied and refilled each night. The selection of boilers to blow down is made in the same manner, about two gages of water being discharged. With the old qualitative tests it was a matter of guesswork whether to "put a condenser on the sewer," when to reconnect it to the feed line, when to "plug" or repack the condenser tubes, whether leak repairs were effective, etc. The definiteness of the present tests eliminates all guesswork, however, so less scale is deposited, less tube cleaning and repairing are required, less fuel has to be burned per pound of steam generated, and less water and absorbed heat are wasted. Some idea of the amount of improvement permitted by the use of the present test and method of changing water can be gained from the fact that the average density of the boiler water has been reduced from 250 to 50 grains of salt per gallon of water.

Graphical Presentation of Conductor Properties

In using the chart which supplemented the article entitled "Graphical Presentation of Conductor Properties" (Feb. 10 issue of the ELECTRICAL WORLD, page 269), it should be noted that the length of copper wire in meters per kilogram must be obtained by using curve 22, the resistance in ohms per foot by using curve 18, and the weight in kilograms per ohm by using curves 12 and 30. The "key to chart" should be corrected accordingly.

Special Contacts for Testing Continuity of Fuses and Lamps

Contact blocks by means of which fuses of different lengths may be tested for continuity are shown in the accompanying illustrations. The blocks contain slanting V-grooves to accommodate fuses of various sizes, and also to protect the operator from electrical contact. Two blocks are so placed in the testing circuit that the smallest fuse can just span the distance between them.



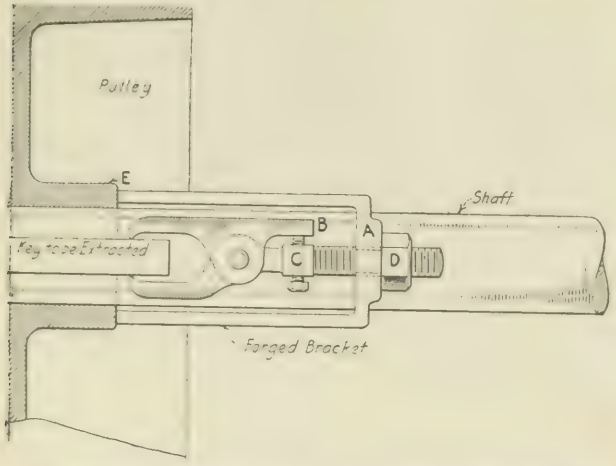
SAFE CONTACT BLOCKS FOR TESTING FUSES OF VARIOUS LENGTHS

Larger fuses make contact nearer the opposite ends of the blocks. With this arrangement the middle point of the fuse held in the operator's fingers is remote from the bottom of the groove, thus insuring greater safety. The terminal blocks and an old-style, threadless socket, into which lamps to be tested can be quickly pressed, are mounted on a slate base with the other apparatus.

Simple Arrangements for Extracting Tight Fitting Pulley Keys

BY EMILE PILPEL

The writer has found the device shown in the accompanying illustration useful when removing pulleys that are tightly fitted and unaccessible from the inner side. Such cases are found frequently on line shafts having loose and fast pulleys, on spiders of electric motors, motor-generator sets, etc. The apparatus consists of

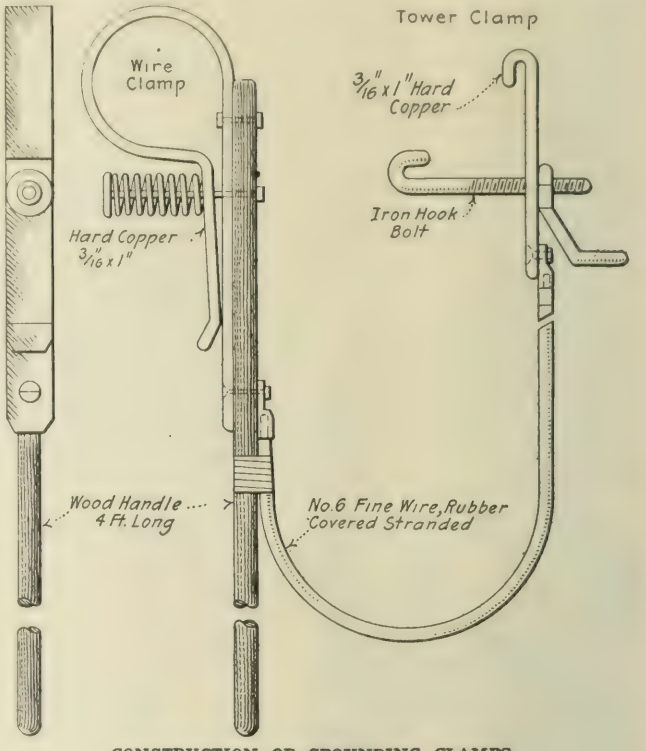


DEVICE FOR PULLING KEYS FROM MOTOR PULLEYS

one inverted U-shaped forge bracket *A* lying very closely to the shaft towards the key to be extracted and pressing against the boss of the pulley *E*. After making an incision with a cold chisel the tongues *B* are placed so as to grip tightly the key at the incision thus made. This grip is held by means of the set screw *C*. Finally by aid of a wrench the legs of bracket *A* are forced against the boss of the pulley by screwing down nut *D*, when gradually the key will give way. A 1-in. machine screw with an extra wide nut will be found satisfactory for the construction shown in the illustration, in most cases.

Scheme for Grounding Circuits to Make Repair Work Safe

Two simple devices which are illustrated herewith have been developed by F. A. Whiting of the Connecticut Power Company for grounding apparatus or conductors preparatory to working on them. The clamps are particularly adopted to conditions which would be met on steel-tower transmission lines but may be used also in stations. The smaller of the two devices is for attaching the grounding cable to grounded structural steel such as tower legs while the larger device which is connected with the other end of the grounding cable is for slipping over the circuit to be worked on. The former consists of a strip of hard copper with one



CONSTRUCTION OF GROUNDING CLAMPS

end bent back on itself so as to fit over an angle iron. Near the other end is a hole through which passes a threaded rod having one end bent back on itself to form a shoulder. Screwed on the rod is a tapped lever.

The conductor clamp which is provided with a seasoned hardwood handle consists of a curved strip of spring metal, one end being permanently attached to this handle and the other free to move but pressed against the former by a helical spring. The latter is coiled around a bolt passing through both ends of the spring strip.

Six pairs of these clamps connected by cables are kept in each line patrolman's booth on the Connecticut Power Company's system to permit grounding the three conductors of a three-phase circuit on each side of the section to be worked on. The tower clamps are attached to the tower legs first. Then, after the line has been "killed," the conductor clamps are slipped over the conductors. The wooden handle of this device attached as shown in the illustration gives ample protection from static and inductive charges.

Flood-Lighting a Dark Corner in a Substation

A dark section in the Greensboro (N. C.) substation of the Southern Power Company is lighted by means of an old automobile headlight in which is placed a 60-watt tungsten lamp. This section, which is at one end of the station, was built without ceiling or wall lights. At this point a number of oil switches are installed and the numerous leads from them make it difficult to place lights in advantageous positions. To enable the operator to go among the switches when necessary at night the automobile lamp was mounted by means of its bracket on a switchboard near the dark section. This gives good illumination directly in front of the lamp, which may be revolved to light any portion of the dark section. H. L. Alderman, division superintendent of the company, who originated the idea intends to install several more of these lights so as to keep the entire section properly illuminated at all times.

Collapsible Cable Splicers' Platform Designed for Easy Handling

A platform which has been found convenient for cable splicers working on overhead construction has been recently developed by the Commonwealth Edison Company of Chicago. The construction is shown in the accompanying illustration. It consists of a compact platform 42 in. square made of 0.75-in. boards nailed to two 1-in. by 4-in. end pieces. At each corner of the floor is bolted a 1-in. by 4-in. pipe flange. One-inch holes are bored in the floor to coincide with the center holes in each pipe flange. From these flanges four pieces of 0.75-in. pipe rise vertically to form the supports for a rope railing which runs around the platform at a height of 30 in. above the floor. The rope at the

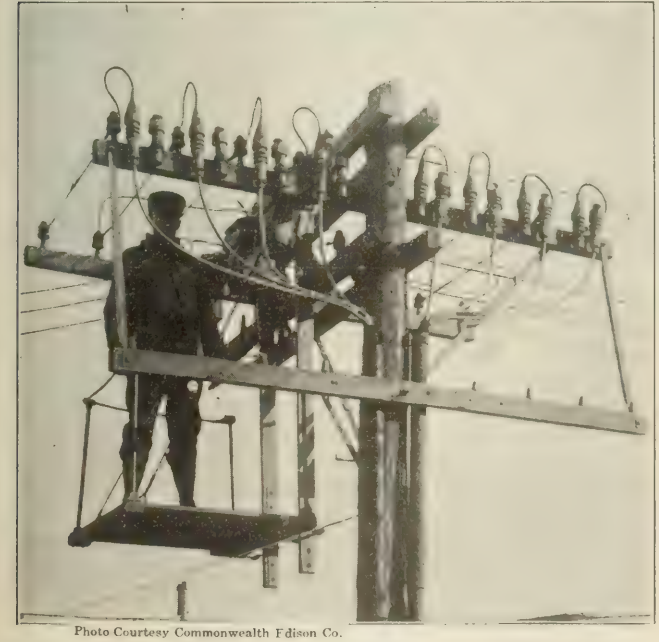


Photo Courtesy Commonwealth Edison Co.

FIG. 1—PLATFORM MOUNTED ON CABLE POLE SHOWING RELATIVE POSITIONS OF UPRIGHT AND FLOOR

top of these pipes is passed through tees, from which the threads have been cut to make them smooth. These upright pieces of pipe are so arranged that when they are lifted they become partially disengaged from the pipe flanges and can be laid over flat against the floor. They cannot, however, be detached entirely from the platform. Under the platform are bolted four eye bars, which are used to fasten the floor to the supports. This type of construction permits a platform and railing, which occupies a space 42 in. by 42 in. by 30 in. when it is set up, and can be packed quickly and conveniently in a space 42 in. by 42 in. by 3 in. The platform completely equipped weighs less than 100 lb.

The method of swinging this platform from a pole is

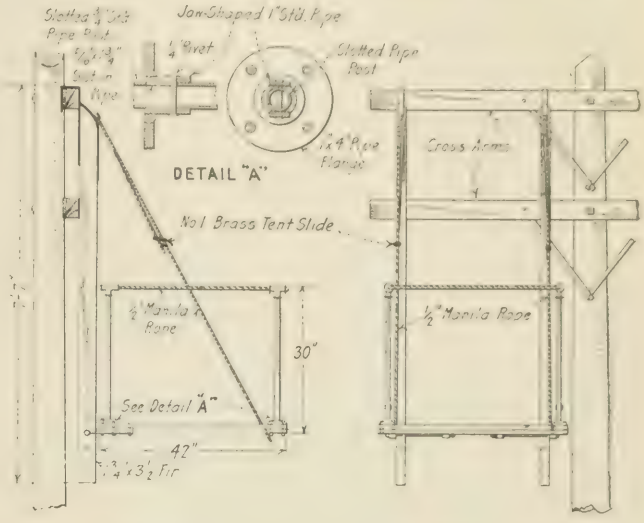


FIG. 2—CONSTRUCTION OF A CABLE SPLICER'S PLATFORM

interesting. Two vertical supporting pieces which consist of forged 0.5-in. iron hangers bolted to 1.75-in. by 3.5-in. pieces of dressed fir 7 ft. 2 in. long, are first drawn up the pole and suspended from the top crossarm. These two pieces are bored to receive a ⅝-in. bolt at several places near their lower ends. They weigh about 20 lb. and can be easily drawn up by a hand line. The line can then be attached to the edge of the platform, and when it is raised to the level of the ⅝-in. holes the protruding eye bars on the edge of the platform can be bolted to the fir pieces. The platform can then be swung out into a horizontal plane and suspended there by means of 0.5-in. ropes which fasten to hooks on the forged hangers. These ropes may be adjusted by means of brass tent slides to make the platform stand in a horizontal plane. With this rope adjustment and the variation in height which is made available by the several holes in the fir pieces, it is possible to place the platform in almost any position that the workmen desire.

An Inexpensive and Accurate System Map

The Utica (N. Y.) Gas & Electric Company, which, in addition to its steam plants operates several interconnected hydroelectric stations that draw from different drainage basins, is using a map of its system made in a novel manner. It consists of United States Geological Survey maps fitted together to show on a large scale the territory covered by the company. Since these maps originally had contours and other physical characteristics of the country plotted accurately on them, it required very little labor to map out and measure the drainage area tributary to each plant, to lay out transmission-line routes and to place any other useful markings in their proper locations.

Aside from being very accurate, a map made in this fashion has the additional advantage of being inexpensive. The sections can be obtained from the United States Geological Survey at Washington, D. C., for 5 cents each for those sections of the country in which the Geological Survey has completed its work.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

DEVELOPING AN ELECTRIC-COOKING LOAD IN SMALL TOWNS

Why an Illinois Company Decided to Sell Ranges—And How Interest in Electric Cooking Was Stimulated

The reasons for making the electric-range business the subject of a special drive in the territories of the Illinois Northern Utilities Company may be summarized as follows: First, electric cooking was seen as one means of substantially increasing the revenue in already served and fairly well saturated territory. In the smaller of the company's many towns where no gas service is available and where electric cooking has been most actively pushed, the electric revenue per capita, excluding merchandise sales, ranged from $3.50 to $10.



THE ARRIVAL OF A CAR-LOAD SHIPMENT OF RANGES WAS MADE THE OCCASION FOR AN ADVERTISING DEMONSTRATION

An opportunity was seen materially to increase this figure since some experience has demonstrated that the average cooking customer consumes about seven times as much energy and returns about twice as much revenue as the average lighting customer. To this, of course, was to be added the merchandising profit.

Second, it was thought that the system load factor of the small interconnected towns would be bettered by electric cooking. From what was known of load conditions in the communities the companies' engineers concluded that the range load would be entirely off peak in the summer and largely off peak in the winter, since the maximum demand of these towns occurred in the early evening.

Third, other advantages were recognized in that circuits carrying electric ranges must have good service. On lines used for electric cooking, voltage regulation and service continuity must be maintained better than for ordinary lighting to avoid complaints. It was, therefore, figured that the installation of ranges in these scattered communities afforded a definite check on the activities of the many local operating departments. It is probable that before long extensive repairs on circuits carrying ranges will have to be made early Sunday morning, since that is about the only time the circuits are not in use.

In this territory the electric range had all kinds of competition to meet. The cities ranged in size from 100 to 20,000 population. The larger towns, of course, had gas. In all the communities other fuel prices were reasonable. Coal was $3 a ton, gasoline was 22 cents a gallon, kerosene was 10 cents a gallon, and wood was not used much for fuel. The electric cooking rate on which the campaign was started brought electricity to the consumer at about 3.25 cents net per kilowatt-hour.

Following the line of least resistance the towns where gas is not available have been attacked first. The first effort in each case has been to sell the ranges outright; for the range installed the customer is asked the list price of the range; but if a prospective customer wishes to purchase a range, but expresses doubt as to its real ability to cook, or as to its using only a moderate quantity of electricity, he is offered a range on fifteen days' free trial. The only expenses the customer agrees to incur for the trial are the cost of energy used and $4 partially to cover the installation cost. If he accepts the range, however, he pays merely the list price of the range in ten equal monthly installments. Five per cent is deducted for cash.

Getting the ranges and the companies' offer before the people favorably has been a job that has called forth the ingenuity of the sales manager. Of his efforts in the campaign of last year, C. B. Yonts of Dixon said:

"In starting a campaign in a town we place an ad in the local newspaper. It states when and where we will hold demonstrations. For these affairs we have generally rented a ground-floor room in the business district. Later we distribute hand bills and at the same time have salesmen make a house-to-house canvass and invite the housewives to attend our demonstration. At every demonstration we succeeded in getting a number

of the ladies to bring their bakings; our demonstrator baked whatever they brought. The salesman was there to take orders for ranges.

"One of the stunts which proves successful in making the sale of a range is that of putting out an ovenette with each electric range. In many instances a customer would want to do just a little baking, such as a few potatoes, a pan of biscuits, a pie or cake, or even a small roast; the ovenette saved heating the range over for this purpose. The cost of the energy consumed with this ovenette was small compared with that used by the large oven for a little baking.

"When we learned we could buy in carload lots, we worked another advertising stunt that proved well worth while. We would order a carload of ranges shipped to the city in which the district office was located. The car would be placarded 'Electric Ranges for Ogle County, Illinois Northern Utilities Company.' The ranges for this town would be loaded on trucks and hauled about town. Boys with trumpets on the trucks made enough noise to attract the attention of everyone to what was going on. Placards on the trucks and hand bills told the story. The freight car would then be forwarded to the next town and the performance would be repeated. This was one of the cheapest and best advertising methods we used.

"In one particular town we did some pioneering three years ago that has netted results. When the cooking rate was 5 cents we sold one range in that town. In the following year when the rate dropped to 4 cents we sold fourteen ranges by referring to that particular installation. This year when the rate dropped to an average of 3.25 cents, we sold eleven ranges during the first canvass and doubled that figure before the end of the summer season.

"But the real success of the electric cooking business depends on properly educating range customers. Evidence of our success in this regard is to be seen in the customers' bills. It is no uncommon thing for customers who have had the services of a demonstrator on the first and second day the range is installed to have bills as low as 80 kw.-hr. a month. Without this educational service at first their bills would run above 100 kw.-hr. The demonstrator, besides giving verbal instructions, leaves printed rules with the housewife. This prevents the customer from forgetting what she has been told and shown. Since the rate was reduced to 3.25 cents the Illinois Northern Utilities Company has sold 200 ranges."

POINTS ON CUSTOMER'S CONTRACTS

Information for the Manager of the Central Station that Sells Motors to Power Customers

The function of a contract is to reduce the terms of an agreement to writing and to prevent future misunderstanding between the parties of that agreement. In an address before the district managers of the Texas Power & Light Company at Dallas, Tex., Hartwell Jalonick, commercial manager of that company, pointed out the importance of having signatures and equipment details of central station contracts absolutely explicit and accurate.

The central station rarely finds it necessary to enforce a contract with a customer, said Mr. Jalonick. Especially is this the case in connection with service contracts. Owing, however, to the fact that many central stations are now handling considerable quantities of machinery which are sold to customers, it is important that the apparatus contracts covering the sale of this equipment should be correct to such an extent that there will be no chance of the company suffering loss on the account of an unfaithful customer.

A very important point and one which is often overlooked, is that the signature to a contract must agree with the name first written in the contract. If a contract is taken with "Smith & Company" and signed simply "J. F. Smith," the point would at once arise, in case the matter should be brought into court, whether the contract was with an individual or with a corporation. Such a contract should be signed

Smith & Company
By J. F. Smith, Pres.

or in a similar manner by some other known executive.

Another important point is to make clear whether the party with whom the contract is being taken is a corporation or an individual. If the company is a corporation, a good form to use is,

Farmers Cotton Oil Company
A Texas Corporation.

Or if it is a partnership,

John Smith and John Jones, a co-partnership doing business under the firm name or Jones & Smith.

If it is an individual operating under a business name, then describe him as

John Jones, doing business as Farmers Cotton Oil Company

In obtaining a signature such as is shown above (Smith & Company) the firm name should always appear first in order that no question may arise as to whether the contract is with the company. If it is signed

J. F. Smith, President, Smith & Company

it might be construed as a contract with the individual, J. F. Smith, the firm name having been added in order to identify Mr. Smith.

In cases of partnerships it is well to have the contract signed by both parties as

Smith & Jones
John Smith
John Jones

If there is a manager and you know that the manager is authorized, then the contract could be signed

Smith & Jones
By John Jones, Manager.

The former practice, however, is the better.

Another important point in connection with equipment contracts is the location of the customer to whom the equipment has been sold. This location is important since the company cannot exercise the privilege of lien as specified in the contract unless the location is known and the place of residence of the party or company who signs the contract is clearly stated on the face of the contract.

Furthermore, when equipment is sold on time, there should be something in the contract which will absolutely tie the equipment or identify it as belonging to the company. It is not necessary in such cases to have a tag placed on all equipment stating that the apparatus is the property of the company, but the equipment should be described very fully as:

One 75-hp., 2200-volt, 1200-r.p.m., three-phase, 60-cycle, motor, complete with compensator, base and paper pulley 13 in. in diameter by 13 in. face.

and not simply as

One 75-hp., 2200-volt motor.

It is well when possible also to give the manufacturer's serial number of the motor.

In connection with installment payments, one cannot

be too definite in stating the exact time at which each installment is to be paid as:

$500 on March 1, 1917
$185 on March 1, 1918
$185 on April 1, 1918
$185 on May 1, 1918.

This is much better than saying "$500 Cash when equipment is installed, balance in three payments of $185 each, payable on the first day of each month, beginning March 1, 1918."

Provision as to the amount and payment or non-payment of interest should also be clearly set forth.

The importance of filing equipment contracts depends on the amount involved and the nature of the specific case. The advantage of filing is that by so doing the company avoids the possibility of some subsequent lien.

The final clause, "This contract supersedes all representations, promises or other inducements, written or verbal, made with respect to matters herein contained," is considered valid, and can be upheld, hence it is important that every agreement made, if of any importance, should be included in the contract. Any changes or interlineations made in the standard form of contract should be initialed or the contract re-drawn.

Rural Service Found Unprofitable by Indiana Company

BY ALEX. R. HOLLIDAY

The case affecting the monthly minimum charge of the Noblesville Heat, Light & Power Company of Noblesville, Ind., which was decided recently by the Indiana Public Service Commission, brought out the experience of this company with rural service. Authority was asked from the commission to make a new classification of rural and village customers, with separate minimum charges for each class. The commission decided to allow a minimum monthly charge of $1 for rural customers instead of the charge of 50 cents which had been made by the company previously. If the operation of the new rate during the ensuing year is unsatisfactory the company will appear before the commission again and ask for additional relief.

The company filed its petition with the commission in March, 1916. The rates charged under its existing schedule were 10 cents per kilowatt-hour for the first 25 kw.-hr., 8 cents for the second 25 kw.-hr., and 6 cents per kilowatt-hour thereafter. The minimum charge was 50 cents per month. Practically all of the rural customers had contributed from $25 to $62.50 on line construction to the company, which was refunded in energy. They had also paid for their service connections and transformers, but for these they were not reimbursed.

In its petition to the commission the company stated that the business was unprofitable, and that if it was to be extended it should be placed on a profitable footing. The actual expenses per customer are over $25 per consumer. It was considered best to increase the minimum charge instead of raising the rate for energy as the chief expense in serving the customers is overhead charges and distribution.

The company wished to define rural and village customers as "all customers living without the corporate limits of a city or town and to whose premises the company owns or shall own an electrical distribution system." A rural customer was defined as a customer who together with not more than three other customers is served by one step-down transformer, and a village customer as one who together with at least four others is served by one transformer. A minimum of $2 per month was asked for rural customers and $1 for village customers. No change was asked in rates for energy. The theory of the two classifications was that the small group of customers were served more cheaply than the isolated farmhouses.

Among the village customers was a county grain elevator on a 3-cent power rate. Eliminating this elevator, the strictly country business was analyzed as shown in the accompanying table for the year ending June 30, 1915:

Kind of Customers	Number of Customers	Number of Motors	Horsepower of Motors	Transformer Capacity	Average Kw.-Hr.	Average Revenue	Average per Kw.-Hr., Cents
Rural	145	25	34 5	163	192	$16 79	8 8
Village	74	2	4 5	36	129	13 90	10 8
Total	219	27	39	199	172	$15 85	9 2

The minimum rate increase which was asked by the company would have increased the gross revenue from $3,716 per annum to $5,086, or $1,370, equal to 37 per cent.

In a paper which was presented by the writer before the Indiana Electric Light Association on Sept. 23, 1914, discussing the results of experiences with rural customers, the statement was made "that until the customer averages nearly $3 per month he is not a paying experiment under these conditions." We still believe that this statement is true. The mistake which we have made is in believing that the rural customers could be developed to the point where they would consume energy of that value. The figures published herewith show that these customers have not reached this level. As but 4 per cent of our gross revenue is derived from this class of business, the question of whether or not the rural customer is profitable is not a controlling one. However, we have devoted more time to an interesting experiment than the revenue warrants. For the present we shall not encourage the construction of rural lines.

Strengthening Relations with the Power Consumer

A central station company operating on the Pacific Coast makes a point of "getting acquainted" with every new power consumer. So far as practicable, the industrial engineer goes over plans for every new installation and serves the customer in a small way as a consulting engineer, suggesting changes and improvements in arrangement where these seem to be called for. Even if there are no recommendations to be made, the customer still receives a call. For example: after a power salesman has closed a contract for new business and the motor is installed, he suggests to the new consumer that he would like to have the "boss" drop in to see how the new equipment is working. Accordingly, when the new apparatus is operating satisfactorily, the industrial engineer in company with the salesman calls on the new consumer and shows his interest by going over the apparatus. Ordinarily he inquires as to its operation, etc., and before leaving suggests that in putting it in service and getting it to run satisfactorily doubtless the company's engineers used up more or less current which would normally be charged on the first month's bill. The industrial engineer suggests that it would be fair to remit this to the consumer. He makes a memorandum to this effect in the customer's presence and reduces the first month's bill accordingly. This has been found invariably to make a favorable impression upon the new customer and he is again reminded of the interest shown when he receives his first monthly bill with the deduction and the explanatory note.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

INDUSTRIAL CONTROLLERS

A Discussion of Controller Design, with Particular Reference to the Control of Direct-Current Shunt Motors

AT the recent New York meeting of the American Institute of Electrical Engineers an interesting paper by H. D. James was presented on industrial controllers for direct-current shunt motors. Stating that present-day development of motors and controllers is such that former limitations as to regulation of starting current from the viewpoint of motor, controller and supply system have been largely removed, the author presented a series of tests on 15- and 20-hp., 230-volt, direct-connected shunt motors, started from rest. The motors were of two types, constant and adjustable speed. These tests were made to determine, first, the load driven by the motor; second, the power supply; third, the motor operation.

For details of the tests the results of which are given in form of a series of diagrams, the reader must be referred to the full paper in the February issue of the *Proceedings* of the American Institute of Electrical Engineers. The author's chief results are as follows: It seems unnecessary, with automatic acceleration, to use more than one switch to short-circuit the armature resistor used with small motors except where special requirements are to be met. The author believes it is practicable to use one switch with motors as large as 15 hp. for general purposes, and operates this switch by counter emf., setting the switch to close at 75 per cent of normal voltage.

If the motor field is zero, or has a small value, when the line switch is closed, the starting torque is also zero or has only a small value and it will increase gradually so that the motor, or its load, will not be subjected to a heavy shock or jar when the lost motion in the drive is taken up.

The shunt field of small adjustable-speed motors can be reduced in one step under normal load conditions without fear of undue torque or current. The author believes this practice can be safely followed with 50-hp. motors and perhaps larger. This covers the usual range of sizes for this type of motor.

The author believes that since most machine tool motors are started light the motor can be started successfully with minimum field strength and the field relay omitted. This will enable one to use the same controller for constant speed and adjustable speed motors supplying a separately mounted field rheostat for the latter.

Adjustable-speed motors can use one step of resistance for dynamic braking as the change in field strength tends to maintain the braking current constant over a considerable range of speed. The use of a "vibrating" or "fluttering" relay is bad engineering for hand-operated field rheostats, unless a "transfer" relay is also used to reverse its action when the motor regenerates. The time required to accelerate to 95 per cent of speed is very short, in these tests not exceeding three seconds.

New problems are interestingly discussed by the author as follows: There are very few problems which present a more fertile field than the control of adjustable-speed motors. The writer has observed cases where gearing has broken, due to a momentary reverse torque of the motor. It is important to see that all interlocks or relays connected to the shunt field resistance are so arranged that they cannot cause a momentary reverse torque of the motor. After a positive torque has been applied to machinery, and all of lost motion taken up, it is seldom that any part of the apparatus is injured, even if the driving torque varies over a considerable range, provided this torque is always positive. A slight negative torque allows lost motion to occur, and is apt to break some part of the apparatus, due to the hammering blow effect, when the positive torque is resumed. This reverse torque may also be caused by a drop in the line voltage below the counter e.m.f. of the motor, or it may occur due to a rapid movement of the field rheostat.

Trouble may also result from increasing the field strength of a motor when it is disconnected from the line. For example, a 400 to 1600 r.p.m. motor is operating at its maximum speed. If the controller disconnects the motor armature from the line, and at the same time increases the field strength to its maximum value, the voltage across the brushes of the motor will rise to something over three times normal voltage, unless the armature is slowed down very quickly. It can readily be seen that a 500-volt motor, having over 1700 volts across its brushes, is apt to flash across at some part of its insulation and may ultimately be damaged. This rise of voltage has actually been observed, and care must be taken not to manipulate the shunt field so as to cause it.

The use of dynamic braking introduces a good many interesting problems, both mechanical and electrical. The additional heating effect on the motor is well known. The effect, however, upon the loading and lubrication of bearings is not so well understood. The resultant change in the field flux of the motor and the rate of change of current are other problems.

The whole field of controller engineering presents many opportunities for the investigator. It has many problems that have not yet been solved, and the author believes that engineers should not take the existing practice in controller engineering for granted, but study each application in a thorough manner, and design as simple a controller as possible for the work.

Generators, Motors and Transformers

Adjustable Speed Induction Motors.—F. CREEDY.—An illustrated description of a new polyphase induction motor, the speed of which can be varied by varying the number of poles. The new motor, which is built under the author's patents, is identical in construction with the squirrel-cage induction motor, but has a drum-wound stator or primary; this is divided into a number of sections which can be connected in either "mesh" or "star." From each section a terminal is brought out, which connects through a suitable controller to a phase converter, consisting of a specially wound transformer, whose function is to convert from the two- or three-phase line to a number of phases equal to that of the sections in

the motor winding. By the use of this phase converter and a suitable controller it is possible to vary the phase difference between adjacent sections of the stator winding in such a way as to produce any desired polarity. In Fig. 1 is shown such a winding, having thirteen terminals connected to a phase converter, giving thirteen phases, in such a manner as to give two, four or six

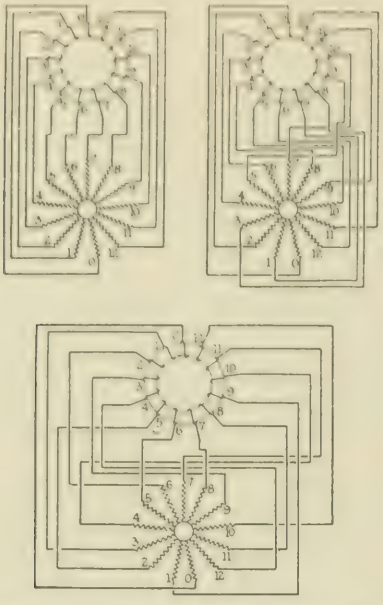


FIG. 1—ADJUSTABLE-SPEED INDUCTION MOTOR CONNECTIONS

poles. If every terminal of the motor is connected in order to the corresponding terminals of the phase converter the phase difference between the adjacent sections of the motor will be the same as that of adjacent sections of the phase converter (that is, 360 divided by 13 in the case shown) when the motor will operate as a bipolar machine. If the motor terminals, starting from a given point, are connected to every second converter terminal, the phase difference between the sections will be doubled, and the motor will operate with four poles. Similarly, if the motor terminals are connected to every third phase converted terminal, the phase difference between adjacent sections will be tripled, and the motor will operate with six poles, and so on. In all cases, if the number of sections is properly chosen, one converter terminal goes to one, and one only, of the motor terminals, so that all terminals of both apparatus are in use on every polarity. The advantages of this type of motor are discussed. Comparing a six-speed machine of this type with a standard drum-wound three-phase

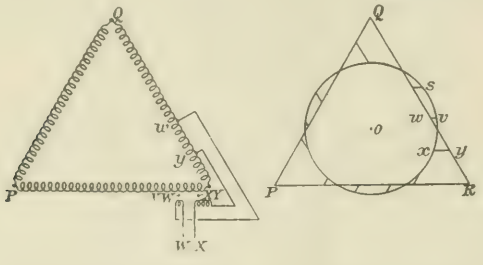


FIG. 2—TYPICAL CONNECTIONS OF COILS ON PHASE CONVERTER

machine with ten poles, the latter will have thirty sections in its stator winding as against thirty-one in the former, these sections being interconnected so that only three or six terminals need be brought out; while in the variable-speed motor no such interconnections exist, but each section is brought out to a separate terminal. The phase converter consists of a mesh-connected three-limbed three-phase autotransformer, the coils lying on each limb being tapped at a number of points and connected to a secondary wound on another limb, in the manner shown diagrammatically in Fig. 2, where, for instance, *w y* is a section of the main three-phase winding of the converter, while *w v* or *x y* are secondaries, the manner in which they are connected being more clearly shown on the left. Fig. 2, of course, shows a three to thirteen-phase transformation, but in the case of the three to thirty-one-phase transformation two of the coils on the three-limbed transformer are divided into ten sections each, while the third has eleven sections. Each of these sections is wound and insulated separately, so that in the event of a fault occurring only one section will need repair. Each section consists of a primary or thick wire portion, part of the mesh connected three-phase winding and a secondary of thin wire, and very few turns, which will be one of the coils marked *x y* in the figure. Thus far the phase converter is identical with a standard three-phase transformer. The terminals are arranged in a row mounted on the steel head of the transformer which is also used for clamping and lifting. They are connected to all such points as *w* and *x*. In order to give some idea of the size of the apparatus, it may be mentioned that it is about equal to that of a normal transformer to deal with 25 to 30 per cent of the motor input. It is supported in a cast-iron oil tank, from which the wiring is carried by means of tubing. The construction of the controller is next described and diagrams giving results of tests of the motor are given.—*London Electrician*, Feb. 2, 1917.

Lamps and Lighting

Precision of Photometric Measurements.—F. K. Richtmyer and E. C. Crittenden.—A brief abstract of a paper read at the Cleveland meeting of the American Physical Society. Progress in any department of physical science, as was pointed out by Professor Zeleny, is dependent in large measure upon our ability to make more and more precise measurements. It is of interest, therefore, to inquire into the present available precision in the various lines of experimental work in order to determine what factors make greater precision possible. The present paper is the result of an analysis of 20,000 observations showing the precision attainable in a number of different kinds of photometric measurements; with a Lummer-Brodhun photometer for both a color match and a color difference; also with a flicker photometer for a large range of color differences. The precision attainable with the Lummer-Brodhun was approximately 0.3 per cent for color match; increasing color difference caused a marked decrease in sensibility. With the flicker photometer the precision 0.75 per cent approximately independent of color difference was obtained. By precision is here meant average deviation of a single observation from the mean of its set.—*Phys. Rev.*, January, 1917.

Generation, Transmission and Distribution

Protection of Transformer Neutrals Against Destructive Transient Disturbances.—Max H. Collbohm.—A paper read at the recent New York meeting of the American Institute of Electrical Engineers. The author points out the danger to which the neutral points of transformers, connected to long-distance transmission lines, are exposed through the building up of excessive potentials at this point under conditions of atmospheric lightning. This is due to the fact that the neutral point in a bank of Y-connected transformers acts as a reflection point for all the waves that are produced by induced lightning, which waves, at the place of origin, have the same amplitude and sign, and therefore, travel with equal speed, considering that the impedance of line and

transformer is the same for each phase. The three waves meeting at the neutral point build up to three times their individual potential at that place, thereby producing excessive potential stresses, and, according to experience, destruction of bushings and windings. The author recommends the installation of lightning arresters at the neutral point to provide a discharge path for the excess potential, which according to measurement with a spark gap, may reach values of 350,000 volts, and higher.—*Proceedings* Amer. Inst. Elec. Engrs., February, 1917.

Traction

French Railway Electrification.—C. THOMAS.—The first part of an illustrated article on the electrification of certain sections of the French State Railways, the change had been projected in 1913, but had naturally been retarded by the war. The present instalment describes the transformer substation of Pont-Cardinet which receives 25-cycle three-phase currents at 15,000 volts from the power plant at Bezons and three-phase current at 5000 volts from the power plant at Molineaux and transforms them to 650-volt direct current for traction and also supplies a 2 x 250-volt three-wire direct-current system for lighting and power.—*Revue Gen. de l'Elec.*, Jan. 6, 1917.

Installations, Systems and Appliances

Centralization of Power Generation and Supply in Germany.—At the general meeting of the Association of German Electrical Engineers last summer Professor Klingenberg had discussed the tendency towards centralization of the German electrical industries. Together with Siegel he had recommended that the German government should undertake the generation of electrical power, but not the distribution. Klingenberg had recommended the erection of thirty large government-owned and government-operated power plants in Prussia which should all be interconnected by 100,000-volt lines. The state thus should generate the electric power on a large scale, but the retail sale should be left to the present owners of the electric stations (which would be substations in future). These recommendations were discussed at some length at the meeting of the German Association on Central Stations in Berlin on Dec. 4 and 5, 1916. Most of the speakers were against Klingenberg's proposals. The main report was made by Ernst Voigt, who emphasized that no real public interest would be served by the government taking over electric power generation. Not more than a very small reduction in cost of power generated could be accomplished in this way. Neither would there be a notable saving in coal since the public central stations of Germany consume only 2 per cent of the total coal mined. Small consumers would have to hope for very little in the way of a reduction in the cost of the kilowatt-hour since only a small part of the cost is due to the cost of generating the power, while the balance (about 8.75 cents, with an average price of 10 cents per kilowatt-hour) is due to the cost of distribution and the profit of the central station. Of all the central stations in Germany about 500 are furnishing yearly in the average each 50,000,000 kw.-hr. while 2500 stations furnish in the average each 100,000 kw.-hr. The present electrical industry is already engaged in inducing these 2500 plants to make connections with the large 500 stations. The government could hardly do much more. The idea of letting the state take over the generation of all the power would meet unsurmountable financial difficulties. The speaker was in favor of combining the present central stations in a compact district into one unit, but not to the extent of combining all the stations in the country into very large units with 200,000-volt transmission lines. Zell then discussed what had been done in Bavaria by the government in the development of water powers for electricity supply. Monath discussed the conditions in Wurttemberg. In his reply Klingenberg emphasized that by the interconnection of all the stations in Germany the load factor would be improved from 0.2 or 0.3 to 0.3 or 0.4. (This idea is further developed in a separate article by Klingenberg in the same issue.) Furthermore, only in large stations it pays to recover the by-products from the fuel. He emphasized that 100,000-volt transmission lines are perfectly safe and reliable. The interconnection of various large stations represents a large reserve capacity for any one of them. Spengel did not think that by centralizing the whole electric power generation in one system owned by the state it would be possible to reduce the cost. He considered the scheme to be financially impossible. Plassmann thought it was a great tactical mistake to let the state generate the energy and deliver it to the cities and let the cities sell the energy to the consumers, because the consumer would then look at the cities as an expensive and troublesome middleman. He recommended that the cities should combine among themselves and erect large power stations and furnish energy directly to the consumers. Voigt, in speaking again, emphasized that he was not absolutely against centralization of electricity supply, but he recommended that the existing central stations should proceed themselves in this direction in a logical and natural way.—*Elek. Zeit.*, Dec. 28, 1916.

Units, Measurements and Instruments

Determination of the Degree of Uniformity of Bars for Magnetic Standards.—RAYMOND L. SANFORD.—Magnetic standard bars are used for the calibration of permeameters and the comparison of methods of magnetic testing with a standard method. One requisite of magnetic standard bar is that it shall be magnetically uniform along its length. If this condition is not met, errors may arise which cannot be calculated or eliminated from the measurements and which may be of considerable magnitude. This paper describes a method for determining the degree of magnetic uniformity of straight bars, indicates the magnitude of the effect of non-uniformities on the accuracy of magnetic measurements and gives a criterion for the degree of uniformity of bars for magnetic standards.—*Scient. Paper, Bureau of Standards*, No. 295, Nov. 21, 1916.

Books Received

ALTERNATING CURRENTS. By Carl Edward Magnusson. New York: McGraw-Hill Book Company, Inc. 526 pages. 475 illustrations. Price, $4.

CONTRACTS, SPECIFICATIONS AND ENGINEERING RELATIONS. By Daniel W. Mead. New York: McGraw-Hill Book Company, Inc. 536 pages. Thirty-seven illustrations. Price, $3.

HYDROELECTRIC POWER. By Lamar Lyndon. New York: McGraw-Hill Book Company, Inc. Vol. I. Hydraulic Development and Equipment. 500 pages. 235 illustrations. Price, $5. Vol. II. Electrical Equipment and Transmission. 360 pages. 194 illustrations. Price, $3.50.

TELEGRAPHY. A Detailed Exposition of the Telegraph System of the British Post Office. By T. E. Herbert. New York: The Macmillan Company. 986 pages. 630 illustrations. Price, $3.50.

THE PRINCIPLES OF ELECTRICAL ENGINEERING AND THEIR APPLICATION. Vol. 1. Principles. New York: Longmans, Green & Company. 356 pages. 176 illustrations. Prices, $4.25.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

STATE-WIDE RANGE CAMPAIGN LAUNCHED IN INDIANA

Plans Have Been Formulated and Member Companies Being Taxed on Pro Rata Basis to Make Up $2,000 Fund

Acting upon a suggestion presented in a convention paper last September by R. A. MacGregor of Indianapolis, the new-business committee of the Indiana Electric Light Association has begun definite work on a state-wide range campaign. The movement has been discussed in several formal and informal committee meetings and partial plans have been formulated. The duration of the campaign will be from March 1 to June 1, 1917. O. M. Booher of Kokomo is sending letters to the central stations in the State, which lay out the preliminary plans and show how the campaign will be financed.

Portfolios, campaign headquarters with a capable manager in charge, state-wide cooking contests, state-wide advertising schemes, etc., are a few of the general details, all of which will be at the complete command of member companies. Each member company is being taxed on an equitable apportionment to make up the minimum required fund of $2,000.

ROCK ISLAND PROPOSED AS SITE FOR NITRATE PLANT

Location, Power Available and Railroad Facilities Are Some of the Advantages Cited for This Location of Proposed Government Nitrate Plant

Extensive efforts have been made to locate a government nitrate plant at Rock Island (Ill.) Arsenal. Members of a committee to further the interests of the tri-cities (Rock Island, Davenport and Moline) accompanied by H. S. Putnam, consulting engineer, New York, went to Washington where their claims were presented. Some of the advantages cited for this location follow. The Rock Island Arsenal reservation, which is far removed from the boundaries of the country, has an area of 990 acres and is the largest and best located arsenal in the United States. Railroad facilities are unequalled, and the Mississippi River and the Hennepin and Illinois canals furnish water transportation to the great lakes and all portions of the Mississippi River Valley. The development of the water power at Rock Island will solve the problem of navigation on the Mississippi River, now handicapped by the limitations imposed by the Rock Island Rapids. More than 150,000 hp. is available at this site. Rock Island is situated on the edge of the Illinois coal fields, and an abundant supply of coal is found within a radius of 60 to 100 miles. The Illinois coal contains from 1.3 per cent to 1.5 per cent nitrogen content. The near-by coal fields furnish an unexcelled location for the construction of an auxiliary steam power plant to insure the absolute continuity, throughout twenty-four hours of every day, of the 150,000-hp. water-power development on the Mississippi. The combination of the water-power plant, with its steam auxiliary plant, is the most economical method of producing power. The power is produced at a total estimated cost, including capital costs, of less than 0.125 cent per kilowatt-hour. A 200,000-hp. combined water-power and steam auxiliary plant and a by-product plant can be constructed at an estimated cost of $19,480,000. All materials for the manufacture of nitrates are found in the immediate vicinity. Rock Island is situated in the center of the great agricultural and food producing region of the United States.

COLORADO COMMISSION SEEKS BROADER POWERS

Asks Right to Grant Certificates of Convenience and Necessity and to Control Bond and Stock Issues

In its second and third annual reports just issued by the Public Utilities Commission of the State of Colorado the idea is expressed that during the past two years the work of the commission has been largely that of laying a foundation for future development. While great strides have been made in establishing cordial relations between the utility corporation and the public, and the commission has had the supervision of all matters pertaining to service, ample power is not provided for protecting the corporation. The commission therefore asks for wider authority.

It recommends to the Governor "that the present public utilities act be amended so as to give the commission full power and authority to issue certificates of public convenience and necessity, or to deny such certificates, to any and all corporations, firms or individuals doing business or seeking to do business as public utilities. Should such authority be given to the commission it would guarantee the public utility corporation immunity from local and State politics and would guarantee the public utility corporation the right to do business for so long as it complies with the requirements of the Public Utilities Commission in regard to reasonable rates and adequate and efficient service or product.

"Thus the people would receive the greatest possible benefit from efficient management of the corporation, and the corporation in turn would be safeguarded against the possibility of unfair competition, for which, in the end, the public must pay, even though it benefits temporarily by reduced rates. Under such a provision a sufficient showing would have to be made to the commission to satisfy the commission that there was actual necessity or that it would serve public convenience for a competing company to enter a field or district already served by a public utility corporation.

"Should such an amendment be passed it should include a provision whereby any municipality would be entitled to purchase a property already constructed at a valuation to be fixed by the commission, and it should also contain a provision whereby a municipality might, upon vote of the people, erect or construct a competing plant, upon securing therefor a certificate of necessity and convenience from the Public Utilities Commission.

"The commission wishes to suggest another amendment which would place under this commission full con-

trol of stock and bond issues of the several public utility corporations already existing within the State of Colorado, and all public utility corporations which hereafter may be organized for the purpose of serving the public. Such a provision exists in the laws of many of the states and has been found beneficial, both to the public and to the corporations, inasmuch as it tends to keep the capitalization of the corporation and the bond issues of the corporation within bounds, and prevents watering of stock to such an extent that a fair return upon the investment is not sufficient to pay interest upon bonds and dividends upon stock.

"Such an amendment also should contain a provision whereby no company could merge with another company or could become a holding company for another corporation without permission to do so from the commission. Such a provision would prevent a paying property from taking control of an insolvent property, or one which was not paying expenses, and thus would prevent the patrons of the solvent company bearing the burdens of an insolvent company."

EDWARD N. HURLEY TO ADDRESS ASSOCIATED MANUFACTURERS

Retiring Chairman of Federal Trade Commission Is to Speak at the Banquet on March 15 in New York

Extensive plans are nearing completion for the annual meeting and banquet of the Associated Manufacturers of Electrical Supplies, to be held at Delmonico's, New York, on March 15. Edward N. Hurley, retiring chairman of the Federal Trade Commission, will make an address at the banquet. A large concentration of meetings of sections in the week commencing March 12 will assure the transaction of business in many of the active lines in which the association is engaged.

In the list of scheduled meetings for March 13 and 14, published in last week's issue, a typographical error made it appear that all of the sections mentioned were to gather on one day. The correct list of committee meetings follows:

March 13.—Fan motor section, offices of the association, 10.30 a. m.; knife switch section, offices of the association, 10.00 a. m.; panelboard and switchboard, offices of the association, 2.00 p. m.; snap switch section, offices of the association, 2.00 p. m.; lighting fixture section, Hotel Biltmore, 10.00 a. m.; outlet box section, Hotel Biltmore, 2.00 p. m.

March 14.—Lamp receptacle and socket, offices of the association, 9.30 a. m.; fuse section, offices of the association, 2.00 p. m.; attachment plug section, offices of the association, 4.00 p. m.; committee on inclosed fuses, offices of the association, 9.30 a. m.; molded or formed insulation section, Hotel Biltmore, 10.00 a. m.; line material section, Hotel Biltmore, 2.00 p. m.; porcelain section, Hotel Biltmore, 10.00 a. m.

The interior lighting fixture committee of the lighting fixture section will meet on March 6, 1917, at 10 a. m. at the association offices, New York City.

The industry conference committee of the outlet box section will meet at the association offices, New York City, on March 12, at 10 a. m. The members of the committee are: H. G. Knoderer, National Metal Molding Company, Pittsburgh, Pa.; N. L. Otis, Chicago Fuse Manufacturing Company, New York; W. T. Ruete, Sprague Electric Works, New York; Edgar R. Slack of the Underwriters' Laboratories. The committee will consider various matters of standardization, prior to submitting a report to the meeting of the outlet box section at 2 p. m. on March 13, at the Hotel Biltmore.

McGraw and Hill Publishing Companies Consolidate

The McGraw Publishing Company, Inc., and the Hill Publishing Company have been consolidated as the McGraw-Hill Publishing Company, Inc. The new company acquires all the properties and interests of the two constituents, including the following technical journals:

"Electrical World," "Electric Railway Journal," "Electrical Merchandising," "Engineering Record, "Metallurgical and Chemical Engineering," "The Contractor," "American Machinist," "Power," "Engineering News," "Engineering and Mining Journal" and "Coal Age."

Two of these papers, "Engineering News" and "Engineering Record" will be consolidated under the name "Engineering News-Record," with Charles Whiting Baker, now editor of "Engineering News," as editor-in-chief.

James H. McGraw will be president of the new company, Arthur J. Baldwin (now president of the Hill Publishing Company), vice-president and treasurer, and E. J. Mehren, vice-president and general manager.

COMMONWEALTH EDISON COMPANY'S ANNUAL REPORT

In Spite of Rate Reductions and Increased Operating Expenses Earnings Are Nearly as Great for 1916 as for 1915

Earnings of the Commonwealth Edison Company of Chicago for the fiscal year ending Dec. 31, 1916, were equal to 9.59 per cent on the capital stock as compared with 10.09 per cent for the previous year. While the operating revenues, reaching $22,863,118.36 for 1916, increased $1,980,791 over 1915, the net income decreased $230,050, due to increased operating charges. The income account and balance sheet compares for 1915 and 1916 as follows:

INCOME ACCOUNT

	1915	1916
Operating revenue	$20,882,327	$22,863,118
Operating expenses	10,453,140	11,907,879
Depreciation reserve	2,442,078	2,822,174
Net operating revenue	$7,987,109	$8,133,072
Taxes and municipal compensation	1,582,089	1,835,912
Operating income	$6,405,070	$6,297,159
Other income	114,393	201,646
Total income	$6,519,463	$6,498,866
Interest on bonds	1,890,000	2,099,393
Net income	$4,629,463	$4,399,413
Dividends	3,677,110	3,667,112
Surplus	$692,353	$732,301

In his report to the stockholders President Samuel Insull said: "The company's business has continued to show constant growth, approximately 40,000 customers having been added to its circuits during the year. This represents an increase of 90,000 kw. The maximum load recorded at any one time was 369,740 kw., on Dec. 19, 1916.

"Owing to this growth in this business the company

has found it necessary to place orders for additional turbine capacity aggregating 142,500 kw. Some of these turbines will be installed during 1917 and some will not be delivered until 1918.

"In pursuance of its established policy to make voluntary rate reductions from time to time as found practicable, the company during the year reduced its net primary rate to lighting customers from 10 cents to 9 cents per kilowatt-hour. This change of rate went into effect in July, and resulted in a reduction in operating receipts, on the basis of the same output, for the remaining six months of the year of around $428,000.

"There was an increase in the operating expenses due to the high price of coal and of other materials, as well as to the greater cost of labor. By reason of the increased gross income the earnings show a satisfactory ratio, although a somewhat smaller amount has been carried to surplus than for the preceding year.

"The company has thought it advisable, in the past year, to make some increases of compensation to the most of its employees. These increases have been made with care, where they seemed appropriate, and not on any general or horizontal basis. There were in the service of the company on Dec. 31, 1916, about 5500 employees, of whom about 3490 had been in its service one year or more. Of these latter 3173 received increased compensation at a rate aggregating $35,131 per month, or an average increase of 15.3 per cent.

"Several times during the year conditions relating to the Chicago coal supply became threatening. It has been the policy of the company to carry in storage for emergency use substantially 250,000 tons (sixty to seventy-five days' supply) of coal at all times. This policy the company was able to maintain successfully, although at heavy expense. The company's coal consumption for the year was approximately 1,780,000 tons.

"There were issued during the year first mortgage 5 per cent gold bonds to the amount of $2,631,000, these being the remainder of an issue of $10,631,000 authorized by the State Public Utilities Commission of Illinois under an order made in 1915. On Nov. 9, 1916, the board of directors authorized the issuance of additional stock to the amount of 10 per cent of the existing stock. With the approval of the State Public Utilities Commission of Illinois, this was offered at par to stockholders of record Jan. 10, 1917."

GOVERNMENT NITRATE PLANT SOUGHT FOR AUGUSTA, GA.

Various Water-Power Sites Available for Developing Electrical Energy Cheaply and for Supplying Encampments

Favorable progress is reported by Augusta (Ga.) interests who are endeavoring to induce the government to locate a nitrate plant in the vicinity above Augusta, where there is available abundant electrical energy from the water powers of Georgia, particularly the developments at Calhoun Falls, Twin City, Anthony Shoals and the plants of the Georgia-Carolina Power Company along the Savannah and Broad Rivers. If the plans are accepted, history may repeat itself and munitions of war furnished to the American army from the same section and practically from the same waters that furnished energy for a factory that supplied the Confederate army during the Civil War. Augusta, it is hoped, may also be selected by the government for the location of a cantonment for 25,000 regular soldiers. In such a case the Augusta, Aiken Railway & Electric Company is prepared to extend its trolley lines and light and power service to meet the demands of such a camp.

NIAGARA POWER EARNINGS TOTALED $3,062,856 IN 1916

Annual Report of American and Canadian Companies Reviews Power Shortage Situation and Federal Action Thereon

Gross earnings of the Niagara Falls Power Company and Canadian Niagara Power Company for 1916 amounted to $3,062,835.68, an increase of $377,237.56 over the earnings for 1915. The increases in expenses and deduction were slight so that the 1916 surplus, which amounted to $1,362,116.49, was in excess of that for 1915 by $334,058.74. The combined comparative account for 1915 and 1916 follows:

	1916	1915
Sales of electric energy	$2,904,842.58	$2,536,757.42
Miscellaneous	157,993.10	148,840.70
Total operating revenue	$3,062,835.68	$2,685,598.12
Operating expenses	$507,641.23	$467,853.27
Amortization	120,000.00	120,000.00
Operating taxes	224,255.03	200,906.35
Total deductions from operating revenue	$851,896.26	$778,759.62
Net operating revenue	$2,210,939.42	$1,896,838.50
Rent revenue	45,830.71	39,239.28
Interest	127,286.30	145,108.25
Miscellaneous	4,506.40	2,212.95
Total non-operating revenue	$177,623.41	$186,560.48
Miscellaneous	10,371.04	8,000.07
Non-operating taxes	12,376.62	12,712.09
Total non-operating revenue deductions	$22,747.66	$20,712.16
Net non-operating revenue	$154,875.75	$165,848.32
Net income	$2,365,815.17	$2,062,686.82
Interest on funded debt	994,760.00	994,760.00
Miscellaneous	980.00	980.00
Paving Buffalo Avenue	7,958.68	38,889.07
Surplus	$1,362,116.49	$1,028,057.75

During the past year the power shortage brought about by the reduction of power from Canada, increasing demand and federal restrictions on the amount generated on the American side of the Falls was the most serious problem the system had to contend with. This situation is thoroughly reviewed in the report by President Edward A. Wicks, who said in part:

"The rapid increase in power use in Canada has led the Canadian government considerably to reduce its permits for the exportation of Niagara power. The export license of our Canadian company has been reduced from 75,000 hp. to 30,000 hp. from American industries despite insistent demands.

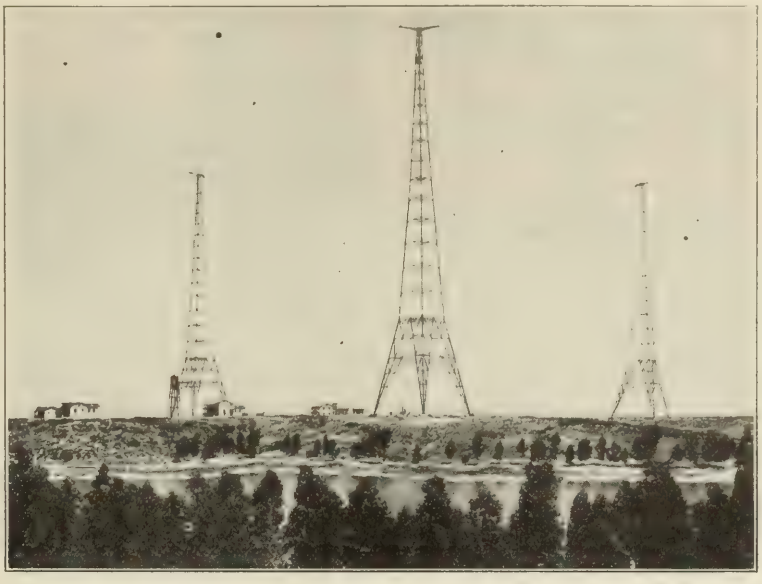
"The American plant has a generating installation some 15,000 hp. in excess of the amount of power that the federal government permits to be generated. That part of our generating plant has been condemned to idleness for most of the time since 1906, when the Burton act became a law, although by its own terms the law expired in 1913. The Secretary of War, however, continued the prohibition of that act.

"When, because of increases in power use in Buffalo and delays in the installation of the Buffalo General Electric Company's steam plant, the power situation in Buffalo became critical, the Secretary of War, upon urgent requests from Buffalo, issued special permits, effective a part of the year and terminating finally Jan. 1, 1917, for the operation of our American plant to nearly its full capacity during certain peak-load hours of the day, limiting the additional power so generated to use in Buffalo only, and, as before, restricting the production of the plant at all other hours in the day.

"Since the expiration of the permit on Jan. 1, 1917, the operation of the plant has again limited at all hours of the day to production as formerly restricted by the Burton act. The Secretary of War stated that he had no authority to extend or to revise the special permit of

1916, although he recognized the critical situation of industries at Niagara and in the much wider circle of industries throughout the United States dependent on Niagara power output. The Secretary of War suggested to Congress the passage of a joint resolution giving to him power to grant relief by permits for additional diversion in the amounts required to operate present installations, not in excess of the allotment to the United States under the provisions of its treaty with Great Britain.

"Upon this suggestion of the Secretary of War, and at the urgent request of power users at Niagara and those dependent on Niagara products in all parts of the country, a joint resolution introduced by Senator Wadsworth passed the Senate and also the House, but with an amendment in which the Senate declined to concur. The joint resolution authorizes the Secretary of War to grant temporary permits, expiring July 1, 1917, for the diversion within the treaty limits of additional water sufficient to operate in full the existing installations at Niagara. (Note—The resolution has become law and a permit has been issued for the diversion of an additional supply.)



NEW GOVERNMENT RADIO STATION AT SAN DIEGO, CAL.

"The date for the expiration of this temporary relief measure apparently has been made in expectation that legislation permanently controlling Niagara diversion would be enacted before adjournment. The Cline bill, for that purpose, has been reported favorably by the foreign affairs committee of the House of Representatives. The terms of that bill are not wholly satisfactory, but it is hoped that before final enactment they may be made less onerous. It is probable, however, that very large expenditures will become necessary so as nearly to double the amount of output of our power.

"It is highly important that there be enacted suitable legislation, settling permanently the questions of the control and regulation by the federal government of the use of the water of the Niagara River for the production of power, so that there may be a reliable basis for providing an adequate supply of power.

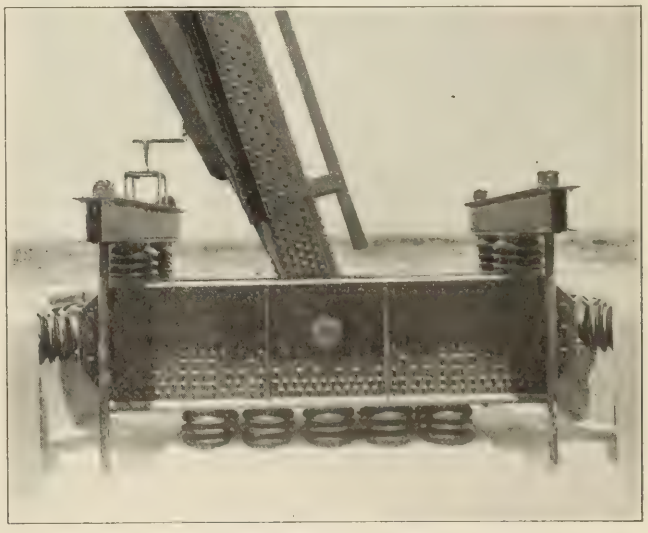
"In 1895 the Niagara Falls Power Company made its first delivery on a large commercial scale of electric energy in the form of alternating current for industrial uses. This also was the first of such deliveries in this country. Beginning with that great achievement the city of Niagara Falls has come to be the world center of industries dependent upon electric energy. Such concerns are the most important group of industries in the United States, for the reason that their products are indispensable to the basic industries of the country. The steel industry is dependent on the alloy ferro-silicon. Ferro-chromium is essential in the making of armor plate, armor-piercing projectiles and automobile steels and is used in all high-speed tool steel. Metallic silicon is necessary in the production of electrical steel. Without carborundum, alundum or the other electric furnace abrasives automobile factories and machine shops could not be operated."

SAN DIEGO NAVAL RADIO STATION IN SERVICE

Operates on Poulsen System and Is Equipped with Three 600-Ft. Steel Towers for Aerials—Most Powerful Station Built

The radio station built for the U. S. Navy Department on Chollas Heights near San Diego, Cal., is now in regular service. The official trials began on Jan. 26, when Lieut. S. C. Hooper of the bureau of steam engineering, Navy Department, sent the first official message to Arlington, using a silver key specially prepared for the occasion. The power-house equipment was operated by L. F. Fuller, chief electrical engineer of the Federal Telegraph Company, and messages were exchanged between the Secretary of the Navy, California Congressmen, the Mayor of San Diego, and H. P. Veeder, vice-president of the Federal Telegraph Company The plant is nominally rated at 200 kw., operates on the Poulsen system, and is the most powerful thus far put in service. Reports of its test announce that the new plant has far exceeded the government's requirements.

The aerial is carried by three 600-ft. self-supporting steel towers placed in a triangular position. In addition to the power house where the radio apparatus is installed, there are also a number of other buildings located on the area which the government has reserved



TYPICAL INSULATED FOOTING OF THREE-LEGGED TOWER

in the vicinity of the station. The operating and office building is separate from the power house, and is provided with a soundproof operating room. There are also barracks for operators and several buildings for officers in charge.

This plant is the third in the chain of naval high-

powered radio stations of which Arlington was the first and Darien the second. Pearl Harbor and Cavite are next two in the progressive development, and these will have apparatus of much higher power than that installed at San Diego. The arcs for Pearl Harbor and Cavite weigh 65 tons each, and are the largest and most powerful pieces of radio apparatus ever built. All of these stations are being constructed by the Federal Telegraph Company and operated on the Poulson system. With the completion of this chain it is expected that it will be possible always to maintain communication between war vessels in the Atlantic or Pacific and Washington headquarters.

The accompanying photographs, showing a general view of the station and the method of insulating tower footings, were placed at our disposal by the Llewellyn Iron Works of Los Angeles, by whom the steel work used in the towers was supplied.

NEW ENGLAND N. E. L. A. QUESTION BOX CONVENTION

Research, Accounting, Commercial Development, Advertising and Accident Prevention to Be Discussed at Boston Meeting Next Week

A question box convention will be held by the New England section of the National Electric Light Association at the Engineers' Club auditorium, Boston, Mass., on March 7 and 8. Four sessions will be held, the convention opening at 10 a. m. each day, with afternoon meetings beginning at 2 o'clock. Among the topics to be discussed are heating research problems, accounting, commercial development, advertising and accident prevention. There will be no evening sessions, but there will be an opportunity to attend the Boston automobile show during the two days. W. A. Whittlesey, Pittsfield, Mass., is chairman of the Question Box Committee and the secretary of the New England section is Miss O. A. Bursiel, 149 Tremont Street, Boston.

NEW HAMPSHIRE COMMISSION OVERRULED BY COURT

New Hampshire Supreme Court Sustains Grafton County Electric Light & Power Company in Its Contention That Property Built Up from Earnings May Be Capitalized

The New Hampshire Supreme Court has issued a decision in favor of the Grafton County Electric Light & Power Company et al. vs. the State of New Hampshire on appeal from two orders of the Public Service Commission bearing upon the value of affiliated properties and the allowable capitalization in connection with their merger. The case has been in progress about four years, decisions of the commission having been reported in 77 N. H. 490 and 539. The commission found that the fair value of the property which the petitioner wished to capitalize was $165,000 as of Nov. 1, 1912; but as the petitioner declined to ask for an order permitting capitalization at this sum, the petition was dismissed.

The case is of quite special interest on account of the finding of the court that the test of value of a public utility is commercial worth; that all elements of value which a prudent investor would consider must be regarded; that reproduction cost is an important element, and that the price obtained at an isolated private sale is not controlling. Also, the ruling is important in its insistance that consideration must be given to going concern value and net earning capacity under customary rates, and that organization expenses, including expense of litigation before the commission and on appeal may be capitalized.

The court states that the question before it is not the amount of the property as a basis for rate-making, but what is the value of the property which in the exercise of their business judgment the company considers it wise to put into the business. The petitioner contended that the value is not less than $300,000. Considering all the evidence the court holds that the property proposed to be capitalized was fairly worth Nov. 1, 1912, $245,000. Since then $73,572 has been expended upon additions to the properties, which the court holds may be capitalized together with an allowance of $15,000 for working capital and an allowance for organization expense.

The criterion or basis of value is what a single individual with abundant means desirous of engaging in the business, but perhaps cautious in investment, would pay for such properties in the situation found upon the date of the proposed capitalization. Such a test must take into account what the property had actually cost the original owners (in this case the capitalization actually issued was low on account of the policy of having put earnings back into the properties); how much it would cost to construct a new plant to carry as economically on the business of the existing plant; how much less the existing plant would be worth than a new one on account of depreciation, inferior or antiquated construction; and what return upon the investment was probable.

The engineers retained by both the plaintiffs and the commission were in substantial agreement as to the cost of reproduction less depreciation. The court is inclined to give more weight to the cost of reproduction as testified to by the engineers than to the price paid for the property in 1912 by the interests in control of it. The court points out that the reproduction cost is the combination of the several market values of the plant components plus the cost of their combination. If the parties owning the plants economized upon construction and have enlarged and improved their property from earnings, such expenditures being concealed from view because never paid or charged to operating expenses, whatever the property is now worth is theirs. The concern of an intending purchaser would be the value of the construction on sale and not the manner in which the proposed seller obtained a valid title. When such property as this is sold privately with no competition, the sale furnishes only the opinion of the seller and the purchaser as to value. In the present case it is clear that the purchasers bought because they thought they were getting the property for less than its real market value.

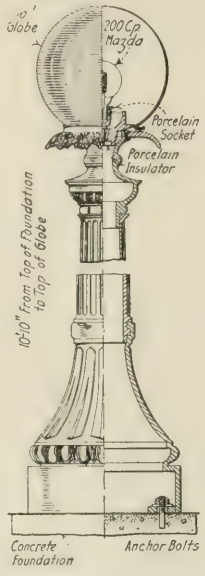
Neither is it material that the petitioners may make a profit by the transaction. If they bought for less than the value, the profit is theirs, as they would have had to stand the loss if they had paid too much. The fact that customers have been secured is an element of value, even if in the past this labor has been charged under operating expenses. Another element in value is the fact that the business is prosperous under existing rates which compare favorably with those throughout the state.

In addition the fact that the peculiar circumstances of this case may make the organization expense large does not alter the principle that proper allowance should be capitalized for legal expenses, including the reasonable cost of the litigation and all expenditures by order of the commission. By this decision the company wins a sweeping victory, the results of which are likely to be far-reaching in their effect upon New Hampshire regulative practice.

EXTENSIVE STREET LIGHTING IMPROVEMENTS AT NEW ORLEANS

Magnetite Arc Lamps and Gas-Filled Tungsten Lamps on Ornamental Posts Will Displace Older Street Lighting System in Crescent City

Construction is now under way at New Orleans for the extensive installation of new street lamps, according to M. S. Sloan, general manager, and V. L. Willoz, superintendent of electrical distribution, New Orleans Railway & Light Company. This work has resulted from the closing of a ten-year contract between the electric service company and the city. Magnetite arc lamps rated at 5.5 amp. will be used in most places, about 4000 units being contemplated for installation within the year. On sections of the boulevards and principal avenues of the city it is intended to use about 2000 gas-filled tungsten lamps mounted on ornamental poles like the one shown in the accompanying drawing. The lamps will be rated at 7.5 amp. and 250 cp. and will be incased in 16-in. globes. The posts supporting them will be placed about 90 ft. apart. In the business section double-lamp standards will be installed. The job calls for the installation of 40 miles of concrete-incased duct. Two and one-half inch and 3-in. fiber duct will be used. Individual transformers will be installed in the base of each lamppost.



ORNAMENTAL POSTS USED IN NEW ORLEANS SYSTEM

The one-lamp poles measure 10 ft. 10 in. high from the ground level to the top of the globe. Between the lamp socket and the top of the pole is a porcelain insulator shaped as shown herewith. Vents are provided in the cap to which the globe is clamped for the escape of heated air. The bases of the lampposts are fastened to anchor bolts cast in 24-in. by 24-in. by 24-in. concrete footings. A hole is left in the center of each footing for the reception of the lamp transformer. Between posts the ducts are incased in 3 in. of concrete.

COLUMBUS UTILITY PLANS EXTENSIVE IMPROVEMENTS

New Station to Take Care of Entire Load, and Costing Approximately $1,000,000, to Be Erected Outside the City

Plans for extensive improvements have been made by the Columbus (Ohio) Railway, Power & Light Company. The chief feature of the plan is a big central station on the Hocking Valley Railroad, 6 miles south of the city, to cost in the neighborhood of $1,000,000. Its consummation depends upon the consent of the Public Utilities Commission to the issue of $1,640,379 of new securities and this will doubtless be forthcoming, since the company asks for nothing which its business does not require. The erection of the proposed station will mean the abandonment of the Third and Spring Street stations and the concentration of its productive operations in the new station.

The company has secured 15 acres of land, plans for the station have been completed and orders for some of the equipment have been placed. Right-of-way for the transmission lines has been secured and, with the consent of the commission, the company is ready to begin work in time to have the station in operation in the coming fall.

A portion of the money to be raised by the sale of the securities will be used in the purchase of equipment and cars for the railway department. The company will also ask for authority to sell securities for refunding about $500,000 improvements made in 1915. This money will be used in operation and in otherwise putting the utility in first-class condition.

CONTROVERSY OVER NAVAL ELECTRIC SHIP PROPULSION

Dr. Schuyler Skaats Wheeler Criticises the Government Plans—Frank J. Sprague, Member of Naval Consulting Board, Defends the Designs

A controversy has developed over the plan of the Secretary of the Navy to introduce electric propulsion on an extensive scale in naval vessels. Dr. Schuyler Skaats Wheeler, president of the Crocker-Wheeler Company, has written letters to the New York daily newspapers criticising the action of the Navy Department and advocating an independent investigation by a committee of engineers. The position of Dr. Wheeler, which he has expressed also to members of Congress, is that without more actual experience the designs involve a dangerous experiment with the country's defenses. Dr. Wheeler is supported by other engineers in his protest.

The criticisms of Dr. Wheeler and others who have joined with him in the movement have been answered by Frank J. Sprague, who is a member of the Naval Consulting Board and chairman of its committees on electricity and ship construction.

CRITICISMS OF DR. WHEELER

In his letters Dr. Wheeler says:

"What is meant by the electric drive can best be understood by saying that the cruisers are each to be equipped with engines of 180,000 hp., which power in the ordinary type of ship would be transmitted to the propellers by mechanical gears. In the electrically driven battle cruisers, however, this mechanical power, produced by the same boilers and substantially the same turbines, is transformed into electric power with the aid of four dynamos of enormous size, and capable together of producing 180,000 hp. of electricity. Then this electricity is to be reconverted into mechanical power with the aid of eight motors, having together 180,000 hp., the motors being directly connected to the propeller shafts.

"These huge electrical machines, carrying enormous currents of electricity, with their appurtenant cables, rheostats, switches and switchboards, and other complicated electrical apparatus, bulky and at the same time delicate, likely to be short-circuited, cut by splinters or otherwise, and in many other ways put out of service, are a new and almost wholly untried experiment. No other country is using electric drive for its warships. We have tried it on a small collier, the Jupiter, of 6500 hp., and the Navy Department's reports show that this collier is run at a high cost.

"The opponents of the electric drive point to the increased cost and to these facts: That it adds 1000 tons more weight to the ship's machinery and to the total net weight of the ship; that it necessitates placing half of the boilers on an upper deck above the protective deck —a most extraordinary innovation in marine architecture, and one which exposes the boilers to direct gun-

fire; that it involves the use of seven smokestacks instead of three, thus seriously interfering with the lookout and gunfire, and presenting a much better target to the enemy's ships, which now fire before the hull of the ship aimed at is seen from the deck.

"Great stress should be laid on one other feature, which is particularly objectionable, namely, that the electric drive involves a three-cornered contract."

Mr. Sprague Defends Flexibility of Operation

Mr. Sprague, in a letter to Claude A. Swanson, chairman of the committee on naval affairs of the United States Senate, says:

"The discussion seems to have concerned itself with two objects: One seeks to condemn the adoption of electricity on the score of increased weight and cost, or the impossibility of construction or safety in operation. The other seeks a reference of the whole matter to the Naval Consulting or some other board to determine whether an electric plant of the size projected can be built and operated, and, assuming that a geared turbine plant can also be built and the difference in cost and weight are such as are indicated in the preliminary bids, to advise which system shall be adopted.

"Unless the department was absolutely convinced of certain facts it could of course very properly have called for some outside advice, but there is a distinct limit to such reference. For example, if desiring to reinforce the statements of the bidders on electric machinery it might have put limited inquiries to a committee of a professional organization, or to selected outside experts, as to whether a turbine-driven central station of 180,000 hp. to operate eight 22,500-hp. motors could be safely constructed and operated, and submitted to sufficient tests prior to actual installation in a ship.

"To this there could be but one possible answer by anyone familiar with actual manufacture or possessed of adequate professional experience.

"On the other hand, the query might have been made as to whether it is possible to build and operate geared turbine equipment aggregating 45,000 hp. per shaft, either divided into two or four units for each shaft, and whether such could be submitted to like crucial tests before installation.

"Assuming that a favorable reply to both these inquiries could be had, and that instead of assuming on the one hand that electric equipment of the required power cannot be built but that geared turbines can be, or on the other hand that electric equipment certainly can be constructed, while it is doubtful if geared turbines can, we accept the fact that both are possible. What then? Let us assume, further, that when compared it is found that there are known differences of costs and weights against the electric equipment, and certain structural differences inherent to each, a large number of which have not been publicly discussed, and which it would seem unwise to open for general discussion at this critical time, when the spreading broadcast of the detail construction of these ships may well be gravely questioned.

"Right here any possibility of decision by outside civilian engineers must halt, for it is inconceivable that with all the known facts in hand the Navy Department could or would surrender to outside advisors, directly or even inferentially, the selection between two known and accepted methods of drive, with their varying influence upon the distribution of weights, location of turrets and armor, size and disposition of compartments and the results of flooding, the distribution of fuel, the distances of machinery from the skin of the ship, provision against torpedo damage, the necessities of handling ships in emergencies and the results of failure of any parts. With these in hand there can be no proper decision except through the proper governmental agencies. Nor is there a single engineer in the lay world who is warranted in taking upon himself any such decision.

"Herein lies the difficulty of any general reference, proper at any time if the department so elects as to facts regarding the possibility of construction and operation of engines, whether electric or turbine, but the decision as to which of two possible drives shall be adopted, and the part they play in the whole question of ship construction and operation in peace or war must stay where it now rests.

"I do know, in spite of any statements to the contrary, whatever the authority, that generators and motors of the size indicated can be built, and that if necessary they can even be controlled by a push button from the bridge."

ACT TO LICENSE NEW YORK JOURNEYMEN ELECTRICIANS

Bill One of Many Introduced at Albany Calculated to Enlist New Means of Creating Revenue

Senator Graves of Buffalo has introduced in the New York State Legislature under Senate print No. 620 a bill entitled "An act relative to licensed journeymen electricians designing to install wires of apparatus for electric light, heat or power purposes."

There is no provision in the proposed law to the effect that the payment of the license imposed to the State, shall exempt the holder of such license from the payment of any local fee for registration or otherwise. The bill is in line with other measures recently introduced at Albany calculated to enlist new means of creating revenue and is said to have the tacit support of the administration. A time for a public hearing on the measure has not at this writing been set.

Sec. 1 provides that on and after Sept. 15, 1917, no person shall work as a journeyman electrician unless such person shall have received a license. The section defines a "journeyman" as a person who does any work of installing wires, conduits, apparatus, fixtures and other appliances. Sec. 2 provides for the appointment by the Governor before July 1 of a commission of three, who shall be wage earners, citizens of the State and who have had at least ten years' practical experience, fixes their compensation and term of service and provides for the holding of examinations.

Sec. 3 of the act provides for the exemption from examination of persons who present proof of five years' experience, for the granting of licenses on examination, fixes the fee for examination at $5, provides for an annual renewal of license at $2.50 and stipulates that holders of license shall carry evidence of their having been so licensed. Sec. 4 prohibits the transfer of a license and provides for its revocation. Sec. 5 states that "Any violation of this act shall be deemed a misdemeanor." Sec. 6 gives fees and fines to the State treasury.

Sec. 7 provides for exception of electrical equipment in connection with railroads, generating stations, substations, storage battery stations, service switches and controlling devices, etc. Sec. 8 regulates the employment of apprentices and stipulates that a traveling theatrical electrician, who is not a duly licensed journeyman electrician may install temporary wiring and appliances, subject to the supervision of a person licensed under the provisions of the act.

Sec. 9 imposes a penalty for misstatements in application for a license. Sec. 10 repeals all acts or parts of acts at present on the statute books inconsistent with this act. Sec. 11 gives the time the act is effective.

REPORT ON THE PROPOSED PORTLAND MUNICIPAL SYSTEM

Commissioner Daly Files Detailed Statement Providing for Expenditure of $1,777,000 for Hydroelectric Plant and Lines

Commissioner Will H. Daly of the Department of Public Utilities has completed a detailed report of a proposed municipal electric lighting system, for lighting the streets and public buildings of the city of Portland, Ore., which he recently filed with the City Council, with the recommendation that the city attorney be instructed to prepare a charter amendment, to be presented to the voters of the city, at the municipal election in June, providing for the issuance of $1,777,000 in bonds, for the installation of the system. Of the proposed bond issue, $770,000 is for the generating system and transmission lines, and $1,000,000 is for the installation of a modern system of street lights in Portland. Commissioner Daly further recommends that the charter amendment be so drawn that the system will be self-supporting.

In his report he sets forth that the city is now paying approximately $200,000 a year to the Portland Railway, Light & Power Company, under contract for lighting the streets and public buildings in the city. There are 3553 arc lights now in service, and he says the system is becoming obsolete and unsatisfactory. He favors the installation of a more modern system of lighting, particularly post lighting. He also believes the city should take over the maintenance of all downtown street light and post lighting, now being maintained by merchants and property owners. With 2500 of the horsepower which may be generated in a municipal plant, he says he will be able to give Portland 5000 arc lights or their equivalent, for the same amount of money that is being paid for the illumination the city is now receiving, and that the rate for illuminating the public buildings with incandescents can greatly be decreased. The surplus 2500 hp. of energy he proposes selling.

The rate for residence lighting he suggests could be fixed at 5.5 cents per kilowatt hour for the first 45 kw.-hr., and 2 cents for each additional unit. For business lighting, he suggests a flat rate of 4.5 cents per kilowatt-hour, and 3.5 cents for power purposes. With the amount now being paid by the city for illumination, and with the sum which may be received from the sale of only 30 per cent of the surplus power, there would be an income into the lighting fund each year of $384,770. He estimates that the expense of operation and maintenance, including sinking fund and interest on bonds, at $327,682, which would leave a surplus and profit from the plant of $57,088 a year, and if the entire surplus of power was sold, the profits would be much larger. Commissioner Daly's recommendation comes as a result of extensive investigation of the feasibility of a light and power generating plant in connection with impounding dams in the Bull Run reserve, to conserve Portland's water supply.

The project includes the following: Area of watershed, 53½ square miles; water available, with storage, 108 second-feet; length of flume, 13 miles; capacity of reservoir, 4,000,000 cu. ft.; length of penstock, 3000 ft.; effective head, 650 ft.; horsepower available with storage (twenty-four hours per day), 6380; transmission line, 30 miles.

The power house will be 60 ft. by 100 ft. concrete building. As now proposed the transmission lines will carry a current of 66,000 volts and consist of a pole line carrying three No. 4 copper wires Delta system, 72 in. between wires. A telephone system will be strung on poles below the power lines.

The cost of this hydroelectric plant will be in the aggregate $1,777,000, being segregated as follows: Diversion, $27,500; flume, $286,000; right-of-way, $1,320; forbay and reservoir, $55,000; penstocks, $82,500; wagon road, $22,000; power house, $49,500; machinery, wiring, etc., $170,500; transmission, $82,500; distribution system, including transformer station, $1,000,000; total, $1,776,820.

COST KEEPING DISCUSSED BEFORE CONTRACTORS

M. A. Curran Emphasizes Importance of Increasing Turnover Rate and Cutting Down Superfluous Expenses

The importance of cost keeping and the best methods of handling accounting problems were discussed at a meeting of the Electrical Contractors Association of Massachusetts in Boston on Feb. 21 by M. A. Curran, general credit manager, Western Electric Company, New York. About 150 electrical contractors convened for a meeting and dinner at the Quincy House, with President A. J. Hixon in the chair. In his paper, Mr. Curran touched upon the principal weak spots in business administration exhibited in the electrical contracting industry, emphasizing the vital importance of increasing the rate of capital turnover, cutting down superfluous costs and adhering to accepted modern methods of billing, credits and collections. Investment in stocks far beyond the contractor's or dealer's early prospective needs was criticized and the reduction of personal calls in bill collections from satisfactory customers was urged. Billing by mail, even in small towns, was advocated. The author pointed out that the retailing of electrical supplies, which is now handled to a great extent by the contractor-dealer, requires business capacity of a higher type than the ordinary wiring business. The retail supplies carry a higher rate of profit and the overhead cost can generally be absorbed in the present overhead. It is advisable, however, to separate the accounting on the contracting from the retail business

Modest investment in office equipment and quarters proportionate to the volume of business were recommended by the speaker, who incidentally said a few words about the opportunities before the contractor to suggest additional outlets in residential wiring, leading sometimes to increased income and augmented appliance sales. The cost of electric wiring and fixtures is so small a proportion of the total cost of a house that it virtually amounts to the salt at a banquet, and often can be increased to the mutual benefit of the house owner and the contractor.

In closing, the speaker pointed out that incompetence with the electrical contractor is not of the technical kind. He knows his trade, how to wire houses and make the electrical equipment furnished operate; but the kind of competence needed is business competence, and that means the broad education which the wireman must acquire to properly hold his place in the business community. That competence embraces the knowledge of costs, accurate estimating, prompt billing and collecting, paying of bills, and the accounting of the business as a whole. To many contractors the credit man may appear as a watch dog solely maintained to worry in the money by his barking and biting abilities. That type of credit man cannot stand in the present business scheme of things. To-day he must be an upbuilder, a generative force, and not merely a brake. He recognizes that his customer's welfare is his and that welfare is based on co-operative action and not on dictatorship.

Commission Rulings

Important Decisions of Various State Bodies Involving or Affecting Electric Light and Power Utility Operation and Practice.

Efficiency of Utilization of Facilities Sought.—The California Railroad Commission has dismissed the complaint of the Coast Counties Gas & Electric Company that the Sierra & San Francisco Power Company is illegally, and against the commission's order, building an electric power line in San Benito County to supply electricity to the Old Mission Portland Cement Company, and has dismissed the application of the Sierra company for authority to build this line and otherwise sell electricity in San Benito County under a franchise granted by that county.

The Sierra company admitted that the Coast company sold electricity in San Benito County near San Juan Bautista, and stated that the Sierra company had begun the building of an electrical line to the cement plant. It said that it had a franchise to do this and that it did not intend to build a general distribution system in San Benito County. It said that it had a contract with the predecessor of the cement company which it was continuing.

The commission found that the Coast company, to serve the cement company, would be required to make a large investment in new lines and equipment. Its expense alone would be $46,000, and a line would duplicate existing lines. The commission in its order, therefore, seeks the highest efficiency in the utilization of the facilities of both utilities before additional investment is made in the territory.

Commission Approval Must Be Secured Though Line Be on Private Property.—The Public Service Commission for the Second District of New York has settled the disputes between the Colliers Light, Heat & Power Company and the Oneonta Light & Power Company over territories in the town of Oneonta, surrounding the village of Oneonta. The application of the Colliers company for approval of its franchises in the town of Oneonta so far as it relates to that part of the town south of the Susquehanna River and that part of the town east of the village, along the Oneonta - Cooperstown Highway, is denied. The Oneonta company is at present operating lines in these territories. The Oneonta company, on the other hand, is ordered to forthwith cease its operations in Oneonta Plains, where the Colliers company has a franchise, approved by this commission some time ago. The third order in these proceedings approves of the transfer of the electric line and the franchise therefor extending from the village of Oneonta to and beyond the Morgan Farm, from Mr. Morgan to the Oneonta company.

Interesting applications of the Public Service Commissions Law are laid down in both of the opinions. In sustaining the complaint of the Colliers company against the operation by the Oneonta company of a line in Oneonta Plains, the commission held that the fact that this line is wholly upon private property does not relieve the Oneonta company from the necessity of securing the approval of the commission before it can construct or use an electric plant. Even though the fact that the lines are on private property may make it unnecessary or impossible for the local authorities to grant a franchise, the commission showed that the Public Service Commissions Law requires the consent of the commission before an "electric plant" may be constructed, and this consent the Oneonta company has never obtained.

Upon the application of the Colliers company for approval of its franchise east and south of the village, the commission applied the broad principle that the interests of the community must come first and that the community may best be served in this territory contiguous to the village by the company operating in the village rather than by the Colliers company, which would have to build lines from 7 to 9 miles long. It suggested that good business policy would not warrant the construction of these lines only to secure the patronage possible, but that they are probably dictated by a desire of the Colliers company to surround the territory of its rival. The commission said in the strongest terms that this rivalry between the two companies should cease and the territory reasonably divided.

It developed on the hearing that the residents of both the east and south sides of the town were desirous of being served by the Oneonta company. It also developed that the Oneonta company was supplying electricity over lines owned by private individuals on the south side of the river and without a franchise. Testimony showed that the franchise of the Colliers company for the whole town of Oneonta was granted by the village board because the Oneonta company was not *persona grata* with it on account of more favorable negotiation in other matters which the board had had with the Colliers company. The commission held that the Oneonta company should at once cease operation in the southern part of the town, where it had no franchise, but also expressed the hope that the town board will see fit to grant the Oneonta company a franchise for that territory, as it is the territory which for reasons of economy and convenience it is entitled to serve.

In the other opinion the commission also criticized the agreement between the Ceperly-Morgan real estate company and the Oneonta company whereby the Oneonta company's lines are run on the laid out streets of the real estate development, and said that the agreement is so discriminatory against the company's customers in the village of Oneonta that the commission should order the agreement abrogated were it not at this time ordering the company to give up this business altogether.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public-utility companies.

Reasonable Exercise of Authority by Commission.—An order of the Public Service Commission, made on petition of a telegraph company, requiring a traction company, owning its right-of-way, to remove its high-tension power wires from dangerous proximity to telegraph wires, did not exceed the constitutional powers of the commission, as being confiscatory of the traction company's property and a taking without due process of law, it was held by the Supreme Court of Vermont (99 A. 4), private ownership of its right-of-way not giving the traction company the right to erect its high-tension line thereon without regard to the rule restricting every man against using his property to the prejudice of others. The findings of the commission having the force and effect of reports of special masters in courts of equity, are conclusive in the Supreme Court on appeal. Where the commission determined the necessity of an elimination of the danger in the close proximity of the wire, it was within the power of the commission to determine the manner in which the elimination could best be accomplished, with a view to the operation of both lines and to the public safety.

Employer Not Liable for Damages if Sufficient Warning Is Given.—Where a person killed by contact with a high-powered wire was a well-developed man physically and mentally, who had never clipped cable in proximity to high-power wires, but was not without experience in the construction of telephone lines, and was repeatedly warned as to the danger, and that contact with the high-power wires near which he was to work would kill him, the telephone company was not guilty of actionable negligence in directing him to ascend to the pole, since an employer is not an insurer of his employee's safety, and is liable for the consequences, not of danger, but of negligence in failing to adequately instruct an inexperienced employee as to unknown danger, it was held by the Supreme Court of Appeals of Virginia (90 S. E. 636). The lineman having been fully instructed and warned as to the danger, his death was proximately due to his own disregard of repeated warning, for which self-imposed injury the law affords no redress. As the burden was on the plaintiff to prove negligence alleged in failure to instruct the deceased in the use of a belt in which he was sitting, in the absence of evidence to the contrary, the defendant is presumed to have discharged his duties in furnishing safe place and appliances and giving necessary warning.

Would Make 50 Cents Legal Minimum Monthly Charge in Ohio.—Representative Cable has introduced a bill in the Ohio Legislature which provides that 50 cents shall be the minimum monthly charge for electric light contracts and it also prohibits an increase in the charge for energy by reason of this established minimum.

Electric Light Guards Treasury Gold.—For the better protection of the huge amount of bullion now stored in the Sub-Treasury and Assay Office located on Wall Street, New York, these buildings are now brilliantly illuminated within and without by high-powered arc lights, for the first time in the history of these institutions.

Lower Rates for Baltimore.—The Consolidated Gas & Electric Company of Baltimore, Md., has announced a reduction in the local electric rate from 8.5 to 8 cents per kilowatt-hour, with monthly minimum also reduced from $1 to 75 cents, effective after the April meter readings. The reduction is voluntary and will represent a saving of about $200,000 per year to consumers.

Bill to Allow Municipalities to Lease Public Utilities.—A bill has been introduced in the Senate of the Pennsylvania State Legislature to permit agreements between corporate and municipally-owned public utilities, providing that the council or governing body of any city, town or borough may acquire by lease an electric light, heat and power plant, or any water works or other utility, with term of lease at the option of the council or governing body. The utility or utilities so acquired are to be conducted as though the property by purchase of the municipality, with establishment of rates under the jurisdiction of the council or governing body.

Brooklyn Edison 1916 Growth Statistics.—The annual Progress Report containing statistics of growth of the Edison Electric Illuminating Company of Brooklyn shows that 1916 was a very gratifying year. The largest increase was in the power bureau, where 50,897 hp. was written in approximately 1500 contracts, an increase of 56 per cent over 1915; 21,000 hp. was signed in new installations, each one of which was in excess of 150 hp.; and 10,000 hp. was signed replacing private power plants. The report shows that forty-one large power plants were closed down and twenty gas engines. The lighting salesmen signed up over 77,000 50-watt equivalents in lighting, a gain of 10 per cent over 1915. The new installation bureau, in charge of house and store wiring, closed 1524 contracts, or 119 per cent better than in 1915. The house-wiring business was especially good—1042 contracts having been taken, or 141 per cent increase over the preceding year. The appliance bureau reports sales of over $107,000, as against $63,000 in 1915, a gain of 69 per cent in 1916 over 1915. The energy sold in 1916 were 187,000,000 kw.-hr., as compared with 143,000,000 in 1915, a growth of about 30 per cent. The increase in number of customers was 14,671 in 1916 over 1915, or 25.2 per cent gain.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Two-Cent Rate for Kansas City.—The commissioners of Kansas City, Kan., announce that there will be a new 2-cent rate on energy for cooking and lighting. The old rate of 6 cents a kilowatt for lighting and 3 cents a kilowatt for cooking, flat rates, are to be supplanted by the new architectural rate. This rate is on the basis of 5 kw. a room a month at 6 cents a kilowatt-hour, and all consumption above the 5 at 2 cents a kilowatt-hour. The minimum monthly rate will continue.

Electric Company Endeavoring to Invade Town with Municipal Service.—On Feb. 14, Mayor John A. Holtzenberger of Hamilton, Ohio, appointed a citizens' committee, consisting of F. J. Sloat, Joseph C. Strategier, S. M. Goodman and C. E. Mason to investigate the reported attempt of the Ohio Gas & Electric Company of Cincinnati to invade Butler county and the city of Hamilton with a line of poles and wires to compete with the municipal light plant. The commissioners of Butler county refused the company a franchise, but it holds it has a right to plant its poles on private property which it has acquired.

Over-All Efficiency in Industrial Heating.—In an editorial on page 163 of the Jan. 27 issue of the ELECTRICAL WORLD, H. J. Kunz of the Toledo Railways & Light Company was quoted as follows: "In some cases the thermal efficiency of the electric application (in industrial work) may be lower than the thermal efficiency of other sources of heat, but the over-all efficiency of the operation is very much higher than that obtained in any other way." This statement should read, "The actual cost of heat in any electric heating application may be higher than with some fuel, but the over-all cost will be lower in a great number of cases."

Public Utility Franchise Tax Bill for New Jersey.—The proposed franchise tax bill covering the earnings of electric, gas and water companies in New Jersey has been introduced in the Legislature by Assemblyman Oliphant. As a result of several hearings, revisions have been made in the bill as initially planned. The new law, which is an administration measure and destined to pass, exempts from its provisions all utility companies with gross receipts of less than $50,000 a year. For all other companies the bill stipulates a franchise tax of 3 per cent for the present year, 4 per cent in 1918 and 5 per cent in 1919 and thereafter, gradually increasing, year by year, the present rate of 2 per cent to this maximum. The bill is estimated to yield $1,000,000 in increased taxes to the different municipalities in the State.

City Cannot Regulate Telephone Rates. — Judge E. B. Kinkead of the Common Pleas Court in a decision rendered on Feb. 19 held that the city of Columbus, Ohio, has no authority to regulate telephone rates, but that this power lies with the Public Utilities Commission only. He also held that the contract for free telephone services for city governmental purposes is illegal, and declared that the city cannot enforce such a contract. The decision was given in the suit to restrain the Ohio State Telephone Company from increasing its service rates.

1917 Electrical Show, University of Illinois.—The University of Illinois will hold its sixth biennial electrical show on April 12, 13 and 14, in Urbana. This show is prepared and managed entirely by students in the Department of Electrical Engineering of the University, and while the principal object is to demonstrate the ability and resourcefulness of the student body, special emphasis is being placed this year upon the influence of electricity in the smallest, as well as the largest, details of modern life. An electrically propelled monorailroad, the use of electricity for stage effects, and an "electrical dog" are some of the features.

New Jersey Superintendent of Weights and Measures Would Test Gas and Electric Meters.—In a statement to the Governor, William L. Waldron, New Jersey State superintendent of weights and measures, has requested an enlargement of the scope of the work of the department to include the testing of electric, gas and water meters. It is proposed to eliminate this feature from the province of the Board of Public Utility Commissioners and revising the present plan of a consumer charge of $1 for requested tests, which is returned when the meter is found to be incorrect, and which, it is held, deters consumers from asking tests. It is suggested that this charge be eliminated and that the utility companies owning the meters pay a nominal sum for inspection. With this plan the public utility companies would be relieved from making meter tests.

Milwaukee Receives Lower Offer to Supervise Lighting System Construction.—Mayor Hoan and Commissioner Simmons of Milwaukee have sent a letter to the City Council withdrawing their recommendation that F. A. Vaughn be retained as engineer to supervise construction of the municipal lighting system. The proposal, which was under consideration by a committee of the council, was that Mr. Vaughn be retained at a salary of $10,000 a year. Arthur J. Sweet, formerly a partner with Mr. Vaughn in the firm of Vaughn, Meyer & Sweet, has offered to supervise the work for $3,000 a year. It was this firm that, while both of the engineers mentioned were members of it, designed the system which the municipality is proposing to install. In withdrawing the previous recommendation Mayor Hoan recommends that the sum for completing the work be made not only "as reasonable as possible but not to exceed $3,000."

Factory Lighting.—Prof. C. E. Clewell of the University of Pennsylvania read a paper on "Factory Lighting" at the Feb. 16 meeting of the Chicago Section of the Illuminating Engineering Society.

Cleveland Electrical League. — Frank Goewey Jones, former president of the American Electric Fuse Company and former convict, addressed the members of the League at their noon luncheon on Feb. 15 on "Another Million-to-One Chance."

National Capitol Company Section, N. E. L. A., Formed.—This section, which is composed of members of the Potomac Electric Power Company, was formed on Feb. 9 with the following officers: John C. McLaughlin, chairman; J. H. Ferry, vice-chairman; H. A. Brooks, secretary, and E. W. Whitehead, treasurer.

San Francisco Electrical Development and Jovian League.—A smoker held by this organization in San Francisco on Feb. 15 was attended by about 200 members for whom a lively program had been prepared, including a variety of entertainment. Prizes in the shape of electric irons, lamps and flashlights were distributed. Three addresses were also made, Albert E. Elliott on "Service," Tom Collins on "The Accomplishments of the Jovian Order," and Henry Holland on "The Opportunities for the Electrical Development and Jovian League."

Farewell Luncheon to J. E. Davidson.—The American Institute of Electrical Engineers, National Electric Light Association and Oregon Society of Engineers, Portland, Ore., sections, at the eighth bi-weekly luncheon, Feb. 14, were addressed by Franklin T. Griffith, president of the Portland Railway, Light & Power Company. The luncheon was a farewell tribute to J. E. Davidson, past chairman of Portland section, N. E. L. A. Mr. Davidson has been general manager of the Pacific Power & Light Company for the past five years and is leaving Portland to accept an executive position with the Electric Bond & Share Company of New York.

Electrical Engineering Fraternity Convention.—The thirteenth annual convention of Eta Kappa Nu, an honorary fraternity of electrical engineering students, will be held March 16 and 17, 1917, at the University of Illinois. Delegates from the following institutions will attend: University of Illinois, Purdue University, Ohio State, Case, Cornell, Pennsylvania State, University of Pennsylvania, University of Wisconsin, Armour Institute, University of Missouri, and the University of California. In addition the following Alumni chapters will be represented: New York, Pittsburgh, Schenectady, Chicago, Milwaukee and St. Louis. All alumni members in the vicinity of Champaign are asked to attend this two-day meeting. Prof. L. H. Harris, University of Pittsburgh, is secretary of the national executive council and is in a position to furnish any desired information.

Associations and Societies

A complete Directory of Electrical Associations is regularly printed in the first issue of each month on the next to last text page.

New Orleans Jovians Plan Rejuvenation.—Plans have been laid by the New Orleans Jovian League for the annual banquet and a rejuvenation on March 17. At the luncheon meeting on Feb. 6 Harold W. Newman, commissioner of public safety, spoke on the "Electricity and Its Importance to the City." The league is making arrangements to assist the local contractors in the entertainment of the delegates to the annual convention of the National Electrical Contractors Association to be held this year at New Orleans.

Residence Lighting. — "Residence Lighting" will be discussed by the New York section of the Illuminating Engineering Society on March 8 at the auditorium of the Consolidated Gas Company, New York City. There will be two papers. H. H. Newman, agent of the Public Service Gas Company, Trenton, N. J., will speak on "Maintenance," and Paul L. Zoellner, secretary of the Nichols Gas Fixture Manufacturing Company of Brooklyn, will discuss the "Development of Lighting Fixtures." There will be a display of lighting fixtures, and the show rooms of the Consolidated Gas Company, the New York Edison Company and the Municipal Lighting Company will be opened for inspection to those attending the meeting.

Ohio New Business Convention.—The next convention of the committee on new-business co-operation of the Ohio Electric Light Association will be held at the Miami Hotel, Dayton, on March 14. The following program has been arranged: Address of welcome by Judge E. P. Matthews, vice-president the Dayton Power & Light Company; "Financing Motor Installations," by F. I. Woltz, power engineer, Union Gas & Electric Company, Cincinnati; discussion by F. B. Steele, H. B. Craft, G. A. Mau; "Free Service" by O. A. Acuff, new-business manager, Massillon Electric & Gas Company; discussion by O. B. Reemelin, C. E. Yacoll; "Salesmanship," by A. F. Siebert; "The Manufacture of Raw Water Ice," by A. M. Heritage, refrigerating engineer, Triumph Ice Machine Company, Cincinnati; discussion by W. B. Wilkinson, J. C. Matthieu; "Commercial Rates," by E. T. Hollingsworth, commercial manager, Ohio Light & Power Company, Newark; discussion by W. A. Wadsworth, L. J. Lemen, H. F. Heyman; "Motion Pictures as An Aid to New Business" by F. H. Hooper, new-business manager, Northwestern Ohio Light Company, Van Wert. In the evening a banquet and cabaret will be held at the hotel under the auspices of the Dayton Jovian League.

Dallas Electric Club and Jovian League.—Ell C. Bennett, Mercury of the Jovian Order, addressed the local order on Feb. 19.

Founder of Cleveland Electrical League Honored.—At a meeting of the stockholders of the Cleveland Electrical League on Feb. 22 the first perpetual membership was awarded to J. Robert Crouse, its founder. In resolutions adopted at the time Mr. Crouse was designated as the father of electrical co-operation. An original patriotic poem was given by William Ganson Rose and addresses were made by President N. H. Boynton, former President M. H. Moffett and F. R. Du Guay.

Minnesota Electric Association Meeting.—The tenth annual convention of the association will be held at the Hotel St. Paul, St. Paul, on March 20-22, 1917. The program includes papers on the following subjects: "Electric Cooking"; "Construction, Operation and Maintenance of Distribution Systems"; "Principles of Rate Making"; "Twenty-four-Hour Service in Cities of 1500 Inhabitants and Less"; "The Effect of Load Factor on Operating Costs," and "Profitable Customers." In addition to this there will be a paper on "New Forms of Illumination," which will be illustrated by photographs and models. On the last day there will be an experience meeting, where everybody will be expected to tell about his troubles and success—with the hopes that by a general discussion some solution may be reached of benefit to the member. Fred A. Otto, St. Paul, has been elected secretary of the association to serve during the remainder of the fiscal year.

Dayton Jovians to Give Banquet.—A banquet and cabaret will be held at the Miami Hotel, Dayton, Ohio, under the auspices of the local league on March 14. During the morning and afternoon of this day the new-business co-operation committee of the Ohio Electric Light Association will hold a convention at Dayton, the program for which is in another column. The banquet program follows: Chairman, Charles S. Hall, president the Dayton Jovian League, Dayton, Ohio; toastmaster, D. L. Gaskill, president the Greenville (Ohio) Electric Light & Power Company; speakers—Hon. James M. Cox, governor of Ohio, on "Present-Day Conditions"; H. M. Waite, city manager of Dayton, on "City Manager Form of Government"; J. E. North, chairman committee on new-business co-operation, Ohio Electric Light Association, on "The New-Business Committee of the Ohio Electric Light Association"; W. W. Freeman, president Union Gas & Electric Company, Cincinnati, Ohio, on "Relation of the Public Utilities to the Public"; C. F. Kettering, vice-president the Domestic Engineering Company, Dayton, Ohio, on "Future Applications of Electricity"; F. R. Coates, president the Toledo (Ohio) Railway & Light Company, on "The Public Be Pleased"; Judge R. W. Baggott, the Court of Domestic Relations, on "Selling Juice." The banquet will conclude with music and a "cabaret."

Men of the Industry

Changes in Personnel and Position—Biographical Notes



GEORGE B. TRIPP

George B. Tripp has resigned as vice-president of the United Gas & Electric Engineering Corporation of New York and on March 1 assumed his new duties as president of the Central Construction Corporation of Harrisburg, Pa. Mr. Tripp, who is president of the Pennsylvania Electric Association, has been connected with central station and utility company operation for many years. In 1911 he resigned as general manager of the Colorado Springs Electric Company to take up the management of the Harrisburg (Pa.) Light & Power Company, of which he was later made vice-president. More recently he was vice-president and operating executive of the United Gas & Electric Company, which operates the Harrisburg company, as well as a number of other utilities in various sections of the country. He will still retain his utility connection as vice-president of the Harrisburg Light & Power Company. The Central Construction Corporation of Harrisburg designs and constructs buildings, manufacturing plants, power plants, railroad terminals and engages in construction projects generally.

D. H. Braymer, who for the past two years has been engineering editor of the ELECTRICAL WORLD, has resigned to assume the editorship of the *Electrical Record.* Mr. Braymer succeeds George A. Wardlaw, who will engage in free lance literary work. Prior to his connection with the ELECTRICAL WORLD, Mr. Braymer was editor of *Electrical Engineering* of Atlanta, Ga., and of its predecessor, the *Southern Electrician.* He is a graduate of Cornell University with the degrees of A.B. and E.E., and spent some years with the Electrical Testing Laboratories and the Western Electric Company in New York City before engaging in editorial work. Mr. Braymer takes with him the best wishes of the publishing company from which he now severs his connections.

Dwight D. Miller has joined the staff of The Society for Electrical Development, to study and develop uses of electricity in the various industries, the work of the Society having grown to a point where it has become necessary to add another engineer to its staff engaged in this field. Mr. Miller is a graduate of Harvard University. He was for over ten years with the Westinghouse Electric & Manufacturing Company as sales engineer, and has been sales manager and consulting engineer for two other firms handling electrical and mechanical apparatus. Mr. Miller has also been a contributor to the technical press.

Lewis A. McArthur, who has been appointed general manager of the Pacific Power & Light Company of Portland, Ore., to succeed J. E. Davidson, who resigned to take a position with the Electric Bond & Share Company of New York, has been with the Pacific company since its organization in March, 1910. He is a native Oregonian, and previous to attending the University of California, he was for two years a newspaper reporter. He graduated from college in 1908, and entered the employ of the Oregon Electric Railway Company as a ticket clerk. Later he was promoted to a position in the general offices of the railway company, and in March, 1910, when the Pacific Power & Light Company took over and consolidated a number of electric light, water and gas plants in Oregon, Washington and Idaho, he was made chief clerk to the president. In 1912 he was appointed assistant general manager of the company, and for a time had charge of the company's properties at North Yakima, Wash. In addition to operating duties, Mr. McArthur has been editor of the company bulletin. Mr. McArthur has been active in society matters, and has been chairman of the program committee for the 1914 and for the 1917 annual conventions of the Northwest Electric Light & Power Association, and he was also chairman of the entertainment and program committee of the Portland Section of the N. E. L. A. during the year 1915-1916.



LEWIS A. MC ARTHUR



CHARLES J. MARSH

Charles J. Marsh, who since 1901 has been connected with the New York office of the Standard Underground Cable Company, has been elected a vice-president of that company. Prior to joining the forces of the cable company, Mr. Marsh was for twelve years connected with the United Electric Light & Power Company and the Brush Electric Illuminating Company of New York City, serving for a great part of the time as secretary and treasurer of both companies. He has been for many years manager of the Eastern and Northeastern sales department of the Standard Underground Cable Company and was also its principal Eastern metal buyer with headquarters in New York City. His many friends look upon his promotion as a well-earned reward for faithful and meritorious service. Mr. Marsh will continue to make his head quarters in New York and to exercise general supervision over the sales territory in which his genial character and ability have won him in his company so many friends. Mr. Marsh is vice-president of the New York Metal Exchange and a member of the Railroad Club of New York, the Montclair (N. J.) Athletic Club and the Commonwealth Club of Upper Montclair.

C. W. Jones has resigned as secretary of the Trumbull Electric Manufacturing Company of Plainville, Conn. Mr. Jones, who is well known throughout the electrical industry, had been connected with the Trumbull company for the last twelve years.

Dr. Morton G. Lloyd, formerly editor of the *Electrical Review* and *Western Electrician,* has accepted a temporary appointment as associate engineer in the Bureau of Standards at Washington.

B. G. Worth has been elected vice-president of Walter Kidde & Company, Inc., engineers and constructors, New York City, the new firm name of the business with which he has been associated for more than fifteen years as electrical engineer. In this capacity Mr. Worth has had charge of a large variety of power plant construction and factory electrification, and in later years also building construction, etc. He will hereafter be in general charge of the engineering and construction work of the company.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

CONDITIONS IN ELECTRICAL SUPPLY JOBBING FIELD

Outlook Uniformly Good Throughout the Country—Demand Noticed for Conduit, Wire and Cable and Other Building Materials

Conditions in the electrical supply jobbing field are excellent and the outlook bright, according to the reports received by the ELECTRICAL WORLD. Slightly higher prices are anticipated in copper and iron products. Stocks generally are large, although there is an unmistakable disposition on the part of certain jobbers to keep stocks down and unload wherever possible because of that ever-present fear of a break in the market. Jobbers for the most part are buying heavily, mostly because of the long time required for goods to reach them. Dealers and contractors, however, are buying in large measure from hand to mouth.

Both credits and collections are uniformly good.

The consolidated reports from the different sections of the country follow:

NEW ENGLAND

A slight falling off in the volume of business is noted by representative jobbers in New England in comparison with the 1916 rate from Jan. 1 to March 1. The question of securing satisfactory deliveries is more troublesome than two months ago, the congestion of traffic on the railroads retarding shipments, in some cases seriously. Anticipating further difficulties along this line, stocks of conduit and wire are in some instances being increased beyond the previous normal. Collections and credits are very good according to reports lately gathered in the field.

Shortage of materials due in part to the railroad situation is likely to lead to further general price advances within the next few weeks or when the present stocks are exhausted. No evidence is at hand respecting any noticeably large demand for particular lines of manufactured goods. Some jobbers feel that the present volume of business is likely to continue substantially unabated up to the first of the year 1918.

In well-informed circles, the opinion has lately been expressed that the industry would be benefited by closer adherence to price levels established on the basis of a mutual understanding among wholesale distributers. In general, prices have advanced about 5 per cent since December, 1916. In the electric heating field, the desirability of special heating rates among many central stations has been emphasized by a prominent jobber anxious to "do his bit" in popularizing electric ranges. With a few notable exceptions this class of equipment has been rather conservatively received in New England, and the opportunities for development appear attractive at this time.

MIDDLE ATLANTIC

It is generally anticipated that prices will advance although there is a feeling that a declaration of war on the part of this country might cause a slump.

Stocks are uniformly large owing to the difficulty in obtaining satisfactory deliveries, and so long as the indications are toward higher prices large stocks will probably be maintained. Buying therefore, will be heavy on the advancing market.

Jobbers sales are heavy but show a tendency on the part of customers to buy more from hand to mouth, fearing a price reaction. Throughout the region there has been a marked demand for conduit, insulated wire and other building materials. Credits and collections are good.

The outlook is especially good just at present. From all indications 1917 will be a large year. Factory and industrial building activity continues, if anything, at a greater rate than last year. Apartment house, hotel, office building and dwelling house construction, however, does not present as bright a prospect. The high prices of building materials have undoubtedly retarded developments in these fields.

There is unmistakable evidence in this region on the part of some jobbers to unload some of their stock because of an impression that the upper limit has been reached and that a break in prices will accompany any statement of war activity from the White House.

SOUTH

Throughout the Southern states slight advances in prices of electrical supplies are anticipated. Some jobbers have large stocks, although for the most part they are normal with shortages in some lines.

It is not believed that buying will be heavy for a few months at least because of this fear of a break. In the Gulf States there seems to be a noticeable demand for conduit, conduit fittings, insulated wire and cable. Inland there is a rather unusual demand for independent telephone line material and an accelerated demand for farm lighting sets.

Credits and collections are reported as in good condition.

The general impression is that the outlook is good although it is doubtful if it would take much to change this view. The South is to such an extent an agricultural region of a peculiar nature that the people are hesitating to take any very definite steps and to buy for much more than immediate needs until they have some rather definite idea of the international policy to be followed by this country in the next few months.

CENTRAL AND NORTH MIDDLE WEST

In the Central and North Middle Western states jobbers' prices have been more staple in the last month than in previous months. Also, they have been well maintained. Such price changes as have been made were advances. Iron pipe and copper wire were the principal commodities to increase.

The condition of stocks now carried by different jobbers varies. The stocks of some are low; those of others fairly full. The impression seems to prevail that manufacturers' deliveries are getting in a little better shape and that jobbers' stocks will be more complete as the month progresses. The one commodity that is harder to get than any other now seems to be lamps. Embargoes are a factor in this situation. Motors are also scarce in some jobbers' stocks. The stocks of the customers of jobbers in general are believed to be low. It seems that the electrical contractors and dealers are perhaps as well stocked in the important staple lines as any of the buyers.

Nevertheless, heavy buying is universally expected in March. Construction work, efforts to accelerate industrial plant production, and the spring spirit that moves buyers, are looked upon as the factors that will influence this unusual demand. No one commodity or product has stood out conspicuously as moving faster than the majority of the stock in the last month and none is expected to in March. Credits and collections everywhere are reported good.

SOUTHERN PACIFIC

While there are some fluctuations, as a general thing the prices are more stable than last month. Such changes as occurred are all upward.

The condition of stocks is a little better and the jobbers feel safer because deliveries are being made more promptly.

Buying will be on a very conservative basis, that is, orders will cover the bare requirements as closely as they can be estimated. It is anticipated that sooner or later there will be a considerable decline in prices and it is the feeling that

purchases should be such as will supply needs and no more. As far as possible orders will be limited strictly to regular stock. When the decline in prices comes, the Pacific Coast jobber who always has to carry, comparatively, a large stock, expects to suffer from the reduction between rates of purchase and resale. Jobbers expect this and are willing to carry the loss on standard lines but are guarding against being caught with other than regular stock on hand.

Industrial business is heavy, contracting business good, but quite likely the latter will not continue at the present rate.

Caution in extending credit is the watchword. In the event of war it is quite possible that industrial business would offset the cessation of the contracting trade, so that jobbers would still be busy, but this would involve a considerable loss if credits had been too liberal previous to the change. Collections have been considerably slower than in the previous months, although this is not an unusual condition in the first and second months after the holidays.

General conditions are healthy. The best business is being done in industrial lines.

NORTH PACIFIC

The large electrical supply houses in this field, as a whole, report prices still on the upward trend, although the increase during the past month was not as noticeable as during the preceding months.

An effort is being made to keep plenty of stock on hand, but considerable difficulty, due to car shortage and the embargo, is experienced. This condition of affairs is expected to continue indefinitely and the various concerns are making their preparations accordingly. If the car-shortage bugaboo was not staring the various buyers in the face, the buying would be normal. Naturally, at this season of the year, buying is heavier as preparations are made for the spring building activities. But, due to prevailing conditions and circumstances, ordering is considerably heavier in order that early Spring and Summer delivery can be obtained.

While the above statements are literally true, other factors contribute to the active ordering mentioned. The Pacific Northwest, and particularly the Puget Sound section, is experiencing an active construction era, this being particularly true as regards shipbuilding. Building construction, too, considering the season of the year, is above normal.

Collections, compared with preceding months of this year, are good.

ELECTRICAL EXPORTS FOR 1916 PASS $40,000,000 MARK

December, the Largest Month in the Year, Closes a Record Twelve Months with a Total of $4,746,837

Surpassing all previous totals by wide margins, the total exports of electrical merchandise of American manufacture during 1916 amounted to $40,241,640. This exceeds the record year of 1913 by more than $12,000,000, or 43 per cent. The increase over 1915 was roughly $16,000,000 or 65 per cent. In comparison with 1914, the increase was more than 100 per cent.

Approximately half of the 1916 exports was in miscellaneous electrical goods. The value of this item in 1916 was $19,740,151, in comparison with $10,316,528 in 1915 and $8,509,468 in 1914. The value of the exports for almost every item was greater in 1916 than in the previous two years. Fans, however, were exported less in 1916 than in 1915, as were arc lamps and carbon filament lamps. Noticeable gains are found in the export of batteries, insulated wire and cable, metal filament lamps, motors, telephones. The exports of generators were slightly larger in 1916 than in 1915. Up to December, however, the export of generators had been running behind those of the previous year.

December brought this record year to a close with the largest monthly exports not only in the year but in the history of electrical shipping. The exports for the month in electrical goods totaled $4,746,837. This is in comparison with $2,177,338 for December, 1915. The gain, therefore, was considerably more than 100 per cent. In December, the exports of generators, meters, motors, and miscellaneous merchandise were the largest of any month in the year.

In using these figures for comparative purposes, too much emphasis cannot be laid on the fact that here values are given only, and not quantities. It must be remembered that the prices of electrical goods in 1916 were considerably in excess of those in 1915 and previous years. While it is undoubtedly true that much of the goods delivered in 1916 was placed at prices that were in effect before the increases took place, still a considerable quantity was shipped at very high prices. It is not doubted that the volume of exports in 1916 was greater than in previous years, owing principally to the fact that German and Austrian goods were shut out of the world market. It is no less true, however, that the excess of 1916 exports over 1915 exports is considerably less than indicated by values. In some items where an increase is shown by the values, it is quite probable that, as a matter of fact, the 1916 exports were less in volume of goods than in 1915, as, for instance, generators and interior wiring supplies. In some of the others it is doubtful how much of the apparent increase is actual.

Articles	December		Calendar Year		
	1915	1916	1914	1915	1916
Batteries	$110,164	$212,457	$635,522	$1,364,999	$2,025,250
Generators	116,383	305,759	2,372,816	1,872,191	1,876,565
Fans	20,308	23,422	295,966	374,649	313,771
Insulated wire and cables	174,886	630,732	1,321,451	2,761,609	4,943,577
Interior wiring supplies, etc., including fixtures	76,967	110,750	591,136	882,891	901,657
Arc lamps	3,392	1,146	42,782	23,983	15,467
Carbon filament lamps	23,945	16,297	88,025	158,815	129,523
Metal filament lamps	120,998	128,394	278,061	865,188	1,415,562
Meters and other measuring instruments	68,463	102,832	157,386	657,129	884,241
Motors	233,250	526,952	3,300,839	3,278,413	4,930,396
Telegraph instruments (including wireless apparatus)	14,201	15,654	93,563	136,890	209,343
Telephones	87,722	301,107	1,251,788	910,623	1,813,969
Transformers	50,477	86,370	934,312	737,680	1,051,168
All other	1,076,182	2,284,965	8,599,468	10,316,528	19,740,151
Total	$2,177,338	$4,746,837	$19,963,115	$24,341,588	$40,241,640

The accompanying table shows the figures sent out by the Bureau of Foreign and Domestic Commerce, classified according to articles.

COPPER MARKET QUIET

Prices Nominal, with Little Evidence of Buying Activity

Last week and early this week the copper market was very quiet. Prices are still high and nominal. There were but few purchasing orders. What orders there were stipulated mostly second quarter delivery.

Nominal prices for electrolytic were quoted on Tuesday as follows: February delivery, 36.5 cents; March delivery, 36.25 cents; second quarter, 34.5 cents; third quarter, 31.5 cents; fourth quarter, 30.25 cents.

NEW YORK METAL MARKET PRICES

	Feb. 19 Selling Prices Bid	Feb. 19 Selling Prices Asked	Feb. 26 Selling Prices Bid	Feb. 26 Selling Prices Asked
Copper	£ s d		£ s d	
London, standard spot	140 0 0†		139 0 0	
Prime Lake	35.00 to 35.50†		35.00	to 36.00†
Electrolytic	36.00 to 36.50†		36.00	to 37.00†
Casting	32.50 to 33.50†		33.00	to 34.00†
Copper wire base	41.50 to 42.50†		42.50	to 43.50†
Lead	8.50		8.50	
Nickel	50.00		50.00	
Sheet zinc, f.o.b. smelter	21.00		21.00	
Spelter, spot	10.55 to 10.67½		10.67½	to 10.92½
Tin, straits	49.00†		49.87½†	
Aluminum, 98 to 99 per cent.	51.00 to 53.00†		51.00	to 53.00†
OLD METALS				
Heavy copper and wire	26.00 to 27.00†		27.50	to 28.00†
Brass, heavy	16.00 to 17.00†		17.50	to 18.00†
Brass, light	13.00 to 13.50†		13.75	to 14.00†
Lead, heavy	7.50 to 7.75†		8.00	to 8.50†
Zinc, scrap	7.50 to 7.75†		8.00	to 8.25†

COPPER EXPORTS

Total tons to 24,446

†Nominal.

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Transformers for Series Lamps on Poles

Transformers have recently been developed by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., which it is claimed render a series direct lighting system of distribution safe, and prevent broken lamp filaments from opening the series circuit and putting a branch of the system out of service. By the use of these transformers in the bases of ornamental poles, low-tension wiring may be employed in the poles, thus making the system safe and less expensive to install.

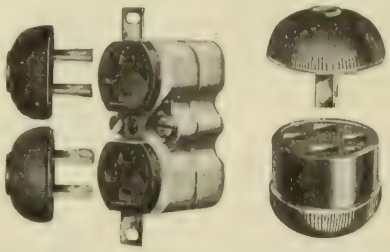
These safety transformers, which are given the trade name "Luxsolite," have two windings not inter-connected and therefore the lamps can be renewed without danger to the operator while the circuit is alive. They are of the core type construction with a case of heavy sheet steel. For manhole service heavy tinned pipe outlets are provided on which a joint with the lead-covered cable may be wiped. Small feet are provided for supporting the transformer in the bottom of the pole base. For overhead service, the leads are brought out through the bottom in porcelain bushings, and a strap is provided on the side for mounting on the pole. Before shipping, an insulation test of 20,000 volts is applied between the primary and secondary windings of each transformer.



TRANSFORMERS THAT ENABLE LOW TENSION WIRING TO BE USED ON LIGHTING POLES

Standard Plugs and Receptacles

Six electrical manufacturers have agreed on making standard plugs and receptacles, the attaching caps of which can be connected to the bodies of any of the several makes. In the accompanying illustrations are shown the C-H No. 7711 standard single flush receptacle, C-H No. 7721 duplex flush receptacle and C-H No. 7717 surface receptacle, all recently brought out by the Cutler-Hammer Manufacturing Company of Milwaukee. The single and duplex flush receptacles are made of white glazed porcelain and rated at 660 watts, 250 volts. The portions of the receptacles exposed through the apertures in the flush plates are enameled black, making a surface which does not show soil.

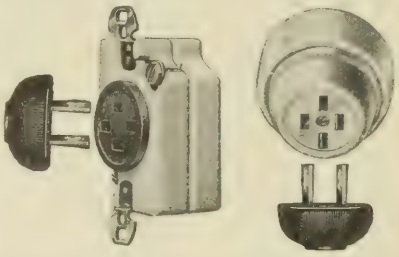


LEFT—DUPLEX RECEPTACLE WITH STANDARD ATTACHING CAP AND POLARITY CAP BELOW

RIGHT—SEPARABLE MOTOR ATTACHMENT PLUG AND CAP WITH STANDARD PARALLEL BLADES

Each outlet is provided with four slots with protected contacts—two parallel to receive the blades of the standard parallel blade cap or polarity cap—and two in tandem to receive the blades of the tandem-blade cap. The duplex receptacle is the same size as the single receptacle but has double the number of outlets, thus allowing the attachment of two electrical appliances from one outlet box. Large terminal screws are provided, one pair taking care of both receptacles. Grooves in the side of the porcelain body accommodate the conductors and prevent crowding in the outlet box.

The surface receptacle like the flush receptacles is of glazed porcelain with concealed contacts and slots arranged to accommodate standard attaching caps. It is designed for concealed wiring and has the same rating as the other receptacles.



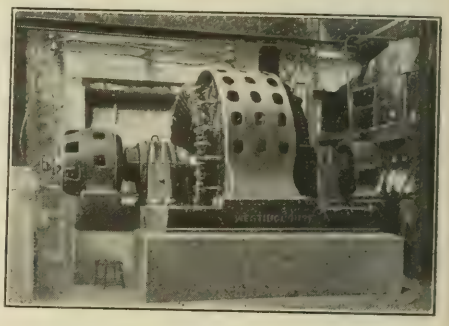
LEFT—SINGLE FLUSH RECEPTACLE WITH STANDARD ATTACHING CAP

RIGHT—SURFACE RECEPTACLE AND STANDARD ATTACHING CAP

A polarity cap with parallel blades, one enlarged to fit a correspondingly enlarged slot of the standard plugs and receptacles, has also been recently placed on the market by this company.

Power Factor Correction and Voltage Regulation Equipment

A large amount of single-phase power is purchased by the Pennsylvania Railroad Company for its twenty-mile Paoli electrification. This imposes unusual operating conditions on the generating station of the Philadelphia Electric Company, from which the power is obtained. Balanced load and high power factor were, therefore, highly desirable features, while in the case of the Pennsylvania Railroad Company voltage regulation was the prime essential. As the equipment in the generating station only took care of balancing the load, additional equipment was necessary to secure power factor correction and voltage regulation. Two 4500-kva., single-phase, 25-cycle, 11,000-volt, 500-r.p.m.



POWER FACTOR CORRECTION AND VOLTAGE REGULATING EQUIPMENT IN RADNOR SUBSTATION

Westinghouse synchronous condensers were therefore installed in the Radnor substation of the Railroad Company, each of which was provided with a 125-volt, direct-connected exciter, a single-phase, 330-volt, alternating-current starting motor, starting transformers, switching equipment, and complete Westinghouse voltage regulating equipment. The substation chosen was at practically the central point of the load. In addition to the continuous rating of 4500 kva., the condensers are guaranteed to carry 6000 kva. for one hour, and 9000 kva. for five minutes, to take care of the widely fluctuating load characteristics of single-phase railroad service, the latter rating being equivalent to 15,500 kva. on a three-phase circuit. As the condensers are used on single-phase circuits the usual alternating-current self-starting method could not be employed, and since the only power available was single-phase, an alternating-current motor of the series type, with suitable step-down transformers, was installed for each condenser. A liberal number of taps on the starting transformer assures

proper starting motor voltage over a relatively broad range of trolley voltage.

The stator winding of the condensers is of the usual three-phase, star-connected type, two legs only being used, and to eliminate vibration due to the widely fluctuating single-phase load, the mechanical parts of the machines are made extra heavy. The condensers are connected through suitable switching equipment, direct to the 11,000-volt trolley and ground. While the power factor of this kind of service is necessarily a varying quantity, due to the fluctuating load and variations due to changes in train locations, in general the resulting power factor with the maximum corrective effect of the condensers will be near unity, being raised to this value from approximately 65 to 70 per cent.

By means of Westinghouse voltage regulators of the broad range type, 11,500 volts is maintained on the trolley at Radnor at no load, gradually dropping off with increases in load to 11,000 volts at maximum overload. Two regulators are installed, each large enough to take care of one or both condensers, the source of direct current required being a small generator mounted on the outer bearing bracket of the starting motors. Each regulator, in addition to performing its function of voltage regulation, will, in conjunction with temperature relays and coils located in the armature winding of the condensers, serve automatically to reduce the load on the condenser in the event a certain pre-determined temperature is exceeded, thus preventing dangerous overloading of the machines.

Silvered-Glass Bowl-Shaped Reflector

The bowl-shaped reflector shown in the accompanying illustration has been designed by the National X-Ray Reflector Company of Chicago, Ill., for use with 75-watt Mazda "C" lamps. This reflector completes the line of one-piece silvered-glass reflectors for industrial and commercial lighting that this company has been making. It is designed in such a way, however, that it can be used with the 60-watt and 75-watt Mazda "B" lamps as well, and for general illumination or for localized light from drop lamps.



REFLECTOR FOR 75-WATT MAZDA "C" LAMPS

Other reflectors have already been developed by this company for lamps up to and including the 1000 watt. The entire line is of a deep-bowl type that practically conceals the lamp from view, and spreads the light flux considerably. The reflector shown herewith is known as No. 535.

Combined Electric Table Lamp and Phonograph

The combination phonograph and electric lamp shown in the accompanying illustration has been developed by the George C. Lynch Company of New York, N. Y. The phonograph is concealed in the base of the lamp, which is so designed that it will accommodate any size records up to the 12-in. disk. When the phonograph is to be played the hood is raised, the disk inserted and the power turned on.

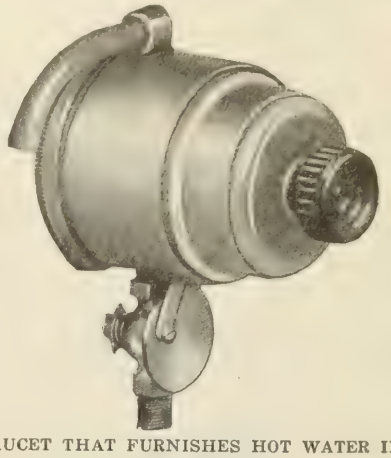
The disk is revolved by a small motor in the same circuit as the electric light, but controlled by a separate switch. This arrangement makes it possible to play the instrument when the lamp is not in use. Instead of using a horn as with some "talking" machines, the sound is diffused through the stem of the lamp, which, it is claimed, considerably softens the tone. The "phonolite," as this combination set is called, is especially applicable where there is a limited amount of room as in small apartments.



PORTABLE LAMP WITH MOTOR-OPERATED PHONOGRAPH CONCEALED IN BASE

Light-Weight Thermo Electric Faucet

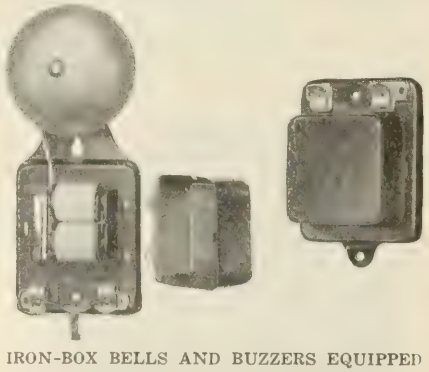
A water heater that can be easily attached to any plumbing, that takes its energy from the most convenient lamp socket, and that is easily operated, is shown in the accompanying illustration. The apparatus is the product of the Thermo Electric Faucet Company, 74 New Montgomery Street, San Francisco, Cal. The heating element is always submerged so that it cannot be exposed to a higher temperature than that of boiling water, and is automatically energized by the same motion that turns on the water. Since cold water may be drawn from the faucet without heating, it is not necessary to have a faucet especially for cold water. The heater, it is claimed, supplies hot water in three seconds, furnishing from 1 pt. to 1 qt. a minute depending upon the temperature required and thus may be used for any purpose except bath or laundry service. Weighing only a little more than 1 lb., the heater can be carried by travelers and tourists.



FAUCET THAT FURNISHES HOT WATER IN THREE SECONDS

Iron-Box Bells with Clip Connectors

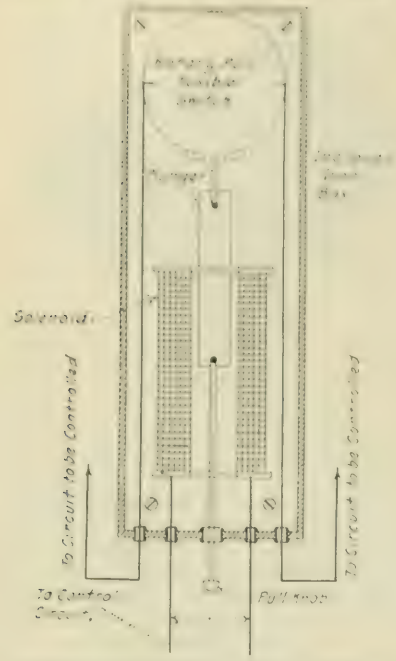
Iron-box bells and buzzers, manufactured by Edwards & Company, Inc., 140th and Exterior Streets, New York City, are now being furnished with Fahnestock clip connectors. They are made in three classes: One equipped with a locking adjustment screw for regulating the separation of the contacts; another does not have this adjustment, and a third is the same as the second except that the resistance is 5 ohms instead of 3. The gongs on these bells are riveted to the support to prevent removal or turning. The hammer rod, ball and armature are made in one piece. It is claimed that there is no space in which foreign matter will collect and interfere with operation because the armature pivot is near the point where the hammer rod passes through the cover, thus there is practically no motion allowing the opening in the cover to be almost the same size as the diameter of the hammer rod.



IRON-BOX BELLS AND BUZZERS EQUIPPED WITH CLIP CONNECTORS

Small-Capacity Remote-Control Switch

A small capacity remote-control switch, which may be used to operate one or more lamps, motors, or other devices, requiring 10 amp. or less, is



DETAILS OF REMOTE-CONTROL SWITCH

being manufactured by the Gardner Electric Manufacturing Company of Bay Point, Cal. These switches can be operated by hand, as well as magnetically, from a push button. The mechanism is inclosed in a weatherproof sheet-iron box, which may be quickly attached to any support. By the use of this switch, it is claimed, electrical apparatus may be controlled at a distance without a heavy cost for conductors and the copper loss in them. The Gardner company is also making a switch similar to the one illustrated, that has a knife switch in place of the ratchet-pull switch.

Motor-Driven Propeller Fans

Propeller fans equipped with interchangeable round-frame motors are being manufactured by the Batterman Truitt Company of Chicago. The fans have an outer retaining ring, to which



PROPELLER FANS EQUIPPED WITH INTERCHANGEABLE ROUND-FRAME MOTORS

is attached three forged steel arms supporting the motor ring. The motor is mounted within the motor ring and is held rigid by three cap screws. The wheel consists of a bored and reamed hub with steel spokes securely riveted thereto. The outer rim is oxy-acetylene welded and riveted to the blades and spokes. The motor bearings, which are made of cast bronze alloy, have large wearing surfaces, and are self-aligning and interchangeable. Speed regulators are furnished with all direct-current fans 18 in. in diameter and larger, giving approximately 50 per cent speed reduction below normal by intermediate steps. These fans are equipped with Peerless motors.

Development of the Induction Relay

The placing of the selective protection of electric circuits upon a present scientific basis has been due largely to the efforts of F. E. Ricketts of the Consolidated Gas, Electric Light & Power Company of Baltimore, one of the earliest practical investigators of the subject of continuity of service. In pursuing his investigations Mr. Ricketts found that mechanically operated time

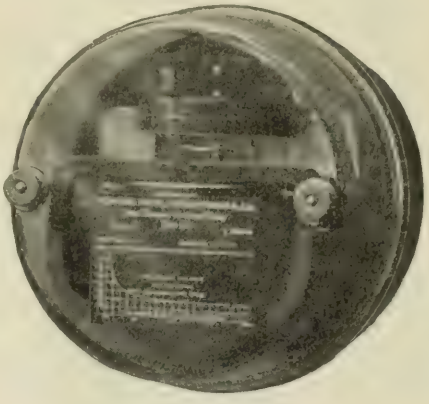


FIG. 1—TORQUE COMPENSATOR TYPE

elements such as bellows, would not answer requirements. Appreciating, however, the inherent advantages and accuracy of magnetically damped induction relays, he used them as a basis in perfecting a relay equipment suitable for carrying out his theoretically determined features of continuity of service. In the course of his search Mr. Ricketts found that the essential features necessary in the satisfactory operation of relays were accuracy of time-limit element and definite-minimum time-limit at any predetermined overload. The first was inherent to the induction relay; the second he obtained by the use of a saturating reactance coil, now known as a torque compensator, connected with the relay windings.

The first induction type of relay, according to the Westinghouse Electric & Manufacturing Company, was placed on the market in 1902. The induction principle of the operation was the same as had been used with great success in this company's alternating-current integrating watt-meters (now watt-hour meters) for several years prior to this time. This earliest relay was made in two forms, one form being illustrated in Fig. 2, and even in its early design, it is claimed, was superior in accuracy, reliability and sensitivity, to relays operating on other principles. One form was inclosed in a round case, while the other was of open construction designed for mounting on a panel board.

The torque compensator was first placed on the market in 1913 by the



FIG. 2—EARLIEST INDUCTION-TYPE RELAY

same company, as a separate device to be used in connection with the induction relay.

Since its introduction the development of the induction type of relay has advanced continuously. It has had various forms and has finally culminated in the overload and the reverse-power relay, the torque compensator being included self-contained, as a part of the relay. The reverse-power relay is shown in Fig. 3.

The adding of the torque compensator to the relay, and other perfections made at the same time, marked a distinctive advance in relay art, and has established the use of protective relays as one of the vital necessities in the continuity of service.

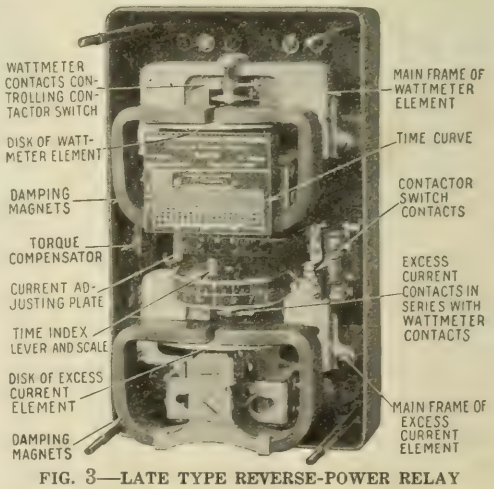


FIG. 3—LATE TYPE REVERSE-POWER RELAY WITH COVER REMOVED

Trade Notes

CAPT. RICHARD S. SATTERLEE, vice-president of the Habirshaw Electric Cable Company, Inc., died on Feb. 15.

F. LLOYD MARK has been appointed Western sales manager of the Central and near Western States for the Stroh Steel-Hardening Process Company. His offices are at 722 Monadnock Block, Chicago.

UTILITIES INDEMNITY EXCHANGE, Railway Exchange Building, St. Louis, Mo., has changed its name to the Utilities Indemnity and Fire Exchanges.

R. H. STARR has severed his connections with the engineering staff of the Toronto Hydro-Electric System, and has accepted a position as sales engineer with the sales office of the Moloney Electric Company of Canada, Ltd., Toronto.

P. H. AFFOLTER AND A. E. GARLAND, who were formerly connected with Fairbanks, Morse & Company, will in the future represent the Moloney Electric Company on the Pacific Coast. The office from which this business will be handled is located in the Rialto Building, San Francisco, Cal.

THE W. S. BARSTOW MANAGEMENT ASSOCIATION, 50 Pine Street, New York City, which will supervise the management of all public utility properties controlled by The General Gas & Electric Company, The Eastern Power & Light Comporation and W. S. Barstown & Co., Inc., has been incorporated. E. L. West has been elected president of the new corporation.

THE EDISON LAMP WORKS OF THE GENERAL ELECTRIC COMPANY, Harrison, N. J., is building a four-story brick and reinforced concrete addition, 135 x 190 ft., to its plant on Fifth Street, to cost about $300,000. An addition to the company's plant at Ampere, three-story, 90 x 150 ft., will also be erected; the cost is estimated at $100,000.

ELECTRIC MACHINERY COMPANY, Minneapolis, Minn., has opened new offices in Boston and New York. The Boston office is in charge of A. B. Boynton, whose address is 161 Devonshire Street. The Boston office will have charge of the entire New England territory. The New York office, situated at 828 Singer Building, is in charge of S. R. Dresser. This office will look out for eastern New York and northern New Jersey.

A. H. ACKERMAN, formerly vice-president and general manager of the U. S. Light & Heat Corporation, and C. C. Bradford, formerly sales manager of the same company, announce the formation of the Bradford-Ackerman Corporation, with offices in the Forty-second Street Building, New York City, to represent manufacturers of electric apparatus, automobile and railway supplies for domestic and export trade.

THE WESTERN CONDUIT COMPANY, a subsidiary of the Youngstown Sheet & Tube Company, and manufacturer of "Buckeye" conduit and "Realflex" armored cable, has been dissolved. The parent company will carry on the manufacture of these two products direct. This will be done at the same plant and under the same organization as heretofore, the change causing no disturbance in either the manufacture or sales end of the proposition.

EXPORT TRADE DIRECTORY.—The fifth edition of the Export Trade Directory has been issued by the Johnston Export Publishing Company, 17 Battery Place, New York. The work was compiled under the supervision of B. Olney Hough, editor *American Exporter*. It contains 536 pages and costs $5. The present volume gives information of great value to every exporter. The material has been presented clearly and concisely, and the classified indexes and cross indexes will be found especially practical.

AN INDUSTRIAL EXPORT EXPOSITION AND CONFERENCE will be held from May 26 to June 2 in the plant of the Eastern States Exposition at Springfield, Mass., as the result of a feeling in the manufacturing centers of the eastern states and New England that something tangible should be done to fortify the industrial interests to meet conditions that will follow the close of the war in Europe. The growth of the export business of this country in the last two years has emphasized the need of taking steps to hold what has been gained when there shall again be competition, and the coming export exposition and conference will be a move in this direction, in the opinion of the large body of industrial leaders and commercial organizations that are promoting it. This is no less true of the domestic expansion.

THE MOLONEY ELECTRIC COMPANY OF ST. LOUIS has just completed another extension to its present plant. This addition is twice as large as the company's old factory. In addition to this the company has another factory at St. Louis which contains three times as much floor space as the old factory. The total floor space at present occupied by the company for the exclusive building of transformers amounts to 128,000 sq. ft. The several plant extensions made during the past year have been necessitated on account of the company's rapid extension in business. Its total monthly shipments at the present are approximately ten times what they were about a year ago. This increase includes both domestic and foreign business. In the latter field the company is making striking strides and is now shipping to nearly all of the countries in the world.

COMMERCIAL MAP OF SOUTH AMERICA. Rand, McNally & Co., 40 East Twenty-second Street, New York, have issued a new Commercial Map of South America. The map is 46 x 66 in., and is exceptionally well printed and arranged. All names are in Spanish except those in Brazil, which are in Portuguese, and those in the Guianas, which are according to the countries which govern them. Accompanying the map is a book containing a list of all cities and towns in South America, with latest census figures. The location of all towns shown on the map are indicated by cross reference index. The spellings in this index are those used in the Postal Service. The map and index will be found of value to all interested in South American trade. The price is $15.

New Incorporations

THE GILL GLASS COMPANY of Millbrook, N. Y., has been incorporated by J. F. Fitzharris, E. C. Wilson and F. D. Gill, East York and Thompson Streets, Philadelphia, Pa. The company proposes to manufacture glass, glassware, electric lighting appliances, tools, etc. The company will carry on business with $335,000.

THE SOUTHERN FEDERAL WIRELESS CORPORATION has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $7,000,000 for the purpose of constructing and maintaining towers for receiving wireless messages. The incorporators are: William J. Cullen, John F. Roach and Clarence E. Bahm, all of New York, N. Y.

THE McDANIEL & CAMPBELL ELECTRIC COMPANY of Springfield, Ohio, has been chartered with a capital stock of $25,000 by William McDaniel, Roy J. McDaniel, R. E. McDaniel of Springfield; Carl Campbell and Fred Campbell of Columbus, Ohio.

THE COOKSON-FORESMAN ELECTRIC COMPANY of Newton, Mass., has been incorporated with a capital stock of $10,000. The directors are: W. B. Cookson, president; Fred A. Foresman of Ashby, treasurer, and C. R. Metchear.

THE CAMPBELL ELECTRIC CORPORATION of Lynn, Mass., has been chartered with a capital stock of $5,000. The officers are: Lawrence E. Gott, of Swampscott, president; Fred R. Campbell, treasurer, and J. Schwartz, clerk, both of Lynn.

THE CHICAGO GLASS SPECIALTY WORKS of Chicago, Ill., has been organized with a capital stock of $25,000 by A. C. Laussen, Henry Dupke and F. B. Yamnicky. The company proposes to blow glass in all its branches by machinery.

THE STIEFVATER ELECTRIC COMPANY of Utica, N. Y., has been incorporated by C. W. Clare, A. C. and E. G. Stiefvater of Utica. The company is capitalized at $15,000 and proposes to do a general contracting and electrical business.

THE EXPERT DISPLAY LIGHTING CORPORATION of New York, N. Y., has been chartered with a capital stock of $5,000 to manufacture and deal in signs, devices, novelties, machinery for distributing electricity. The incorporators are: L. Friedman, H. C. Wiley and H. Harris, 31 Nassau Street, New York, N. Y.

THE AMPER LOCK & SWITCH CORPORATION of Buffalo, N. Y., has been incorpofated by W. H. Farnsworth, 937 Main Street; A. L. Higley, 920 Niagara Street, and W. H. H. Davenport, 219 Ellicott Square, Buffalo, N. Y. The company is capitalized at $100,000 and proposes to manufacture locks, switches, electrical machinery, etc.

Trade Publications

PNEUMATIC EJECTOR.—The Yeomans Brothers Company, 231 Institute Place, Chicago, Ill., is distributing bulletin No. P-4000, descriptive of the Shone system pneumatic ejectors for automatically raising sewage and drainage from basements below street sewer level, municipal sewerage systems, etc.

CLAY PRODUCTS.—The Laclede-Christy Clay Products Company of St. Louis, Mo., is distributing its January issue of the L-C bulletin, giving information regarding its clay products.

CALL SYSTEM.—The Autocall Company of Shelby, Ohio, has recently issued a well-illustrated bulletin descriptive of its autocall system. This is an electrically operated audible signaling service, the purpose of which is to promptly locate any of the heads or important members of an organization without disturbance to any but the party wanted.

LAMPS.—The Franklin Electric Manufacturing Company of Hartford, Conn., is distributing a leaflet entitled, "Disarm the Darkness." This folder is descriptive of the Franklin Mazda lamps.

TROLLHATTAN CANAL.—Two handsome books describing and giving the history of the Trollhattan Canal of Sweden have been received. These two volumes show care in preparation and are well illustrated.

AUTOMOBILE ACCESSORIES. — The Benjamin Electric Company has issued a twenty-four page catalog illustrating and describing such automobile accessories as horns, push buttons, dry-battery cases, lamp regulators, speedometer lamps, magneto magnetizers, garage lighting equipment and tools.

INSTRUMENTS. — Ampere-hour meters are described and illustrated in Bulletin No. 45 now being distributed by the Sangamo Electric Company of Springfield, Ill.

ELECTRICAL INSTRUMENTS. — The Harvard Electric Company, 525 West Van Buren Street, Chicago, Ill., manufacturers of ammeters, voltmeters, and battery indicators, have just issued a new catalog, No. 25, illustrating and describing its instruments.

LAMPS.—The Faries Manufacturing Company, Decatur, Ill., is distributing an illustrated leaflet of its Verdelite desk and piano lamps.

FANS.—The Robbins & Myers Company of Springfield, Ohio, has recently prepared Catalog No. 1106 descriptive of its electric fans for alternating and direct-current circuits.

HEATING PAD.—The Standard electric heating pad is illustrated and described in a leaflet now being distributed by the Standard Electrical Appliance Company of Beverly, N. J.

REFLECTORS.—Bulletin No. 15-22, descriptive of steel reflectors for industrial lighting, has just been issued by Harvey Hubbell, Inc., Bridgeport, Conn.

AIRCRAFT ENGINE.—The Packard Motor Car Company of Detroit, Mich., has prepared an illustrated bulletin descriptive of its aircraft engine.

GRINDERS.—The Van Dorn Electric Tool Company of Cleveland, Ohio, has issued an illustrated leaflet descriptive of its electric grinders.

TRUCKS.—The General Motors Truck Company of Pontiac, Mich., is distributing issue No. 15 on truck talks.

FANS.—The Knapp Electric & Novelty Company, 511 West Fifty-first Street, New York, N. Y., has prepared a leaflet descriptive of its fans for 110 volts and for battery service.

SEWING MACHINES.—The Western Electric Company, Inc., is distributing illustrated leaflet descriptive of its complete line of portable sewing machines. There are three types in this line, the vibrator type, the rotary type and the automatic type.

CONSTRUCTION ENGINEERS.—"The Puzzle of Prosperity and Its Solution" is the title of a carefully prepared and well-illustrated bulletin now being distributed by W. S. Barstow & Company, Inc., 50 Pine Street, New York, N. Y. The book contains photographs of some of the construction work accomplished by this engineering and construction company.

MOTOR GENERATORS.—Bulletin No. 1001 descriptive of self-operating generating units has been issued by the S. V. M. Sales Corporation, 1765 Broadway, New York, N. Y.

New England

RANGOR, ME.—The Bangor Railway & Electric Company is planning to erect an electric transmission line from the Ellsworth, Veazie and Milford stations to the plant of the Eastern Manufacturing Company at Lincoln, with whom it has contracted to supply 2000 hp. The cost of the line is estimated at about $75,000.

BIDDEFORD, ME.—Plans are being considered by the Clark Power Company of Dayton, a subsidiary of the Pepperell Manufacturing Company, for the construction of a hydroelectric power plant on the Saco River near Union Falls, to supply energy for the Pepperell and York Mills.

HOLYOKE, MASS.—After noting the need of many improvements at the municipal electric light plant, John J. Kirkpatrick, manager of the gas and electric department, recommends in his annual report the construction of an entirely new plant along the river front somewhere, rather than making the improvements suggested. Among the new machinery needed are a new scrubber, exhauster, condenser, two extractors and station meter. The electric plant needs additional coal storage capacity and new boilers.

NORTH DANA, MASS.—The power house of the North Dana Electric Light Company was recently destroyed by fire, causing a loss of about $2,000. The town is at present without electrical service.

PROVIDENCE, R. I.—Bids will be received at the office of the city clerk, City Hall, Providence, until March 12, for furnishing an 8,000,000-gal. pumping unit at the Mount Hope pumping station. Further information may be obtained at the office of the city engineer, City Hall. W. C. Pelkey is city clerk.

Middle Atlantic

BAINBRIDGE, N. Y.—The Public Service Commission has granted the Standard Light, Heat & Power Company of Unadilla permission to construct an electric plant and exercise a franchise in the town of Bainbridge.

BUFFALO, N. Y.—Preparations are being made by the Buffalo General Electric, Postal Telegraph, Western Union Telegraph and New York Telephone Companies to place their wires in underground conduits in accordance with city ordinances. An appropriation will be asked by Arthur W. Kreinheder, commissioner, for an appropriation to bury all police and fire department wires in conduits constructed by these companies.

HEMPSTEAD, N. Y.—The Nassau Light & Power Company of Mineola is negotiating with the village officials for a contract for lighting the streets of the village. Gas is now used.

NEW YORK, N. Y.—Bids will be received by Robert Adamson, fire commissioner, Eleventh Floor, Municipal Building, New York City, until March 9 for furnishing 1400 twin fire alarm posts. Bids will also be received at the same time and place for upper parts for 161 fire alarm posts. Blanks and further information may be obtained at the office of the Fire Department, Eleventh Floor, Municipal Building, upon deposit of $5.

NEW YORK, N. Y.—The Metropolitan By-Products Company, 52 Vanderbilt Avenue, New York City, has awarded the wiring contract for its plant at Lake Island, Staten Island, N. Y., to Louis Kalischer, 1225 Myrtle Avenue, Brooklyn. The plant will be equipped with 2200 hp. in motors and about 100 kw. in interior and flood lighting. This is a three-phase, 60-cycle, 440-volt installation.

NEW YORK, N. Y.—Bids will be received at the office of Robert Adamson, fire commissioner, eleventh floor, Municipal Building, New York City, until March 5 for furnishing and installing underground lead-covered cables and appurtenances for Rockaway Improvement, borough of Queens. Blank forms and further information may be obtained at the office of the Fire Department, upon deposit of $5.

NEW YORK, N. Y.—Bids will be received by the Board of Trustees of Bellevue and Allied Hospitals in the office of the general medical superintendent, Bellevue Hospital (entrance 415 East Twenty-sixth Street) until March 5 for furnishing and installing lighting fixtures for the outpatient department at Gouverneur Hospital, situated at Front Street and Gouverneur Slip, borough of Manhattan. Blank forms and further information may be obtained at the office of the chief clerk and auditor, 400 East Twenty-ninth Street, New York City.

RENSSELAER, N. Y.—A movement has been started by local business men for the installation of an ornamental lighting system on Broadway.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

TOMPKINSVILLE, N. Y.—Plans are being considered by the Richmond Light & Railroad Company, it is reported, for the erection of aerial cable line from Linoleumville to Lake Island, over Fresh Kill Creek, to supply light and power service.

WALDEN, N. Y.—The Public Service Commission has granted the Wallkill Valley Electric Light & Power Company franchises to operate in Montgomery and Crawford, Orange County.

ALTOONA, PA.—The Penn Central Light & Power Company contemplates the erection of an electric transmission line from Warriors Ridge to Lewistown, to cost about $150,000.

ALTOONA, PA.—The Penn Central Light & Power Company will duplicate its high-tension transmission line in Cambria County at a cost of about $56,000. The proposed line will be extended from the substation at Collinsville to Cresson and thence to Ashville.

ERIE, PA.—The construction of a new lighting and heating plant, at a cost of about $1,000,000, is under consideration by the Erie Lighting Company. Negotiations are under way for the purchase of a site for the proposed plant. Fred B. Hofft is vice-president and general manager.

PHILADELPHIA, PA.—Work has begun on the erection of the high-tension line, which will connect the power house at Twenty-sixth and Christian Streets with the plant of the Beacon Light Company, now under construction, in South Chester. The cost of the transmission line is estimated at $300,000. The entire development undertaken in Chester, including the connection with Philadelphia, will cost about $6,000,000.

SUMMIT HILL, PA.—The installation of a new fire alarm system is under consideration by the borough officials.

SWISSVALE, PA.—The plant of the Union Switch & Signal Company at Swissvale, recently destroyed by fire, will be rebuilt at once. The new plant and equipment will cost about $6,500,000. The loss by the fire was about $4,200,000.

GARFIELD, N. J.—Bids will be received by the Mayor and Borough Council of Garfield until March 9 for furnishing and installing pumping equipment as follows: (1) Two air compressors for air lift pumping system; (2) one 110-hp. horizontal tubular boiler; (3) one air receiver. Specifications, etc., may be obtained at the office of Anton L. Petterson, borough engineer, Post Office Building, Passaic, N. J.

JERSEY CITY, N. J.—The Public Service Electric Company has applied to the City Commission for a fifty-year franchise for an underground conduit system in Jackson Avenue.

JERSEY CITY, N. J.—The Ocean Avenue Business Men's Association is negotiating with the City Commission for the installation of a new street lighting system on Ocean Avenue, Greenville.

JERSEY CITY, N. J.—Plans, it is reported, are being perfected by the Erie Railroad Company for equipping its Greenwood Lake branch from Jersey City to North Newark and vicinity for electrical operation.

NEWARK, N. J.—The Board of Freeholders, it is reported, has authorized a call for bids, to be received on March 15, for four new boilers at Overbrook Hospital.

PERTH AMBOY, N. J.—Negotiations are under way between the Public Service Electric Company and the Board of Aldermen relative to franchise applications for the installation of underground conduits on several streets. The company proposes to place its overhead wires underground.

PRINCETON, N. J.—The Borough Council is considering the installation of additional new street lamps.

SEWELL, N. J.—The Township Committee has authorized the town clerk to obtain estimates of cost for the installation of an electric-lighting system for both street and residential lighting.

TRENTON, N. J.—The Chamber of Commerce will co-operate with the City Commission for the installation of the proposed ornamental lighting system in the business district and improvements in other sections.

WOODBURY, N. J.—The Borough Council is considering the installation of an electric street lighting system to replace the gas lamps now in use.

WILMINGTON, DEL.—The Street and Sewer Department is contemplating the installation of an improved street-lighting system on King Street.

MIDLAND, MD.—Rights of way have been secured for the erection of the new high-tension transmission line between Midland and Junction Park by the Midland Electric Light Company. A line is being built across the Ohio River a short distance above the Merrill dam to supply energy to the Beaver County Home buildings. The construction of a large substation near the eastern end of the borough is also under consideration.

ETTRICKS, VA.—The installation of an electric lighting system in Ettricks is under consideration.

FREDERICKSBURG, VA.—The Rappahannock Electric Light & Power Company will install this spring water tube boilers, engine and auxiliaries, bids for which will be asked in about 30 days. The Richmond, Fredericksburg & Potomac Railroad Company is now installing automatic signals (6600 volt, single phase); the Rappahannock electric company will supply energy to the Fredericksburg substation. S. C. Foster is general superintendent.

WINCHESTER, VA.—In a decision handed down by the Berkeley County Court in regard to the franchise for the Northern Virginia Power Company of Winchester, to erect and maintain electric transmission lines along various roads in Berkeley County, the company is given the privilege of building and operating lines in Berkeley County.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Washington, D. C., Schedule 769—200 altimeters; Schedule 770—one vertical milling machine. New London, Conn., Brooklyn, N. Y., Schedule 773—nine portable lead-burning outfits, 250 storage battery testing outfits. Brooklyn, N. Y., Mare Island, Cal., Schedule 765—two distilling plants. Mare Island, Cal., Schedule 767—four lubricating oil pumps; Schedule 766-767—12 air, condenser and feed pumps; Schedule 752—9725 lb. steel wire rope; Schedule 758—57,000 lb. class "C" angle steel, 137,500 lb. class "B" boiler plate steel. Brooklyn, N. Y., Schedule 749—one motor delivery wagon. Application for proposal blanks should designate the schedule desired by number.

North Central

CHEBOYGAN, MICH.—Plans have been prepared by Gardner S. Williams, 134 South LaSalle Street, Chicago, Ill., it is reported, for rebuilding the hydroelectric power plant owned by the Cheboygan Electric Light & Power Company.

GREENFIELD, MICH.—Bids will be received at the office of Leon W. Webster, secretary school district No. 1, Highland Park, P. O., Mich., until March 19 for addition to Greenfield Park School in Greenfield Township, separate bids to be submitted on general contract, electrical work, plumbing and heating. Copies of plans and specifications may be obtained at the office of Edward C. Van Leyen and Edward A. Schilling, H. J. Keough, architects, Union Trust Building, Detroit, upon deposit of $15.

MONROE, MICH.—At a special election to be held in March the proposal to issue bonds for the construction of a new plant or to grant a franchise to either the Detroit Edison Company or the Toledo (Ohio) Railway & Light Company to enter the city to supply electricity to private manufacturing plants will be submitted to the voters. The cost of a new plant is estimated at more than $100,000.

TEKONSHA, MICH.—The local electric plant, owned by the Warner Electric Light Company, has closed down, leaving the village without electrical service. The company offered to sell the plant to the village but the offer was refused. The plant was not self-supporting.

WHITEHALL, MICH.—The Frugale Power Company will erect an electric transmission line, 10 miles long in the spring, and also rebuild its dam at Hesperia, Mich., installing new wheels and generators. F. H. Speese is secretary and manager.

BELLEVILLE, OHIO.—The Guinsler Electric Light & Power Company of Junction City has recently been granted a new 35-year franchise in Belleville, and also a new street-lighting contract for ten years, effective as soon as the company installs a new circuit. W. E. Guinsler is manager.

BLOOMVILLE, OHIO.—The village of Bloomville has abandoned the project of establishing a municipal electric plant and will probably contract with a private company, probably the Ohio Light & Power Company, whose high-tension line passes through the town.

CINCINNATI, OHIO.—Bids will be received by the Commissioners of Hamilton County, Court House, Cincinnati, until Mar. 21, for construction, including heating, plumbing, ventilating apparatus, electric work, for new women's receiving cottage for Longview Hospital. The work includes erection of power plant in connection with building. Elzner and Anderson, Ingalls Building, Cincinnati, are architects.

CLEVELAND, OHIO.—Bids will be received at the office of commissioner of purchases and supplies, City Hall, Cleveland, until March 9 for laying cable under Cuyahoga River at Jefferson Street bridge. Specifications may be obtained upon application to the bridge engineer.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, until March 9, for one 150-hp. gas engine-driven generating unit for the division of infirmary, Warrensville, Ohio, department of public welfare. Specifications may be obtained on application to the office of the secretary to the director of public welfare, 327 City Hall.

HAMILTON, OHIO.—Plans are being considered by city officials for extensions and improvements to the municipal electric light plant. The cost is estimated at $50,000.

LIMA, OHIO.—The contract for electric wiring for the illumination of the ten grade schools has been awarded to Reed Brothers of Lima. The work must be completed by May 15.

NEW LONDON, OHIO.—Bids will be received by the clerk of board of public affairs, New London, until March 12, for construction of water-works system, consisting of 5.7 miles of 8, 6, and 4-in. cast-iron pipe, together with necessary valves and hydrants, two high-service pumps and motors, concrete receiving well and a 50,000-gal. elevated tank and tower. Plans and specifications may be seen at the office of the Board of Public Affairs or may be obtained at the office of Philip Burgess, consulting engineer, Columbus, Ohio, upon deposit of $5.

NEWTON FALLS, OHIO.—The Village Board, it is reported, has awarded a contract for the installation of a new lighting system. Energy to operate the system will be purchased. The village has been without electrical service several months.

PIQUA, OHIO.—Specifications are being prepared under the supervision of Chief Coulfield of the fire department for the installation of a new fire-alarm system. A new police telephone system may be provided for at the same time.

TROY, OHIO.—Plans are being considered for merging the municipal electric-light plant and water-works system in connection with increasing the output of the power plant. A new location and complete reconstruction for both plants may be decided upon. The Richards Engineering Company of Columbus is consulting engineer.

YOUNGSTOWN, OHIO. — Preparations are being made by the Republic Iron & Steel Company for equipping its finishing departments for electrical operation, energy to be generated at Haselton, where large quantities of furnace gas are produced, which will be used for fuel to supply power to operate the generators.

CHAVIES, KY.—The Coneva Coal Corporation contemplates the installation of a steam-driven electric plant and would like to receive prices on a 125-kw. belt-driven generator, new or second hand. Lee Congleton is manager.

COVINGTON, KY.—The City Council has engaged G. Hornung, Woosack Building, Newport, engineer, to prepare plans for the proposed municipal electric-light plant.

EDMONTON, KY.—The installation of an electric-light plant in Edmonton is reported to be under consideration.

ELKTON, KY.—The local electric light plant has been purchased by the South Kentucky Power Company of Guthrie. A. F. Trimble of Guthrie is vice-president and general manager of the South Kentucky Power Company.

PADUCAH, KY.—H. T. Ward and F. L. Wilcox, electrical engineers of St. Louis, Mo., have advised Mayor Burns and the City Commissioners that the project to establish a municipal electric plant to supply electrical service throughout the entire city would probably call for a new installation. It was proposed to enlarge the present municipal electric plant, which furnishes the street-lighting service, to supply electricity for commercial and residential lighting. The commission, it is stated, will have surveys made and an estimate of cost of a plant with a view of issuing bonds for same.

WALTON, KY.—The local electric-light plant, owned by E. L. Kelly, was recently destroyed by fire, causing a loss of about $5,500.

NAPPANEE, IND.—The Hawks Electric Company of Goshen has submitted a proposal to the Board of Town Trustees for the purchase of the municipal electric-light plant. Plans have been prepared for equipping the plant, but some of the taxpayers are in favor of selling the property.

SHERIDAN, IND.—The Sheridan Water, Light & Heat Company has petitioned the Public Service Commission for authority to issue $10,000 in bonds, the proceeds to be used for extensions to its electrical plant and for ice storage facilities.

CHICAGO, ILL.—The removal of all overhead telephone, telegraph and electric wires has been recommended by a subcommittee of the City Council gas, oil and electric light committee. The cost of placing the wires underground is estimated at between $2,000,000 and $3,000,000. The cost to the Sanitary District is placed at $400,000 and to the city of Chicago at $300,000. The proposed measure exempts the trolley lines.

LENA, ILL.—The Lena Electric Light & Power Company expects to be in the market in the early spring for material to erect 16 miles of 33,000-volt, three-phase electric transmission line, two-pole type, substations, one 200-kva. generating unit complete, with switchboard for same; also distribution line for street-lighting system, consisting of about 95 series 6.6-amp. lamps. The company also contemplates reinsulation of 8 miles of single-phase, 6600-volt line to three-phase, 33,000-volt line. G. W. Benfer is manager.

SPRINGFIELD, ILL.—If the present plans of the City Council in regard to the Centennial Civil Improvement scheme are carried out additional expenditures of approximately $900,000 by the Springfield Gas & Electric Company and the Springfield Consolidated Railway Company will be necessary. The work will include ducts and manholes for underground wire system, to cost about $98,000; cables for underground system, $300,000; street railway company's share of paving, $89,069; railway construction work, labor, etc., $233,203; replacement and overhauling steam, hot water and gas mains on repaved streets, $100,000, and seven new "pay within" cars $40,000. A. D. Mackie is general manager.

ASHLAND, WIS.—The L. E. Meyer Company of Chicago, Ill., has assumed control of the holdings of the Appleyard interests in Wisconsin and Northern Michigan, which include the Ashland Street Railway Company, the Ashland Power Company and the Ironwood & Bessemer Railway & Light Company. The headquarters of the company will remain in Ashland.

BEAVER DAM, WIS.—The Wisconsin Telephone Company contemplates placing its local overhead wires in underground conduits, at a cost of about $25,000.

EVANSVILLE, WIS.—The city of Evansville has placed contract for 300 hp. in boilers, to be delivered May 1, for the municipal electric-light plant. E. S. Cary is superintendent.

FOND DU LAC, WIS.—The Kelsey-Brewer Company of Grand Rapids, Mich., is negotiating for the purchase of the properties of the Eastern Wisconsin Railway & Light Company of Fond du Lac and the Winnebago Traction Company of Oshkosh, which include the traction lines at Fond du Lac and Oshkosh, gas and electric properties in this city, the interurban lines and water power rights in Marathon and Langlade Counties. Improvements involving an expenditure of about $700,000 are contemplated, including the erection of a new gas plant in Fond du Lac in a new location and improvements to the local power plant. Joseph H. Brewer of Grand Rapids, Mich., is president and general manager of the Kelsey-Brewer Company.

MELLEN, WIS.—Within the next six months the Mellen Water & Light Company expects to purchase one or two horizontal water wheels, steel flume and harness, and a generator with a rating of about 150 kva. for direct connection, and also an engine of about 150 hp. A. W. Pribnow is president and manager.

OSHKOSH, WIS.—A committee has been appointed to consider the question of improving the electric-lighting system.

RIPON, WIS.—The Ripon Light & Water Company contemplates the erection of 100 miles of electric transmission lines from Portage to Beaver Dam and neighboring towns this spring.

UNION GROVE, WIS.—The power plant of the Union Grove Electric Light & Water Company was recently destroyed by an explosion, causing a loss of about $12,500. The plant, it is understood, will be rebuilt at once. William Hardy is proprietor.

WATERLOO, WIS.—The Council has appropriated $4,000 for extensions and improvements to the municipal electric-light plant.

WHITEWATER, WIS.—The City Council contemplates rebuilding its electrical distributing system at a cost of about $25,000. The present wire is too small to carry the load.

BENSON, MINN.—Plans are being prepared for remodeling the municipal electric lighting system from direct to alternating current. W. E. Skinner, 714 Plymouth Building, Minneapolis, is consulting engineer.

DEER RIVER, MINN.—The property of the Everton Electric Light & Power Company has been purchased by R. M. Dungan and H. E. Griswold of Eveleth. The new owners, it is understood, will make improvements to the plant and establish a 24-hour service. The installation of a central heating system is also under consideration.

RUTHTON, MINN.—The installation of a municipal electric-lighting system in Ruthton is under consideration.

CEDAR RAPIDS, IOWA.—The National Oats Company contemplates equipping its plant for electrical operation. Energy will be obtained from the Iowa Railway & Light Company.

SHEFFIELD, IOWA.—The property of the Sheffield Light & Power Company has been purchased by the Cedar Valley Electric Company of Charles City. Improvements, it is understood, will be made to the system.

CLARKTON, MO.—The local electric light plant has been purchased by Louis Dunn. The new owner, it is understood, will enlarge and improve the system.

HARRISONVILLE, MO.—The Board of Aldermen is considering a proposal submitted by L. K. Green & Sons to supply electricity in Harrisonville from their plant at Pleasant Hill.

KIRKSVILLE, MO.—Improvements are contemplated to the local electric-light plant, which is controlled by the North American Securities Company. Energy will be furnished to small towns between Kirksville and Bonneville that are now without electrical service.

PECULIAR, MO.—The L. K. Green & Sons Electric Company has applied to the City Council for a franchise to supply electricity in Peculiar.

POPLAR BLUFF, MO.—The City Council is reported to be considering a proposal to issue $10,000 in bonds for the installation of an electric-lighting system.

SPRINGFIELD, MO.—The Federal Light & Traction Company is reported to have purchased a site on which it proposes to erect a substation, to cost about $250,000, which will be used to relay the hydroelectric power now being supplied to the Springfield Gas & Electric Company from the power plant at White River dam. The present plans provide for the installation of a 5000-kw. turbine.

CENTERVILLE, S. D.—The Centerville Milling Company contemplates the installation of a large engine, an additional boiler, another water wheel and generator and building a concrete dam. R. W. Nash is superintendent.

ALEXANDRIA, S. D.—The Council is considering calling an election to submit to the voters the proposal to issue $18,000 in bonds for extensions to the municipal electric-light plant.

CRAWFORD, NEB.—The City Council has passed an ordinance providing for the installation of an ornamental lighting system in the business district.

HUTCHINSON, KAN.—The City Council is securing estimates on the cost of an ornamental street-lighting system with a view of installing new lamps in the Ninth addition.

LEAVENWORTH, KAN. — Preparations are being made for a survey of a pipe line for water supply from the Missouri River to the power plant of the Leavenworth Light, Heat & Power Company.

MEADE, KAN.—The Meade Light & Power Company is completing the installation of a new 50-kw. generating unit driven by an oil engine.

TOPEKA, KAN.—The Town Meeting Club on Feb. 7 adopted a platform for the coming city campaign favoring the rebuilding of the municipal electric-light plant at the waterworks station.

TOPEKA, KAN.—Changes in the street lighting system have been recommended by E. G. Stahl, superintendent of the municipal electric plant, which provide for replacing 100 arc lamps with 400-cp. incandescent lamps, installing alley lamps in the fire district, establishing a low voltage lighting system in the parks in place of the high-voltage arc lamps now in use and the purchase of new generating equipment.

WILSON, KAN.—The City Council is considering the installation of an additional generating unit, about 40 kva., in the near future. J. H. Williams is superintendent

Southern States

BURLINGTON, N. C.—The Piedmont Railway & Electric Company has begun work on the extension of its transmission lines to Elon College and Gibsonville.

COLUMBUS, GA.—An election will be called to submit the proposal to issue bonds for the establishment of a municipal electric light plant to the voters.

GAINESVILLE, GA.—Plans are under way for removing all unnecessary duplication of lines and other equipment and remodeling the local distribution system by the Georgia Railway & Power Company. Electrical service was served by both the Georgia Railway & Power Company and the Gainesville Railway & Power Company until the latter was taken over by the former.

STATESBORO, GA.—Bonds to the amount of $60,000 have been voted for improvements to the electric-light plant and waterworks system and street paving.

UNADILLA, GA.—At an election held recently the proposal to install an electric-lighting system was carried.

ORLANDO, FLA.—The City Council is considering calling an election to vote on the proposal to issue $20,000 in bonds for a new street-lighting system, including ornamental lamps.

WETUMKA, ALA.—The Montgomery (Ala.) Light & Water Power Company is contemplating extending its service to Wetumka. Preparations, it is understood, are being made to equip the prison plants for electrical operation.

COLUMBUS, MISS.—The Columbus Railway, Light & Power Company is installing a new 1000-hp. steam turbine, which will double the output of its plant.

BATESVILLE, ARK.—Improvements are contemplated to the municipal electric-light plant and waterworks system.

FORT SMITH, ARK.—The Coal District Power Company, recently incorporated with a capital stock of $120,000 to furnish electrical service to towns and mines in Sebastian County, has taken options on electric plants in Greenwood, Hartford, Mansfield and Booneville. Hugh Means of Lawrence, Kan., is president of the company.

LOCKESBURG, ARK.—The Arkansas Light & Power Company of Arkadelphia has been granted a franchise to supply electricity in Lockesburg.

PARIS, ARK.—Preliminary surveys are being made in connection with the installation of the proposed municipal electric-light plant and water-works system. Winters & Dove of Fort Smith are engineers.

COLFAX, LA.—Negotiations are under way between the Town Council and the Colfax Light & Power Company for the purchase of the local electric plant. If the electric plant is taken over by the town the output will be doubled. The installation of a water-works system is also under consideration.

MONROE, LA.—At an election to be held March 20 the proposal to issue $612,000 in bonds, of which the proceeds of $61,000 will be used for construction of power house and reconstruction of electric generating plant, and $146,000 for filtering plant and reconstruction of water-works system, the remainder for street improvements, etc.

BARTLESVILLE, OKLA.—The City Council has granted the Oklahoma & Northern Traction Company a franchise to build an electric railway from Bartlesville to Miami. W. K. Palmer & Company, 919 Baltimore Avenue, Kansas City, Mo., are engineers.

CLINTON, OKLA.—The city of Clinton is contemplating the installation of an ornamental lighting system on ten blocks and rebuilding power transmission lines on account of paving. N. E. Stone is superintendent.

FREDERICK, OKLA.—At an election to be held March 20 the proposal to issue $75,000 in bonds for extension of the water-works system and for purchase and improvements to the electric-lighting plant of the Foster-Harris Gin & Electric Company will be submitted to the voters.

MILL CREEK, OKLA.—The City Council is considering the installation of a municipal electric-lighting system.

POND CREEK, OKLA.—The city of Pond Creek is considering securing energy from a transmission system some time this summer to operate the municipal electric-light system. At present the plant is driven by steam power. C. C. Shepard is superintendent.

SALLISAW, OKLA.—The Board of Trustees is planning to install a 500-kw. generating unit and boilers in the municipal electric-light plant this spring. George E. McCants is general manager.

TULSA, OKLA.—The Tulsa Traction Company contemplates extensions to its system in several directions. The railway to Bixby will be extended to Muskogee, to Okmulgee, thence to Sapulpa via Collinsville and Oologah. A line will also be built from Tulsa to Sapulpa. Plans are also being considered for the construction of a railway system connecting the various oil field towns, forming a belt line having terminus in Tulsa.

AMARILLO, TEX.—The City Light & Water Company, it is reported, contemplates improvements to its water works system involving an expenditure of about $100,000.

BROWNWOOD, TEX.—As the result of the special rate given by the Texas Power & Light Company local merchants will install approximately 500 lamps.

DALLAS, TEX.—Improvements are contemplated to the street lighting system, involving an expenditure of about $6,000.

Pacific States

BREMERTON, WASH.—The City Council is considering the purchase of the local electric light plant, owned by the North Pacific Public Service Corporation, to be owned and operated by the municipality. The plant also supplies electrical service in the towns of Charleston and Port Orchard.

INDEX, WASH.—The Council has engaged G. N. Miller & Son, engineers, Burke Building, Seattle, to complete surveys for the proposed municipal power plant and water works system for which $20,000 in bonds were recently voted. Power will be secured from Deer Creek.

TACOMA, WASH.—Work will soon begin on the construction of a new power plant on the tidelands for the Wheeler-Osgood Company, to cost between $30,000 and $40,000. A permit has been granted for the erection of a smokestack 150 ft. A battery of boilers to furnish power for the generators will be installed. About 1800 hp. will be developed.

TACOMA, WASH.—The Tacoma Railway & Power Company has applied to the Commissioners of Thurston County for a franchise to erect electric transmission lines along certain roads in Thurston County. The company proposes to extend its transmission lines from the Tacoma city limits through Thurston County to serve small villages and farming districts. The initial line will be from the Tacoma city limits to the Brown Ranch at Nisqually.

WAPATO, WASH.—The Pacific Power & Light Company has petitioned the Council for a new franchise, which if granted will provide for the reconstruction of the local street lighting system.

MEDFORD, ORE.—The formation of a co-operative district to be bonded for the construction of an electric power plant and irrigation system has been proposed by W. J. Scott of Antioch. The proposed district will include 25,000 acres of land in Sams Valley. The cost of the project is estimated at about $1,000,000.

SALEM, ORE.—A valuable power site near Salem, recently purchased by the C. K. Spaulding Logging Company, it is reported, will be used to develop power for a large paper mill.

BANNING, CAL.—Application has been made to the State Water Commission by Marcus Pluth, 111 West Ninetieth Street, Los Angeles, for permission to appropriate 60 miner's inches of water from Snow Creek and Whitewater River for power purposes; also to construct four hydro-electric plants, two on each stream.

ESCONDIDO, CAL.—The San Diego Consolidated Gas & Electric Company, which recently purchased the property of the Escondido Utilities Company, contemplates the erection of a 22,000-volt transmission line from Olivenhain to Escondido, 10 miles long, to cost $21,290, and a 11,000-volt line from Vista to Escondido, a distance of 13 miles, to cost about $14,141.

LOS ANGELES, CAL.—The Atchison, Topeka & Santa Fé Railroad Company is considering the extension of the electric automatic block signal system over its entire lines within the state during 1917, at a cost of about $500,000.

LOS ANGELES, CAL.—The city of Los Angeles has applied to the State Water Commission for permission to divert 200 second ft. per second of water from the south fork of Kern River in Tulare County for the purpose of generating electricity. The city contemplates the construction of a diversion dam, 20 ft. high, 150 ft. long at top, conduit pipe line 5½ miles long to carry water to the proposed power house, to cost about $1,500,000. This to be the first unit of a number of hydroelectric plants, the others to be located in Inyo and Mono Counties. William Mullholland is chief engineer of board of public service.

SAN BERNARDINO, CAL.—The installation of a municipal electric-light plant in San Bernardino is under consideration.

VISALIA, CAL.—The Board of Supervisors has awarded the Mount Whitney Power & Electric Company a 50-year franchise to erect and operate electric transmission lines on the roads and highways of Kings County.

LEWISTON, IDAHO.—The creation of an auxiliary organization for the purpose of promoting the construction of a power and storage dam at or near Lewiston for municipal purposes has been authorized by the governing board of the Commercial Club.

POCATELLO, IDAHO.—The Pocatello Traction & Interurban Company, it is reported, contemplates extensions to its system, involving an expenditure of $1,500,000.

POCATELLO, IDAHO.—The committee appointed to investigate the proposal of Joseph Burns to establish a municipal electric-light and power plant, recommends that an electrical engineer be employed to make investigations and estimates of cost of such a plant.

SHELLEY, IDAHO.—The Shelley Light & Power Company contemplates the reconstruction of its local distribution lines this spring and is also considering extending its transmission lines to three or four neighboring towns within a radius of 6 miles. A. C. Schweitzer is superintendent.

SALT LAKE CITY, UTAH.—The Utah Power & Light Company has applied to the City Commission for a franchise to operate a heating plant to supply heat for the greater part of the city. The proposed plan will involve laying underground conduits for steam pipes to connect the various plants.

SNOWFLAKE, ARIZ.—The installation of a municipal electric-light plant in Snowflake is under consideration.

KALISPELL, MONT.—The County Commissioners have granted the Northern Idaho & Montana Power Company of Sandpoint permission to erect an electric transmission line and telephone line to run from Bigfork to Polson along the east shore of Flathead Lake, and from Polson to Ravalli, via Ronan and Mission. The line will also connect Dayton and Polson on the west shore of Flathead Lake.

HAXTON, COL.—The City Council has decided to install a municipal electric light plant for which $15,000 has been appropriated.

COLUMBUS, N. M.—The Columbus Electric Light & Power Company, recently organized with a capital stock of $200,000, proposes to construct a large electric power plant near here to supply electricity for lamps and motors in Columbus, and will also erect transmission lines into adjacent territory and furnish energy to operate pumping plants and other industries. J. L. Greenwood is interested in the project.

Canada

WINNIPEG, MAN.—Surveys have been made by the British North American Hydro Electric Power Company of Winnipeg in connection with a proposed power development in Manitoba, which will involve an expenditure of several million dollars.

ATHENS, ONT.—The local electric light plant and telephone exchange were recently destroyed by fire.

SUDBURY, ONT.—Improvements involving an expenditure of about $7,000 are contemplated to the municipal electric light plant.

Miscellaneous

PANAMA.—BIDS will be received at the office of the purchasing officer, the Panama Canal, Washington, D. C., until March 14 for furnishing galvanized steel, steel plates, driving-wheel centers, ferro-titanium wire, grommets, street-lighting units, valves, watt-hour meters, etc. Blanks and information relating to this circular (No. 1126) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until March 12 for furnishing planer cylinders, brass sockets, oil cups, engine lubricators, safety valves, steam whistles, steam gages, gage lamps, sockets, ignition cable, etc. Blanks and information relating to this circular (No. 1128) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y., and Whitney-Central Building, New Orleans, La.

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, Arthur Kneisel, 29 South LaSalle St., Chicago, Ill.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Permanent Secretary, L. O. Howard, Smithsonian Institution, Washington, D. C.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 8 West 40th St., New York.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS. Secretary, F. A. Molitor, 35 Nassau St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York, Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country. Annual convention, Hot Springs, Va., June 26-29.

AMERICAN PHYSICAL SOCIETY. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio.

AMERICAN SOCIETY OF TESTING MATERIALS. Secretary-treasurer, Edgar Marburg, University of Pennsylvania, Philadelphia.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary-treasurer, Roy B. Fowles, Pine Bluff, Ark. Annual convention Pine Bluff, May 16-18.

ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. General Secretary, C. E. Dustin, 62 Cedar St., New York. Annual meeting, Delmonicos, New York City, March 15.

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ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, John F. Kelly, McKeesport, Pa.

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EASTERN NEW YORK SECTION N. E. L. A. Secretary, J. E. Kearns, General Electric Company, Schenectady, N. Y.

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ELECTRICAL DEALERS' AND CONTRACTORS' ASSOCIATION OF ONTARIO. Secretary, E. A. Drury, 45 Murray St., Toronto, Can.

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ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General Secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill. Semi-annual meeting Hot Springs, Va., May 22-24.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, 34 Ellis St., San Francisco, Cal.

ELECTRIC POWER CLUB. Secretary, C. H. Roth, 1410 West Adams St., Chicago.

Directory of Electrical Associations

Printed in the First Issue of Each Month

ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Affiliated with the N. E. L. A. Secretary, A. Jackson Marshall, 29 West 39th St., New York.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 29 West 39th St., New York.

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GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA. Secretary-treasurer, Prof. H. V. Bozell, Norman, Okla.

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ILLINOIS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, M. L. Blumenthal, 179 West Washington St., Chicago, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, G. H. Stickney, 4th and Sussex Sts., Harrison, N. J. Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston. Annual convention September.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donahue, Lafayette, Ind.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General Secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

IOWA SECTION N. E. L. A. Secretary-treasurer, L. E. Caldwell, Iowa City, Iowa. Annual meeting, Des Moines, May 25 and 26.

IOWA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, M. T. Humphrey, Waterloo, Iowa.

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NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, William L. Smith, Concord, Mass. Biennial Convention, New York, March 27-29.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, 33 West 39th St., New York. Annual meeting Atlantic City, N. J., May 29 to June 1.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, George H. Duffield, 41 Martin Building, Utica, N. Y. Next meeting, New Orleans, October, 1917.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1343 Marquette Bldg., Chicago, Ill.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass. Biennial meeting, New York City, March 28, 29.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, B. E. Egan, Room 201, Union Pacific Building, Omaha, Neb.

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SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. General manager, J. M. Wakeman, 29 West 39th St., New York.

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SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex. Annual convention, Dallas, April 26-28.

TEXAS STATE ASSOCIATION OF ELECTRICAL CONTRACTORS. Secretary, Eugene Ashe, Dallas, Tex.

TRI-STATE WATER & LIGHT ASSOCIATION. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C. Meeting, Macon, Ga., April 17-19.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, C. H. West, Rutland, Vt.

VIRGINIA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, E. M. Andrews, Richmond.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 Jackson Bldg., Chicago, Ill.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, 1410 First National Bank Building, Milwaukee, Wis. Annual meeting Milwaukee, Wis., March 15-16.

1,216,294. Combined Cal, Teat, Pipe and Electric Coupling; James S. Doyle, Mount Vernon, and Frank Hedley, Yonkers, N. Y. App. filed March 24, 1913. Improvement.

1,216,301. Heating Device for Water Jackets of Carburetors; Ray A. Fisk, Auburn, Maine. App. filed June 1, 1916. Water in the water jacket will be kept in proper circulation during the operation of the engine.

1,216,[illegible]. Automatic Telephone System; Charles L. Goodrum, New York, N. Y. App. filed May 19, 1916. Improvements.

1,216,[illegible]. Electric Heater; Leo Heller, Fünfkirchen, Austria-Hungary. App. filed Dec. 19, 1914. For cooking utensils.

1,216,[illegible]. Key for Electric Conductors; Harry E. Huling, Schuylkill Haven, Pa. App. filed Sept. 15, 1913. Used in connection with an automobile.

1,216,[illegible]. Telephone Subscriber's Call and Mechanism; Alexander E. Keith, Highlands, Ill. App. filed Aug. 7, 1907. Improvement.

1,216,[illegible]. Changeable Valve Structure for Electric Melting Furnaces; Bernhard Christian Kvaerno, Haugesund, Norway. App. filed Nov. 10, 1916. Whereby certain inconveniences existing in the constructions hitherto known are avoided.

1,216,[illegible]. Electric Conductor; Alfred H. McCulloch and Caroline D. McCulloch, Boston, Mass. App. filed Dec. 2, 1912. Improvement in the coverings.

1,216,36[illegible]. Automatic Telephone System; Clarence E. Rogers, Oakland, Cal. App. filed Dec. 12, 1913. Improved means for uniting into one system two-wire and three-wire apparatus.

1,216,369. Railway Signaling; John E. Saunders, Edgewood Borough, Pa. App. filed Sept. 12, 1914. Improvements.

1,216,370. Telltale and Switch for Rear Signal-Lights for Automobiles; Wendelin P. Seng, Chicago, Ill. App. filed Dec. 24, 1915. New and useful.

1,216,371. Process for the Manufacture of Hydroxid of Aluminum; Botho Schwerin, Frankfort-on-the-Main, Germany. App. filed May 13, 1915. Makes use of the sodium aluminate liquor produced in the usual way from bauxite.

1,216,372. Trolley-Hanger; James Scott, Cleveland, Ohio. App. filed May 20, 1916. Improvements.

1,216,379. Vibrator for Induction-Coils; Henry C. Thomson, Boston, and Harold N. Michaelsen, Canton, Mass. App. filed Feb. 10, 1914. Improvements.

1,216,380. Exhibition-Screen for Projecting-Machines; John F. Robert Troeger, Brooklyn, N. Y. App. filed Dec. 24, 1913. Translucent screen.

1,216,386. Electric Switch; Anthony F. Williams and Edward A. Halbleib, Rochester, N. Y. App. filed Jan. 9, 1917. Improvements.

1,216,397. Induction-Motor; Benjamin F. Bailey, Ann Arbor, Mich., and John Martin Barr, Orlo S. More, and L. Guy Long, Indianapolis, Ind. App. filed Feb. 15, 1913. Internal controlling mechanism dependent in its action solely upon the speed of the motor.

1,216,404. Self-Igniting Electric-Arc Candle; Jean Billiter, Vienna, Austria-Hungary. App. filed Jan. 28, 1914. Two parallel electrodes and an intermediate layer between said electrodes.

1,216,406. Electrical Receptacle for Conduit Outlet-Boxes; Carl H. Bissell, Syracuse, N. Y. App. filed Dec. 27, 1910. New and useful.

1,216,413. Current-Converting Device; Arthur R. Bullock, Cleveland, Ohio. App. filed July 28, 1913. Employ a rotatable body of segments.

1,216,420. Relay; Frank L. Dodgson, Rochester, N. Y. App. filed Dec. 1, 1914. Electric signaling systems for railways.

1,216,422. Portable Electric Lamp; William P. Dunham, Los Angeles, Cal. App. filed April 21, 1914. Movable base.

1,216,429. Refillable Indicating-Fuse; George W. Fiske, Akron, Ohio. App. filed Feb. 2, 1915. Cartridge fuses.

1,216,435. Traffic-Indicator for Automobiles; John M. Gillies and Andrew Moynihan, Salem, N. Y. App. filed Jan. 5, 1916. Operated to indicate the direction of travel intended by the operator, and which may be illuminated for night service.

1,216,446. Electromagnetic Apparatus; Clinton O. Harrington, Edgewood Borough, Pa. App. filed March 9, 1915. Causing repeated operation of a member.

1,216,450. Electric Battery; Major E. Holmes, Lakewood, Ohio. App. filed Nov. 21, 1912. Improvement.

1,216,451. Battery-Depolarizer; Major E. Holmes, Lakewood, Ohio. App. filed Nov. 22, 1913. Improvement.

Record of Electrical Patents

Notes on United States Patents issued on Feb. 20, 1917

1,216,461. Telephone Ring Back or Reverting Call System; Geo. E. Kimball, Rochester, Pa. App. filed June 23, 1909. Provides an improved ring back or reverting call arrangement whereby one subscriber may call another on the same line.

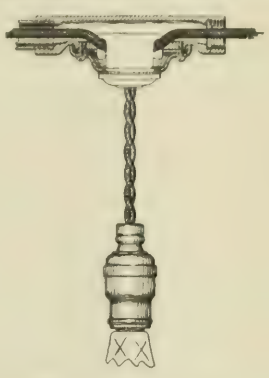
1,216,466. Assembling Machine; Joseph Ledwinka, Philadelphia, Pa. App. filed April 14, 1915. Applicable to machines for assembling automobile bodies.

1,216,467. Assembling Machine; Joseph Ledwinka, Philadelphia, Pa. App. filed May 6, 1915. Applicable to machines for assembling metal vehicle fenders, such as automobile fenders.

1,216,480. Telephone; Katherine Nichols, Cincinnati, Ohio. App. filed April 19, 1915. Particularly directed to a type of instrument having two receivers.

1,216,481. Signaling Device for Automobiles; Harvey P. Noble, Philadelphia, Pa. App. filed April 30, 1915. Improvements.

1,216,513. Knife-Blade Switch; Alexander K. Sutherland, Plainville, Conn. App. filed Nov. 26, 1915. Locking means.



1,216,406. Electrical Receptacle for Conduit Outlet Boxes

1,216,518. Electrical Regulator; Allen A. Tirrill, Pittsburgh, Pa. App. filed Jan. 5, 1915. Regulation is effected by opening and closing a shunt circuit to a resistance in series with the field magnet winding of an exciter or other dynamo-electric machine.

1,216,533. Electrical Telegraph and Indicator System; Frank W. Wood, Brooklyn, N. Y. App. filed June 24, 1915. Used on shipboard for transmitting orders between different points on the ship.

1,216,534. Automatic Telephone System; George A. Yanochowski, Chicago, Ill., and Harry E. Hershey, Whitewater, Kan. App. filed Nov. 28, 1913. Improvements.

1,216,538. Means for Producing Electrical Oscillations; Georg Graf Arco and Ragnar Hakan Rendahl, Berlin, Germany. App. filed Jan. 8, 1917. Particularly for use in radio-telegraph.

1,216,545. Wire-Connector; Joseph E. Burgess, St. Louis, Mo. App. filed April 21, 1916. Connected to the adjacent portions of a broken wire of an electric circuit to serve as a temporary connection.

1,216,553. Push-Button; Halley C. Dolan, Detroit, Mich. App. filed April 26, 1915. Multiple switch by which a plurality of electrical circuits can be easily controlled.

1,216,559. Switch-Lock for Motor-Vehicles; Gustav Frank, Jefferson, Tex. App. filed Oct. 1, 1913. Suitable indicating means with the lock.

1,216,570. Electromagnetic Time-Retarding Relay; Karl Hohn, Zurich, Switzerland. App. filed June 16, 1915. Particularly adapted to be mounted in switch boxes.

1,216,595. Transmission of Electrical Impulses Over Circuits of High Electrostatic Capacity; Giuseppe Musso, Vado, Italy. App. filed March 14, 1914. Method of improving, both in quality and efficiency.

1,216,598. Holding Means for Housings; Herman G. Pape, New York, N. Y. App. filed June 23, 1916. New and useful.

1,216,60[illegible]. Electric Heater; Joseph Porzel, Buffalo, N. Y. App. filed May 14, 1915. Improvements.

1,216,615. Apparatus for Producing Powerful Electrical Oscillations; George Seibt, New York, N. Y. App. filed Dec. 27, 1909. Particularly showing damped oscillations capable of being radiated, received and detected in the form of a high musical note.

1,216,632. X-Ray Table; Julius B. Wantz, Chicago, Ill. App. filed Jan. 15, 1915. Adapted for either fluoroscopic or radiographic work.

1,216,641. Automatic Telephone System; Charles S. Winston, Chicago, Ill. App. filed Feb. 19, 1913. Particularly with metallic line or two wire control circuits for controlling the operation of selective switches.

1,216,643. Composition for Polishing Iron; Matuichi Yasuda, Koishigawa, Tokyo, Japan. App. filed March 14, 1914. Composition of matter for removing rust and the like from iron.

1,216,646. Method of Producing High-Frequency Oscillating Currents; James C. Armor, Ingram, Pa. App. filed Oct. 14, 1911. From either direct or alternating-current sources.

1,216,647. Means for Producing High-Frequency Oscillatory Currents; James C. Armor, Brooklyn, N. Y. App. filed Nov. 23, 1911. Particularly adapted for the direct production of intermittent unidirectional impulses.

1,216,651. Electrical Make-and-Break Tripping Mechanism for Two or Four Cycle Gas Engines; Matthew H. Borland, Seekonk, Mass. App. filed March 15, 1916. Improvement.

1,216,678. Bilge-Water Alarm; Charles R. Ford, Paducah, Ky. App. filed Sept. 22, 1915. Indicating the depth of water.

1,216,720. Wireless-Telegraph Transmitter of the Portable Type; Marion Alvin Mulrony, Randwick, near Sydney, New South Wales, Australia. Improvements. App. filed July 23, 1915.

1,216,743. Electric Bell; William J. Smith, New York, N. Y. App. filed March 13, 1913. Alternating-current circuit.

1,216,756. Dimmer for Electric Lamps; Ira C. Williams and Charles F. Williams, Albany, Ind. App. filed June 12, 1916. May also be used as a rheostat for any other purpose.

1,216,776. Telephone Attachment; John J. Convery, New York, N. Y. App. filed July 25, 1916. Receiver-holding and hook-operating attachment for telephones.

1,216,792. Ignition System; Valere Alfred Fynn, St. Louis, Mo. App. filed April 13, 1914. In connection with internal combustion engines.

1,216,819. Lighting Fixture; Ferdinand C. Krueger, Milwaukee, Wis. App. filed June 14, 1916. Lighting may be both direct or indirect.

1,216,820. Electric Signal; Theodore P. Lancaster, Boston, and James L. Struthers, Lynn, Mass. App. filed April 29, 1914. Automobile signal.

1,216,828. Automobile Horn; Ray H. Manson, Elyria, Ohio. App. filed Sept. 29, 1913. Increase the sound produced by horns of the vibrator type.

1,216,829. Electric Musical Instrument; Harry S. Martin, Boston, Mass. App. filed April 29, 1916. Sonorous body is vibrated through the influence of appropriately timed magnetic pulsations.

1,216,844. Electrical Controlling System; John G. Roberts, Dobbs Ferry, N. Y. App. filed Dec. 8, 1914. Multi-office telephone exchange systems.

1,216,862. Electric Pencil; Amada E. Sickles, Coyle, Okla. App. filed May 14, 1915. Electric light has its bulb arranged near the writing point.

1,216,867. Control of Current to Large Inductances; John C. Smith, Louisville, Ky. App. filed Oct. 14, 1912. Prevention of sparking at switch contacts.

1,216,883. Detachable Attachment-Plug; George B. Thomas, Bridgeport, Conn. App. filed July 17, 1914. Simple in construction and efficient in operation.

1,216,884. Lamp-Grip; George B. Thomas, Bridgeport, Conn. App. filed August 25, 1914. To prevent backing out.

1,216,887. Inductive Wireless-Telephone System for Railroads and the Like; Thor Gustaf Thornblad, Karl Hjalmar Warfvinge, and Victor Gabriel Werner, Stockholm, Sweden. App. filed June 6, 1914. Improvements.

1,216,888. Electrical Regulator; Allen A. Tirrill, Pittsburgh, Pa. App. filed March 3, 1914. Improvement.

Electrical World

The consolidation of Electrical World and Engineer and American Electrician
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Vol. 69 NEW YORK, SATURDAY, MARCH 10, 1917 No. 10

Ideals in Editorial Service

BIGNESS by itself is significant only when it carries with it the power to render a greater service, the desire to take and carry the greater responsibility. The consolidation of the two great publishing companies, the McGraw Publishing Company, Inc., and the Hill Publishing Company, into the McGraw-Hill Publishing Company, Inc., as announced in our issue of last week, is potential with the possibilities of this greater service. Strength is in the union, not alone because of the resources at the command of this great new publishing house, but because the co-ordination of effort makes possible the fuller realization of ideals of editorial service which each year become increasingly difficult to carry out as our industries become more complex and the costs of rendering service to readers increase. Each of the journals in the combined companies has been edited with serious purposes. All have analyzed the intimate needs of their readers and built publications which have striven not only to present the news of engineering and business progress but to interpret this progress for the guidance of their respective industries.

Heavy Depreciation—A Burden of Prosperity

WEAR and tear go on rapidly with hard usage. Depreciation may come from any one of several causes, but it is sure to come from use. It is unfortunate that we cannot do more than estimate the annual rate of depreciation. With all the experience of the past to guide us, we still must guess the percentage of value in plant which disappears year by year. We say that under normal conditions the life will be five years or ten years, and if we are wise we plan our depreciation charges accordingly. Then when this question appears to be settled an abnormal condition develops to disturb the careful figures prepared in easy-going days, and immediately the rate of depreciation on some elements of plant rises to double its old figure. The truth is, that this is what has actually taken place within the last year in steam stations. Boiler-room parts are wearing out twice as fast as they would do if they were subject to only ordinary service. Extraordinary loads, making it necessary to run plants at full capacity, demanding that every part shall do its utmost, mean a reckoning which cannot be avoided. We make extra money, but we accelerate the insidious physical depreciation which requires early replacement. Extra gross profits are illusory if they blind the senses to the costs which follow in their train. Scrap value now is high, but if it is low when the actual replacement goes through the books the net cost will be high. The benefits of the long period of heavy demand are not real benefits unless they provide amply for the consequences of heavy wear which accompany them.

The Ranking Problem in Operation

COAL cost plus shortage gives the sum of the chief operating problem, which shows no sign of vanishing. Acute it has been for nearly all steam stations and it still looms large as the haunting question mark in operations. Our report tells of great central stations caught with a meager ten days' coal supply and the danger of blizzard ever present; of smaller stations measuring their supply in anxious hours, not days; of demands for service necessarily refused; of street lighting curtailed or cut off; of industrial establishments closing temporarily; of city authorities commandeering enough of the precious commodity to keep their utilities physically alive. Cost does not count when the alternative is to stop operations, to confess inability to give service; and coal cost is a very heavy burden which cannot be shifted to the consumer by daily fluctuations in rates. It has been a hard and costly lesson, a lesson which was not required by most properties, for ample coal reserve is a first principle of plant management. We shall see the results of the lesson in future plans, it will be less easy to catch the stations napping in times of light coal supply. Storage capacity will be more extensive, coal piles will bulk larger, foresight will remember the hindsight view of the trying winter of 1916-1917.

The Water-Power Fiasco

CONGRESS has come to an unseemly and scandalous end with most of its important work left undone. We refrain from commenting on its sins of omission with respect to national defense, partly because we would not wish to scourge the few guilty over the shoulders of the many innocent, and partly that adequate and publishable words fail us. We merely wish to call again attention to the fact that the water-power bills have gone down in the general wreck, insuring another probable long season of struggle before the country is able to utilize the natural resources which it possesses, and which before action can be taken it may most keenly need. The wasted energy of the nation due to negligence in developing these all-important hydraulic resources is a grave loss to national wealth. Every cubic foot of water that falls unutilized is valuable material thrown away, and in this case thrown

away without cause, and to the great detriment of the country's industries. If the history of the last two years has shown anything it has proved that even a pacific nation may readily be put in a place where conservation of all its economic resources becomes a prime necessity.

In spite of all that has been said and written about the need of provision for the fixation of atmospheric nitrogen in one form or another, substantially nothing has been accomplished, nor can anything be done until the cheaply developable powers are set free for human utilization. In peace or in war nitric acid lies at the very foundation of many chemical industries of the greatest national importance, and it is painfully evident that the time may come when we may bitterly regret not having made at least a start in the utilization of power for this purpose. The balance between supply and demand is infinitely more delicate than people generally realize, so sensitive indeed that a very small increase in the latter produces startling changes in price which are not compensated by a subsequent fall. This is indeed the theory of corners and other artificial interference with the relations between supply and demand. The rise and fall of prices with the decrease and increase of supply are not along a line, but describe a sort of hysteretic loop which represents the profits of the operators. We are going through just now a flurry in the coal market which bears hard on many industrial establishments. For this reason if for no other the fullest utilization of our water powers is necessary and the failure of the bills before Congress is a misfortune. They may not have been perfect, but they at least represented a long step in the right direction toward the ultimate goal of cheaper power for American industries. Even after all necessary rights are granted it is a long operation to put hydraulic power into service and to distribute it where it will do the most good. It will be hard to reckon in millions the annual loss represented by the dog-in-the-manger policy which has been followed in respect to these undeveloped resources, and harder still to speculate upon the increasing loss which the lack may force upon the nation.

Characteristics of Inclosed Fuses

THE open fuse for protecting electric circuits from accidental current overloads is a very simple device and was very early introduced into the art; but its mode of operation is comparatively complicated, when examined in detail. The steady temperature of the fuse wire rises until the power input by I^2R is just equal to the power output dissipated by conduction, radiation and convection. When the temperature is rising rapidly, by the sudden application of current through the fuse, the thermal capacity of the fuse-metal substance comes into account, as well as the dissipation.

The I^2R thermal input into the fuse metal is not the same for the same fuse at the same current strength, because R is not constant. This resistance increases with the temperature of the fuse. The conductively dissipated heat, issuing longitudinally from the fuse into its clamps, is roughly proportional to the temperature elevation. The radiatively dissipated heat, emerging as invisible light from the fuse in outward straight lines, is very roughly proportional to the temperature elevation of the metal, depending actually on the fourth power of the absolute temperature. The great variant, however, is the convectively dissipated power, emerging from the fuse in the ascending stream of heated air particles. This convective output for a given transverse velocity of air passing the fuse, varies approximately as the temperature elevation of the fuse above the impinging air. If there is no wind, the heat communicated to the surrounding air has to create its own local movement, at a comparatively low velocity. If, however, the fuse happens to be exposed to a draught or wind, the convective output is very greatly increased. A large amount of the uncertainty of open fuses is attributable to accidental variations in their convective thermal output. If the fuse is sealed into a vacuum chamber, like the filament of an incandescent lamp, the convective output is almost completely eliminated, and only the conductive and radiative outputs are left. This procedure of inclosing fuses in evacuated glass chambers, makes them more definite and reliable as to current-carrying capacity, but greatly reduces their simplicity and cheapness.

The inclosed fuse, or fuse embedded in a chamber of powdered non-conducting substance, is a great improvement on the open fuse, in regard to definiteness of behavior and current-carrying capacity. The convective output is eliminated as though the fuse were in vacuo, except in so far as concerns the surface of the external case or containing cylinder. The thermal output is now nearly all conductive; but the thermal storage capacity of the filling material comes into very appreciable evidence. In the steady state, the temperature of the fuse settles at the point where the I^2R thermal input equates the total thermal conductive output, as far as the surface of the cylindrical cover, with minor modifications beyond that surface, owing to mixed thermal dissipation. Variations in the evironment as to wind and location will influence the final melting current; *i.e.*, a ventilated location will increase the ultimate carrying capacity somewhat; but with sudden current rises and rapid overloads, such changes of environment have negligible influence. Under all such sudden applications of current the inclosed fuse behaves much more definitely than the open fuse, besides being better protected from dust, moisture and oxidation. Moreover, the inclosed fuse does not scatter molten metal. The quantitative theory of the behavior of inclosed fuses is much easier than that of open fuses; but has never been reduced to simple engineering terms, and only fuse designers, as a rule, are interested in it.

The article by Walter Arthur on the performance characteristics of inclosed fuses, which we print this week, throws light on the subject from an experimental standpoint. The effects of the coarseness of filler, of initial temperature, and of the nature of the filler, on the time of application before blowing, are clearly brought out.

The Fight Against Sleet

IN a climate like that of the northern United States the danger from sleet on transmission lines is a serious one. On the earlier systems before the suspension insulators came into use the only danger from sleet which had to be seriously considered was the actual mechanical failure of the cables, insulators, or some part of the supporting structure. A heavy coating of ice combined with strong wind may actually bring down a line either by parting the wires or by collapse of the supports. Fortunately, in a well-designed line this dangerous combination is one very rarely formed, so that failure of service from this cause has been rather rare. With the coming of the suspension insulator, however, the conditions were materially changed. In using such insulators there is a certain lengthwise flexibility controlled only by the anchoring of the spans at more or less frequent intervals. If all spans were loaded equally no trouble would result because, whatever the spacing of the wires might be unloaded, a somewhat analagous spacing would result when all were borne down by a load of ice. If, however, one of the wires is much more heavily coated than the others or, being initially like them, retains its coating after its neighbor has been freed from it, the vertical clearance between spans may be very considerably decreased. The loaded span comes down, while the wire below it, freed from ice and perhaps pulled up by loads still retained on neighboring spans, rises, so that there may be considerable danger of contact or sufficient approximation of the circuits to start an arc. In addition, there may be electrical breakdown from very large snow masses or icicles, but this contingency is so rare that it may be practically neglected. The variations in sag of spans due to this unequal loading on suspension insulator lines may be of surprisingly large amount, and it is particularly likely to cause trouble on double-circuit tower lines where the wires are spaced one above the other. On horizontal single-circuit lines it is very unlikely to result in trouble since the swaying of the loaded lines is extremely unlikely to be sufficient to bring them into even approximate contact.

Our paper on this interesting topic in this issue gives some valuable information regarding sleet preventive measures as derived from the Pennsylvania Water & Power Company, which operates three 70,000-volt tower lines, two from the power plant to Baltimore, Md., the third to Lancaster, Pa. The first Baltimore line carried two circuits spaced 7 ft. apart in a vertical plane. The second Baltimore line carries at present only a single circuit, but the crossarms are 9 ft. apart, and staggered, the middle conductor being 2.5 ft. further out than the upper and lower ones. The virtue of this difference in construction is well shown by the fact that while the first line has been twice short-circuited from sleet, the second one had sufficient clearance. between the lines, even under extreme conditions, to cause no trouble. Some valuable experiments were tried out on the single-circuit Lancaster line, built with 7-ft. clearance, to determine how great the actual sag due to loading might be. This was done by actually loading the cable through one entire span and measuring the effect in sag of the cable and deflection of the insulators from one strain insulator to the next, over a distance of seven spans. In a 640-ft. span the increase of sag, due to a loading equivalent to a half-inch coating of ice, proved to be 15 ft., the effect of the load being chiefly to pull over the suspension insulator strings so as actually to shorten the distance between supports and thus to drop the catenary to a corresponding amount, which agreed very closely with the theoretical result in thus shortening the span with the same length of conductor.

Staggering the wires, and more frequently anchoring, can reasonably be expected to free the line from danger of this particular sort, but to avoid trouble with the existing lines which were not staggered experiments were tried as to the amount of current required on the cables to keep sleet from freezing upon them. Sleet forms only when the temperature is just a little below the freezing point, and it does not form through a wide range of temperature, so that the possibilities of loading the circuit sufficiently to get above this critical temperature seem reasonably good. Trial showed that when the circuits, which were of 300,000 circ. mil, were carrying about 300 amp., there was very little likelihood of the adherence of sleet. This plan of campaign against sleet has been tried in practice with good results by cutting out on the long Baltimore line one or more of the three circuits so as to maintain the load at about the required point. At times when the normal load was not sufficient to reach this result even with one circuit, quadrature current was added by feeding back through one of the circuits to under-excited generators, a somewhat heroic remedy, but one which worked. The obvious course in most cases would seem to be the installation of suspension insulator lines with the conductors staggered enough to limit the danger from unequal sag.

Co-ordination of Scientific Research

IN a pamphlet sent by the editors some weeks ago, an editorial program for the co-ordination of scientific research in the electrical industry was announced. The response to this invitation to forward the broad research movement in the electrical industry was immediate. The editors wish to thank the writers of these many letters and to announce that beginning with the issue for March 17, the ELECTRICAL WORLD will publish monthly in the third issue, a Research Department. This department will be conducted by Vladimir Karapetoff, professor of Electrical Engineering at Cornell University. Professor Karapetoff will present our program for the new department in the issue for next week. He will be glad to send to research men in university, central station, industrial and private laboratories the preliminary program and to receive their comments and suggestions for the forwarding of the work of scientific research in the United States.

Prevention of Sleet Trouble on High-Tension Transmission Lines

Nature of Sleet Troubles—Tests to Determine Maximum Sag of Conductors—Line Current Required to Prevent Formation of Sleet During Storms—Operating Procedure to Prevent Troubles from Sleet

By Ralph L. Thomas

Member Engineering Staff, Pennsylvania Water and Power Company

Sleet storms, in a broad sense, may be considered to include any weather condition that causes a deposit of ice or heavy, icy snow on branches of trees, wires, etc., which may be a prolific source of trouble on an overhead transmission system. During the years 1910 to 1915 several interruptions due to these causes occurred on the high-tension lines of the Pennsylvania Water and Power Company. Such trouble, however, has now been practically eliminated, partly by improved mechanical design of the lines, but more especially by the *prevention* of sleet formation by keeping the temperature of the cables above the freezing point. The necessary temperature rise is secured by operating at low power factor, or if this method is inadequate, by short-circuiting one line and subjecting it to a heat run.

Vigilance and co-operation between patrolmen and operators have been found essential to success. If ice is once allowed to form, much more current is needed to clear the wires on account of the heat required to melt the coating of ice, and the damage may be done before this is accomplished. Prevention is proverbially better than cure.

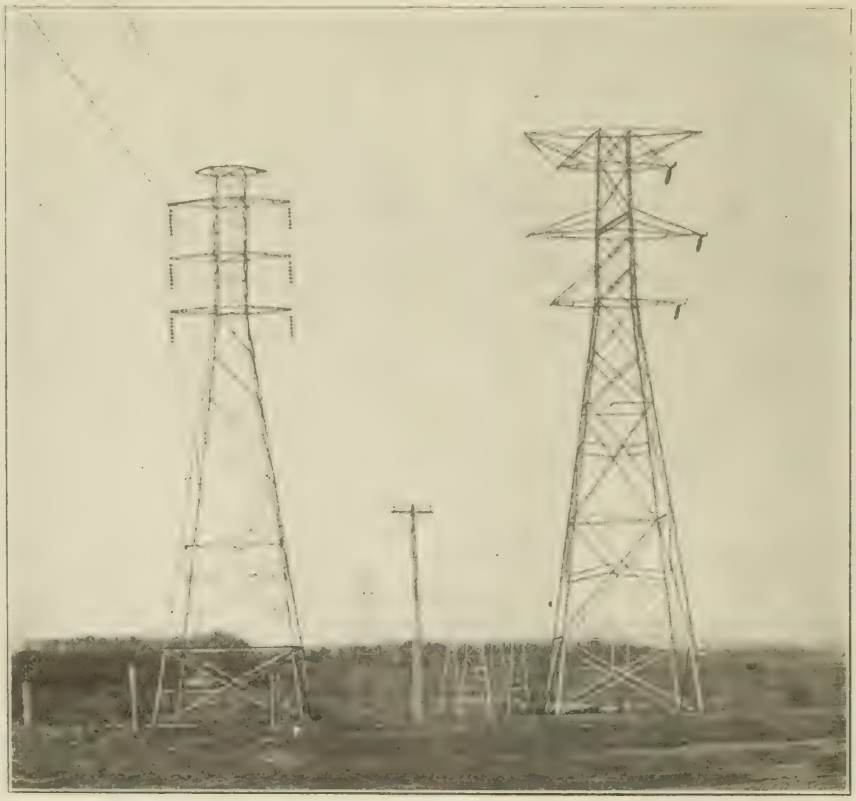


FIG. 1—BALTIMORE TRANSMISSION LINE SHOWING OLD STYLE TOWERS ON LEFT AND NEW STYLE ON RIGHT

The old style towers carried conductors in a vertical plane while the new style carry conductors in a staggered position. The tower shown at the right in this case is a strain design.

In the following text a brief description is given of tests from which the best methods of protection were determined, with a statement of the operating procedure.

The Nature of Sleet Trouble

Sleet damage may be either mechanical or electrical, or both. The factors involved are:

1. Mechanical failure of cables, insulators, crossarms, poles, or towers. Such failure may be caused by the sheer weight of the ice load, usually combined with excessive wind load due to the increased area in the path of the wind. Pure mechanical failures are very rare on a power line carefully designed and constructed in accordance with standard rules of loading, and may be classed with those unusual catastrophes, the complete protection against which is debatable. These failures could practically be eliminated by extreme assumptions of loading in designing the line, but it is a question of balancing the loss in money and service prestige caused by such interruptions against the increased investment cost of extremely safe lines.

2. Electrical breakdown and short-circuit may be caused by very long icicles on insulators or between wires, or by masses of ice or snow on insulator strings. The experience and tests of the power company, however, indicate that this almost never occurs.

3. Electrical breakdown and short-circuit may be caused by mechanical unbalancing or distortion, as by unequal sag due to uneven distribution of the ice load. Such electrical breakdown, followed by a power arc, may weaken the cable sufficiently to cause mechanical failure, and it is sometimes hard to distinguish between cases 1 and 3.

The mechanical remedies for the second and third troubles are shortening of the span, using more anchor towers, using pin type or rigid insulators, increasing the spacing of conductors, or changing their arrangement.

On a high-tension line strung on flexible suspension insulators, anchored only at strain towers several spans apart, the third trouble mentioned above is of most frequent occurrence. On such a line, if one span of one phase is loaded more heavily than other spans in the same section between strain towers, all the suspension insulators on that cable in that section will incline toward the heavily loaded span, thus taking up the sag in the lightly loaded spans and adding it to the sag in the heavily loaded span. Thus the latter cable may be brought close to the one next below it. Even if the

latter is not in the same vertical plane, the wind may swing the wires together.

It will be shown that on this type of line the spacing of conductors required to give complete insurance against such trouble is prohibitive. Nevertheless, the experience of the Pennsylvania Water & Power Company is that the "staggering" of the conductors in a vertical plane is of great value, and that this precaution, combined with electrical sleet preventive measures, is an effective protection.

DESCRIPTION OF LINES

The Holtwood generating station of the Pennsylvania Water & Power Company feeds three 70,000-volt steel tower lines. Two of these, paralleling each other on a private right-of-way 100 ft. wide, transmit energy to Baltimore, 40 miles distant, while the other carries power to Lancaster, Pa., a distance of about 14.2 miles.

On the first Baltimore line (No. 12), carrying two three-phase circuits (Nos. 1 and 2), the conductors are spaced 7 ft. apart in a vertical plane. On the new Baltimore line (No. 56), carrying at present only one three-phase circuit (another to be installed in the future), the crossarms are 9 ft. apart, and the conductors are staggered, the middle conductor being about 2.5 ft. farther from the center line of the tower than the upper and lower conductors, as shown in Fig. 1. More strain towers are also used, the maximum number of spans between such towers being five. All the conductors on the Baltimore lines are 300,000-circ. mil, 19-strand aluminum cables.*

Since the construction of the second Baltimore line (No. 56) in 1914, both circuits on the old line were short-circuited on two different occasions during sleet or snow storms, while the new circuit was not affected. The Lancaster line (No. 34) was built in 1913. It consists of a steel tower line carrying two three-phase circuits, the cables of each circuit being spaced 7 ft. apart in a vertical plane. There are 136 towers, of which forty-three are strain and ninety-three suspension towers. The average length of span is about 550 ft. The conductors are No. 0 B. & S. gage, 7-strand copper cable. The insulators at standard suspension towers consist of strings of six units each of the Ohio Brass Company's 10-in. porcelain disk type. At anchor towers the strain insulators consist of seven units each. The conductors were drawn up to a tension of 535 lb. at a temperature of 25 deg. C. In a span of 550 ft. this gives a sag of about 23 ft. The line was designed for an ice coating of 0.5 in. measured radially, and a wind pressure of 10 lb. per square foot at a temperature of minus 25 deg. C.

MAXIMUM SAG

The greatest possible sag due to unequal loading would occur if ice formed on one span only, or a more probable condition, if ice had formed on all spans but had fallen off all but one. The worst possible condition would occur if the cable below this heavily loaded cable were free of ice, and had been pulled above its normal position by an adjacent loaded span.

Perhaps formulæ for these conditions could be derived theoretically, but it is believed that they would be so complicated as to be entirely impracticable, and that simplified approximate formulæ are likely to be applicable only to the cases for which they are created. Recently an attempt has been made to derive an approximate formula for the deflection of the lower ends of the insulators in terms of the length of the span, the stressed length of cable, and the load, and the sag is computed by assuming that the tensions in the loaded and unloaded cables are the same. The writer believes, however, that it is impossible to derive an approximate formula of general application for the linear deflection of insulators which does not involve the length of the insulator string (or the angular deflection) and the number of spans between strain towers. The best method of determining the sag analytically would seem to be to start at one of the anchor towers and work to the other, span by span, determining the deflection by trial and error. Prof. Harold Pender gives such a method in his "American Handbook for Electrical Engineers," pages 1697-1699.

*For a complete description of these lines see a paper by A. Bang on "Four Years' Operating Experience on a High-Tension Transmission Line," Trans. A.I.E.E., 1915. Vol. XXXIV, page 1243.

MECHANICAL SAG TESTS

In order to determine experimentally how great the increase in sag might be, some interesting mechanical tests were carried out by the Pennsylvania Water & Power Company in the summer of 1913 on the Lancaster line described above. Later in the same year V. H. Greisser reported the results of somewhat similar tests on an experimental line of the Washington Water Power Company (Trans. A. I. E. E., 1913, Vol. XXXII, page 1829).

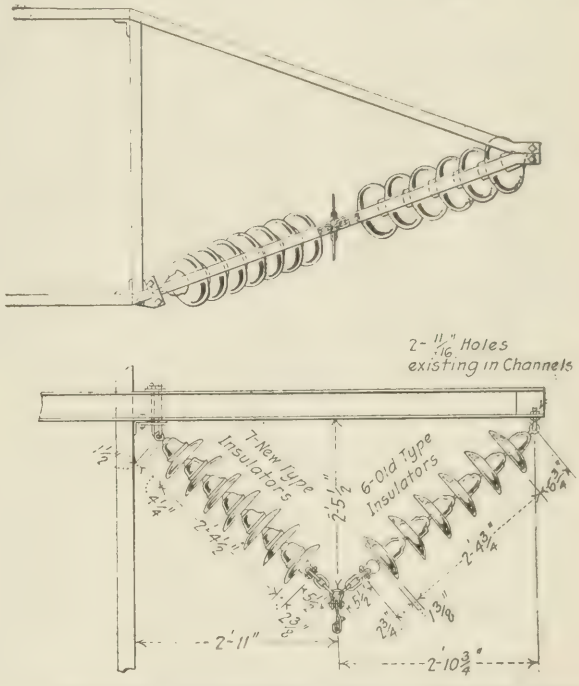


FIG. 2—INSULATOR ARRANGEMENT USED TO STAGGER CONDUCTORS ON OLD STYLE TOWERS WHICH HELD CONDUCTORS IN VERTICAL PLANE

Evidently the greatest sag due to sleet can occur in one of the spans in the section between the two strain towers which are farthest apart. At the point where the tests were made there are seven spans of a combined length of 4152 ft. between strain towers. For topographical reasons the span chosen for observation was the third from a strain tower. Its length is 640 ft. and the spans on either side are 792 ft. and 550 ft.

The first test made was to imitate an ice load on one phase of one span only, and measure the increase in sag. It can easily be computed that a 0.5-in. radial coating of ice on a No. 0, 7-strand cable imposes a load of about 0.545 lb. per linear foot of cable. In order to imitate this load weights were loosely clamped to the cable so that they could easily be drawn along. These weights were pulled out on to the span and held at the proper spacing (16 ft.) by means of a messenger rope, the weight of which was taken into account in computing the spacing. The arrangement is shown in Figs. 3 and 4.

After the load was applied, the sag of the cable was approximately 40 ft., or 15 ft. greater than before the

weights were put on, as determined by means of a transit. Before the application of the load the deflections from the vertical of the suspension insulators supporting the phase tested were found to be negligible. After the load was applied the deflections of the bottom clamps, measured by plumb-bob and rule, were as follows:

TABLE I—DEFLECTION OF INSULATORS—SPAN NO. 83-84 LOADED

Tower No.	Deflection	Direction of Deflection
82	Strain	South
83	0 ft. 6 in	South
84	2 ft. 8 in	South
85	3 ft. 5 in	North
86	1 ft. 0 in	North
87	0 ft. 7 in	North
88	0 ft. 3 in	North
89	Strain	North

The new length of the loaded span is seen to be approximately 4 ft. shorter than the original length, or 636 ft. The sag computed by ordinary formulæ for this span, using the new loading of 0.867 lb. per foot, and the length of cable derived from the original sag, will be found to check the experimental sag closely. The length of a suspension string of six insulators from point of support to cable is 3 ft. 4 in.

After these observations the spans on either side of the loaded span were weighted in the same manner. With three spans thus loaded, the sag of the middle span was found to be approximately 31 ft., or 6 ft. greater than when there was no load on the spans. The deflections of the insulators in this case are given in Table II.

TABLE II—DEFLECTIONS OF INSULATORS WITH SPANS NO. 83-84 NO. 84-85, NO. 85-86 LOADED

Tower No.	Deflection	Direction
82	Strain	South
83	1 ft. 5 in.	South
84	0 ft. 1 in.	South
85	0 ft. 11 in.	North
86	2 ft. 4 in.	North
87	0 ft. 9 in	North
88	0 ft. 5 in.	North
89	Strain	North

After all weights had been removed the cable did not return to its original position. The sag of span No. 84-85 was 0.5 ft. greater than originally. This was to be expected, as it is not likely that the insulators would

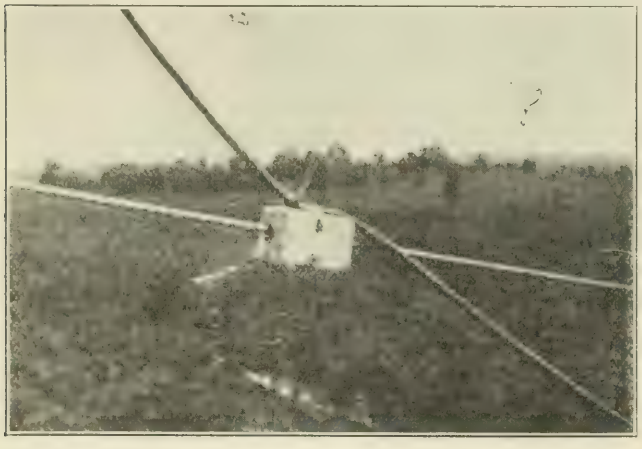


FIG. 3—LOADING WEIGHT USED IN SAG TESTS

all assume exactly their original positions, and that the sag would be distributed throughout the seven spans in exactly the same manner. Also the temperature may have been slightly different (the two measurements were taken on consecutive days), and there may have been a slight stretching of the cable, or a little slipping in the clamps.

The temperature during the tests was about 25 deg. C. The temperature with an actual sleet load would be about 0 deg. C. No attempt has been made to reduce the results to the latter conditions, as only approximate results were desired. The results are sufficient, however, to show that the spacing required absolutely to prevent trouble on this type of line from unequal load and sag is prohibitive.

The mechanical tests, as well as experience and observation during actual sleet storms, indicate the danger of allowing sleet to collect on the transmission lines, and the desirability of tackling the problem at its source by preventing the formation of sleet on the wires by keeping the temperature of the cables above the freezing point during the storms. In 1914-1915 several tests were made to determine the amount of current necessary to accomplish this. The current required depends on the atmospheric temperature (which determines the temperature rise necessary), the weather conditions and the physical characteristics of the wire.

In 1914-1915 heat runs were made on the type of conductor in service on the Baltimore lines. One of the tests was made on the actual transmission line. The others were made on short experimental lengths of cable. In some cases the cables were sprinkled with water in a finely divided state in imitation of rain. In three of the tests a dead cable, referred to as an "idler," was placed near the cable being tested and the temperature rise of the latter was measured with reference both to the temperature of the atmosphere and to that of the idle cable. It was found that there was a difference in these when the sun was shining or rain falling.

The results of these tests are given in Table III. The actual currents used ranged from 278 to 478 amp., but the temperature rises were reduced to the basis of 300 amp. for comparative purposes by multiplying the observed rise by $\left(\frac{300}{\text{actual amp.}}\right)^2$, since it has been shown both by theory and experiment that, for the same external conditions, approximately $T = I^2/K$ where T = temperature rise, I = current, and K = a constant.

From this table it will be seen that the data are rather meager, and that the amount of current required is rather indefinite. Nevertheless, it is believed that except under extraordinary conditions 300 amp. on the 300,000-circ. mil aluminum cable will prevent the formation of ice. Sleet has never been observed on a cable carrying that current.

TABLE III—RESULTS OF HEAT RUNS ON 300,000 C. M. ALUMINUM CABLE

Amperes (Adjusted)	Wind Vel. Miles per Hour	Temp. in Deg. C. of Water Used for Sprinkling	Atmos. Temp. in Deg. C. In Shade	Atmos. Temp. in Deg. C. In Sun	Temp. Idle Cable	Temp. Rise of Loaded Cable in Deg. C. Above Idler	Temp. Rise of Loaded Cable in Deg. C. Above Atmos.	Conditions of Test
					Deg. C.			
300	High	None	+13	....	.....	....	6.5	Transmission line test, cloudy windy weather. No rain.
300	None	None	+21	....	....	....	21.	Indoors.
300	1.8	Zero	-3.3	....	-3	7.3	7.6	Outdoor test. Ice formed on idler only.
300	6.4	Zero	-8.7	-4	-6	2.5	5.2	Outdoor test. Ice formed on both cables. Less on loaded cable.
300	3.6	Cold, Rain	-0.2	....	0	3.1	3.3	Outdoors. Natural rain with a little sleet, which melted from cable.

There is considerable uncertainty as to the maximum temperature rise which should be provided for. In the opinion of the Baltimore office of the U. S. Weather Bureau, the minimum wet bulb temperature during a sleet storm is —3 deg. or —4 deg. C., and this is borne out by the power company's experience.

The velocity of the wind and the rate of precipitation

are probably the most important factors. Opinions differ as to whether or not a high wind is likely to occur during the formation of ice or sleet. It is very likely, however, to *follow* the formation of ice, which is another argument for prevention.

A great service would be rendered if operating companies would systematically observe the current carried by cables on which ice does and does not form, as well as other conditions such as atmospheric temperature, wind velocity and rate of precipitation. A compilation of such observations would be of great aid in determining the line current which should be maintained during sleet storms.

Preventive Operating Methods

The only customers of the Pennsylvania Water & Power Company are the public utility companies in Baltimore and Lancaster. The co-operation of these customers renders possible methods which could not universally be adopted. The first requirement is the immediate reporting to the power-house operator at Holtwood by patrolmen, substation operators, or any other employees to whom the information may come, of the presence on the line, or approach, of conditions tending to form a deposit of ice or heavy snow on the lines.

Referring first to the Baltimore lines, on receipt of sleet report, if the load is less than 60,000 kw., the Holtwood operator cuts out one of the three Baltimore circuits. This is then short-circuited and grounded at the substation end. At Holtwood it is connected to the low-tension bus. The heat run consists of about 390 amp., or 5000 kw.

Meantime if the load is not sufficient at normal power factor to put 300 amp. on each of the six conductors remaining in service, the customers are asked to under-excite their synchronous machines or to increase the "wattless" current, so as to bring the line current up to 300 amp. Such under-excitation at the receiving end increases the line drop, and the limiting condition is reached when the Holtwood generators are fully over-excited (all rheostats cut out and maximum "boost" on the booster) and the substation voltage drops below normal. Should this limit be reached (allowing, of course, a small margin for control) before the line current reaches 300 amp., one circuit is given the preference and is brought up to a load of 300 amp. The lightly loaded circuit and the circuit on heat run are then interchanged if necessary, so as to keep both free from ice. If the sleet conditions occur during peak load, all three circuits are left in service until the Baltimore load decreases to 60,000 kw. at the Holtwood end.

Before the above method was finally determined upon, and especially before the load had grown to its present proportions, other schemes were tried, which will be briefly outlined.

If the sleet occurred during the early morning hours, the Baltimore load, when less than 24,000 kw., was carried on one circuit only. The other two circuits were tied together at the Baltimore substation. At the generating station, one circuit was short-circuited, and the loop thus formed was subjected to a heat run with current supplied by two generators and two transformers. When the load began to increase, all three circuits were put in service, and circulating current was provided as follows: Five over-excited generators in parallel fed two circuits through their respective transformers. Two other generators with open field circuit were connected to the third circuit through their transformers. At the substation the connections were normal—that is, the three groups of transformers, one for each circuit, were paralleled on the low-tension side, but not on the high-tension side. "Wattless" current was circulated from the over-excited generators through the lines back to the generators with open field. In other words, the latter generators were excited by the former. Sufficient current was thus secured to keep the temperature of the lines above the freezing point.

Referring now to the Lancaster line, this is normally operated in parallel with the Baltimore lines. If the voltage on the latter at the generating end is considerably raised, as already pointed out, by under-excitation of receiving apparatus, the main Holtwood bus voltage may become too high for the Lancaster circuits, in which case the line drop is much less than in the Baltimore circuits. In this case the Lancaster system is segregated, with one generator, transformer and auxiliary bus.

The best method of preventing the formation of sleet on the Lancaster circuits has not yet been definitely determined. Formerly one of the two circuits was taken



FIG. 4—CABLE ARTIFICIALLY LOADED TO IMITATE SLEET LOAD

out of service and subjected to a heat run. This, however, required a separate generator, which can no longer be spared. One scheme which may be tried this winter is a heat run on one circuit with 2300-volt energy supplied at the Lancaster end, feeding into a short-circuit at Holtwood. A special "sleet bus" consisting of three cables strung beneath the roof trusses of the switch room in two sections, with suitable connections through an oil switch to the low-tension bus, and through disconnectors to the three outgoing Baltimore circuits, has been installed in the generating station in order to facilitate making the sleet heat-run connections.

These methods of keeping the lines clear, with modifications, have been in use now for nearly two sleet seasons, and have proved effective. Nevertheless they must be regarded as still in the experimental stage. Their efficacy depends largely on the immediate reporting of threatening weather conditions to the operator at the generating station.

This is well illustrated by the partial interruption of April 8, 1916. Early on this morning heavy, wet snow began to fall between Holtwood and Baltimore, which was not reported to the generating station. This snow accumulated on the cables unevenly and short-circuited both circuits on the old Baltimore line. During this partial interruption one span of this line was observed in which, on each circuit, the middle phase cable had sagged below the lower cable, there being no snow on

the latter. Tapping the cables with a wooden mallet caused the snow to fall, and the cables returned to their normal positions.

The new line, with staggered conductors and greater spacing, was not short circuited, and in fact there has been no disturbance on this line due to sleet.

The results obtained by staggering the conductors on the new Baltimore circuit have been so satisfactory, as already pointed out, that it was desired to stagger the conductors on the older line. This was accomplished without making any change to the crossarms by means of so-called "V-insulators," which the power company has recently installed on approximately every other suspension tower on its line No. 12. The arrangement is shown in Fig. 2. The old insulator strings were left intact, but the lower ends were pulled in from 2.5 to 3 ft. by means of new insulators. The new string forms a V with the old one, with the cable clamp at the apex. These insulators have been on the line only a few months, and hence have not been thoroughly tried out. It may be found necessary to pull over every suspension string, since with the V-insulators at only every other tower the intermediate old-style insulators are pulled in only a few inches.

With the electrical preventive measures outlined above, and improved mechanical design as a second line of defense, as it were, the Pennsylvania Water & Power Company hopes that the "irreducible minimum" of sleet damage has been attained. The mechanical and electrical tests described by the writer were carried out under the direction of A. Bang, testing engineer of the Pennsylvania Water & Power Company.

Characteristics of Standard Inclosed Fuses

Results of an Investigation of Suitable Construction Materials, Performance of Fuses Under Different Operating Conditions, and Effect of Size, Kind and Amount of Filler on Operation

BY WALTER ARTHUR

ONE of the earliest attempts at an automatic device for opening an electric circuit was the insertion of a piece of metal or an alloy with a high electrical resistance and a low melting point in the circuit. This device has been handed down and is still in use, in some instances, in its original form. The operation of such fuses as they were originally constructed was not reliable as in most instances it is necessary that an electric circuit with a definite current be opened in a very definite time This the ordinary fuse can not always be depended upon to do.

It has been found that the factors controlling the behavior of small fuses are as follows: (1) Material of fuse element; (2) shape of cross section of fuse element; (3) specific heat capacity of filler used; (4) heat conductivity of inclosing case; (5) length and diameter of case; (6) location of fuse element in the filler; (7) temperature of the atmosphere in which the fuse is used; (8) previous heat treatment of the fuse element and the effect of indicator wires.

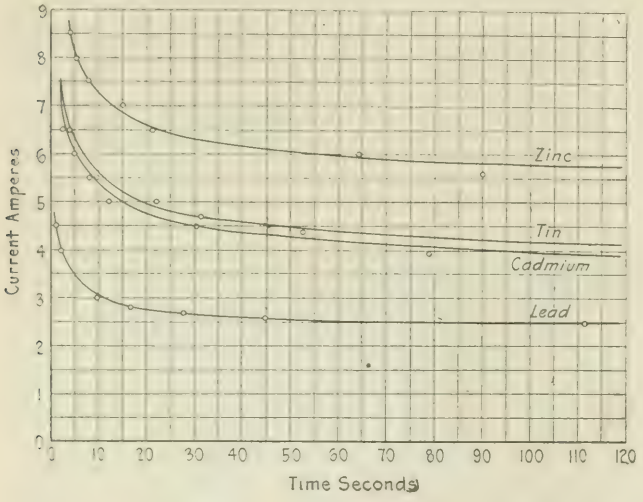


FIG. 1—CURVES (FROM TABLE I) SHOWING COMPARATIVE RATINGS OF FUSES MADE FROM ROUND WIRES 0.0125 IN. DIAMETER

The properties that must be considered in selecting a metal for the fusible element are: electrical resistance; tendency to oxidize, and the melting point. The only metals or alloys suitable for inclosed fuses are those of low melting point, since any metal melting at or near red heat would be required to dissipate heat when held at or near this temperature for any length of time, sufficient to char or burn the inclosing case unless the case be very large. The only metals melting below this temperature are: zinc, melting at 420 deg. C.; lead, melting at 327 deg. C.; cadmium, melting at 320 deg. C.; bismuth, melting at 268 deg. C., and tin, melting at 232

TABLE I—COMPARATIVE CAPACITIES OF INCLOSED FUSES MADE FROM ROUND WIRES

Wires—0.0125 in. diameter; filler—silicic acid; cases—fiber, length 1¼ in. external diameter, 0.5 in., internal diameter, ⅜ in., terminals brass.

Lead Wire		Zinc Wire		Tin Wire		Cadmium Wire	
Current in Amp.	Time in Sec.	Current in Amp.	Time in Sec.	Current in Amp.	Time in Sec.	Current in Amp.	Time in Sec.
4.5	4	8.5	4	6.5	4	6.5	2
					4		3
4.0	2	8.0	5				
	2		6	6.0	5	6.0	5
					5		5
3.5	3	7.5	8				
	3		9	5.5	9	5.5	7
			8		9		8
3.0	11		6		10		9
	10						
	8	7.0	14	5.0	20	5.0	11
	10		14		28		10
			11		23		11
2.8	17		11		17		16
	13		15				
	20			4.7	30	4.5	35
	16	6.5	21		30		30
	18		20		35		24
			22		30		32
2.7	33		28				30
	25		16	4.4	38		
	25				85	4.2	60
	28	6.0	83		40		100
			70		49		60
2.6	55		58				95
	42		52	4.2	135		
	45		60		100	3.9	270
	37				150		180
		5.6	120		110		275
2.5	107		60				195
	103		90				
	103		90				
	133		90				

deg. C. Any of these may be obtained in the form of wire by extrusion or by drawing. But tin, lead and bismuth must be extruded. Each of these metals except bismuth when in the form of wire is sufficiently pliable and possesses the mechanical strength necessary for working into serviceable fuse wire or ribbon.

Bismuth oxidizes quite easily indeed. The temperature at which it oxidizes is very much below its melting point, and when a wire is held at this temperature for any length of time the cross-section is very much decreased, thus increasing the resistance. The next of the metals in the order of their tendency to oxidize is lead. It does not oxidize as easily as bismuth, but the coating that may be formed is of sufficient strength to hold the metal in place when at a red heat. Frequently the current carried by a fuse wire under these conditions is many times the normal rating and breaks only when the lead completely oxidizes or reaches the boiling point. This behavior of the metal may considerably delay the time of blowing or breaking of the fuse. Zinc oxidizes quite easily when the temperature is near the melting point, but not as easily as lead or bismuth. This layer of oxide, like that formed on lead, often holds the metal in its original position until it reaches the boiling point.

The tendency of tin to oxidize is very slight indeed to within a few degrees of the melting point. When conditions are favorable a sufficient coating of the oxide will form on the surface to hold the metal in position until the temperature rises to a red heat. The range of temperature over which this oxide forms is so limited that only very rarely will the fuse element refuse to break at its normal rating.

Cadmium oxidizes but very slightly below the melting point. Its tendency in this direction is less than that of any of the metals mentioned. The amount of oxide formed is so very small that oxidation does not affect its reliability or its current carrying capacity.

The resistance of the metal composing the fusible element is one of the factors which enters into the choice of a metal for such purposes. The resistances usually given for the five low melting point metals given are:

Element	Specific Resistance in Micro-ohms per Centimeter Cube. Temp. 0 Deg. C.
Bismuth	108
Lead	18.5-19.5
Tin	9.5-11.5
Cadmium	6.0- 7.0
Zinc	5.5- 6.0

The resistance of the fusible element in large fuses is not so important but in low capacity fuses such as those below one ampere rating, it must be considered. A metal having a low specific resistance like zinc or cadmium is not suitable for fuses of this rating. A cadmium or zinc wire suitable for this rating would have a diameter less than 5 mils and this is too small to be practical. A lead wire of a convenient working size can be made which would carry 0.5 amp. but the tendency toward oxidation prohibits its use. Bismuth with its high specific resistance would seem ideal for this purpose but is too brittle and oxidizes too easily.

An alloy of bismuth and some of these low melting point metals, which would melt at a temperature below which either constituent would oxidize and have a fairly high resistance should, however, meet the requirements of a 0.5 amp. fuse. An alloy of 40 per cent lead and 60 per cent bismuth produces an alloy melting at about 125 deg. C. and has a resistance of 50 or 60 micro-ohms per centimeter cube. This alloy gives a material meeting the requirements of fuses but is impractical for large sizes. It possesses but little mechanical strength and requires a special low melting point solder.

By consulting Fig. 1 based on Table I it will be observed that fuses made from round lead and zinc wires occupy positions, relative to each other, such as might be predicted from their melting points and specific resistances. Lead, with a specific resistance of about 19 micro-ohms per centimeter cube and a melting point of 327 deg. C., should carry much less current than zinc having a specific resistance of about 6 micro-ohms per centimeter cube and a melting point of 420 deg. C.

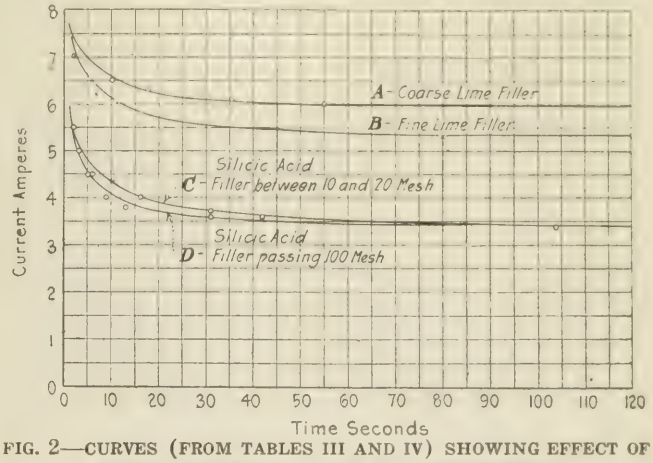


FIG. 2—CURVES (FROM TABLES III AND IV) SHOWING EFFECT OF SIZE OF PELLETS ON TIME OF FUSE BLOWING

Fuses made from tin wire having a specific resistance of about 10 micro-ohms per centimeter cube and a melting point of 232 deg. C. would be expected to carry less current than fuses made from the same size cadmium wire which has specific resistance of about 7 micro-ohms per centimeter cube and a melting point of 320 deg. C. By consulting the curves drawn from Table I, it is found, however, that fuses made from tin wire carry slightly more current than those from cadmium wire of the same size. The probable explanation is that tin and cadmium do not radiate heat at the same rate and that the resistances may not have been the same as given in the table.

TABLE II—DIFFERENCE IN REGULARITY DUE TO THE USE OF DIFFERENT FILLERS—CASES OF FIBER, 0.5 IN. x 1⅛ IN.

Pellet-Lime Filler (10 per Cent Passing 20 Mesh) With 2x35 Mil Zinc Ribbon			Silicic Acid Filler With 2x50 Mil Zinc Ribbon		
Current in Amp.	Time in Sec.	Average Time in Sec.	Current in Amp.	Time in Sec.	Average Time in Sec.
7.0	2	2	8.0	3	3
				3	
6.5	7	6		3	
	5				
	7				
			7.0	7	7
				6	
6.0	11	15		7	
	18				
	19		6.0	18	16
	13			23	
	11			9	
	17			12	
				18	
5.8	60	44		16	
	18				
	35		5.5	42	38
	90			35	
	42			33	
	20			28	
				27	
5.7	55	44		37	
	55			50	
	30			43	
	45			65	
	35			22	
5.4	95	102	5.0	66	191
	65			60	
	150			90	
	130			120	
	85			360	
	90			450	

The shape of the cross-section of the fusible element in no way influences the carrying capacity, but does

exercise a decided influence upon the sensitiveness of the blowing or breaking of the element. When the element has a circular cross-section it may be, and sometimes is, held in place by a finely divided, closely packed filler, after the metal has become molten. If in the cross section the width is much greater than the thickness, this tendency to "hold in place" is much lessened. Also a very thin element has a tendency, when molten, to contract to a circular cross-section. This contraction to a circular cross-section invariably results in the breaking of the element. This effect is so marked that the susceptibility to rapid fusing is quite noticeable.

In making a fuse element of this kind a suitable sized wire was rolled into a ribbon of 2 mils thickness. This thickness was selected because it was about the thinnest ribbon which could be handled with ease and dispatch

TABLE III—EFFECT OF SIZE OF LIME PELLETS ON TIME OF BLOWING
Wires—zinc, 10x22 mils; cases—fiber, 0.5 in.x1¼ in. No indicator wires.

Fine Lime Filler (10 per Cent Passing 20 Mesh)				Coarse Lime Filler (Between 10 and 20 Mesh)			
Current in Amp.	Time in Sec.	Average Time	Extreme Time	Current in Amp.	Time in Sec.	Average Time	Extreme Time
7.0	2	2	2	7.0	2	2	2
	4		4				
				6.5	5	6	5
6.5	7	10	7		5		7
	10		15		7		
	9						
	15			6.2	7	6	2
					5		9
6.3	35	17	7		6		
	30		35		9		
	15				7		
	12				6		
	7						
	7			6.0	18	11	5
					15		18
6.1	17	39	9		10		
	9		65		15		
	50				7		
	65						
	35			5.5	120	83	23
					23		120
6.0	45	55	45		110		
	70		70				
	70		70				
	55						
	55						
	50						
5.5	300	240	180				
	240		300				
	180						

and without injury to it. In attempting to secure a ribbon of less thickness difficulties in rolling are encountered. A ribbon thicker than 2 mils shows greater irregularities in its operations. A comparison of the time-blowing points of fuses made from round zinc wires and zinc ribbon and pellet-lime filler shows greater regularities in the blowing of the ribbon fuses.

Much of the variation in the time required for the ordinary fuse to open a circuit on an overload comes from the difference in specific heat capacity and heat conductivity of the various fillers used. In many standard fuses with zinc wires the ordinary pellet-lime filler is used. By an examination of these pellets quite a variation in size is observed which introduces a difference in heat capacity and conductivity. These differences give a wide variation in the time required to blow the fuses on an overload. This is well illustrated by comparing the regularity of the blowing points of fuses made with the ordinary pellet-lime filler and silicic acid filler. It may be observed by consulting Table II that fuses made from zinc ribbon (2 x 35 mils) and ordinary pellet-lime filler show less regularity in time of blowing than fuses made from zinc ribbon (2 x 50 mils) and silicic acid filler. The reason obviously is that the silicic acid filler being much lighter and more fluffy has a much more even heat conductance than the lime filler. At the same time the silicic acid filler has much less material in contact with the fuse element; thus the difference due to the variation of heat capacity of the filler is much less effective. The effect of heat capacity and heat conductivity of different sized pellets in the pellet-lime filler is shown in Table III and in Fig. 2 based on this table. Fuses made from fine pellets carry

TABLE IV—EFFECT OF USING SILICIC ACID FILLER OF DIFFERENT GRANULATIONS
Wire—2x35 mil cadmium ribbon; cases—fiber, 0.5 in.x1¼ in.

Silicic Acid Filler Between 20 and 10 Mesh			Silicic Acid Filler Passing 100 Mesh		
Current in Amp.	Time in Sec.	Average Time	Current in Amp.	Time in Sec.	Average Time
5.5	2	2	5.5	2	2
	2				
			5.0	3	3
5.0	3	3		3	
	3				
			4.5	5	5
4.5	6	6		5	
	5			5	
	6				
			4.0	7	9
4.0	18	16		7	
	16			11	
	12			11	
	14				
	15		3.8	15	13
				13	
3.7	29	31		14	
	38			12	
	32				
	29		3.6	24	31
	29			28	
	29			40	
				30	
3.6	42	42			
	42		3.4	210	125
	40			115	
	49			145	
	47			75	
	30			80	
3.4	140	140			
	100				
	112				
	92				
	93				
	90				

0.5 amp. less than those made from the coarse pellets. The differences in the time-blowing points of fuses made from different granulations of silicic acid is shown in Table IV, and in Fig. 2 the fuses containing

TABLE V—EFFECT OF VARYING THE AMOUNT OF FILLER
Ribbon—2x38 mil cadmium; filler—silicic acid; cases—fiber, 0.5 in.x1¼ in. Internal diameter, ⅜ in. exact.

Weights of Filler in Grams	Time in Seconds to Blow Fuse with 3.7 Amp.
0.700	20 Average time, 19
	18
	18
0.750	27 Average time, 26
	26
	25
0.800	27 Average time, 28
	29
	30
0.850	32 Average time, 29
	27
	28
0.900	27 Average time, 30
	29
	34
0.950	34 Average time, 33
	31
	33

the finer filler giving a curve with a much sharper angle and having a slightly lower carrying capacity.

The quantity of the filler, especially that of the silicic acid has a marked influence upon the time of blowing; due to the changes in the heat capacity and heat conductivity of the filler. In Table V is shown the effect of varying the amount of the filler.

The effect of the length, diameter and heat conductivity of the fuse case, location of fusible element and temperature of surrounding air will be discussed with other subjects in a later issue.

Rehabilitation Without Service Interruption

How a New 1800-Kw. Station Was Built on the Site of an Old Power-Plant Building and New Switching and Control Equipment Installed at a Cost of $35,000 with Data on the Unit Coal Consumption

THE electric light plant at Holland, Mich., has just been rehabilitated to give added surety of continuous service, to reduce fire plant hazard, to increase safety of operation and to provide for future growth. All of the changes, involving the construction of a new building and the installation of new electrical control equipment, were made under regular load conditions without a single interruption in service. The reconstruction plan was unusual in that no money was spent in an attempt to reduce the present operating costs of the plant, the entire effort being directed toward the improvement of the quality of the service rendered. On the other hand the over-all production cost was increased since the expenditures appreciably increased the overhead charges. The only reduction in expense was in the cost of insurance, which the plant now carries itself. All expenditures will be provided for from accumulated profits and no new money will be required for the improvement.

One of the largest engineering problems, probably, was to erect a new 82.5-ft. by 70.5 ft. building on the site of the existing station, leaving the boiler room intact for the present, but providing a plan for changing the boiler room layout within the next few years. Arrangements were also made so that the turbine room might be extended at a later date. Along with the task of "building over a building," so to speak, was the necessity of installing new buses and switching apparatus to reduce the fire hazard and make for greater safety of operation. Reliability of service was especially important, since the town is dependent upon this source of power for both its water and electricity.

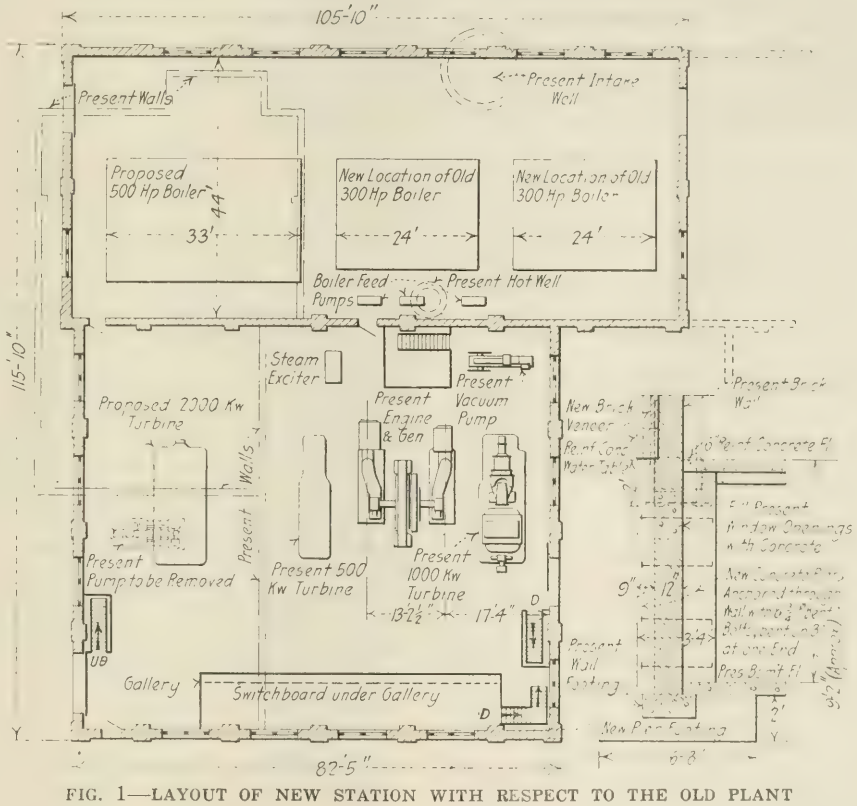


FIG. 1—LAYOUT OF NEW STATION WITH RESPECT TO THE OLD PLANT

How the Building Problem Was Attacked

The building which housed the plant just rehabilitated was a very old structure with 13-in. brick walls, a wooden main floor and a low wooden roof supported on wooden columns. The new building is a steel-frame structure faced with tapestry brick and equipped with metal windows and metal skylights. The roof is of concrete covered with tar and gravel. The steel columns in the wall of the building which will later be the partition between the turbine room and the yet unconstructed boiler room, were made sufficiently heavy to hold their share of the additional roof load and the overhead coal bunkers.

To minimize the excavating and other foundation expenses the existing 13-in. brick foundation was left intact and at such places as supports were needed for the columns of the new steel, framework footings, like those in Fig. 1, were installed. The placing of these column footings was accomplished by digging down 2 ft. on both sides of the existing foundation, drilling it for the reinforcing tie rods, setting the rods in place, building up the footing form and casting the concrete column footing in place. Eight of these column supports were used under the sides of the building, and seven similar footings under the ends to support pilasters for reinforcing the end walls. The new footings now carry the load of the entire steel frame, roof and walls of the building except that portion of the side walls which stands below the level of the original walls of the old building. The lower section of the side walls is carried by the old foundation, which now is really under a lesser load than it was in the old building. This treatment of the foundation, it is estimated, cost $5,000 less than a new foundation would have cost and the result is proving just as satisfactory as if new construction had been used throughout.

When the footings were in place portions of the old wall were torn away to give places for the steel columns. The entire steelwork and roof were then erected around and over the old building. A new roof was put on and a 15-ton traveling crane was erected between the old roof and the new roof. After a wood bulkhead had been placed inside the old walls to protect the machinery from the weather, the old walls were torn down and the new ones laid, that portion of the new side walls above the window tops being supported on steel lintels, which transmit the load to the columns. Almost the last step in tearing away the old building was removing its roof, which was left standing on wooden columns to protect the turbines and engine from the weather and material which might fall during the re-

construction. While the new concrete main floor was being laid the prime movers were operated from the old floor and from planks laid on the steel reinforcing which was later to support the concrete. The machine foundations were not changed.

In reconstructing the electrical control equipment the problem was considerably simplified by removing all of the old generating panels to one corner of the station and carrying bus wires out through a window to a tem-

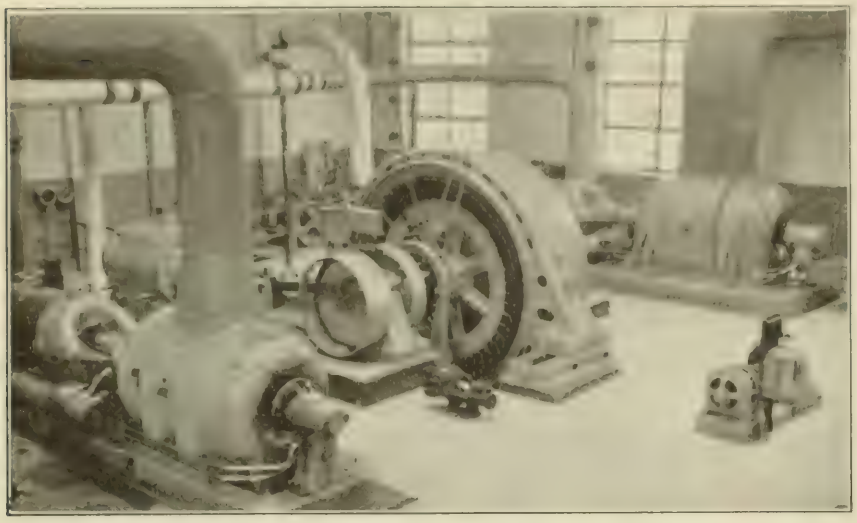


FIG. 2—ENGINE ROOM SHOWING FLUES FOR VENTILATING GENERATORS

porary switch house, in which the old feeder panels had been erected. While the plant was operated in this manner the new generator leads, buses and switchboard were installed.

The four-wire leads from the generators run directly to the buses in the basement, passing through disconnect switches. In the leads from two of the generators to the buses no automatic circuit-breakers are used. There is an automatic oil switch, however, in the circuit of the 1000-kw. generator, but the automatic feature is used only when paralleling, and after the machine is in synchronism the automatic control is cut out. Since the generator leads are placed in separate single-conductor fiber conduit, it is thought that there will be little if any chance for trouble between the busbars and the generators. Furthermore, the construction and secure location of the bus structure practically prevents the occurrence of short-circuit in this portion of the system unless one develops in the generators. The principal reason for placing all generator leads in fiber conduit is that the choking effect is less than with iron pipe.

Feeders connected with the buses pass through disconnect switches in the basement and from there rise, with each wire in a separate fiber pipe, to automatic oil switches equipped with inverse time-element relays. These units are set on the first floor and attached directly to the panels 24 in. apart. The relays are set to operate on 50 per cent overload in ten seconds. From the oil switches the lighting circuits run in iron pipes, with a single pipe to each circuit, to the gallery floor directly over the switchboard. One leg of each circuit passes through an automatic induction feeder regulator and then runs to the outgoing line rack, which carries the potential and secondary transformers, choke coils and spark-gap type lightning arresters. The automatic feeder regulators replace old-style step hand-operated regulators formerly used. Multiple conduit was used for leads near the generators and single pipes for single feeder circuits to eliminate as nearly as possible trouble that would affect the entire plant output.

Safety of operation was a ruling consideration in laying out the bus room in the basement. Instead of connecting the current transformers permanently in the generator leads they were supported below the station buses and connected therewith by disconnecting switches. Thus the transformers may be removed from the live part of the system for repairs whenever desired.

Tub-type regulators for the city lighting system have been placed inside a wire grating in the bus room. So that operators will not have to go inside the bus room to lift the tub weights each time the street lamps are lighted, however, 12-in. by 18-in. swinging doors have been placed in the grating so that the weights may be reached from outside the busroom.

TABLE I—THE COST OF THE IMPROVEMENTS AT HOLLAND (MICH.) STATION

Engineering and superintendence	$2,539.86
Exciter set, 12-kw. engine-driven and foundation	524.99
Building construction	17,151.69
Labor and material for all temporary work in connection with electrical apparatus	972 90
Conduit, labor and material	809.42
Bus structure (a.c. and d.c.)	1,284 02
New switchboard, feeder voltage regulators, generator cable and outgoing lines, labor and material	5,751.21
Plant-service conduit and wiring	1,097.65
Traveling crane (15-ton)	2,518.08
Rearranging atmospheric exhaust	127 23
Ventilating ducts for turbo-generators	391.12
Painting	1,057 45
Wall of bus room in basement	210 61
Motor-generator set bedplate, coupling and setting	79 76
Miscellaneous items	427.18
Total	$31,943 17

TABLE II—POUNDS OF COAL USED PER KILOWATT-HOUR IN PLANT AT HOLLAND, MICH.

	1913	1914	1915	1916
January		4.93	5 34	4 79
February		5.44	4.74	4 42
March	4.90	5 34	5 12	4 75
April	4.82	5 21	4.95	5 09
May	4.70	4.87	4.93	4 73
June	5.19	5.24	4.81	
July	5.33	5 42	5.08	
August	5.28	4 92	4.85	
September	5.56	4.99	4.78	
October	5.50	5.03	4.57	
November	5.27	4.77	4.38	
December	4.71	5.40	4.86	

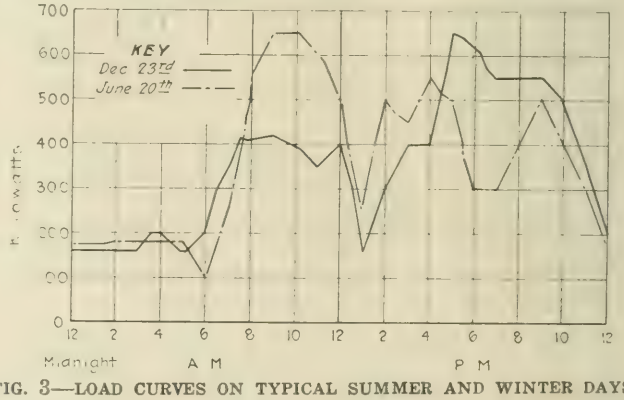


FIG. 3—LOAD CURVES ON TYPICAL SUMMER AND WINTER DAYS

The plans for the building at Holland were made by James N. Hatch, consulting engineer, of Chicago, and Clark, Jonkman & Clark of Holland were the building contractors. The reconstruction and electrical work was carried on under the direction of R. B. Champion, superintendent of public works.

INSTALLATION OF FIBER DUCT LINES IN CONCRETE

Features of Underground Concrete Conduit Construction When Using Fiber Duct and a Graphical Method of Determining Materials Required

Until quite recently underground transmission and distribution systems have been confined to the larger cities. There is at present considerable agitation by municipalities tending to require public utility corporations to resort to underground construction even in the smaller cities. Many city authorities now require an agreement whereby the electric lighting interests promise to spend either a predetermined amount of money in each municipality annually or to install a certain amount of conduits. From this it may be gathered that the scope of underground conduit construction is constantly widening. The rapidity with which the advantages of underground construction have been accepted has led to the adoption of numerous materials for the construction of conduit lines. Each of these materials has some peculiar advantage over the other, but all are manufactured with definite fundamental requirements in view.

The fundamental requirement of any conduit regardless of the material is protection to the cables it will contain. Allied with protection there should be durability and permanence. Protection is a broad term and covers many items. For instance, the duct should not be affected by the chemical elements in the soil, whether they be natural or due to the proximity of industrial plants. If a short-circuit should occur in one duct, the material should be fireproof so as not to permit the arc to communicate with the other cables. For the above and other electrical reasons the material should have a high insulating value. The material should withstand high-voltage tests when installed in wet soil and in service as well as in the preliminary tests. The duct should not be subject to corrosion or disintegration. The material should be moisture proof and offer protection against electrolysis. Aside from these physical requirements, the duct should be so manufactured as to permit facility of handling and installation, and also permit the ready installation and removal of cables.

Duct materials may be divided into three general classes, according to the material upon which they are

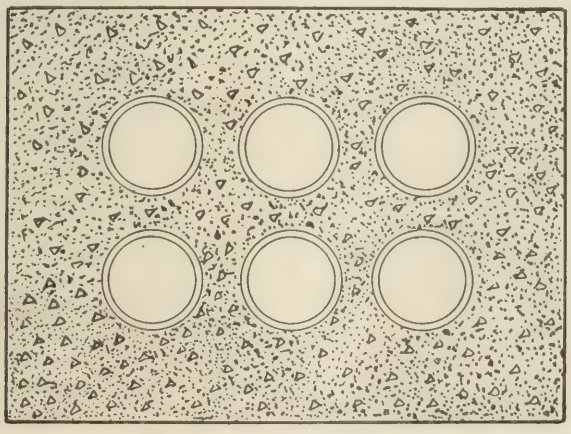


FIG. 1—SECTION OF CONCRETE CONDUIT LINE USING FIBER DUCT

based, as metals, vegetable and silicious materials. The first type, of which wrought-iron pipe is the best known, is rather expensive for main-line conduits, and is used generally for services between the distribution manholes and the consumers' premises. In the second class are fiber duct and creosoted-wood conduits. The fiber duct is rapidly advancing in favor in underground construction. The creosoted-wood conduit, known also as pump log, lacks durability, but at one time had an extensive use, the chief advantage being its low initial cost. In the third class are cement and stone conduits and vitrified clay or tile duct. In this latter class the tile duct finds the most extensive use.

Fiber duct possesses many advantages over the other

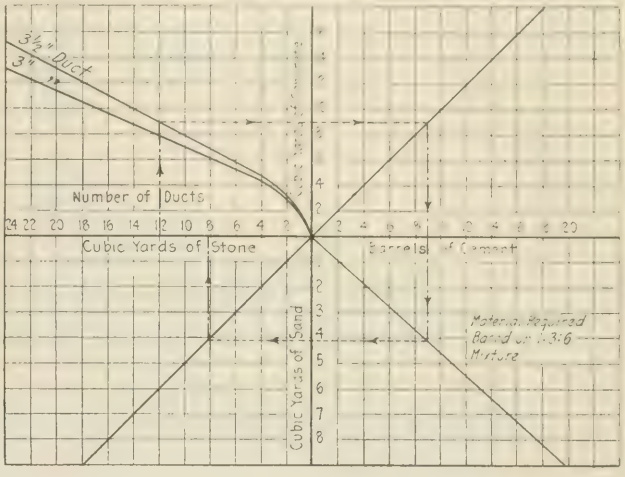


FIG. 2—DIAGRAM FOR DETERMINING MATERIAL REQUIRED FOR INSTALLATION OF CONDUIT USING 1 : 3 : 6 MIXTURE

forms of conduit materials. Recently it has been used in great quantities, supplanting other materials, and is increasing in popularity. Fiber duct consists of wet wood pulp or fiber which is wrapped about a mandrel in a thin film while under pressure. When built up to the proper thickness it is dried and then saturated with a bituminous compound. The conduit is manufactured with four general types of joints, the use and nature of which is implied in the name. These are the socket, the drive, the screw and the sleeve. The socket type is generally used with the concrete envelope, while the other types have no form of protection, being laid directly in the earth.

The advantage of light weight stands out primarily for fiber duct, and due to this the freight and cartage rates per foot are much lower than for other types of materials. Approximately three times as many duct feet of fiber duct may be carried in the same car as of tile duct. Likewise in handling the duct, one man can carry several lengths of fiber duct aggregating many lineal feet as opposed to one section of multiple tile duct. In installing the duct one man can remain in the trench and another hands him the duct, while with other materials it usually takes more than one man to handle the material at the top of the trench.

The breakage and waste is almost negligible with fiber duct, a distinct advantage being that broken pieces may be sawed off as if of wood and the good section trimmed up and used in piecing out the line. If a multiple tile is broken it means a loss of several duct feet and little use can be made of the remainder. As the sections are long a very good alignment can be secured with fiber duct without the use of mandrels. The length also means fewer joints and eliminates greatly the danger of particles of concrete sifting through and damaging the cable sheaths at some future time. Obstructions can be easily by-passed when in the path of the conduit line and when fiber duct is used.

In constructing conduit lines with fiber duct the construction is similar to that shown in the cross-section of Fig. 1. The ducts are separated by an inch of concrete and surrounded on the outside by an envelope 3 in. thick. The trench is dug with sufficient width to

allow the proper spacing and a 3 in. base of concrete is poured. The first tier of ducts is laid and held in place by a wooden rake designed to maintain the spacing. More concrete is poured and tamped into place and the second tier laid, and so forth, until the line is constructed. Between the tiers the joints are staggered, which tends to increase the strength of the finished line. The trench is dug according to the width of the

TABLE I—DIMENSIONS OF DUCT LINES USING 3.5 IN. FIBER DUCTS ARRANGED AS SHOWN IN FIG. 1

Number of Ducts	Number of Ducts Wide	Number of Ducts High	Outside Width	Dimension, In., Height
4	4	1	25	10
6	3	2	20	15
9	3	3	20	20
12	4	3	25	20
16	4	4	25	25
20	4	5	25	30
24	4	6	25	35
30	6	5	35	30
36	6	6	35	35

line, so that no wooden forms are used and the concrete is poured and confined by the sides of the trench. The arrangement of the ducts in the line and the outside dimensions for 3.5-in. ducts are shown in the accompanying table.

The set of curves based on a 1:3:6 mixture for both 3-in. and 3.5-in. fiber ducts constructed as illustrated in Fig. 1 has been worked up by an Eastern central station company, and is used for estimating the material to be ordered for the job. For instance, for 100 trench feet of twelve 3.5-in. ducts there would be required 9 cu. yd. of concrete made up of nine barrels of cement, 4.2 cu. yd. of sand and 8.4 cu. yd. of stone.

A Quenched-Gap Method of Opening Heavy Alternating Current

Alternating-current switches are usually built so as to open the contacts wide and with high speed in order to get a reliable and quick extinction of the interruption arc, in the same way as it is usual with direct current.

In patent 1,212,125, issued to Walter Burstyn of Berlin, Germany, the same effect is secured by opening the contacts so slowly that their distance at the moment of the next minimum of the alternating current is very small not exceeding 2 mm. with a weak current; with stronger currents the distance is preferably chosen to equal about 0.5 mm. In this case the resulting interruption arc extinguishes in consequence of the quenching effect known with quenching gaps at the moment the current passes through zero. Immediately afterward the voltage is not able to jump the gap again. The same effect is also obtained if the contacts, initially, are not opened more than the critical distance.

There are several reasons why knife switches are not suitable for application according to the above theory. One reason is that a small opening distance of the contacts cannot be accurately adjusted. Another reason is that just at the moment of the break the electrodes of the switch form edges which on account of their small heat capacity, are considerably heated by the arc even if the latter is of short duration. In consequence they would soon burn away and necessitate a readjustment of the small gap required. Furthermore, they would reduce the quenching effect for which cold electrodes are a requirement. A third reason is that the quenching effect requires the arc to be inclosed, so far as possible, between two large metallic masses, which cannot be done by means of edges and points. That is the reason why plate spark gaps are used in wireless telegraphy as quenching spark gaps.

As a consequence of these considerations for automatic switches the invention proposes contact pieces of slight convexity.

THE PHASING-OUT OF AN UNDERGROUND SYSTEM

Methods Used to Identify Conductors and Properly Connect Seven Three-Phase Feeder Cables in a Substation

BY G. W. TEFFEAU, JR.

While reconstructing a substation which feeds the underground area in Los Angeles, Cal., it was necessary to transfer seven three-phase 2200-volt feeders from one end of the station to the other where a new bus and switching compartment was located. So as not to interrupt service the transfer was made with the cables energized, but while doing so the phase relations of the outside circuits to the station buses were lost. Since it is frequently necessary to balance the load on the transformer by changing the connections between the station buses and the transformer vaults, steps were taken to identify the conductors so connections could be made intelligently.

Attempts were therefore made to phase the circuits by connecting the primary of a 1-kw. transformer across one bus and ground at the station, closing the secondary through a bank of lamps. Then with another 1-kw. transformer similarly connected in the first transformer vault, it was hoped to complete the circuit through the ground and identify the conductor by the lamps going out when both transformers were connected to the same conductor. This scheme was found impracticable, however, due to the existence of so many electrical circuits underground in this district. For instance, there were three electric service companies, two telephone, two railway and two telegraph companies occupying the streets with their underground cables. Some carry 15,000, 2200, 440, 220 and 110 volts, alternating current, others 650, 500, 220 and 110 direct current, while the remainder are telephone and telegraph cables. On account of these conditions, the writer was detailed to "phase out" the 2200-volt cables and the problem was attacked as follows:

Since no loads were tapped off No. 1 feeder between the station and the first transformer vault and as the load was not balanced it was decided that the conductors could be easily identified by taking simultaneous readings of the current in the vault and at the cable entry in the station. It was unnecessary to carry the test on any circuit beyond the first vault as all the vault buses had been phased previously. This scheme of identifying conductors could not be used on any of the other circuits because there were several wiped taps between the station and the first vault in each case.

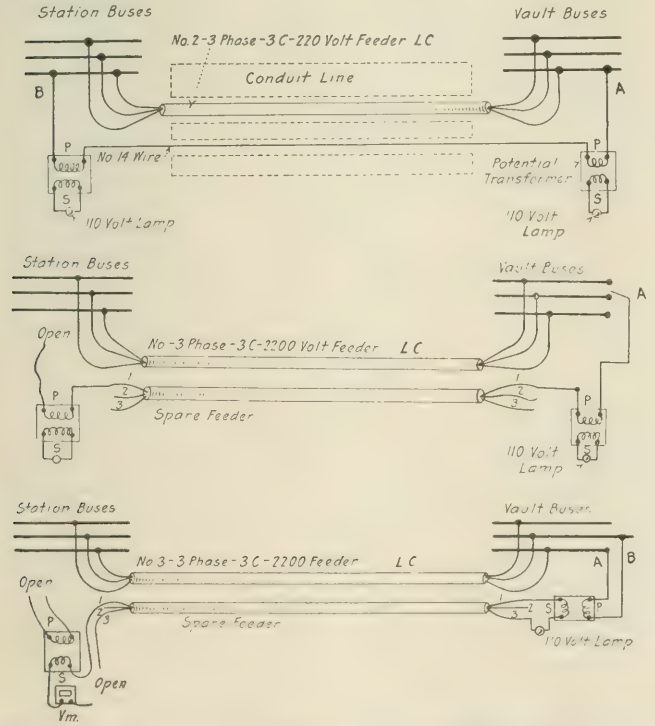
On circuit No. 2 a potential transformer was installed in the vault and one at the station, the primary windings of which were connected by a No. 14 wire. The remaining primary terminal of the vault transformer was connected with one bus and the remaining primary terminal of the station transformer was connected successively with the three conductors at the station. Since the secondaries of both potential transformers were closed through a 110-volt lamp, it was possible to tell when the vault and station transformers were connected to the same conductor as the lamps were then dark. By following this procedure each of the conductors was identified.

The same method was attempted on circuit No. 3 with the exception that one conductor of a spare three-conductor 4/0 lead-covered cable was used in place of the No. 14 wire. This was found impracticable, however, because the lamps across the potential transformer secondaries burned with normal brilliancy whenever either potential transformer primary was energized. As a second resort, two conductors of the spare cable were

connected with the secondaries of the potential transformers, placing the secondaries in parallel and a lamp and a voltmeter connected in series with the secondary circuit at the vault and station respectively. With these connections, however, the capacity of the cable was so great that the lamp at the vault attained full brilliancy as soon as the potential transformer primaries were connected to the buses. Upon testing the voltage between the conductors of the cable and ground at the station, it was found that the cable was picking up about 500 volts by induction. Yet, a 110-volt lamp connected across the conductors and ground showed no indication of current flowing.

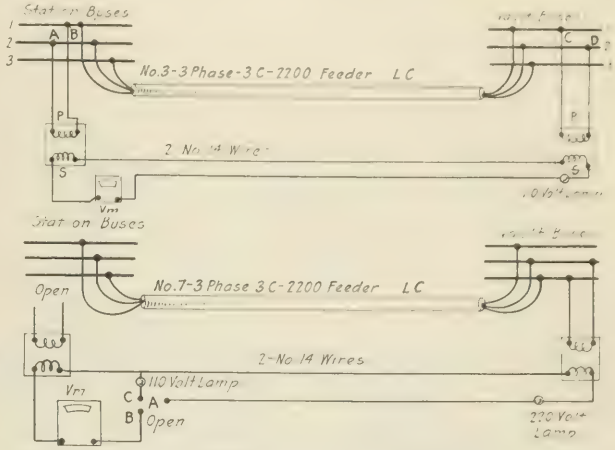
Having no success with this method, two No. 14 wires were pulled in the ducts to connect the secondaries of the transformer at the station and the transformer at the vault. A lamp and voltmeter were interposed in the secondaries at the vault and station respectively as before. With the primaries of the transformer at the vault connected to buses Nos. 1 and 2 and the primaries of the station transformer connected alternately to two of the buses at the station, it was an easy matter to change the connections at the station until a zero reading was obtained. This indicated that the test-set was connected to Nos. 1 and 2 buses at the station. It was then known that the station bus not connected to the test-set was feeding the conductor connected with No. 3 bus at the vault.

The lamp in the test set at the vault was for signaling purposes. A lamp could also have been used at the station in place of the voltmeter, but it would not have been as reliable because, when a zero reading was obtained by reversing the primary connections of the test set at the station, double potential was obtained supplying a check on the work. This method was continued with satisfactory results until attempts were made to test circuit No. 7.



FIGS. 1, 2 AND 3—CONNECTIONS USED TO PHASE CIRCUIT NO. 2 AND TWO SCHEMES WHICH WERE NOT SUCCESSFUL ON CIRCUIT NO. 3

For fear the signal lamp in the vault would burn out from the 220-volt flashes which it was subjected to, the men working in the vault substituted a 220-volt lamp before starting the test on circuit No. 7. When the primaries of the vault transformer were connected to buses No. 1 and 2 and before the transformer in the station was connected, the ends of the two secondary leads at the station were closed through a 110-volt lamp so as to indicate when the vault connections were complete. As no indication was given by the station lamp, investigation was made and it was found that the lamp in series with the secondaries at the vault was burning



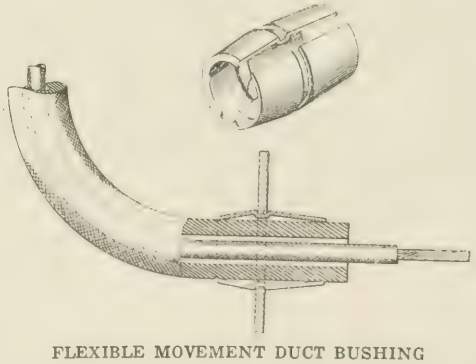
FIGS. 4 AND 5—IDENTIFICATION METHODS THAT PROVED SUCCESSFUL ON CIRCUITS NOS. 3, 4, 5, 6 AND 7

at about half candle power. At this time, the substitution of the 220-volt lamp was discovered. The lamp at the station end was removed, but the lamp in the vault still burned. The latter, which was the 220-volt lamp, was replaced by a 110-volt lamp, but this would not burn either, although voltage readings across the secondaries showed 125 volts. When the secondary of the transformer at the station was connected, however, the circuit was phased without further difficulty.

It may be of interest to state that to date there has been no reason discovered for the 220-volt lamp burning when the 110-volt lamp would not. Careful tests were made to make sure that no grounds or short-circuits existed in the secondaries of the test set.

Flexible Duct Bushing for Cut-Out Boxes

An exceedingly simple and easily applied bushing that will facilitate attaching a flexible woven conduit to an outlet box is the subject of patent No. 1,204,625, issued to Carl M. Wheelock, of Milwaukee, Wis. The device is made in one piece, formed from sheet metal and split along one side. Its diameter is such that it will fit snugly around the "circular loom" or other flexible tubing. Around the periphery of the bushing near the middle are a number of sharp points or teeth which grip the tubing and prevent it from slipping longitudinally. To place the bushing in position, it is slipped over the tubing to the proper point and then pushed in the entrance to the outlet box.



FLEXIBLE MOVEMENT DUCT BUSHING

OPERATING HYDROELECTRIC PLANTS TO BEST ADVANTAGE

How a Graphical Study of Hydraulic Conditions Has Permitted a Wisconsin Company to Operate Its Hydroelectric Plant and Steam Reserve to the Best Advantage

BY W. J. WADSWORTH

Chief Operator of High Falls Station, Wisconsin Public Service Company.

Hydraulic data have been plotted, as shown in the three accompanying curves, by the Wisconsin Public Service Company to determine how to make the best possible use of pond storage at its High Falls station (Crivitz, Wis.) with the least possible help from auxiliary steam stations. The first winter these curves were used the head water was drawn down to 77 ft. (85 ft. being maximum elevation and 65 ft. the minimum) before steam reserve was called into service. When this assistance was secured the head water raised. To determine when steam reserve should be dispensed with a second curve was drawn. From records it was found that the first effects of spring water (rain and melted snow) would probably be felt between the middle of March and the first of April. In order to allow for possible trouble with the steam plant it was considered advisable to draw the head water down to only 70 ft. so as to allow 5 ft. for emergencies. If the hydroelectric plant had to carry the entire load, this 5 ft. of water would last about five days, thus affording a reasonable period for getting the steam plant in operation.

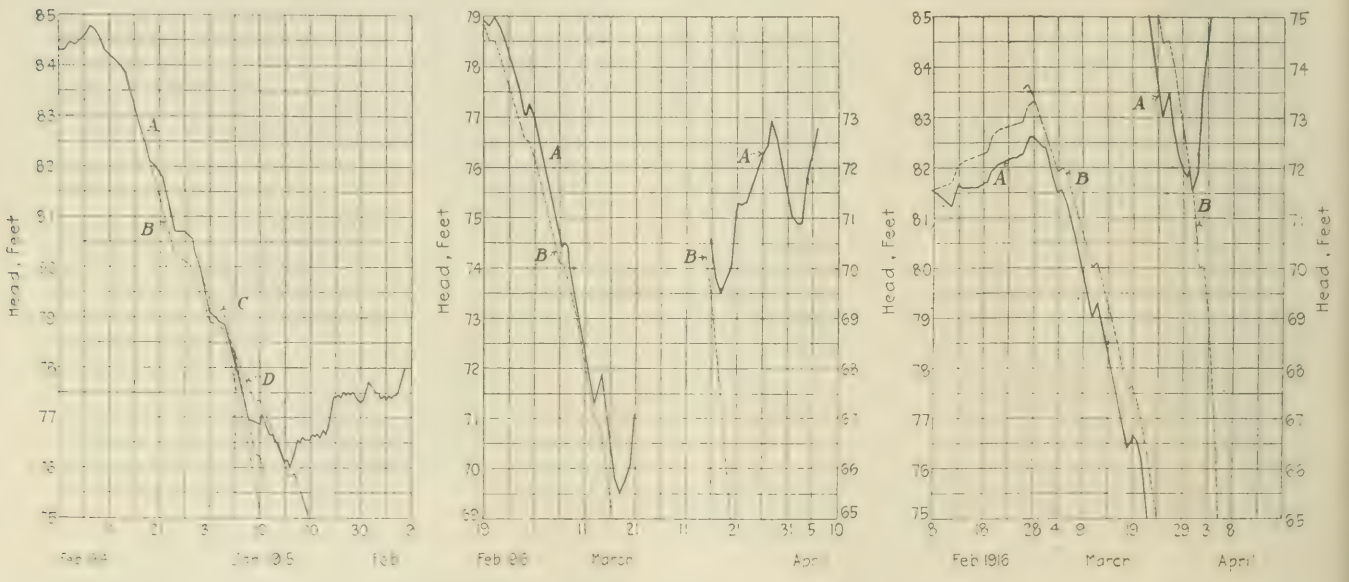
The predicted curve was based on the assumption that the steam reserve would be shut down on Feb. 19. The steam plant actually ran one day longer, however. Considering this difference, which has the effect of shifting the predicted curve one day to the right, it will be found that the predicted curve is remarkably close to the actual head-water readings. Spring conditions were not obtained until later than usual, so the steam reserve had to be employed from March 18 to 27.

Following this experience it was realized that steam reserve was being used at the wrong end of the winter because it would take less steam to hold the head constant or make it increase during the higher heads than during the lower heads. Consequently during the winter of 1915-1916 the curve was started differently. A very dry fall necessitated employing steam earlier than usual. A curve was drawn on Feb. 8 predicting heads with the steam plant carrying 1200 kw., which gave the best operating conditions. It was assumed that 70 ft. of head water would be required on April 1, so a curve was drawn beginning with this date and plotting backward. This showed the probable head for each day with the entire load on the hydroelectric plant. Where these two curves cross steam should be shut down. Actually, however, steam was shut down shortly before this date, but the curve of actual heads runs parallel to the predicted heads until rains occurred, which was during the last few days of March. Two years' experience has indicated that this method of analysis is quite accurate.

Arc Electrodes for Indicating Movement From Focus

When it is necessary to keep an electric arc fixed in position as, for instance, in connection with locomotive headlights where it is essential that the arc remain at the focal point, it is desirable to use one electrode, which is consumed very slowly by the arc.

Charles W. Dake of Chicago, Ill., assignor to the Pyle-National Electric Head Light Company, also of Chicago, has obtained a patent (No. 1,212,610) on an improved type of negative electrode, which notifies the operator by changing the color of the arc and subsequently by extinguishing the arc. The negative electrode is made of a cylindrical shank terminating in an expanded conical head which has a base that holds it in a fixed position. The shank together with the head is cored or drilled. The bottom of the hole which extends almost to the apex of the cone contains a conducting plug of metal, such as lithium or strontium, which will change the color of the arc when acted on by the open arc. An insulating plug of asbestos or other suitable material is provided so that when the arc has consumed the plug the arc will be extinguished.



FIGS. 1, 2 AND 3—HEAD-WATER READINGS AT HIGH FALLS STATION OF WISCONSIN PUBLIC SERVICE COMPANY

In Fig. 1, curve *A* refers to actual head readings, curve *B* to heads predicted for Dec. 19, with entire load on station, curve *C* to heads predicted for Dec. 28 under the same conditions, curve *D* to predicted heads for Dec. 28, assuming that the steam station would carry 500 kw. after noon of Jan. 5. The steam reserve started on Jan. 8 and carried 500 kw. until Jan. 18, after which 1000 kw. was carried. In Fig. 2 curve *A* refers to actual head readings, and curve *B* to predicted heads for Feb. 19, assuming all steam reserve is shut down at midnight of the same date. Steam reserve was actually shut down at midnight of Feb. 20 and started again on March 18, carrying about 600 kw. until March 27. Rainstorms occurred on April 4, 5 and 6. In Fig. 3, curve *A* refers again to actual head readings, and curve *B* to predicted heads, assuming 70-ft. elevation is to be obtained by April 1. The steam reserve carried about 1200 kw. until Feb. 29 and then 600 kw. until March 2. In predicting the head-water readings it was planned to shut the steam reserve down on the day that the two curves crossed (about Feb. 25).

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Transformer Alarm System Used by Connecticut Power Company

Transformers constitute one part of a central station's equipment whose service cannot be readily supplemented when trouble develops, so provisions have been made by the Connecticut Power Company in its Falls Village (Conn.) plant to automatically indicate excessive transformers temperature or interruptions of cooling-water circulation. With these arrangement, undesirable operating conditions can often be called to the attention of the station attendants in time to be corrected before serious damage and possible service interruption can occur. Low oil level can also be indicated by making simple connections if this additional precaution is ever found necessary. The alarm system consists of a dial-type thermometer and a flow indicator on each transformer so connected with an annunciator and an alarm bell that dangerous conditions in any transformer will ring the bell and indicate on the annunciator the particular bank in trouble.

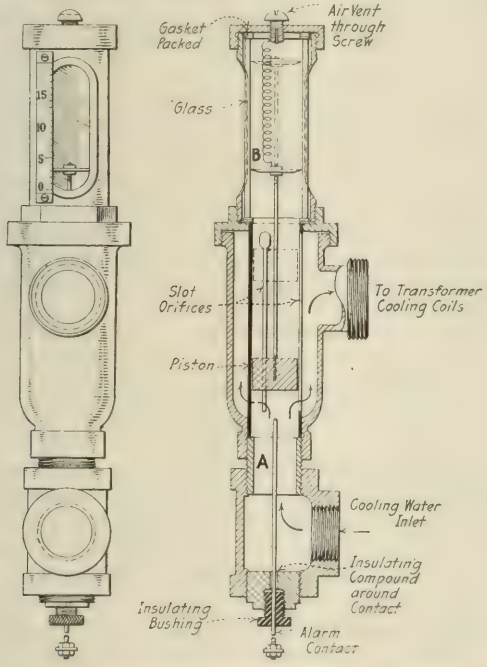


FIG. 1—FLOAT WHICH OPERATES ALARM

As shown, the flow indicator consists of a movable contactor attached to a piston which slides in a slotted cylinder. The lower end of the cylinder is open to the incoming cooling water and the chamber around it discharges into the transformer cooling coils. Connections are made with the indicator at the top and bottom. The upper terminal connects with the body of the indicator and the piston through contact with the cylinder. The lower terminal is adjustable in position and consists of an insulated spindle extending up to the bottom of the piston cylinder. When water is circulating properly it forces the piston upward away from the lower contact until the slotted apertures are exposed enough to allow water to flow to the cooling coils. Thus, the higher the rate of flow the higher the piston will be forced, its position being indicated on the scale attached to the flow indicator. Gradual clogging of the coils would reduce the flow and cause the piston to drop in proportion to the obstruction presented to flow. Complete interruption of circulation caused either by stoppage of the coils or failure of cooling water supply will allow the piston to drop to the extreme lower end of its travel where it will make contact with the spindle terminal. By raising the spindle terminal the alarm can be made to ring with partial stoppage of water circulation. While a battery was used with the alarm at first, so much electrolysis occurred in the flow indicator that a bell-ringing transformer was substituted. The flow indicator was developed by Mr. Vaughn of the Stone & Webster Engineering Corporation.

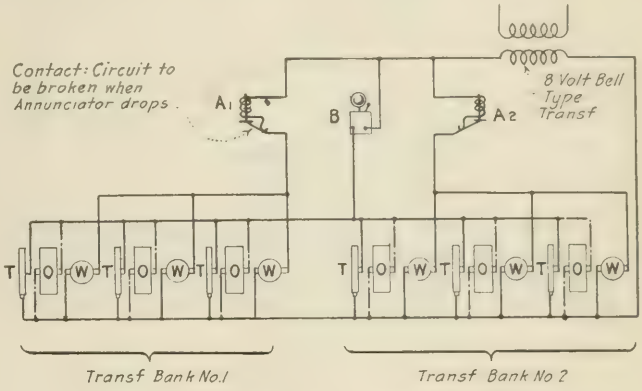
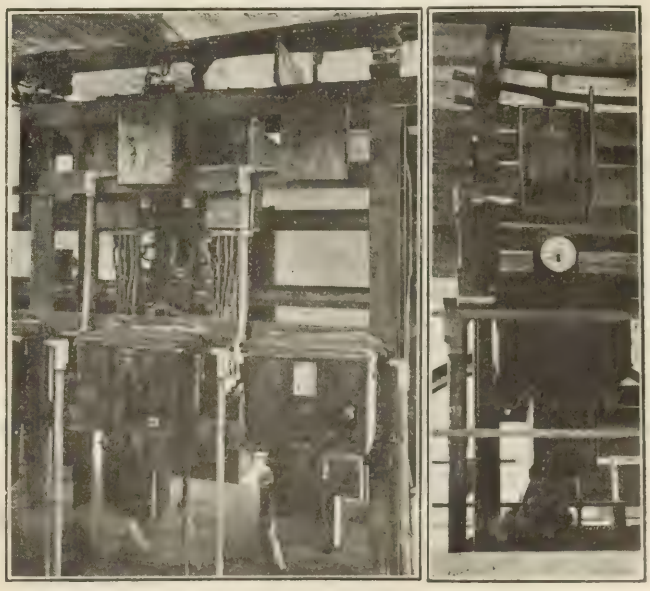


FIG. 2—CONNECTIONS IN ALARM CIRCUIT

Arrangement of Compensators in an Oregon Cement Mill

Starting compensators for each department in the plant of the Oregon Portland Cement Company at Oswego, Ore., are grouped on structural steel frame-



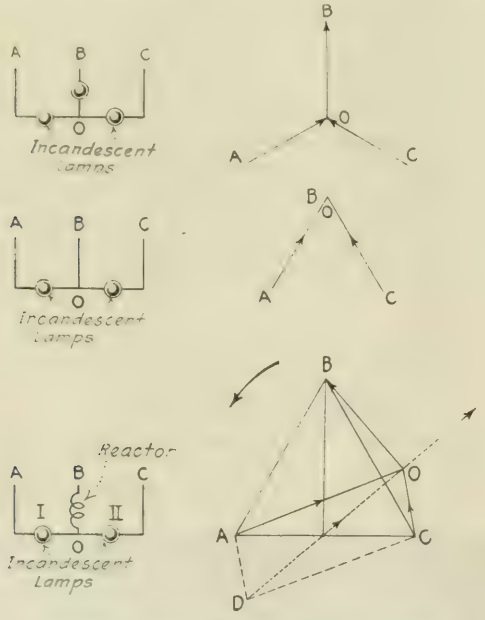
GROUP MOUNTING OF CEMENT-MILL COMPENSATORS

works, as shown in the accompanying halftone illustration. Energy delivered to them is carried by single conductor cables supported horizontally above them on groove-top pin-type insulators attached to channel irons. From these busbars taps are taken off above each switch and connected to three-blade knife switches inclosed by sheet-metal cabinets. Conduits are provided for the circuits between the disconnecting switches and the compensators and between the latter and their respective motors. The compensators are of the Westinghouse dust-proof type, with ammeters for all circuits serving motors rated at 75 hp. or more. Control circuits consisting of No. 14 duplex cable are run from each compensator low-voltage release coil to the corresponding motor and there connected with a 600-volt snap switch so that men in the plant can stop motors in an emergency without going to the compensators. D. C. Findlay is the electrical and mechanical engineer.

Simple Method of Determining Phase Rotation

BY T. W. VARLEY

By connecting two incandescent lamps and a reactor (or condenser) in star, the phase rotation of any two or three-phase system can be readily determined by observing the relative brilliancies of the lamps. For



EFFECT OF REACTANCE ON Y VOLTAGES

example, if the lamps and reactor are connected with a three-phase system, as shown herewith, relative dimming of lamp II will indicate that the phase rotation is counter-clockwise, whereas reduction in relative brilliancy of lamp I indicates that the rotation is clockwise. If a condenser is used in place of a reactor, dimming of lamp I will indicate opposite rotation from that shown if the same lamp dims with a reactor in circuit. Where phase rotation has to be determined frequently, as may be the case where considerable reconnection of cable and overhead systems is required, or when numerous motors or transformers must be connected, it may be advisable to mount the lamps and reactors in permanent form.

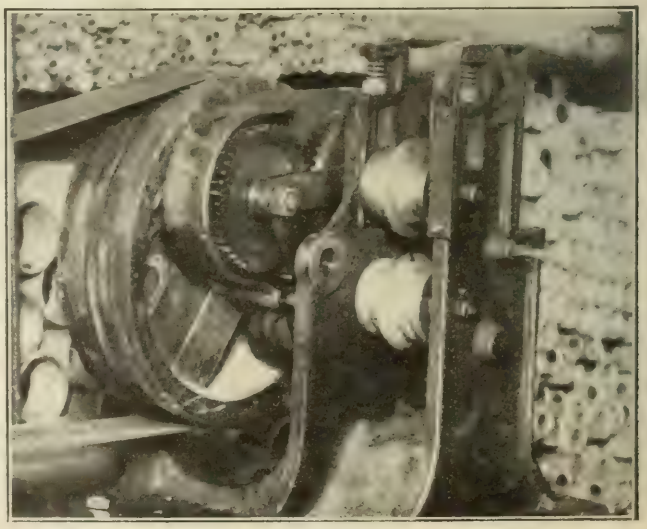
The action of the indicator can be explained by considering the voltage vector relations. For instance, suppose three equal resistances are connected in star, then the vectors will be equal and will fall 120 deg. apart as shown. If the resistance of one circuit is reduced the vector representing the voltage across the reduced resistance will shorten, allowing the other vectors to lengthen, thereby decreasing the angle between the last mentioned vectors. Under the extreme conditions of no resistance in one leg of the star the vectors *AO* and *CO* will assume the positions shown, which is an open-delta connection. However, if a reactance is inserted in one leg of the star and plain resistance, such as incandescent lamps, connected in the other legs, the intersection of the vectors will not fall on a median. On the other hand, the locus will be a circle whose diameter lies along a medium of the triangle *A*, *B*, *C*. Thus the voltage across one lamp will be increased while that across the other is reduced. The portion of the circle which the intersection of the vectors will follow, and consequently the relative brilliancy of the lamps, depends on the phase rotation.

To show that dimming of lamp II indicates a counter-clockwise phase rotation, and that reduction in brilliancy of lamp I indicates the opposite, consider the lower diagram showing the voltage relation with lamp II dimmer than lamp I. Since the incandescent lamps are non-inductive their currents will be in phase with the potentials across them and proportional thereto. Consequently vectors *AO* and *CO* may represent the current relations also. The resultant of these currents will extend in the direction *DO*, and will be the same as the current through the reactors. *OB* which represents the potential across the reactor is perpendicular to *DO* since it is due principally to reactance. According to fundamental laws the voltage across a reactor always leads the current, therefore the phase rotation will have to be in the direction indicated by the arrow to satisfy this condition. The converse can be proved in a similar manner, the same reasoning applying to two-phase circuits.

Utilization of Scrap Cable

BY K. C. CAMPBELL

To command the highest market price for its scrap cable, the Detroit Edison Company has installed in its stores department apparatus for removing all insulation from cables. The scrap cable is first passed through a motor-driven cutoff machine used for cutting the cable into lengths convenient for stripping and burning to remove insulation. The cutting-off machine makes a clean cut without flattening the cable. The stripping machine, which is motor driven, has two rollers with



MACHINE FOR STRIPPING INSULATED CABLE

circular cutters, which force the cable through the machine and at the same time cut the lead and the overall covering of insulation lengthwise in two pieces. The lead is then ready for sale. The conductors are reclaimed by burning their individual insulations off in a furnace. The draft from this furnace is so regulated that the metal is not subjected to temperature which would fuse or weld the copper together. This furnace is also used for burning the insulation from weatherproof wire. After the copper is removed from the furnace it is baled in bundles weighing about 300 lb.

Cleaning Turbine Blades and Condenser Tubes

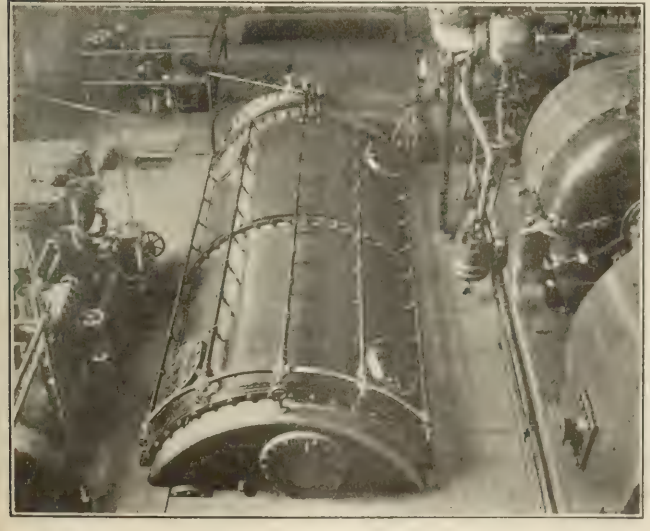
BY F. C. CHAMBERS

Mechanical and Electrical Engineer Des Moines City Railway Company.

Exhaust steam from two 1000-kw. reciprocating engines is being utilized to operate a 2000-kw. mixed-pressure turbine at the power station of the Des Moines (Iowa) City Railway. Since considerable suspended oil is carried over in the exhaust steam, means had to be provided for removing the deposit and scale formed on the turbine blades and tubes of the surface condenser used with the mixed-pressure unit. Arrangements have been made as follows:

A 2-in. pipe was installed to connect the circulating pump with a 2-in. header at one end of the condenser. From this head five pipes, tapering from 2 in. to 0.75 in in diameter, were connected across the section of the condenser above the turbine room floor, as shown in the photograph. Each pipe was tapped into the condenser through nine small bore pipes. About every three months, when a machine is shut down, the hot well is pumped dry and a barrel of kerosene oil dumped into the handhole in the condenser. The discharge pipe on the hot-well pump leading to the heaters is closed and the valve in the pipe leading up to the header over the condenser opened. The hot-well pump is then used to force the kerosene from the hot well through the spray nozzles. The circulation is continued for two to three hours and the kerosene then drained off and the deposit allowed to settle. The light oil, which rises to the top, is drawn off for treating the turbine.

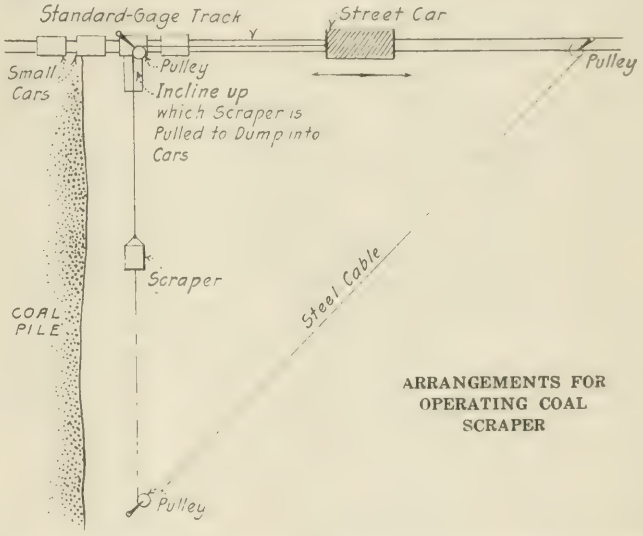
The kerosene treatment is given to the turbine in 50-gal. quantities once a week through a 0.75-in. pipe with numerous needle-point holes in it. This pipe is inserted across the steam intake pipe. Since the kerosene is carried into the condenser with the steam it helps to keep the tubes free of deposit. This procedure, supplemented by the thorough cleaning of the condenser every three months, keeps the turbine and condenser in good condition. Determination of the condenser condition is made frequently by means of the vacuum gage, which is connected so that it may be made to read the pressure at the intake and outlets separately, the difference giving a good indication of the condition of the condensing surfaces when compared with the same reading taken when the tubes are clean.



ARRANGEMENTS FOR SPRAYING KEROSENE ON CONDENSER TUBES

Transferring Coal from Storage to Dump Cars

At the power station in Moline, Ill., an old street car furnishes the power to load coal from the yards onto small dump cars. A scraper is used to drag the coal from the pile up a roughly constructed incline, from which it dumps its contents into the cars on the track. A steel cable fastened to the scraper runs over a pulley at the head of the incline and then parallel to the track to the street car. A return cable from the front of the car runs over another pulley directly in front of the car,



ARRANGEMENTS FOR OPERATING COAL SCRAPER

but at sufficient distance to allow the full travel of the scraper, then back over another pulley placed on a line with the scraper and the incline, and is finally fastened to the scraper. On backing up, the car pulls the scraper back and on reversing its direction the scraper is filled and pulled up the incline. The accompanying illustration indicates how the equipment is utilized.

A Scheme for Preventing Overloading of Patrol Telephone Lines

BY J. W. SWAREN

A novel arrangement is employed by the Pacific Power & Light Company on its telephone line along the Naches Canal to prevent overloading the line. A telephone instrument is mounted in a small wood cabinet at each mile pole. The service leads terminate at one pair of terminals of a single-throw, double-pole, "baby" knife-switch, and the instrument is connected to the other terminals. This switch is mounted on the inside of the cabinet in such a position that a wood lug fastened to the cabinet door strikes the handle when closed, thus cutting the telephone off the line. This simple arrangement, which was devised by J. H. Siegfried, superintendent of power of this company, effectually prevents a common fault of patrol lines, that of leaving the telephones in circuit.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

SELLING RANGES IN SMALL TOWNS SYSTEMATICALLY

Experience with Three-Cent Rate, Thirty-Day Free Trial, Installment Payment Plan in Small Pennsylvania Villages

Last spring the Northwestern Electric Service Company, Erie, Pa., entered upon its first campaign and experience in the sale of electric ranges.

A rate of 3 cents per kilowatt-hour for cooking and heating, with a minimum charge of $1 per month, subject to a discount of 5 per cent for prompt payment, was established and the sales department authorized to get results. With some qualms of conscience and many misgivings, an order was placed for twelve ranges, and a plan of procedure outlined.

The Northwestern company serves a population of 18,850 people, located in one city of 15,000 and six smaller towns. The city of 15,000 population is served with natural gas at the very low rate of 30 cents per 1000 cu. ft., so that the sales effort, as a starter, was devoted almost entirely to the smaller towns, which were using coal, wood, oil and gasoline with which to cook.

	Name	Address	Commodity	Got Attention	Got Interested	Got Chance to Close	Secured Order
	APPROACHED						
1	W. R. Murphy	New Range		/	/	o	o
2	Walter Armour			/	/	/	/
3	A. W. Purdue			/	o	o	o
4	J. W. Morse			/	/	o	o
5	W. S. Munson			/	o	o	o
6	J. B. Lo 9			/	/	/	/
7	A. C. Zimmer			/	/	o	o
8	L. F. Betts			/	/	/	o
9	A. B. Miller			/	/	/	/
10							
11				9	7	7	3
12							
13							
14							
15							
16							
17							
18							
19							
20							
	Total						
	Per Cent						

SALESMAN'S SCORE CARD

The range manufacturer kindly shipped us four ranges, and a systematic campaign of our customers was started. Two salesmen were delegated to proceed in a follow-up on a form letter, which was mailed to twenty customers each day. This letter spoke of the experience of other central stations with ranges, and offered a free trial of thirty days of any range to which the customer might take a fancy. In the follow-up work, two cards were used, which have proved very effective.

Reproduced herewith is the score card which the salesmen used. The salesmen were required to keep a record of each approach made, showing for each whether or not the salesman succeeded in getting the prospect's attention; whether he succeeded in getting her interested in the range after her attention was secured; whether he got a chance to "close" with the prospect; and whether he secured the order. This card helped the salesman to note his weak points, so that he could strengthen his argument at this particular point of the interview.

Another form used was a plain white card, 3 in. by 5 in., on which was typewritten the prospect's name, address, date, and appliance to be sold. Ten of these cards were mailed to each salesman each day, and on the same day that the form letters were mailed to corresponding prospects. As the prospects were called upon, salesmen noted results and future prospects on the white card and also showed his record on the score card, which he retained and, with the sales manager, picked out the flaws in his arguments. The white card when filled in, was returned to the tickler file in the sales office.

The four ranges on hand were sold in the first week's effort and a good many more promised, but as other central stations experienced at that time, delivery was slow and material hard to get. Six more ranges were ordered immediately and we are now merely selling electric cooking and recommending the best range that we feel our customer can afford to buy.

Our proposition to the customer was, any range selected to be sold, installed free in the home at list price, payable, $5 down and the balance in twelve equal monthly payments. Results were so good that we have now invaded our "city of 30-cent gas," and the year 1917 will prove a big year in electric cooking alone, for our present range owners have been requested for letters of recommendation and have, with very few exceptions, complied and are all "boosters."

On April 1 of this year, a big demonstration will be put on in every town we serve and no fear is felt as to the results, for electric cooking is here to stay.

RELATION OF UTILITY INCOME TO INVESTMENT

Why Gross Profit Must Be Such a Large Percentage of Gross Earnings Told in a Way That Public Can Understand

A little knowledge is a dangerous thing and particularly is this true of the general public. Rate investigations are many and costly and can as a rule be laid to the door of a little knowledge on the part of the consumers. The relation of gross profits to investment is pretty generally known for the ordinary retail business and there is no hesitation on the part of the public in thinking that the same relation is true of an electric lighting business.

A comparison of the relative investments, income and expense in the central station industry and in ordinary mercantile businesses was presented by T. K. Jackson, president and manager of the Mobile (Ala.) Electric Company, before the Mobile Rotary Club in the following words, which the public has no difficulty in understanding.

"Our business, on its face, is a pretty good business. Our operating expense is about 50 per cent of our income. This sounds pretty good. I dare say that there are very few mercantile enterprises whose income shows as great a per cent of profit as those figures would indicate, but there is a fly in our ointment.

"In fact, we have quite a few flies in our ointment. When we made 50 per cent net profit on the gross volume of our business we earned only 8 per cent on our investment, as our gross income—and I speak rather in this instance of average figures of all utility companies

than of our own company—is less than one-sixth of our capital investment. In other words, we invest more than $6 for every dollar of gross income, and, therefore, if our net profit is one-half of our gross income our net profit is one-twelfth of our investment, which is 8 1/3 per cent. In practically every line of business, with the exception of the public utility businesses, the volume of business done is very greatly in excess of the investment. So, a grocery store with an investment of $5,000 reasonably expects to do six times that volume of gross business, and if the grocery store makes 2 per cent on its gross sales it earns 12 per cent. * * *

"A retail dry goods company or a retail shoe store expects to turn its capital approximately four times a year, or, in other words, its volume of gross business is four times as great as its capital invested; therefore, if a shoe store or dry goods store makes a profit of 2 per cent on its sales, it is equivalent to our company earning 50 per cent on its sales. I think that a large part of the adverse legislation which has beset public utility companies in the past, but which is no longer besetting them, has been due to the failure of the legislators to understand the disparity between the volume of business done and the investment of public utility companies as compared with other normal merchandising or manufacturing enterprises. * * *

"It is essential that a public utility company, in order successfully to conduct its business, should conduct it at a profit. Otherwise plants are not maintained, capital is not available for new expenditures, and service suffers with even greater loss to the community served than to the company serving. * * *"

MOVIE DEMONSTRATION OF ELECTRIC FIRE TRUCKS

Electric Vehicle Section, N.E.L.A., Has Co-operated with Manufacturers to Produce Film Showing Apparatus in Service

The Electric Vehicle Section of the National Electric Light Association, with the co-operation of the Commercial Truck Company of America and the Electric Storage Battery of Philadelphia, has developed a motion-picture film showing modern electric fire apparatus in service runs responding to alarms, ascending steep hills, threading traffic jams, and returning to the engine house.

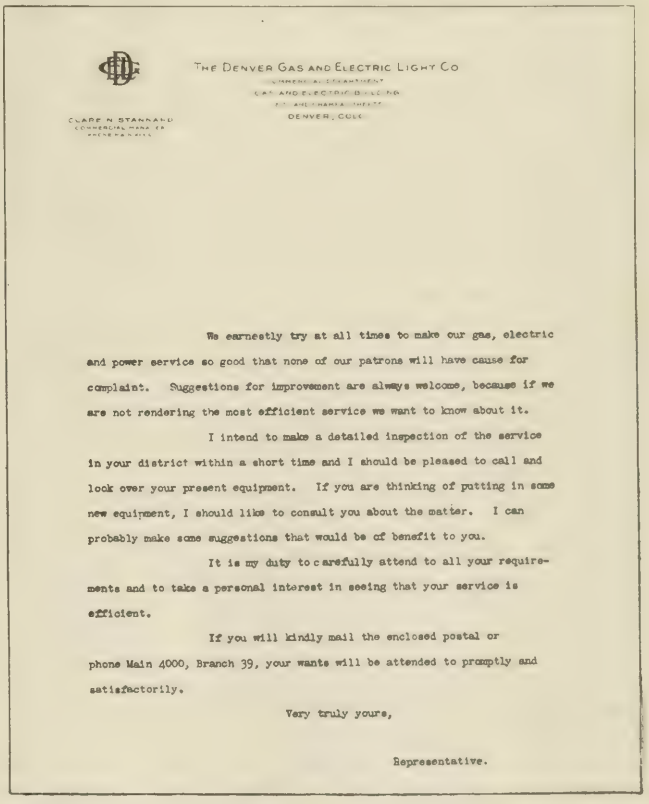
One of the chief claims for the battery-driven fire truck is the facility with which congested city traffic can be penetrated, owing to the rapid acceleration and complete control of the truck, and an interesting section of the new film, reproduced herewith, shows the electric fire apparatus speeding through an ordinary street jam that might have blocked less facile vehicles. Several striking tests of the hill-climbing ability of electric trucks are also shown.

The Electric Vehicle Section, N. E. L. A., is arranging to loan the film to central stations and others who desire to demonstrate to their local publics or officials the possibilities of the electric truck in fire department and other branches of municipal service.

THE DENVER COMPANY'S "GOOD SERVICE" DEPARTMENT

Appointment of "Supervisors" to Canvass Customers' Installations, Suggest Improvements and Forestall Complaints

Experience in more than one community has demonstrated that "service" work on the part of the central station pays in commercial results as well as in public good will. In fact, according to C. N. Stannard, commercial manager of the Denver Gas & Electric Light Company, each dollar spent in service improvement for the customer has brought a return of $3 to the company.



THE DENVER GAS AND ELECTRIC LIGHT CO

DENVER, COLO.

We earnestly try at all times to make our gas, electric and power service so good that none of our patrons will have cause for complaint. Suggestions for improvement are always welcome, because if we are not rendering the most efficient service we want to know about it.

I intend to make a detailed inspection of the service in your district within a short time and I should be pleased to call and look over your present equipment. If you are thinking of putting in some new equipment, I should like to consult you about the matter. I can probably make some suggestions that would be of benefit to you.

It is my duty to carefully attend to all your requirements and to take a personal interest in seeing that your service is efficient.

If you will kindly mail the enclosed postal or phone Main 4000, Branch 39, your wants will be attended to promptly and satisfactorily.

Very truly yours,

Representative.

COPY OF LETTER SENT OUT IN ADVANCE OF SUPERVISORS

Some time ago the Denver company inaugurated a "Good Service Department," assigning seven of its best representatives to the work in hand, giving them titles of "supervisors of good service" and paying them good



SECTION OF MOTION-PICTURE FILM, SHOWING ELECTRIC FIRE TRUCKS THREADING AROUND TRAFFIC AT HIGH SPEED

salaries plus commissions dependent upon the results secured by the men in their good-service endeavors.

Seven "Supervisors of Good Service"

The city was divided into seven territories. Each man was given 350 names, it being his duty to spend a three months' period on the names selected. He was to call on each consumer, make a careful examination of the premises, ascertain whether or not the company was giving full, complete and satisfactory service. If, in any way, the service was unsatisfactory, he was to report it to the office and make sure conditions were immediately remedied.

As the men employed in this work were excellent salesmen, and were able to come into close contact with the consumer, they were often able to suggest improved service and additional current-consuming devices, which, in many instances, were easily sold, connected up, placed on the lines and became productive of additional revenue for the company.

The supervisors made a specialty of increasing the candle power by selling high efficiency lamps and a system of indirect lighting fixtures. They made a specialty of making quite sure that all sockets were filled with lamps and burnt-out lamps replaced with perfect ones. They also made sure that all appliances not in use (ofttimes on account of some defect) were placed in use again through the medium of simple repairs.

Bonuses Granted on Results Achieved

At the end of the three months' period, the revenue accounts of the consumers were compared with the accounts for the same three months of the previous year, and the supervisors were given a bonus upon all accounts which showed an increase in revenue secured by the company.

The supervisors have canvassed the entire city on three distinct and separate occasions, and in each instance the successive trip has proven more profitable than the first. In addition to this revenue feature relations with the customers have been rendered more cordial as the public has learned that the company is primarily interested in giving the best possible service.

The advertising in this connection consisted of personal letters sent out in advance by the supervisors and representatives, which outlined the purpose of the representative's call and requested that the customer be prepared to tell how the company could improve its service in his particular case. Inclosed with each letter was a return post card on which the customer was invited to state a convenient time for the representative's call.

Adjustment of Complaints

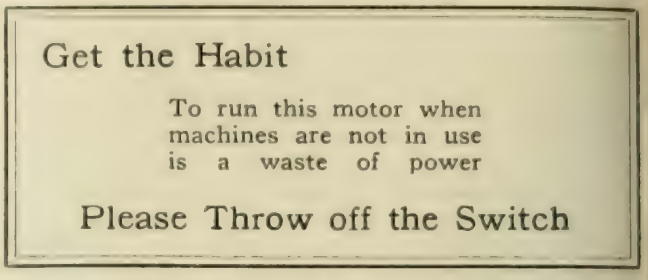
Many complaints were adjusted on the premises by the supervisor, thus saving the expense of sending out trouble men from the office.

The supervisors spent much time in going over ledger accounts, and where a reduction in consumption was noted immediately called on the consumer, ascertaining the cause and frequently bringing the account back to normal or even in excess of normal. In fact, in some instances, it was found that consumption existed without registration, which condition was immediately remedied by a change of meters.

The good service work was not confined alone to the supervisors, but their influence spread to the other departments, such as floor salesmen, special engineers and other outside employees. The men also made it a point to keep in close touch with prominent citizens, city officials and others vitally interested in the city's welfare, making quite sure that they were given full, complete and satisfactory service.

Helping Motor-Service Customer Avoid Waste of Power

It is sometimes hard to convince a motor-service prospect or consumer that the electric company really considers it the best and most profitable policy to help him reduce his light and power bills to the lowest minimum consistent with efficient production.



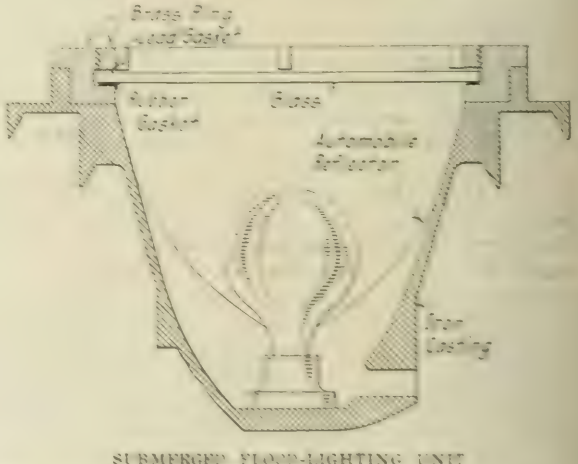
SIGN PASTED ON EACH MOTOR STARTING BOX

Not long ago the Westchester Lighting Company at Mount Vernon, N. Y., made up a number of blueprint signs, like the one in the illustration, and pasted one on each motor starting box in a large factory on its lines. In addition to the saving effected in consumption, this evidence of good faith immediately converted the customer into an active "booster" for the electric company.

Lighting a Swimming Pool with Submerged Lamps

The problem of designing and installing submerged lighting in a Seattle, Wash., swimming pool on short notice, was solved by Gray & Barash, electrical engineers of that city, with the aid of the lighting unit shown in the sketch. The largest automobile reflector obtainable was chosen, and a cast-iron housing was designed to carry the reflector with suitable arrangements for socket and conduit attachments.

In order to insure rigid fastening to the concrete floor, and to prevent the seepage of water through the floor along the plane of contact, the iron casing was provided with lugs as shown in the illustration. A brass



SUBMERGED FLOOD-LIGHTING UNIT

socket ring was fitted into the top of the iron casing, and was tapped to receive a smaller ring also of brass.

Fifteen such units were installed in the bottom of the pool, spaced 10 ft. apart from center to center. Mazda lamps of 150-watt rating were used in the projectors and the effect of the installation as a whole is said to add much to the attractiveness of the pool.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

HYDROELECTRIC POWER IN FRANCE

A First-Hand Sketch by Dr. C. O. Mailloux of the Development of Hydroelectric Power and of Electrochemistry and Electrometallurgy in France

The American Manufacturers Export Association, of which E. M. Herr, president of the Westinghouse Electric & Manufacturing Company, is the president, appointed last year an American Industrial Commission to visit France for a first-hand study of present industrial conditions and future possibilities. Dr. C. O. Mailloux, a prominent consulting engineer of New York City and a past-president of the American Institute of Electrical Engineers, was the electrical member of the commission, and during his stay of several months abroad prepared extensive notes on hydroelectric developments in France, with special reference to the electrochemical and electrometallurgical industries. Only a brief abstract of part of these notes was published in the condensed official report of the commission. In view of the authoritative character of Dr. Mailloux's notes, however, it is gratifying that they are now being published in full in *Metallurgical & Chemical Engineering*, the first part dealing with hydroelectric power in France being published in the issue of the ELECTRICAL WORLD of March 1.

Before the war the annual coal consumption in France was, in round numbers, 60,000,000 tons, of which amount about 40,000,000 tons were obtained from French coal mines, leaving a shortage of about 20,000,000 tons to be made up by importation from other countries. About 75 per cent of the total coal consumed, or about 45,000,000 tons, are used for producing steam for generating mechanical power, aggregating about 12,000,000 hp. This corresponds to about 3,750,000 tons of coal per year for each 1,000,000 hp. of steam-power capacity, so that the full development and utilization of 6,000,000 hp. of water power would, theoretically, more than make up for the entire coal shortage in the whole country. This indicates the immense national importance of water-power developments for France.

Dr. Mailloux gives a very interesting historical sketch of the evolution of hydroelectric developments and of electric transmission systems in France, paying a sympathetic tribute to the life work of Aristide Berges. The term "houille blanche," meaning literally "white coal," for designating the power obtainable from the melting ice and snows of glaciers, is said to have originated with Cavour, the Italian statesman, but it was introduced and made popular in France by M. Berges, the inventor of the high-head hydraulic turbine. He originally employed this term to designate all streams which are fed and regulated by glaciers, because the solidified water in the form of ice and snow in this glacier represents stored energy available for power similar to the stored energy contained in ordinary ("black") coal. The energy available in streams not fed by glaciers was termed "green" coal ("houille verte"), because the energy comes from water stored in green vegetation. The expression "white coal" has, however, gradually enlarged its meaning, and it now means the energy of any waterfall that is available for developing water power; therefore it now practically includes "green" as well as "white" coal.

The first "white-coal" or water-power congress was held at Grenoble in 1902, at the time about 200,000 hp. of hydroelectric power had already been developed. In 1903 the government took action by creating a commission for large water powers, which was entrusted with the work of estimating the hydraulic resources of France. A second water-power congress, organized by an association of water-power owners, was to have been held at Lyons in September, 1914. It was, of course, postponed. It will likely be held after the war is over.

As in the case of all large industries in France, the water-power industry has its interests looked after by a "get-together" organization, having a very comprehensive name, which includes all concerns interested in water power, electrometallurgy, electrochemistry and "all the industries related thereto." It consists of three groups, the first being devoted to power transmission and distribution (fifty-four companies), the second to electrometallurgy and electrochemistry (twenty-four companies), and the third to "sundry and miscellaneous concerns" (thirty companies).

The aggregate power capacity of all the water powers owned or exploited by the various power companies belonging to that association is 660,000 hp. Of this total, 412,000 hp. represents power transmitted and distributed for general lighting and power purposes in cities, towns and villages; the rest (248,000 hp.) is power consumed by electrometallurgical and electrochemical industries. The distribution systems owned by the power companies belonging to the association constitute a network of 16,200 km. (10,066 miles), of which 13,400 km. (8325 miles) are overhead lines, and the rest (2800 km. or 1740 miles) are underground lines. These distribution systems serve to supply electric current for light and power to communities aggregating between 4,500,000 and 5,000,000 inhabitants. The capital investment represented by all these plants exceeds 600,000,000 francs ($120,000,000).

But as there are many water powers in the Alps and elsewhere operated by companies and individuals not members of the Water Power Association, the above statistics are incomplete. The complete statistics for Jan. 1, 1916, for the region of the Alps are as follows:

	H.P.	Per Cent of Total
Power used for light and power	291,000	39.4
Power used for electrometallurgical works	255,000	34.6
Power used for electrochemical works	147,000	19.9
Power used for electric traction	16,000	2.2
Power used for paper mills, saw mills, etc.	23,000	3.1
Power used for various industries (lime and cement works, mining, etc.)	6,000	0.8
Total	738,000	100.0

The 1916 map of the government commission gives the following additional information for the same region: Power plants under construction or for which contracts have been made, 100,000 hp.; water powers whose development is contemplated or proposed, 700,000 hp. The two most important new water-power projects are the Durance and the Upper Rhone projects, [illegible]

cerning which interesting notes are given by Dr. Mailloux. After some remarks on developments in the Pyrenees, figures are given showing the growth of the electric service in France. The total electrical energy consumption in kilowatt-hours, supplied by the electric plants of the Lyons Gas Company, has increased from 399,100 kw. hr. in 1897 to 35,400,000 in 1915, or at the end of eighteen years it was more than ninety times greater. Of that growth 88 per cent occurred in the last five years of that period.

Interesting figures are given on the rates charged for electrical energy in France, with special reference to Lyons and St. Etienne. At Lyons the kilowatt-hour is charged at 60 centimes (12 cents) for domestic lighting, at 55 centimes (11 cents) for stores, offices and factories, at 50 centimes (10 cents) for hotels, cafés, restaurants, theaters, churches, schools, etc., and at 40 centimes (8 cents) for small power consumers. Discounts from 2 to 20 per cent are allowed, according to the amount of the yearly bill. At St. Etienne 55 centimes (11 cents) are charged per kilowatt-hour for lighting for the first 1000 hours, but the rate is 50 centimes (10 cents) for the next 400 hours, etc., and 30 centimes (6 cents) for all above 3300 hours. There are flat-rate and meter tariffs in use for power purposes, and it is interesting to note that the minimum price for metered power current comes down to as low as 5 centimes (1 cent) per kilowatt-hour in St. Etienne as well as at Lyons. This is a very low figure, which prevails only where hydroelectric power is available. At Bordeaux, where black coal is the only source of power, the power used for operating the coal and ore-handling and conveying system at the Bordeaux docks costs 12 centimes (2.4 cents) per kilowatt-hour. This is regarded as a low figure for electric power current derived from a steam station, even allowing for the advantage which a seaport city has of being able to get its coal supply at lower cost than an inland city. Nevertheless, this very reasonable cost is still 2.4 times greater than the lowest cost of electric power at Lyons and at St. Etienne, which is a significant fact.

Generators, Motors and Transformers

Transient Conditions in Non-Synchronous Induction Motors.—R. E. HELLMUND.—A profusely illustrated paper read at the New York meeting of the American Institute of Electrical Engineers discussing a number of transient conditions in a non-synchronous machine immediately after certain changes in the circuit connections are made. The principal subjects considered are undesirable peak currents which may be caused by the damping effect of the short-circuited rotor windings, and the over-voltages which are obtained with certain control arrangements. These matters have to be taken into consideration in the control layout so as to provide for a harmonious combination of motor and control design.—*Proceedings*, Amer. Inst. Elec. Engrs., February, 1917.

Lamps and Lighting

Economics of Office Building Lighting.—SAMUEL G. HIBBEN.—A paper read before the Illuminating Engineering Society. Study is made of the lighting of typical offices by different methods, including various sizes of units and types of equipment. Consideration is given to the wiring, fixtures, upkeep and other details of service. The rental value of offices as affected by natural and artificial illumination is dealt with. A number of curves and charts are included, showing the effects of different types of shades, of different hanging heights, etc., on the intensity of illumination. The cost of several sample installations are compared from the standpoint of economy in installation and operating costs.—*Transactions Illum. Eng'ing Soc.*, Dec. 30, 1916.

Wires, Wiring and Conduits

Fuses on Short-Circuit.—In the testing of fuses as an ultimate safeguard it is desirable to test them on a dead short-circuit, and it is emphasized that the change of generating plant from reciprocating engines to steam turbines has increased very materially the current which fuses may be called upon to carry before they blow, and that consequently the rate at which energy is dissipated at the moment of rupture may be much higher than was usual some years ago. This has been the experience of S. W. Baynes of the municipal electric supply station of the St. Pancras Borough in London, where many more failures of fuses have been noticed since the introduction of large turbo-alternators.

Tests have been made of fuses under working conditions and some photographs of fuses on short-circuit are shown. Baynes concludes that fuses of the

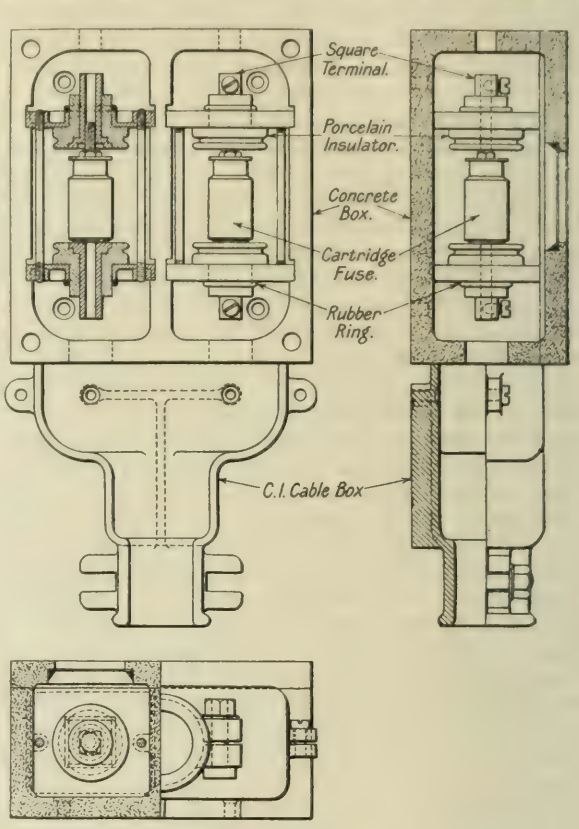


FIG. 1—DETAILS OF LATEST TYPE OF CONCRETE FUSE BOX AND FITTINGS

cartridge type should be used, and that they should be so made that they cannot be easily bridged by ordinary fuse wire instead of being properly replaced when blown. Owing to the destructive effect which takes place if an arc strikes earthed metal, he has designed fuse boxes made entirely of special concrete. Details of the latest type of boxes are given in Fig. 1.

These new fuse boxes made of special concrete are fitted with brass screw sockets so that the lids can be easily fastened on, and they are used in conjunction with cast-iron cable sealing boxes, both the cast-iron box and the concrete box being fixed to the wall as indicated. The internal fittings are of simple design for carrying fuse cartridges; these are fixed very easily by means of the screw shown. There is no possibility of damage by an arc striking earthed metal. The boxes are so made that they can be fixed side by side and coupled together so as to be adaptable to the circuit to be supplied.—London *Electrician*, Feb. 9, 1917.

Electrophysics and Magnetism

Unipolar Induction: An Experiment and Its Significance as Evidence for the Existence of the Ether.—E. H. KENNARD.—The question as to the correctness of the "moving-line" theory can be subjected to experimental trial. A suitable but difficult arrangement consists of a cylindrical condenser inside a coaxial solenoid (Fig. 2), both capable of rotation about their longitudinal axis; the condenser is connected to an electrometer as shown. Let the condenser be short-circuited and set in rotation with the solenoid energized. Then, according to either Lorentz's or the moving-line theory (but not according to Hertz's), the two cylinders of the condenser should come to different potentials, and the inner one at least should be charged. According to Lorentz's theory, rotation of the solenoid should have no effect upon this charge. According to the moving-line theory, rotation of the solenoid alone should charge the condenser in the same manner, while the condenser should remain uncharged when condenser and solenoid rotate together with no relative motion between them. Barnett constructed an apparatus of this sort and showed that rotation of the solenoid alone developed no charge upon the condenser. The present author has made a careful investigation with a new apparatus of this kind. His results are somewhat rough, but they seem sufficient to warrant the conclusion with fair certainty that the condenser becomes charged by its own rotation in the manner required by Lorentz's theory, independently of the rotation of the solenoid. In the author's opinion, the moving-line theory is definitely disposed of by the results obtained by Barnett, Fehrle and the author. Electromagnetic induction depends in part upon absolute rotation in the mechanical sense. Analysis in terms of electrons seems to make necessary the existence of a stationary ether in order to explain the observed effect; so that the phenomenon seems to present difficulties for those relativitists who reject the ether. "The practical bearing of these experiments is small, yet they do necessitate a correction of certain statements that are common in the text-books. For instance, it is not correct to say



FIG. 2—ARRANGEMENT OF CYLINDRICAL CONDENSER INSIDE COAXIAL SOLENOID TO DETERMINE CORRECTNESS OF "MOVING-LINE" THEORY

that the effect of rotating the armature of a dynamo is the same as that of rotating the field magnets in the opposite direction. The total emf. is the same, but in the first case it is developed almost entirely in the longitudinal parts of the winding, while in the second case a large fraction of it is developed in the radial parts, and the distribution of electrification on the armature will be different."—*Philos. Mag.*, February, 1917.

Units, Measurements and Instruments

Resistance Standardizing Bridge.—C. V. DRYSDALE.—A detailed and fully-illustrated description of a universal resistance standardizing bridge of the combined Kelvin-Carey-Foster type which enables resistances of all values from the highest to the lowest to be compared with the greatest degree of accuracy and convenience, and enables all the values to be determined in terms of a single standard. Some recent improvements of design are described and the complete theory of the bridge is given with numerical examples.—London *Electrician*, Dec. 29, 1916, and Jan. 5, 1917.

Localization of Faults.—H. HEINZELMANN.—If two auxiliary cables, *AB* and *CD*, are available, it is possible to locate a fault in a cable, *EF*, by two resistance measurements made at the end, *F*, of the faulty cable by the method described, in which the resistances of the two auxiliary cables do not enter. The cables are connected as shown in Fig. 3, *G* being a galvanometer and

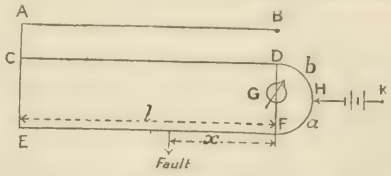


FIG. 3—METHOD OF CONNECTING AUXILIARY CABLES AND FAULTY CABLE TO LOCATE FAULT

DHF a bridge wire. The balance point *H* is found with the battery terminal *K* connected first to *B* and second to earth. If the bridge wire is divided into the ratios $a : b$ and $a' : b'$ in these two measurements, and if the faulty cable has a length l and the fault is at distance x from *F*, it follows that $x = la'/a$. It is assumed that $a + b = a' + b'$.—*Elek. Zeit.*, Sept. 21, 1916; abstracted in *Science Abstracts*, Section B, Jan. 31, 1917.

Lubrication of Resistance-Box Plugs.—J. J. MANLEY.—It is important that the resistance of plug resistors should be practically invariable. When a plug is seated by the usual screw-like movement, the engaging surfaces tend to plough each other, and as a result burrs and grooves appear upon both. These burrs and grooves, which change in size, number and form as the coils are used, appear to be entirely responsible for the variations observable in plug resistance. The author describes quantitative experiments which show that lubricating plugs are an efficient remedy. The best results were obtained by the use of vaseline.—*Philos. Mag.*, February, 1917.

Miscellaneous

The Adoption of the Metric System in the United States.—A series of articles on this subject. A. E. Kennelly discusses the metric system from the standpoint of the electrical engineer; William C. Wells from the Pan-American standpoint; Fred R. Drake from the standpoint of the wholesale grocers and canning industry; A. W. Miller from the standpoint of the wholesale druggist; H. V. Arny writes on the metric system in every-day life and G. F. Kunz on the international language of weights and measures. In Kennelly's article it is pointed out that the real question to be considered at this time is not whether the Anglo-American system shall or shall not be indefinitely retained. That question was settled long ago, when all the other countries of the world came, one by one, to adopt the metric system. The real question is how, and how soon, the English-speaking peoples should change to the international metric system. Deferring the change does not make it any easier. The individuals most inconvenienced by the change would probably be the intellectually aged. The American Institute of Electrical Engineers took a canvass in 1902 of their membership on the question of the adoption of the metric system by Congress. A large majority were in favor of the change. Electrical units, which are international and in world-wide use, are already metric. No sudden transition should be invoked by Congressional action. Ample time for preparation should be allowed in any legislation directed toward the change. In this way lists, catalogs and sizes could all be tabulated in advance in both systems, side by side, so that gradually the old numerical values could be dropped. The easiest and least expensive way of introducing the system

would probably be to have certain United States government departments adopt the system exclusively after a certain date. Only those persons or firms dealing directly with those departments would then be compelled to change their listings and prices. Gradually, the process would be likely to extend into general literature, business and manufacture, without the exercise of compulsion.—*Scientific Monthly*, March, 1917.

Book Review

THE MECHANICAL ENGINEERS' HANDBOOK. By Lionel S. Marks, Editor-in-chief. New York: McGraw-Hill Book Company, Inc., 1179 pages. Illustrated. Price, $5.

This volume, compiled under the able direction of Prof. Lionel S. Marks as editor-in-chief, assisted by fifty specialists, has been based on the mechanical engineering section of the famous "Hutte," the German reference work generally accepted by German engineers. The material of the "Hutte" has not been closely followed except in the more theoretical sections, the data and information on engineering practice being carefully selected from American practice, the German text being followed mainly in form and schemes of handling the various topics.

The book divided itself into two main sections, the first 860 pages being devoted to theoretical topics, and the last 960 pages to current practice. The more theoretical portion is subdivided into seven sections, dealing with the following subjects: Mathematical tables and weights and measures; mathematics; mechanics of solids and liquids (including friction); heat; strength of materials; materials of engineering, and machine elements. The portion treating of practice is divided into eight sections dealing with power generation; hoisting and conveying; transportation; building construction and equipment; machine shop practice; pumps and compressors; engineering measurements, mechanical refrigeration, etc. The section on friction was prepared by Professor Hess of Cornell University, and the section on hydraulics by Professor Schoder, also of Cornell University. The section on heat has been written by Professor Goodenough of the University of Illinois. Professor Hatt of Purdue University contributed a section on strength of materials, including theory of reinforced concrete design. The list of contributors for the section on "materials of engineering" includes Dr. Fischer of the Bureau of Standards, Dr. Moldenke, secretary of the American Foundrymen's Association (cast iron); Mr. Clamer of the Ajax Metal Company (non-ferrous metals), Sanford E. Thompson (cement, mortar and concrete), Mr. Hood of the U. S. Bureau of Mines (fuel), and six others. The subject of machine elements has been contributed by Professor Rauttenstrauch of Columbia University, with the important addition by Dr. Loewenstein of the General Electric Company, of articles on disk wheel stresses and critical speeds of shafts, and of Professor Ham of Cornell University on pipe and pipe fittings.

Power generation is treated under the headings of steam boilers, the steam engine, steam turbines, condensation, internal combustion engines, waterwheels, hydraulic turbines, and cost of power. The authors include Professor Ennis of the Polytechnic Institute of Brooklyn (steam engines), Dr. Loewenstein of the General Electric Company (steam turbines), Professor Marks of Harvard University (internal combustion engines), Mr. White of the Allis-Chalmers Company (hydraulic turbines), and Mr. Orrok of the New York Edison Company (condensation). This section occupies more than 240 pages. C. K. Baldwin of the Robbins Conveying Belt Company prepared the section on hoisting and conveying. The subject of machine shop practice is adequately covered by Mr. Alford, former editor of the *American Machinist*. Reciprocating pumps were handled by Mr. Nickel of the H. R. Worthington Company, air compressors by Professor Thorkelson of the University of Wisconsin, centrifugal pumps and centrifugal compressors by Dr. Lowenstein of the General Electric Company, and centrifugal fans by Mr. Williams of the B. F. Sturtevant Company. Much hitherto unpublished information is contained in these pages, particularly the treatment of the centrifugal machines.

The section on electrical engineering has been contributed by Professor Beebe of the University of Wisconsin. A miscellaneous section includes the subjects of measuring instruments by Professor Moyer of Pennsylvania State College, surveying by Professor Raymond of the State University of Iowa, mechanical refrigeration by Mr. Fairbanks of the Quincy Market Cold Storage & Warehouse Company, patents for inventions by Mr. Odin Roberts, the A. S. M. E. testing codes, instructions for first aid treatment, and other matter.

The use of the book is facilitated by thumb tabs, which mark the locations of the different sections, and by the section subject index on the inside of each cover referring to the number of the corresponding thumb tab.

Books Received

ALTERNATING CURRENTS. By H. R. KEMPE. New York: D. Appleton & Company. Twenty-five illustrations; 83 pages. Price, $1.50.

GOVERNMENT TELEPHONES. The Experience of Manitoba, Canada. By James Mavor, Ph. D. New York: Moffat, Yard & Company. 176 pages. Price, $1.

SELLING YOUR SERVICES. New York: The Sales Service Company. 176 pages. Price, $1.

THE MECHANICAL WORLD POCKET DIARY AND YEAR BOOK. For 1917. Baltimore, Md.: The Norman, Remington Company. 382 pages. Illustrated. Price, 40 cents.

UNDERGROUND TRANSMISSION AND DISTRIBUTION FOR ELECTRIC LIGHT AND POWER. By E. B. Meyer. New York: McGraw-Hill Book Company, Inc. 312 pages. 156 illustrations. Price, $3.

LIGHT AND SHADE AND THEIR APPLICATIONS. By M. Luckiesh. New York: D. Van Nostrand Company. 135 illustrations. Ten tables. 266 pages. Price, $2.50.

EXPERIMENTAL ELECTRICITY COURSE. In Twenty Lessons. By S. Gernsback and H. W. Secor. New York: The Experimenter Publishing Company. 160 pages. Illustrated. Price, $1.

WIRELESS COURSE IN TWENTY LESSONS. By H. W. Secor, S. Gernsback and A. Lescarboura. New York: The Electro Importing Company. 160 pages. Illustrated. Price, $1.

THE BOOK OF ELECTRICITY. Written to conform to the tests of the Boy Scouts. By A. Frederick Collins. New York: D. Appleton & Company. 186 pages. 145 illustrations. Price, $1.

ENGLISH AND ENGINEERING. Edited by Frank Aydelotte. New York: McGraw-Hill Book Company, Inc. 390 pages. Price, $1.50.

MANUFACTURING COSTS AND ACCOUNTS. By A. Hamilton Church. New York: McGraw-Hill Book Company, Inc. 452 pages. 138 illustrations. Price, $5.

Phase-Rotation Meter

To the Editor of ELECTRICAL WORLD:

SIR: The writer was very much interested in the description on page 226 of your Feb. 3 issue, of a phase rotation indicator devised by E. P. Peck of Atlanta, Ga. I would like to call your attention to the fact that such a device was used by me about thirteen years ago and that a patent (No. 787,345) issued to me contains, among the eleven claims allowed, the following one, which fully covers devices of the kinds used by Mr. Peck:

"A device of the class specified, comprising means operable by the energy of the polyphase system and means whereby such operation can be interpreted to indicate the direction of phase rotation with reference to the leads of such system and substantially as described."

Commercial instruments based on this patent have been manufactured for many years and are in use in a great many central station systems.

R. F. SCHUCHARDT.

Chicago, Ill.

Naval High-Powered Radio Station

To the Editor of ELECTRICAL WORLD:

SIR: With reference to the editorial in the ELECTRICAL WORLD of Feb. 10, 1917, entitled "Naval High-Powered Radio Stations," I beg to submit the following comments and explanations, as I feel that without them the editorial is not complete.

The San Diego station is nominally rated at 200 kw., not 150 kw. as mentioned. However, high input means little as the efficiency of the apparatus governs its output and the latter is the measure of its sending radius. Speaking more technically, the product of antenna amperes times the effective height is the only true measure of the sending radius of a radio station.

On this fair basis of comparison the San Diego station is not "nearly as large as the great Sayville station, which has been used to communicate with Germany," as your editorial states, but is rather the most powerful plant in the world to-day.

The Pearl Harbor and Cavite plants when completed will exceed the San Diego station in antenna current and will then become the most powerful plants in existence.

With reference to your mention of the electrical efficiencies of the large arc converters, I am not permitted to give figures, but can assure you that they compare very favorably with the efficiency of any other method of obtaining continuous undamped oscillations in use at the present time.

The performance of these arc converters on test has shown that units of 1000 kw. capacity can be built by the Federal company at any time and that their efficiency in converting direct-current power into high-frequency power will be, to many, surprisingly high.

L. F. FULLER,
Chief Electrical Engineer
Federal Telegraph Co.

San Diego, Cal.

Readers' Views and Comments

Significance of Digits

To the Editor of ELECTRICAL WORLD:

SIR: The writer has received copies of the "Code of Lighting for Factories, Mills and Other Work Places" of the State of New Jersey, department of labor, and the "Lighting Code," State of Pennsylvania, industrial board, department of labor and industry.

I wish to call attention to the disregard of the significance of digits. In each publication, Rule 2, covering "Intensity Required," states: "The desirable illumination intensity to be provided and the minimum intensity, which shall be maintained, are shown in the following table:

TABLE I—NEW JERSEY CODE OF LIGHTING—INTENSITY REQUIRED

	AT THE WORK	
	Minimum Foot-Candles	Ordinary Acceptable Practice
A. Roadways and yard thoroughfares	0.05	0.05- 0.25
B. Stairways, passageways, aisles, storage spaces	0.25	0.25- 0.50
C. Rough manufacturing operations such as foundry work, rough machining, rough assembling, rough bench work	1.25	1.25- 2.50
D. Fine manufacturing operations such as fine lathe work, pattern and tool making, light colored textiles, tobacco manufacture	3.50	3.50- 6.00
E. Special cases of fine work, such as watch making, engraving, drafting, dark colored textiles	5.00	10.00- 15.00

TABLE II—PENNSYLVANIA CODE OF LIGHTING—INTENSITY REQUIRED

	AT THE WORK	
	Minimum Foot-Candles	Ordinary Acceptable Practice Foot-Candles
1. Roadways and yard thoroughfares	.05	.05-0.25
2. Stairways, passageways, aisles, storage spaces	0.25	0.25-0.5
3. Rough manufacturing operations such as foundry work, rough machining, rough assembling, rough bench work	1.25	1.25-2.5
4. Fine manufacturing operations such as fine lathe work, pattern and tool making, light colored textiles, tobacco manufacture	3.50	3.50-6.0
5. Special cases of fine work such as watch making, engraving, drafting, dark colored textile	5.00	10.00-15.00

The values of illumination given for the first class of working planes contain two significant figures. The values given for the second class of working planes contain in some cases two and in another case one significant figure. The values given for the third and fourth class of working planes contain in some cases three and in another case two significant figures. The values given in the fifth class of working planes contain in some cases three and in other cases four significant figures. In order that the result of any measurement may be of value, it is necessary to include some numerical measure of its reliability.

When the results of a scientific investigation are of sufficient importance to become a law enforced by fine or imprisonment, the figures defining the law should be correctly written to conform with accepted practice.

DAVIS H. TUCK.

Pittsburgh, Pa.

The Small Pumping Load

To the Editor of ELECTRICAL WORLD:

SIR: Pumping is usually considered a very desirable form of load by central-station companies and one they are anxious to develop to the full. With the increase of rural transmission lines and the ever-increasing territory served by them the pumping load is one the salesman is frequently called upon to solicit. In many cases the water to be pumped may be for domestic or agricultural purposes or for fire protection. The ability to place an installation upon central-station service, however, depends upon whether it can be done with a low initial cost.

In designing small rural pumping stations which will be served from rural transmission lines, and often from inexpensive outdoor-type sub-stations, one of the chief factors to consider is whether to install a relatively small motor and pump which can operate continuously over long periods or whether to put in a larger motor and pump for occasional operation over shorter periods of time. This is necessary since economy of operation as well as first cost depends on this consideration. Speaking generally, it will be found to the best advantage of both customer and central-station to adopt the smaller unit. The smaller unit has a lower first cost, while the expense for renewals and depreciation likewise will be lower. Furthermore the load factor will be higher because the unit is in service longer each day. Since the average water level will be higher when the smaller pump is used, the average head will be lower, thus compensating for the lower efficiency of the smaller pump.

For the customer the smaller pumping set possesses the advantages of having a lower initial cost and a lower operating expense, factors that often enable him to make such an installation where otherwise he could not afford to do so. For the central-station company the smaller pumping set offers the advantages of higher load factor, lower peak demands and relatively constant demands for power from its lines. In connecting loads of this kind the storage tank and the pump should be chosen to allow the customer the benefit of off-peak service. This can be done by using a higher-rated pump or larger-capacity tank, the latter being the more economical.

GILBERT RUTHERFORD.

Evanston, Ill.

Steady Growth from Unvarying Service to the Engineering Industries



JAMES H. McGRAW

Founder and head of McGraw Publishing Company, who becomes president of the new McGraw-Hill Publishing Company, Inc., formed to extend and strengthen the influence of great engineering and business journals, leaders in their fields, creative workers for industrial welfare and prosperity.

Position of the Electrical World in the Large Technical Newspaper Consolidation

IN last week's issue, a brief announcement was made of the consolidation of the McGraw and Hill Publishing companies. By this means, the McGraw-Hill Publishing Company, Inc., acquires the ELECTRICAL WORLD, *Electric Railway Journal, Electrical Merchandising, Engineering Record, Metallurgical & Chemical Engineering, The Contractor, American Machinist, Power, Engineering News, Engineering & Mining Journal* and *Coal Age*, each the leader in its field. The new organization, therefore, under the guidance of James H. McGraw, its president, becomes the dominating influence in American technical journalism.

All the traditions and aspirations of both institutions fall as a heritage to the new publishing company, and inasmuch as the personnel of the two organizations will remain intact, the service to the reader will be greatly improved through the advice and counsel of the greater number of editors. The *Engineering News* and *Engineering Record* will be consolidated as *Engineering News-Record*, making the largest and most influential civil engineering and contracting journal in the world.

PRINCIPLES OF SERVICE

It is well that readers should know the principles which have animated James H. McGraw throughout his long and successful career as a publisher and which have been instilled into the minds of everyone connected with the organization. These principles, which may be referred to as the decalogue of journalistic practice, have also pervaded the Hill organization and are as follows:

1. To consider, first, the interests of the subscriber.
2. To subscribe to and work for truth and honesty in all departments.
3. To eliminate, in so far as possible, personal opinion from news columns, but to be a leader of thought in editorials, and to make criticisms constructive.
4. To refuse to publish "puffs," free reading notices or paid "write-ups"; to keep reading columns independent of advertising considerations, and to measure all news by this standard: "Is it real news?"
5. To decline any advertisement which has a tendency to mislead or which does not conform to business integrity.
6. To solicit subscriptions and advertising solely upon the merits of the publication.
7. To supply advertisers with full information regarding character and extent of circulation, including detailed circulation statements subject to authentic verification.
8. To co-operate with all organizations and individuals engaged in creative advertising work.
9. To avoid unfair competition.
10. To determine what is the highest and largest function of the field which is served, and then to strive in every legitimate way to promote that function.

FIELD OF THE ELECTRICAL WORLD

Although Mr. McGraw has been the active head and publisher of the *Electric Railway Journal* since 1888, his connection with the other branches of the electrical industry dates from 1896, when he purchased *Electrical Industries* which was renamed the *American Electrician* and issued as a monthly publication devoted to electrical and mechanical engineering. Three years later he acquired the *Electrical World* and the *Electrical Engineer*, the two leading electrical weeklies, and consolidated them into the *Electrical World & Engineer*. In 1906 the *American Electrician* and the *Electrical World & Engineer* were combined into the present ELECTRICAL WORLD. Last year *Electrical Merchandize & Selling Electricity* was purchased and the name changed to *Electrical Merchandising*. This journal, which is published monthly, is designed to supplement the ELECTRICAL WORLD, which still remains the great electrical weekly dealing with the serious side of the electrical industry. The ELECTRICAL WORLD is edited for the technically trained and professional electrical engineers, the managers and operators of electrical public utilities and large industrial establishments, electrical manufacturers, jobbers and contractors. *Electrical Merchandising*, on the other hand, finds its field with the dealer, contractor and other commercial men engaged in the sale and exploitation of apparatus and appliances. Last month the *Lighting Journal* was merged with the ELECTRICAL WORLD and *Electrical Merchandising*, that branch of the paper dealing with the science and art of illumination being added to the ELECTRICAL WORLD.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

QUESTION BOX CONVENTION OF N. E. L. A. NEW ENGLAND SECTION

Good Attendance at This Week's Meeting in Boston, with Accountants' Responsibility, Depreciation, Accident Prevention and Other Central Station Topics on the Program

A well-attended question box convention was held this week by the New England Section of the National Electric Light Association at the Engineers Club auditorium, Boston, Mass.

On Wednesday morning an accounting session was held under the chairmanship of H. A. Gidney, general auditor of C. H. Tenney & Company, Boston. An extended discussion took place upon the question of making accounting officers of public utilities responsible for all records and charged with authority to establish the form of these in production, distribution and other departments outside the office. Depreciation accounting also occupied the convention's attention, after which the general subject of accident prevention was opened for discussion under the chairmanship of H. W. Moses, superintendent of the welfare bureau, Edison Electric Illuminating Company of Boston. The afternoon session was devoted to a discussion of the economics of steam heating with respect to the installation of central station service, G. F. Parsons, of C. D. Parker & Company, Boston, presiding.

On Thursday morning advertising and publicity were discussed under the chairmanship of Willard Hall, of the Narragansett Electric Lighting Company, Providence, R. I., followed by a discussion of the problem of increasing gross income from electric lighting and the education of employees in public relations under the chairmanship of C. E. Greenwood of the Boston Edison company. For the closing session a general discussion on central station topics was scheduled.

FEDERAL AUTHORITIES VISITING SITES FOR NITRATE PLANT

Inter-Department Board and Associates, Cabinet Officers and Other Government Officials to See Locations Proposed in Various Cities

The inter-departmental board on the location of nitrate plants left Washington on March 8 to visit several sites mentioned as possible locations for the federal nitrate plant. Among the cities to be visited are Birmingham, Ala.; Columbia, S. C.; Tuscaloosa, Ala.; Augusta, Ga.; Louisville, Ky.; Sheffield, Ala.; Wheeling, W. Va., and Nashville, Tenn.

The inspection party includes Secretary Lane of the Interior Department; Secretary Houston of the Agricultural Department; Secretary Baker of the War Department; General Black and Colonel Keller of the Corps of Engineers, War Department; Colonel Wheeler of the Ordnance Department of the Army; Mr. Merrill, chief engineer of the Forestry Bureau; Mr. Carruthers, chemist in charge of nitrate experimental laboratory; Mr. Parsons, chief chemist of the Bureau of Mines. They will return to Washington about March 16.

LARGE ATTENDANCE PROMISED FOR ASSOCIATED MANUFACTURERS

Edward N. Hurley Asks That Members Be Prepared with Questions if They Seek Particular Information Bearing on His Far-Reaching Activities

In addition to Edward N. Hurley, retiring chairman of the Federal Trade Commission, who is to address the Associated Manufacturers of Electrical Supplies at the annual banquet in New York on March 15, the members will hear the Hon. Job Hedges, attorney, of New York City. As stated in previous issues, the annual meeting and banquet will be held at Delmonico's.

Mr. Hurley has suggested that the members be prepared to ask him any questions they choose on subjects bearing on his recent work. His deep interest in the promotion of sound accounting principles for merchants and manufacturers and his conviction that only the adoption of such principles will place industry on a stable foundation have had a profound effect upon the activities of the Federal Trade Commission. This movement is close to the Associated Manufacturers, and the appearance of Mr. Hurley presents an opportunity for the members to talk over a subject bearing directly upon their future prosperity.

At the annual meeting of last year about 160 representatives were present. Inquiries received this year by the general secretary of the association, Charles E. Dustin, indicate a much larger attendance at the gatherings to be held next week.

INDUSTRY TO VOTE ON 1917 ELECTRICAL WEEK

Society for Electrical Development Sends Out Ballots Asking Whether 1917 Activities Shall Be Held as Formerly or Split Into Two Campaigns

Because there seems to be a difference of opinion concerning the best time for a national electrical week the Society for Electrical Development is sending out this week to the members of the electrical industry of the country a ballot with two questions: (1) Shall there be another electrical week in 1917? or (2) shall the electrical week of 1917 be set over until the spring of 1918 and the effort this fall centered in a "Buy Electrical Christmas Gifts" campaign?

Comments have shown the society that there is a well defined feeling in the industry that the plan followed in the past two years to promote the "shop early" idea for the Christmas trade, and thereby stimulate holiday sales, could be bettered by using Christmas time for promoting the holiday trade alone, and to further the general education of the public in electrical matters by a national electrical week at some other time.

The ballots go out in a booklet entitled "A $3,000,000,000 Industry Pulls Together," which is an official record of America's Electrical Week. The booklet takes up the many activities of the week in detail according to the character of the local celebrations.

Coal Cost and Shortage—Meeting the Problem

What Central Western Companies Are Learning as a Result of the Unprecedented Fuel Conditions, Which Endanger Continuity of Service and Add Heavily to Operating Costs

CENTRAL station companies are looking for a solution of the large problem revealed by the winter's experience in coal cost and shortage. They are turning, first, to efficiency in the purchase, transportation, handling and burning of this prized commodity. If they cannot reduce unit costs to a figure which can be absorbed in operating expenses without undue strain, they will have to consider whether rates should be revised. Experiences of various companies, as told to the ELECTRICAL WORLD in this issue, show how closely the problem is being studied. Facts and probabilities of the future are being appraised so that the meaning of this powerful change in the conditions governing central station operation may be appreciated in its full importance.

WHAT SHALL CENTRAL STATION COMPANIES DO?

John F. Gilchrist: Advise railroads to figure on rapid growth in coal tonnage.

W. W. Freeman: It may be imperative to readjust power rates.

D. L. Gaskill: Conferences looking toward united action to raise power rates are being held.

J. F. GILCHRIST ON CHICAGO SITUATION

In an interview with the representative of the ELECTRICAL WORLD, John F. Gilchrist, vice-president in charge of purchasing, stores, transportation and statistical departments of the Commonwealth Edison Company, Chicago, said that it is high time for central station companies to call forcibly to the attention of railroads the vast growth in the use of coal in their cities. In these great centers of population there are many plants in daily operation burning coal. Even in ordinary times they pretty well strain terminal facilities. When there is a threatened railroad strike, as there was in 1916, or when a car shortage like the one at hand arises, things are worse. The Commonwealth Edison Company is now using 7000 tons of coal a day. Experience indicates that its coal consumption doubles every four years. In 1921 the company will use probably 14,000 tons; in 1925, 28,000 tons; in 1929, 56,000 tons. The use of coal by others in the city will no doubt also grow. So, in arranging for terminal facilities, plans for which must necessarily be laid years in advance, the railroads should figure on this rapid growth in tonnage. They should be warned to do so by the central station men, who can help them see ahead.

Other suggestions made by Mr. Gilchrist were: "Another thing this winter has brought out is that the rulings of the Interstate Commerce Commission, which are fair in the main, do not always work most advantageously toward the desired end. To illustrate, there was a coal company in Illinois owning five mines—four small and poorly equipped, and one large and well equipped with most modern and efficient electrical machinery. By operating the latter mine at its full capacity, this company could have produced and sold coal as cheaply and perhaps more cheaply than any other producing company in the State. But the commission had ruled that each mine should have and should use a certain allotment of cars. The allotment for the big mine was not sufficient to keep it operating at its full capacity and highest efficiency. The company's total allotment of cars for all five mines would have been enough for the big mine, but on account of the commission ruling, the cars had to be used at the mines to which they were assigned. The result was that this coal company with its magnificent equipment to produce coal cheaply, could not do its utmost to help reduce the abnormal prices. Neither could it make money for itself.

"The recent situation has also demonstrated that coal for public utilities should be a preferred commodity. Under the great boilers of their plants it is burned most economically and renders a needed service to the greatest number of people.

UTILITY RATES SHOULD COVER COAL MAN'S PROFIT

"This winter's coal shortage has demonstrated conclusively that it is poor policy for utilities to try to run their businesses and base their rates on coal figured at prices less than the actual mining and transportation costs. Just because mine operators do not know their costs and have sold coal at less than they could afford to produce it, is no reason why a great coal-consuming industry should base its operations on those ridiculously low prices. Some day the mine owners will know their costs, the market will become better organized, or a real railroad tie-up may arise. Then trouble will loom for the public utilities. The central-station executives should recognize this; furthermore, commissions should frown on rate schedules that do not include a coal cost sufficiently high to permit the coal producer to make a profit. Such a schedule could not be other than unstaple.

COAL SUPPLY PREPAREDNESS NOT EXPENSIVE

"The coal used by the Commonwealth Edison Company this winter has cost more than it does ordinarily, but even in spite of this the company seems to have been more fortunate than the great majority of Middle Western utilities. Its good fortune can be attributed to the foresight which led its president, Samuel Insull, many years ago to provide adequately against coal shortage. This has been done by purchasing mines and mining rights, providing strategically located transportation and switching facilities and adequate coal-storage spaces. From its own mines the company gets 50 per cent of its coal at a cost of a little over $2 a ton—not mining coal itself but securing it through an operating company—the Peabody Coal Company. The remainder of its fuel supply is 'free' coal purchased in the local market. Sometimes, on account of market conditions, it is possible to pick up a few per cent of the needed supply of free coal at prices as low as $1 a car plus demurrage. The cost of free coal this year was from $4 to $5 a ton.

"From its own mines the company owns a short steam railroad which intersects the lines of four great north and south railways reaching Chicago. At that city the company has two electric and three steam switching locomotives that can assist in straightening out terminal difficulties. Besides taking these precautions the company always enters the winter with 450,000 tons,

or from sixty to ninety days' supply, in storage at its plants. How adequate this storage must be is indicated by the fact that to-day the company has about 210,000 tons of coal in storage in Chicago.

"In ordinary years the company no doubt paid more for its coal under this system than it might have through some other. A short-sighted critic might have said, therefore, that the coal-supply system was expensive. But the experience of this winter has demonstrated beyond doubt that the existing plan is not expensive if the coal costs are figured over a fair period of years.

"In Chicago not much electricity business came to the Commonwealth Edison Company directly as the result of coal shortage and high coal prices among isolated plants. The fact that coal prices fluctuate and upset carefully laid estimates of industrial earnings has been called to the attention of industrial plant owners, however, not only by their own balance sheets but by the direct-by-mail advertising of the central station. The stability of central-station rates has also been pointed out, and it is believed that the ultimate result will be an increased industrial plant business."

Giving Rates Careful Consideration, Says W. W. Freeman

W. W. Freeman, president of the Union Gas & Electric Company, Cincinnati, said: "The cost of our service has been very largely increased by the advance in coal prices during the past three months. Such increased expenses have been out of all proportion to the increased earnings. I believe that our position in this matter is no different from that of practically every electric-lighting company in the country. I very much doubt that the abnormal prices which we have had to pay for coal will be continued very long, but I do believe that coal will permanently be more costly than was the case a year ago and previously. This may make it imperative to readjust the rates for electric power service. We are giving the matter careful consideration with a view to meeting the probable future conditions in a manner fair to all concerned."

Situation Improving in Duluth

Speaking for the Duluth Edison Company, C. E. Van Bergen, the secretary of the company, said: "While we buy most of our energy from the Great Northern Power Company—a hydroelectric property—we have had hard work to get what coal we need for our auxiliary steam plant and for our steam-heating business. We ordinarily carry on hand as a reserve about 1000 tons, but our stock of late has been reduced to under 200 tons on account of the shortage of cars. The only cars we get are ore cars, gondolas, or old flat cars with temporary sides built on them. There are no box cars. During February we received less than 250 tons of coal, but in the first three days of March we received five cars of coal, so the situation seems to be improving."

Conditions as Viewed by Byllesby Companies

While the high coal prices had a serious effect on the net income of the properties of H. M. Byllesby & Company, the difficulties in securing sufficient coal have not been at all serious. This lack of difficulty is attributable to the company's plan of handling its coal purchases and to the proximity of many subsidiary companies to coal mines. Coal for its companies in the Northwest is delivered from the east to the head of the Great Lakes before navigation closes. By anticipating the car shortage and laying in large stores of this coal at the plants, the Byllesby operating companies in Northwestern cities were assured of an adequate supply. At no time was any plant within ten days of shutdown. In Oklahoma the Byllesby plants burn gas; in California they use oil; at Louisville (Ky.), at Ottumwa (Iowa), and at Pueblo (Col.), the coal fields are near at hand.

R. G. Hunt, assistant to the vice-president in charge of operation for the Byllesby company, believes that coal prices will return to their normal level. He said when the present war prosperity is over there will be a readjustment of labor prices. Factories that have been operating three shifts will lay off two of them. The formerly unskilled laborers, who have of late been educated in the factories, will become competitors of men who were the former skilled workmen. Prices of factory labor will be forced down. There will be a dearth of common labor, however, which will be aggravated by the return to Europe of many men who will return with their savings to help relatives rebuild their fortunes. The states that are now legislating to exclude the Japanese common laborer will see their folly for he will be the man they will need. With such readjustments taking place coal prices will come down. They may not recede as much as prices of other commodities on account of labor shortage in the mines, where there are many foreigners.

Mr. Hunt said that while the power business has increased materially, it is wrong to attribute the increase to the fuel or isolated plant machinery situation. Most of the power business has been obtained because of the continuous activity of the companies' sales departments.

Views of Mr. Gaskill

D. L. Gaskill, president of the Greenville (Ohio) Electric Light & Power Company and secretary of the Ohio Electric Light Association, says:

"The effect of this winter's coal situation is a very appreciable one in the operating expenses of the Ohio companies. Nearly all of the companies report an increase of about 300 per cent in fuel cost for this winter's operation. So serious has this become that conferences are now being held looking toward a united action in raising the power rates to meet this situation. This extra cost has not affected the service of the companies in that all of them have maintained service at whatever cost it entailed.

"In our particular case we have been singularly fortunate in that we started in the winter with a very large stock of storage coal, and having dealt continuously with the same firm for eighteen years they have kept up their shipments on our regular contract very fairly. In fact, they are now 100 per cent on their contract. In our Eaton property we have not been so fortunate and have had to buy some high-priced coal.

"The situation at this time is becoming easier. Some of the companies report that their regular contract men have resumed shipping to them on a 100 per cent basis. It is probable that the situation will very materially ease within the next thirty days, but the coal prices will not drop back to low figures until probably the year 1918."

Inferior Coal in Omaha

H. A. Holdredge, general manager of the Omaha (Neb.) Electric Light & Power Company, said: "We were obliged to pay in December an average price for coal which exceeded the former December price by 35 per cent; the average price in January exceeded that of the previous year by 26 per cent; the February average price exceeded that of the previous February by 16 per cent. In addition to this we were obliged to use large quantities of coal that was far inferior in quality to that which we obtain under normal conditions."

ACTIVE WORK OF THE N. E. L. A. COMMERCIAL SECTION MEMBERS

Meetings Held in New York This Week by the Electric Range, Merchandising and Executive Committees in Preparation for the Annual Convention

The committees of the Commercial Section of the National Electric Light Association are very actively at work completing their convention papers and reports. The electric range committee, with twenty members present, met at association headquarters in New York on Monday, March 5. The meeting lasted all day Monday and Tuesday, adjoining at 9.30 o'clock on Tuesday evening. The committee reviewed all of the subcommittee reports to be presented at the convention. Mr. C. E. Michel of the Union Electric Light & Power Company, St. Louis, Mo., is chairman of this committee.

The merchandising committee, of which J. V. Guilfoyle of the Western Electric Company is chairman, met at association headquarters on Tuesday, March 6. Two of the sub-committees submitted their convention reports, which were discussed in detail. The principal topic discussed was electrically equipped furniture and plans for exhibiting some such furniture at the Atlantic City convention.

The executive committee of the Commercial Section held an all day session on Wednesday, March 7, with sixteen members present. Reports were received from all standing committees. Special interest was shown in the report of the committee on compensation of salesmen, and it was decided to recommend to the next administration that this committee be continued next year as a consulting bureau, many of the member central station companies having shown great interest in this subject.

January	Better lighting
February	Outdoor lighting (tennis courts, playgrounds, etc.)
March	Stores and windows
April	Residence lighting
May	Electrical advertising (signs, outline lighting, display lighting)
June	Public building lighting
July	Industrial lighting
August	Stores and windows
September	Electrical advertising (signs, outline lighting, display lighting)
October	Residence lighting
November	Better lighting—with emphasis on office buildings
December	Industrial lighting

Chairman Pembleton of the publications committee reported that the booklet on wiring of old houses, "Electricity in Your Home," was completed and copies had been sent to all central station members of the association. Orders are being received for this booklet at the following prices: f.o.b. New York including imprinting company name and address on booklets: 25,000 and up, $26.15 per 1000; 20,000, $26.55 per 1000; 15,000, $26.95 per 1000; 10,000, $27.35 per 1000; 5000, $27.75 per 1000; 2500, $28.15 per 1000; 1000, $29.00 per quantity; 750, $23.25 per quantity; 500, $16.50 per quantity; 250, $8.75 per quantity; 100, $3.65 per quantity.

Mr. Pembleton also advised that the booklet on wiring of new homes will be ready for distribution on March 15 and that samples will be sent to all Class A members with order blank. A meeting of this committee will be called for the latter part of the month, when dummies of the 1917 Christmas booklet will be presented. It is planned to have samples available by the time of the Atlantic City convention.

Chairman Jones of the power sales bureau reported that the American Electrochemical Society had appointed a sub-committee of three members, to meet with a sub-committee of the power sales bureau in the development of electrochemical work.

Chairman Kelly of the lighting sales bureau presented a progress report, mentioning especially the schedule suggested by the Bureau to fit in with the merchandising schedule of the committee on co-ordinate advertising and sales campaigns. [This schedule is published in the preceding column.]

Both the power sales and lighting sales bureaus reported that they are planning get-together dinners at the convention so that the lighting and power men in attendance may become better acquainted and discuss their problems in different parts of the country.

Upon invitation Charles H. Lum, assistant to the general manager of the National Board of Fire Underwriters, and Joseph B. Forsyth, chief inspector of the New York Board of Fire Underwriters, met with the executive committee at luncheon to discuss the subject of fire hazard resulting from the careless use of electrical appliances. These gentlemen indicated that in their opinion such appliances were not only remarkably safe but that the electrical industry and the N. E. L. A. especially, had rendered the most valuable hearty cooperation with the Underwriters. The suggestion was made by Mr. Lum that a sub-committee of the Association be appointed to co-operate with a sub-committee of the Underwriters to carry on this important work for the education of the public.

CHANCES OF EXTRA SESSION OF BOTH HOUSES OF CONGRESS

Present Prospect Is That President Wilson Will Not Call the Two Branches Together Before June—Conservation and Webb Bills Lost in the Filibuster

It appears likely now that an extra session of Congress will not be called by President Wilson before June. The President changed his original intention, which was not to call the Senate in extraordinary session, and that body is now assembled in Washington.

There is a likelihood that the Senate will revise its ancient rules which have allowed unlimited debate and under which it has been necessary to do business by unanimous consent rather than by majority rule. If it changes its rules so as to limit debate and provide for a vote and action by the majority, there is a possibility that an extra session of both Houses of Congress may be called before June. This would be primarily for the purpose of acting on foreign affairs, but if there is a joint session of both bodies, with Senate debate limited, such a condition would make for favorable action on water power bills and the Webb bill which permits combinations in export trade.

President Wilson in a statement to the American people the beginning of the week drew attention to the importance of the legislation before Congress which has been advocated by the business interests, such as the conservation bills, the Webb bill, etc. It is not doubted that if there is an extra session of both Houses the President will urge this business legislation as well as the foreign legislation he desires.

The present appropriations expire June 30, the end of the government fiscal year, and if both Houses are called by June 1, it is believed that the month to the last of June would be sufficient for appropriation legislation.

It is still doubtful whether the Republicans or the Democrats will organize the House, a question on which important committee chairmanships hinge. One Democrat, however, died recently, and there are now 215 Republicans, and 214 Democrats, with 5 Independents, to go into the House, with the possibility of complication by other deaths.

FUTURE OF THE ONTARIO HYDROELECTRIC SYSTEM

Sir Adam Beck Says It Must Absorb All Other Electric Systems in Province—He Expects the Commission and Municipal Investment to Be $100,000,000 Within Five Years

In an address before the Ontario Municipal Electric Association on Feb. 15, Sir Adam Beck reviewed the work of the Ontario Hydro-Electric Power Commission and spoke on the future of the provincial system. The commission at present supplies 191 municipalities, and expects to supply over 200 in the course of the next two or three months. Over 200,000 hp. is now developed by the commission, with a total investment on the part of the commission and municipalities of more than $40,000,000. Within five years Sir Adam expects this amount to increase to $100,000,000.

In regard to the future Sir Adam said in part as follows:

"The Chippawa development is merely the foundation of the beginning of greater things. My own opinion is that the hydroelectric power system must absorb the whole of the electric systems in the province of Ontario, and I hope it will begin at Niagara Falls. If that policy is carried out there will be no difficulty in making available 1,000,000 hp. by using only the waters we have a right to use under the treaty.

"Our regret is that the eastern district has not been included, as it were. The eastern district will be in as advantageous a position and in a more wealthy district as soon as the deepening of the waterway from Lake Ontario to Montreal is undertaken by the Dominion government. Then it should not be a very difficult matter. I know the State of New York, and if not New York a private enterprise, is ready to undertake half of the capital cost of building dams that will be necessary to make the St. Lawrence a deep waterway."

PROTEST AGAINST CANADIAN WATER DIVERSION AT NIAGARA

Formal Presentation of Claim That Proposed Chippawa-Queenstown Power Canal by Ontario Hydroelectric Commission Would Violate Treaty

Formal protest has been made to the Canadian government by the United States against the proposed Chippawa-Queenstown power canal by which the Ontario Hydro-Electric Commission will divert additional water from the Canadian channel of the Niagara river for power development. The United States claims that the project would violate the treaty under which the diversion limit above the cataracts is fixed at 20,000 cu. ft. per second on the American side and 35,000 cu. ft. per second on the Canadian side.

The Ontario provincial legislature has been advised by Attorney-General Lucas that there is no necessity for seeking the consent of the International Joint Waterways Commission to carry out the Chippawa-Queenstown power development project and, acting under this advice, the provincial legislature will proceed with the plans without the permission of the international commission. Surveys for the canal have been completed and excavations will be started in the early spring. The canal will start at the village of Chippawa near Niagara Falls, Ont., and will parallel the upper river and lower Niagara gorge to Queenstown, Ont., where gigantic power generating plants will be constructed. The Ontario Hydro-Electric Commission is handling all plans and construction and operation details.

LARGE GAIN IN DAYTON COMPANY GROSS EARNINGS

Policy of Extending Transmission Lines Gives a Total of 36 Cities, Towns and Villages Served—President Tait Confident of Satisfactory Business in 1917

Gross earnings of the Dayton (Ohio) Power & Light Company for the year ended Dec. 31, 1916, were $1,613,873, a gain of 46.98 per cent over 1915; operating expenses were $999,961 while net earnings amounted to $613,912, a gain of 18.4 per cent over 1915.

President F. M. Tait, in reporting to stockholders, describes the extensions of transmission lines during the year, aggregating a total of 48 miles, of which 12 miles are of steel tower construction. The villages and towns added by these extensions make a total of 36 cities, towns and villages supplied. Mr. Tait adds:

"An analysis of our 1916 operation shows an increase of 3989 in the number of consumers connected to our lines, making a total increase in connected load of 16,511 hp. The past year has been an abnormal one in many respects and particularly noticeable in the large increase in the operating expenses of the company, brought about chiefly through the high cost of coal and materials. It is not expected that the company's business in 1917 will be adversely affected by the return of more normal industrial conditions and it is confidently expected that the business for the year 1917 will be satisfactory."

GAINS BY PUBLIC SERVICE COMPANY OF NORTHERN ILLINOIS

Increases in Both Gross and Net Earnings—Particulars of Extensive Construction Work—Large Amount of Material on Hand

Notwithstanding higher costs of operation, the Public Service Company of Northern Illinois increased both gross and net earnings in the year ended Dec. 31, 1916. Much construction work was completed during the year or is under way. The income account follows:

	1915	1916
Gross earnings	$6,903,228	$7,783,156
Operating revenue from electricity, gas, heating and water	6,244,477	6,862,988
Merchandise sales and other income	658,750	920,168
Expenses (including taxes)	3,749,370	4,508,483
Operating for gas, electricity, heating and water	3,200,917	3,740,885
Merchandise department	548,452	776,597
Net earnings for the year	3,153,857	3,274,673
Deduct—bond and note interest	1,492,280	1,497,818
Net income for year	1,661,577	1,776,855

Electric customers were 75,900 in 1916, as compared with 64,540 in 1915 and 54,850 in 1914.

In his report to stockholders Samuel Insull, the president, said:

"The year was characterized by an increased cost of operation due to the high price of coal, oil and other materials as well as to the greater cost of labor. But this increased cost of operation is not reflected in the earnings, as a satisfactory ratio of net earnings has been maintained by reason of the large increase in gross income.

"Following its policy of reducing rates to customers when it is practicable and safe to do so, the company lowered its rates for both electricity and gas during the year.

"As authorized by the State Public Utilities Commission of Illinois, the company, on June 1, 1916, reduced

its maximum rate for lighting from 12 cents (net) a kilowatt-hour to 11.5 cents (net). On Oct. 1, 1916, this rate was still further reduced to 11 cents (net) a kilowatt-hour, the secondary rate being 7 cents (net). These rates are effective throughout nearly the entire territory of the company.

"In several cities and towns a general gas-service rate was put into effect during 1916. This rate is $1 (net) for the first 1000 cu. ft. of gas consumed in any month; 90 cents (net) each for the next 2000 cu. ft., and 80 cents (net) per 1000 cu. ft. for the excess over 3000 ft. consumed in any one month.

Demand System in Gas Rates

"On April 13, 1916, a wholesale gas-service rate was put into effect. This rate is based on the demand system of rate making which years of experience in the electric service utility have shown to be correct. The Public Service Company of Northern Illinois was one of the first companies in this country to apply the demand system to gas rates. The new wholesale gas-service rates are divided into two parts—a demand charge based on the maximum demand in cubic-foot-hours in any month and an output charge, being an additional charge for all gas used, based on the cubic feet of consumption in any month. By the adoption of this modern and equitable system of rate-making it is expected that the company will secure a large amount of industrial gas business.

"With the decrease in customers' rates for both gas and electricity, there was an increase in the dividend rate paid on the common stock. On Nov. 1, 1916, this dividend rate was increased from 6 to 7 per cent per annum.

Construction Work

"Fairly satisfactory progress was made during the year in the construction of the large electric generating station 3 miles south of Joliet; but much delay was encountered on account of the non-delivery of material. The building under construction will contain two 10,000-kw. electric generating units. The first of these will be ready for operation in the spring of 1917, and an order has been placed for the delivery of the second 10,000-kw. unit next October. As planned, the ultimate rating of this station will be 60,000 kw., and it is probable that the next unit installed will be a 20,000-kw. unit.

"The large electric generating station at Blue Island has a present rating of about 25,000 kw. An additional 12,500-kw. unit was practically finished during the year and is ready for service. Another generating unit of the same size is to be installed during 1917. Additional land adjoining the Blue Island station property was purchased to provide for these extensions. A new steel-tower transmission line of 8000 kw. capacity has been built to connect with the Commonwealth Edison Company's lines at the southern city limits of Chicago.

"In Joliet a new electric substation is under construction. It is capable of serving as a center for the distribution of 10,000 kw. of electrical energy. It will be supplied by two 12,000-volt circuits from the new Joliet generating station. These circuits will be partly underground and partly supported on steel towers 65 ft. high. In the vicinity of the new Joliet electric generating station about 28 miles of new 33,000-volt transmission lines are now under construction. These new transmission lines will connect the new station with the present network of electric transmission and distribution circuits. They will ultimately carry about 50,000 kw. of electrical energy.

"A new 33,000-volt electric transmission line between Pontiac and Streator generating stations is nearly finished. The section between Streator and Cornell is ready for service, and it will enable the Cornell generating station to be shut down, twenty-four-hour service being supplied for that town.

"A new transmission line, upon which work was started in September, 1916, between the Waukegan generating station and the Lake Bluff station, is in service. This line is built of standard 33,000-volt construction, and it will materially improve operating conditions in the northern division.

"The company has provided itself with a larger amount of material in its storerooms than is usually carried on hand. This precaution was taken owing to the difficulty experienced in getting material from the manufacturers."

LOS ANGELES RESCINDS PLAN TO BUY PRIVATE SYSTEMS

Arrangements for Charter Amendment Election Withdrawn and New Propositions, Involving Purchase, Wholesale Disposal of Power, or Paralleling of Existing Systems Are Considered

The Los Angeles City Council on Feb. 21 rescinded all steps toward holding a charter amendment election on March 8, which would enable the city to purchase the distributing systems of two private companies. In place of the scheme thus abandoned, the Council debated the advisability of submitting to the people three direct propositions, namely: Shall the city purchase the distributing systems of the two power companies? Shall the city wholesale its power to the power companies? Shall the city parallel existing distributing systems?

The reasons which led to this action, according to a declaration made by the Council, are that "after three months of negotiations with the two companies, the city has been unable to secure from them a contract for the sale of their distributing systems in accordance with the offer made in writing by the city Nov. 29, 1916, and the outcome of negotiations in relation to the contract which the proposed charter amendment is intended to validate are at this time entirely uncertain."

Councilman Conwell commented on the situation as follows: "The committee of three negotiating with the companies has endeavored to iron out the points of difference between the Council and the proposed contract. I feel convinced that the extreme limit to which the Council would go in an effort to meet the demands of the companies would not be acceptable to them.

"We might grant the ten-year conditions, but the thought of tying the city, either directly or indirectly, to a hard and fast contract to buy power for a period of twenty years succeeding the ten would, in my opinion, never be acceptable to the electorate.

"That the contract as formulated by the experts is financially favorable to the city, I admit. At the same time I hold that the maintenance of a principle is more important than financial gain. The principle is the right of the city to govern its own affairs, free from entangling contracts for a long period of years.

"I am a believer in municipal ownership under proper conditions, but those conditions involve monopoly of the utility, whereas this entire arrangement would leave in the field an active competitor whose ability and financial strength cannot be questioned.

"Moreover, we know that that competitor is in possession of a steam plant and 14-cent gas—a combination which, applied through modern means, will produce electric energy at a cost dangerously near the cost of hydroelectric generation with transmission. [The Midway Gas Company delivers 1000 B.t.u. natural gas to

the Los Angeles Gas & Electric Company at city limits for 14 cents per 1000 cu. ft. This gas can be used as fuel at the steam plant.]

"Aside from all considerations, it appears to me that this is an inopportune time to vote bonds for any purpose. National and international affairs interfere, and, lastly, the attitude of our electorate toward its officials is not, to say the least, of a nature to inspire confidence. Upon the whole, therefore, it would seem the better part of wisdom to postpone the matter until the situation clears, in the hope that we may in due time conclude an arrangement whereby the city may come into possession of the distributing systems of all three companies."

The action of the Council came as a surprise to the Public Service Commission, according to statements of members of that body, but the commission still plans to continue negotiations in the hope of bringing the matter to a successful conclusion.

QUESTION INTER-COMPANY AND BANKING LOANS IN NEW YORK

Transactions Between Consolidated Gas Company and Subsidiaries and Loans to National City Company Investigated by Public Service Commission

A letter has been sent by the New York Public Service Commission of the First District to George B. Cortelyou, president of the Consolidated Gas Company of New York, asking for information in reference to about $9,000,000 loans made by subsidiaries to the National City Company. The subsidiary companies mentioned by the commission are the New York Edison Company, the United Electric Light & Power Company, the New York & Queens Electric Light & Power Company and the Astoria Light, Heat & Power Company.

LETTER OF THE COMMISSION

The letter of the commission, signed by James B. Walker, the secretary, says:

"From the company's annual report to the commission for 1915, it appears that after providing for the payment of short-term notes and other obligations, there remained approximately $9,000,000 of cash proceeds of debentures for which the company had no immediate use, and that on or about Feb. 15, 1915, the company, principally through certain subsidiary companies in the First District, loaned $9,000,000 to the National City Company at interest rates varying from 2.8 per cent to 3.05 per cent."

REPLY FOR THE COMPANY

On behalf of the Consolidated Gas Company a statement was made, in effect as follows:

"Obligations of the company were created to finance construction requirements of subsidiaries, which have been financed by the Consolidated Company for 17 years past. Construction requirements were anticipated and the burden of carrying the funds properly belonged to the subsidiaries. Stagnation has reduced output below expectations; otherwise larger expenditures would have been made and cash balances greatly reduced. Companies are obligated to have facilities equal to maximum demand and it is vitally important that they should be in sound financial condition at this time. The companies are exceptionally fortunate in obtaining so satisfactory a rate of interest on funds which they were obliged to carry, in part at least, longer than was anticipated. No company under the jurisdiction of the commission obtained any higher rate on loans.

"WE ASK ADJUSTMENT OF ALL EXISTING DIFFERENCES"

Plea of A. D. Mackie, General Manager of Springfield, Ill., Companies, Which Are Asked for Improvements While Franchises Are Expiring

A statement issued by A. D. Mackie, general manager of the Springfield (Ill.) Gas & Electric Company and the Springfield Consolidated Railway asks for an extension of the franchises for electric and heating service, which expire in 1921.

To carry out improvement plans of the city commission would involve expenditures by the companies in the downtown district alone of $738,003. Of this $312,670 would be for underground wires, $267,613 for the electric railway's share of street paving and ornamental lighting system and for railway construction work on repaved streets in the downtown district, and $157,720 for replacement and overhauling of steam, hot water and gas mains on repaved streets in the downtown district. Other necessary expenditures, costs and incidentals would increase these figures. The improvements are desired in connection with the centennial which is to be celebrated by Springfield next year. Mr. Mackie says that it will not be possible to incur the obligations necessary for the improvements if they are to be of use to the companies for only three years. He adds:

SAVE DEFENSE COST AND REDUCE RATES

"We ask an adjustment of all existing differences. We believe that the large sums which we have been compelled to expend, almost annually, during more recent years, to defend our right to do business, could better be used for rate reductions to our customers. We believe that the loss of revenue which would come to us in such reductions would largely be offset by closer friendliness and co-operation on the part of the general public. We believe that every citizen would be a gainer by a satisfactory settlement of the long-continued and vexing struggle in which we have been involved.

"In connection with the extension of our license by the city we are willing to make reasonable rate reductions which would apply not only to electricity but to gas and which would mean that cheaper current and cheaper gas would be at once available to every consumer in Springfield. We sincerely believe that immediate and general rate reductions, both of gas and electricity, necessarily would be of far larger advantage to the people as a whole than any that possibly could come to them through a system which could provide cheaper electricity only to a limited few and which could not be available to a majority of consumers for very many years to come and then only through vast expenditures of public funds.

"We are willing that the extension of our license shall include the stipulation that the city can take over our electric light and power plant at the end of any five-year period at a price to be determined either by arbitration or by condemnation proceedings. We believe that the fairness of this proposition must be apparent to everyone and will again demonstrate the lack of any just reason for a continuation of the attacks to which we have been subjected.

"We would add that, so far as our proposed underground wire system is concerned, we are not asking and have not asked the city to place its wires in our ducts. On the contrary, we are quite willing that the city shall dispose of its own wires in such manner as it may see fit. We did suggest that which must be obvious to everyone, that a duplication of underground duct systems means an unwarranted duplication of expense and an unnecessary congestion of subsurface conditions."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public-utility companies.

Anticipation of Highways Being Used for House Moving.—The Empire District Electric Company maintained across a public road a system of poles and wires, including two telephone wires and a ground wire which were 19 ft. above the roadway, and two high-tension wires, uninsulated, charged to 33,000 volts, and which were suspended 23 ft. 3 in. above the highway. The Supreme Court of Kansas held in the case of Logan versus the company (161 P. 659) that it was the duty of the company to anticipate the moving of buildings of greater height than the wires and to take precautions to protect persons liable to be on such structures from danger of coming in contact with wires. The mere fact that wires operated at such a high tension could not be insulated would not preclude the right of the plaintiff to recover on the ground of negligence charged, namely, a failure to place the wires high enough to avoid interference with the lawful use of the highway.

Contract by Implication.—The City of Sonora, Cal., by ordinance, provided that electric energy, except for street lights, should be furnished for twenty-four hours daily, and for street lighting for a stated period each night. The Tuolumne County Electric Power & Light Company wrote the city that to comply with this ordinance it would be necessary to leave power on its former night circuit for twenty-four hours and that it would be necessary for the city to turn off the street lights belonging to the city which were attached to such circuit, during the day, or the city would be charged for power used in the street lamps during the day, and that the obligation of the company ceases when it furnished power to the city's connection. The city replied that it would only pay for energy furnished at the time and in the manner required by the ordinance, unless otherwise specifically requested, that the obligation of the company was to furnish power at the time and in the manner required in the ordinance, and that its obligation did not cease when it furnished power to the city's connection. The District Court of Appeals of California held (161 P. 128), and a rehearing was refused by the Supreme Court that regardless of the question of whose duty it was to furnish appliances to prevent the waste of electricity, the company could not recover for electricity used in the city's street lighting system during the daytime on the theory that its use created an implication that the service was performed at the instance and request of the city authorities.

Damages from Water Flowage.—A person whose property was flooded by a power company was entitled to adequate damages for the injuries sustained under the circumstances shown, it was held by the Supreme Court of Michigan in the case of Morrison vs. Queen City Electric Light & Power Company (160 N. W. 434). In such case, it was immaterial whether the power company actually contemplated the damages which resulted or not, since the court showed that it must be held to contemplate all the damages legitimately following from its wrongful act. However, it was the duty of the plaintiff to minimize the damages occasioned by the flooding of his property, and having failed to do so, he could recover only such damages as would not have been avoided by so doing; and he should have made an honest endeavor to reduce the damages by changing and improving the property, as had been suggested. A party is always entitled to recover the legitimate expenses incurred by him in an honest endeavor to reduce the damages flowing from or following a wrongful act.

Duty in Furnishing Sufficient Help.—The Supreme Court of North Carolina held (90 S. E. 996) that it was the duty of a telephone company loading poles on railroad cars to have a sufficient force of hands to do the work and make it reasonably safe to perform it. Where the foreman ordered his gang to do work which would expose them to danger and the order was negligently given, so that injury resulted to an employee, he was liable jointly with the telephone company for any injury sustained.

Contributory Negligence in Obedience to Orders.—An interesting case in which some of the fine points about the care to be exercised not only by the employer but by the employees as well according to their duties, was laid down by the California District Court of Appeal in Earl vs. San Francisco Bridge Company (160 P. 570). It was here held that it is negligent for an employer to change the cut-off switch so that it did not entirely cut the current off and then to direct an employee who had previously inserted fuses after cutting off the current at the switch, to insert a switch without warning him that the switch had been changed. Although the employee knew of the danger of working around wires carrying a current with such a voltage he was justified in assuming that the switch would still cut the current off the wires, the difference in its appearance not being so palpable as to come to the conclusion that in the exercise of ordinary care he could have discovered it. Furthermore, an employee who had knowledge that the cut-off switch had been changed so as not to cut off the entire current was not contributorily negligent in attempting to replace a fuse under the direct supervision of the engineer where the change merely rendered the attempt at replacement more dangerous but did not make it inevitably or imminently dangerous.

Commission Rulings

Important Decisions of Various State Bodies Involving or Affecting Electric Light and Power Utility Operation and Practice.

New York Commission Objects to Pending Legislative Bills.—On motion of Commissioner Travis H. Whitney, the New York Public Service Commission of the First District has adopted a memorandum addressed to Senator Charles D. Newton, chairman of the committee on codes of the New York State Senate, and to Assemblyman Fred. M. Ahern, chairman of the codes committee of the Lower House, pointing out serious objections to the so-called Martin bills now pending before the Legislature, which relate to review of decisions by certiorari. The memorandum points out that the bills would set aside the recent decision of the Court of Appeals in the New York & Queens Gas Company case to the effect that upon a certiorari the court may not substitute its own judgment for that of the commission. In the memorandum the bills in question are asserted to be "undoubtedly the answer of the public service corporations to that decision. By apparently simple amendments to the code of civil procedure, relating to certiorari proceedings, these bills would greatly impair prompt and effective regulation by the commission, orders of the commission being reviewable by a writ of certiorari. Those bills would set aside the decision of the Court of Appeals in that they specifically provide for a review of the facts."

Distributing Company Must Secure Ample Supply to Give Adequate Service.—In a recent ruling, the Maine Public Utilities Commission declares that the Wiscasset Electric Light Company, which purchases energy from the Portland Power & Development Company for local distribution, must secure an adequate supply for its customers. Residents of Wiscasset appealed to the commission on the ground that service interruptions occurred frequently. The company admitted the fact, but said that it could not secure a regular supply of electricity from the generating company, and had no other available source. The commission states that while the reason advanced for the failure to give reasonably adequate service is based on fact, it does not relieve the company of its duty to the public, and some other means of supplying energy must be sought. Stockholders of the Wiscasset company have interested the management of the Central Maine Power Company in the field and arrangements will be in effect soon by which the distribution of energy locally will be carried out on the basis of transmission by the Central Maine company to Wiscasset, and then retailing by the local company.

Cities Service Company Stock Increase.—Stockholders of the Cities Service Company will be asked to authorize, at the annual meeting on April 3, increases in the preferred stock from $60,000,000 to $100,000,000, and in the common from $40,000,000 to $50,000,000, making the total authorized issue $150,000,000. These increases will provide for future corporate needs.

Municipal Electric Plant Displaced by Central-Station Service.—The Minneapolis General Electric Company has closed a contract with the city of Anoka, having an approximate population of 4000, covering its electric light and power requirements amounting to 300 kw. The city will discontinue operation of its municipal electric plant, but will continue the distribution and sale of electric energy as heretofore.

Amalgamation Recommended for New York Commissions.—The Thompson joint legislative committee recommends that the two Public Service Commissions in New York State be amalgamated. Its report to the Legislature says that consolidation would save $400,000 in "needless salaries." A rapid transit commissioner should be appointed in the First District, but the commission should confine itself exclusively to regulation, the committee holds.

Difficulty in Storing Coal in Stone Quarries.—A Chicago concern, which experimented during the winter with a plan of storing soft coal screenings in abandoned stone quarries at Kankakee and Lemont, Ill., met an unexpected difficulty. The coal in the quarries was covered with water to prevent fire. To remove the coal a suction pump was employed. The coal did not ignite, but when it was most needed it was under a foot of ice. When the coal was pumped into the cars, much of the water froze, making the car load a body of ice and coal dust. Further experiments are likely to be made to develop a successful method.

Street Lighting Improvements in San Diego, Cal.—The San Diego Consolidated Gas & Electric Company recently removed from its lines the last remaining arc lamps used in municipal or public lighting. Two years ago the important lighting was effected by means of arc lamps, but these have now all been replaced by incandescent units. The main lighting of the city of San Diego and adjacent communities is by means of 600 cp. Mazda C Novalux refractor units. Of these there are now installed a total of 979, and there are also in suburban towns 418 smaller units varying in size from 40 to 400 cp. The business district is illuminated by 539 five and seven-light electroliers containing 3255 multiple lamps of 60 and 100 watts, and there are 159 single-light electroliers containing 250 cp. Mazda C lamps. The first installation of higher candlepower Mazda C units was completed in May, 1915, when 700 units were placed in San Diego. This installation has proved so successful that a replacement of arc lamps followed as rapidly as contracts expired.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Dry Laws Turn Breweries Into Electrically Operated Ice Plants.—In some states where legislation has prohibited the manufacture of beer, the brewers are remodeling their plants and operating them electrically as artificial ice plants.

Radio Station for Porto Rico.—The Senate Committee on Naval Affairs in reporting the Pagett Bill making naval appropriations for the coming year recommended increases aggregating $167,000,000. One of the items in this increase was one for $400,000 for a radio station at Porto Rico.

Ohio Senate Committee Favor Gilmore Bill.—The public utilities committee of the Ohio Senate has approved the Gilmore bill, which requires a company to secure from the Public Utilities Commission a certificate of public necessity before it can invade a municipality where a similar utility is already in operation.

Storm Damage in Kentucky.—Severe snowstorms have been doing a great deal of damage to electric wire systems throughout Kentucky. In Louisville many lines were broken, while all over the State there was much of the same kind of trouble. Telephone and telegraph companies were hit the hardest, although electric light and power systems suffered damage. Companies had difficulty in finding linemen capable of making repairs.

Cold Weather and Lack of Fuel Results in Big Demand for Electric Heaters and Equipment at Cleveland.—Dealers in Cleveland report a big rush for electrical heaters during the recent cold spell. The mercury stood below zero much of the time, and there were neither gas nor coal to be had at any price in many homes. Cooking devices were also sold in large numbers. Some dealers said their stocks ran very low on these things for a time and it now appears that many people will have them on hand in the future, even if they do not make use of them regularly.

Amendments to Meter Test Regulations in District of Columbia.—The Public Utilities Commission of the District of Columbia has amended the regulations for electric service in the district so far as they pertain to the intervals between tests of meters, as follows: Single-phase meters up to and including 25 amp. rated capacity, at least once in every thirty-six months; over 25 amp., at least once in every twenty-four months; polyphase meters up to and including 50 kva. rated capacity, at least once in every twenty-four months; over 50 kva. rated capacity, at least once in every twelve months.

Monthly Publication for Toledo "Rail-Light."—A monthly publication for employees, to be issued under the direction of E. R. Kelsey, advertising manager, is recommended to President Frank R. Coates by the safety department of the Toledo Railways & Light Company and the executive committee of the company's section.

W. S. Barstow & Co., Inc., Retain Control of Pennsylvania Utilities Co.—It is announced by W. S. Barstow & Company, Inc., that E. L. West, president of the W. S. Barstow Management Association, Inc, has assumed personal control of the operations of the Pennsylvania Utilities Company, Easton, Pa., and its associate companies. The company states: "Mr. West will continue to direct the business policy of the companies and the development and expansion of their properties on an absolutely dependable and efficient basis, in keeping with the high character of service it is desired to furnish. No change in the control or ownership of the companies has occurred or is contemplated, and they are on a sound financial basis. The General Gas & Electric Company and W. S. Barstow & Company, Inc., still retain their interests, and adequate financial support is absolutely assured."

Toledo Company May Take Over Municipal Plant at Monroe, Mich.—A special committee of eighteen citizens, appointed by the Mayor of Monroe, Mich., recommends the acceptance of the offer of the Toledo Railways & Light Company to supply service, supplanting the municipal plant. The committee was appointed to review the advisability of financing improvements in the municipal plant and obtain proposals from the Toledo company and the Detroit Edison Company. After several weeks of investigation the committee made its report. If this is ratified by special vote of the citizens, the Toledo company will take over the municipal plant. At present the company supplies some power to consumers in Monroe, and recently it secured a contract for 1500 h.p. Monroe has about 1100 meters. A. K. Young, new business manager, sees a promise of large future business.

Telephone Inquiry for Massachusetts.—An exhaustive inquiry into the rates, finances and relations of the New England Telephone & Telegraph Company with the parent Bell organization is presaged by a vote of the Massachusetts Senate on Feb. 19 appropriating $15,000 for the Public Service Commission's use in this connection. The last telephone rate inquiry in the State took place in 1909 by the Highway Commission. For the past two or three years the Public Service Commission has sought an appropriation for this special purpose. Last year the company opposed an inquiry on the ground that the time and energies of its executives were entirely occupied in providing for the service demands growing out of the business boom following the outbreak of the European war. Purchasing and licensee relations will receive special consideration.

Minneapolis Jovians Hold Banquet.—On March 8 the Jovians of Minneapolis held the largest "get-together" banquet they have ever had, over 200 being present.

Los Angeles Synchronous Club.—At the March 1 meeting of the club, Leo Keller, chief engineer of the Home Telephone Company, read a paper on "The Telephone Consolidation." Following him, H. N. Beecher, chief electrical inspector for the city of Los Angeles, spoke on "The Electrical Code."

Indicating and Watt-Hour Meters.—E. L. Brown of the General Electric Company delivered a lecture on Feb. 28 before the electrical engineering class of the Worcester Polytechnic Institute on the subject, "Indicating and Watt-Hour Meters." This was the fifth lecture in the electrical engineering non-resident series.

Portland Contractors' Outing.—The Electrical Contractors of Oregon met in Portland on Feb. 21 for their annual "High Jinks." The entertainment committee, headed by Sam C. Jaggar of the Morrison Electric Company, Portland, chartered Crown Point Chalet, on the Columbia River Highway, where the festivities were held. Covers for the banquet were laid for 150.

Monthly Luncheon of Jovian League of New York.—Hon. Joseph Hartigan, commissioner of weights and measures of New York City, addressed the Jovian League of New York at its monthly luncheon on March 7 on the subject "Is there a Food Crisis in New York City?" The speaker discussed the present food prices, the chances of further increases, and the recent food riots. A business meeting was also held.

Associated Engineering Societies of St. Louis.—Under the auspices of the St. Louis Branch of the American Institute of Electrical Engineers the Associated Societies of St. Louis, Mo., held a joint meeting on Feb. 28, at which Howard B. Shaw, member of the Public Service Commission of Missouri, delivered an address on "Rates for Electricity Supply."

American Association of Engineers.—The American Association of Engineers at Chicago has received application for a charter for a local chapter at the University of Illinois. The application was signed by twenty certified and student members at the university. This will be the first engineering university chapter. The temporary officers are: Chairman, D. R. Norris; secretary, Victor A. Pecchia; treasurer, Harry E. Fisher.

H. L. Doherty Addresses Kansas City Jovians.—At the meeting of the Jovian Electric Club of Kansas City on Feb. 16 at the Sexton Hotel, H. L. Doherty, reigning jupiter of the National Jovian Order, spoke on the gas situation, and W. S. Woodland, head of the safety and service department of the Kansas City Railways Company, spoke on the safety placard work he is conducting in the public schools. Several reels of moving pictures were shown along the safety idea by the Kansas City Railways Company.

Associations and Societies

A complete Directory of Electrical Associations is regularly printed in the first issue of each month on the next to last text page

Causes of Prosperity.—George E. MacIlwain addressed the Schenectady section of the American Institute of Electrical Engineers, March 2, on the subject "Real Causes of Prosperity."

New England Section, I. E. S.—The New England Section of the Illuminating Engineering Society held its March meeting on March 7 at the Massachusetts Institute of Technology, Cambridge, Mass. Prof. William C. Wickenden delivered a lecture on the "Elements of Illumination."

Mobile Armaments.—Andrew M. Coyle, M. E., will give an illustrated lecture on "Mobile Armaments" at a meeting of the New York Section of the A. S. M. E. on March 13. Mr. Coyle is connected with the Coast Defense Board of Engineers, U. S. Army, and is therefore well qualified to talk on this subject.

Undeveloped Sources of Power.—Dr. Charles S. Howe, president Case School of Applied Science, addressed the March 1 meeting of the Electrical League of Cleveland, Ohio, on "Undeveloped Sources of Power." The club held a special entertainment and party on March 2. Motion pictures entitled "A Trip Through the Ford Factory" were shown, being followed by music and dancing.

Convention of the Southwestern Society of Engineers.—The first convention of the recently organized Southwestern Society of Engineers was held at El Paso, Texas, on March 8, 9 and 10. Several interesting papers were read, of which two were "Engineering Education, Its Purpose and Necessity," by Dean Butler of the University of Arizona, and "Engineering In National Defense," by Lieut.-Col. Walker of the U. S. Army.

Toledo Association Members Form Joint Section.—A new joint section has been formed in the Toledo Railways & Light Company, consisting of employees who are members of the National Electric Light Association, American Electric Railways Association, National District Heating Association and the American Gas Institute. The section will have 318 charter members. The officers are: T. J. Nolan, president; G. E. Snider, vice-president; Henry Friede, secretary, and A. C. Van Drieson, treasurer.

Pacific Coast Section, N. E. L. A.—The first annual meeting of this newly formed section, announcement of which appeared on page 72 of the ELECTRICAL WORLD for Jan. 13, will be held at the Old Mission Inn at Riverside, Cal., on April 19, 20 and 21. The committees, which have already been at work on their respective reports for some time, are as follows: Commercial, chairman, Stanley Walton, San Francisco; engineering, chairman, J. E. Woodbridge, San Francisco; accounting, chairman, B. T. Story, Los Angeles. The commercial committee includes members from various parts of the territory and is preparing an elaborate report which is expected to occupy an entire day of the convention. The first two days of the convention will be devoted to business sessions, and the third day to a trip and other entertainment features. About 1000 members had been enrolled in the new organization prior to March 1.

The Engineers' Country Club.—A group of well-known engineers has organized the Engineers' Country Club and, through the Engineers' Land Corporation, has acquired about 240 acres of highly-cultivated and cleared land on the north shore of Long Island, New York, near Roslyn. The properties, which will be quickly developed into what promises to be one of the most complete country clubs in the United States, include the Powell and Duryea farms and the old Villetts manor, one of the historic Long Island homes, dating back to Revolutionary times. Engineers by profession, members of engineering societies and those closely allied with the engineering profession are eligible for membership. Charles F. Quincy of New York is the president of the club. The club has issued a booklet illustrating and describing its properties and explaining its plans. N. M. Garland, 30 Church Street, New York, is chairman of the membership committee.

Southwestern Society of Engineers.—An engineering association which has been named the Southwestern Society of Engineers, has been formed in the southwest to afford engineers in west Texas, New Mexico and Arizona the opportunity of getting acquainted and of co-operating to their mutual benefit. Formation of sections of national societies was considered at first but this was impracticable as there are not enough men available in any one locality to make a strong section. While the new society does not intend to have local sections at present, they may be formed in the future at the larger centers of population. At present the value of the society depends a great deal on securing a geographically well-distributed membership. According to the constitution which has been drafted the objects of the society are the professional improvement of its members, the encouragement of social intercourse among engineers, the advancement of engineering knowledge, education and practice and the maintenance of a high professional standard among its members. There are three classes of membership: Full, associate and affiliated. The constitution provides for semi-annual conventions. Prof. A. F. Barnes, dean of engineering, New Mexico College of Agriculture and Mechanic Arts, State College, New Mexico, is secretary and organizer of this engineering society.

James Coles has been appointed new business representative of the Interstate Light & Power Company at Galena, Ill.

W. Porter Jones, formerly new business manager of the Oklahoma Gas & Electric Company, Oklahoma City, has been appointed manager at Norman, Okla.

R. D. Jennison has been appointed vice-president and general manager of the Pennsylvania Utilities Company, Easton, Pa., and associated companies, to succeed W. D. Ray, resigned. These companies are controlled by W. S. Barstow & Company, Inc.

A. L. Scott, for many years sales manager of the Edison Electric Illuminating Company at Lebanon, Pa., a subsidiary of the Reading Transit & Light Company, because of his ability in campaign work, has been promoted to a specialization in this line. Mr. Scott will conduct his first house-wiring campaign in Reading under the new arrangements in co-operation with H. E. Dawson, commercial sales manager, Metropolitan Electric Company.

L. K. Funkhouser, Dayton, Ohio, has resigned as secretary, treasurer and director of the Dayton (Ohio) Power & Light Company in order to devote all of his time to personal interests. He was connected with the company for the past seven or eight years, starting as timekeeper and clerk. He has been very active in the work of the Ohio Electric Light Association, and at one time was chairman of the accounting committee of the organization.

John A. Hoeveler, recently appointed deputy in charge of lighting with the Wisconsin Industrial Commission, took up his new duties on March 1. After graduating from the University of Wisconsin in the electrical engineering course, Mr. Hoeveler was engaged in illumination design in the offices of Vaughn & Meyer, Milwaukee, Wis., and



JOHN A. HOEVELER

for the past four years has been assistant chief engineer on design and new development work for the National X-Ray Reflector Company. His new work consists of lighting inspection of all places of employment and public building in the State.

Men of the Industry

Changes in Personnel and Position— Biographical Notes

N. M. Longbothum has resigned as manager of the Connecticut Power Company at Thomaston, Conn., and accepted a position in the organization of the Winsted Gas Company.

B. F. Hires, Bridgeton, N. J., manager of the Bridgeton & Millville Traction Company, and the Bridgeton Electric Company, and recently acting in a similar capacity for the Electric Company of New Jersey, has been appointed special agent of the American Railways Company, which operates these properties. He will be succeeded by W. J. Kyle as manager.

Benjamin F. Wood, who for sixteen years has been electrical engineer with the Pennsylvania Railroad and for the past three years has served as vice-president and chief engineer of the United Gas & Electric Engineering Corporation, has opened an office in the Woolworth Building, New York, for general consulting practice. He has organized the B. F. Wood Engineers, Inc., which will investigate, design, construct and supervise engineering works and power development, transmission, railroad electrification, electric railways, lighting systems and industrial plants.

Charles F. Gray, consulting electrical engineer, Winnipeg, Manitoba, has been elected controller for the city of Winnipeg for the ensuing year. Prior to opening consulting engineering offices, Mr. Gray was chief engineer in charge of the construction staff of the Canadian Westinghouse Company in the installation of apparatus for the Winnipeg municipal hydroelectric system and the terminal stations and substations in the city. In addition to engineering and construction experience covering twenty years in many Canadian hydroelectric developments, Mr. Gray gained experience in the electrification of the underground tubes in London, England.

Walter S. Gifford, statistician of the American Telephone & Telegraph Company, has, at the request of Secretary of War Baker, been granted a twelve weeks' leave of absence by the telephone company in order that he may act during that time as director of the Council of National Defense, a government body recently authorized by Congress. This council is composed of six members of the Cabinet and is assisted by an advisory committee of seven civilians. Mr. Gifford had previously acted as director of the Committee on Industrial Preparedness of the Naval Consulting Board, at that time a semi-official organization, assisted by the engineering societies of the country. In that capacity he supervised the work of taking an inventory of the industries of the country.

R. Tschentscher, who has been connected for the past thirteen years with the Illinois Steel Company of Chicago, has severed his connection with that company to become general superintendent of the steel plant of the Keystone Steel & Wire Company, Peoria, Ill. The plant will be ready for operation in a short time.

H. W. Brunell has been appointed local manager of the North Western Ohio Light Company's station at Delphos, Ohio. The Delphos station supplies energy to twenty cities located in northwestern Ohio. Mr. Brunell was formerly power engineer of the company, and previously was in charge of the industrial power department of the Pennsylvania Utilities Company.

A. H. Stack has resigned from the Henry L. Doherty Company of New York to become district general manager of the Ohio Service Company with headquarters in New Philadelphia, Ohio.

Obituary

Col. Curtis Vickery Hard, president of the Wooster (Ohio) Electric Company and the Cleveland (Ohio) Light & Power Company, died suddenly at his home at Wooster at the age of seventy-two years. For many years he played a prominent part in the activities of the Ohio Electric Light Association, of which he was president during the 1914-1915 association year. He was born at Wooster in 1845, and received his education at Berea College. A veteran of the Civil War, he was appointed colonel of the Eighth Ohio Infantry at the outbreak of the Spanish-American War, in which conflict he saw service during the entire Cuban campaign and at Santiago. Colonel Hard, with several associates, in 1886 organized the Wooster Schuyler Electric Company, later renamed the Wooster Elec-



C. V. HARD

tric Company, becoming president of the company in 1909. In the meantime he and his son, D. J. Hard, organized the Cleveland Light & Power Company, of which at Colonel Hard's death they were respectively president and treasurer.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

MANUFACTURERS OF PLUGS AND SOCKETS BUSY

All Indications Point to a Slight Rise in Prices Shortly, Probably Not More Than 10 Per Cent

An excellent business is being enjoyed by manufacturers of plugs, sockets and similar wiring devices. Jobbers are placing large orders for future delivery. There is an unusual amount of new building of one kind and another in prospect if not actually in the course of construction, as is evidenced by the sold-out condition of the market for building materials. There is also an unmistakable tendency toward a better type of factory illumination in order to better working conditions and increase plant efficiency. All of this is leaving its stamp on the market for electrical fittings to the extent that the demand far exceeds the supply.

Prices are higher than they formerly were, but there is no evidence of a reduction likely to go into effect this year. In fact, everything points to a slight rise, probably not more than 10 per cent, before long. The manufacturers are paying more and more for supplies, and it is only a question of the manufacturers finding out exactly how much production costs have increased before the advance is announced. February brass, for instance, which was brought on the basis of the average price of copper for December plus a fixed amount, went up in price every few days, because the fixed amount was raised. While the brass manufacturers have been taking care of old customers, the customers have had to pay the price. It has clearly been an inconvenience to the brass mills to supply small tonnages that required considerable rolling when the munitions manufacturers were in the market for very large tonnages that required much less rolling.

Socket and plug manufacturers have had another problem to face, namely, that of scrap. In the neighborhood of 40 per cent of the brass purchased is scrapped. When the price of brass was around 18 cents it was possible to obtain 15 cents for scrap. Now that brass is 40 cents and more it is possible to obtain but 18 cents for scrap. This makes a very considerable increase in production cost. Take a purchase of say 10,000 lb. of brass. At the price new of 18 cents this would be $1,800; the scrap would bring at 15 cents $600, so that the cost of brass used would be $1,200 or at the rate of 20 cents per pound used. Now, at 40 cents new the brass would cost $4,000, the scrap would bring but $720, so that the cost of brass used would be $3,280, or at the rate of 54.7 cents per pound used.

The price of porcelain has also been advancing, and, moreover, it has been very difficult to obtain, particularly by the New England manufacturers. In this respect the railroad congestion has proved a severe handicap.

Labor has been a perplexing problem for the socket manufacturers. This has been particularly acute in regard to the supply of female operatives. In spite of the over demand, it is no uncommon sight to walk through a factory and see a machine or two idle in this row and another one in the next row, and so on, simply because it was impossible to get girls to run them.

Every effort is being made at the factories to hasten deliveries, and there is no doubt but that this condition is improving. However, with the difficulty in obtaining raw materials and operators still prevalent it is doubtful if much can be done for some time.

Collections are in good shape. Most of this class of materials is sold to jobbers and there seems to be no effort on the part of the manufacturers to limit jobbers at all. The manufacturers expecting a rising market naturally would do nothing to prevent the buying of large stocks. On the other hand, buyers are not allowed the privilege of placing a large order and stringing along the deliveries. If deliveries are specified the times must be close together, and, furthermore, the contract must be filled about as quickly as it is convenient for the manufacturers to do so. The manufacturer has been buying on delivery price and selling on contract price, and to protect himself he must demand quick acceptance of the order. Furthermore, the manufacturer is very positive on this point for another reason. He does not care to give the buyer any opportunity to purchase on long delivery dates and then cancel the order if the price drops. He is willing to protect the buyer to a certain extent but not to the extent that he himself becomes the victim.

SHORTAGE OF FEMALE LABOR

Changed Economic Condition of Laboring Classes Largely Responsible

Difficulty in securing sufficient labor has been one of the greatest of the many problems with which the manufacturer has been confronted during the past year and a half. Since the first of the year the supply of male labor has become better, but there is still a great dearth of female workers.

In the manufacture of many electrical goods there are some processes in which girls are used almost entirely. Small and nimble fingers are required. Furthermore, these processes usually require the employment of large numbers of girls. Up to the influx of war orders in 1915 there was a plentiful supply of female help for factory work, but thereafter the supply became inadequate to meet the demand.

Munition plants went into the market for female workers and did not hesitate to offer higher wages than were being paid elsewhere. This lured large numbers of girls away from other factories, including those engaged in the manufacture of electrical products. Furthermore, it has been noticed that there are actually less women working at these tasks to-day than formerly. The young men have been earning wages better by far than they formerly received, and, while living is much higher, this is not considered. As a result the girls are marrying faster. Moreover, many girls who went into the factories because the family earnings were not sufficient to keep them in school or at home, are now again taking up their studies or home duties because the wages of the father have increased sufficiently.

BUILDING MATERIALS AGAIN ADVANCE IN PRICE

Industrial New Construction Large but Weakness Shown in Speculative Development—Effect on Market for Electrical Supplies

Building materials are again advancing, and very shortly higher prices can be expected in almost every line. Construction costs, therefore, at the opening of the 1917 building season will be much more than before. There is sufficient new construction under way or contracted for to keep producers busy well into 1918, and there is consequently every reason to believe that high prices will prevail for some time.

New construction is strong in industrial buildings, but weak in speculative development. The former is a necessity. Real estate operators find little that is healthy in

speculative development at present high prices. This would include such construction as office buildings, apartment houses, hotels and dwellings for rent or sale. In industrial construction, cost is not as great a factor as is speed. One important feature in industrial construction is shipbuilding, which is going on at a tremendous rate.

For some time then it can reasonably be expected that the great demand for electrical supplies will be for industrial use. Until prices of building materials are lower the demand for electrical supplies for offices, hotels and dwellings will probably not be as large as formerly in volume, although because of higher prices the value of the sales might show no decreases.

THE SECOND-HAND MARKET OF TO-DAY AND TO-MORROW

High Cost of Buying Reduces Net Profits—Keen Competition Between Second-Hand Dealers and Motor Builders Seen as Future Possibility

While the volume of second-hand electrical machinery business is still very large, sales are beginning to ease off in most of the lines. The three-phase, 60-cycle motor is the one product for which the demand still markedly exceeds the supply. The second-hand dealer who can find one of these machines can command the highest price. A large part of all central-station energy sold for industrial work is of the three-phase, 60-cycle variety. Hence, the demand for motors of this type. In addition it is difficult to obtain new apparatus of this type quickly because manufacturers of new three-phase, 60-cycle equipment need from three to five months to build a motor of any size for this type of service, stock having been depleted months ago.

The present large volume of business in second-hand machines does not mean necessarily that large profits are being made. In the six-month period, eighteen months ago, the net profits made by wideawake second-hand dealers were high enough to cause considerable satisfaction. This condition, on account of the steadily rising prices of new apparatus, continued so that net profits up until three months ago were still felt to be ample. Within the last three months, however, there is every indication that conditions have changed considerably. Now it is reasonable to believe that the net profits are so low that the merchant is earning only a little more than a banker's rate over and above his operating expenses.

Several conditions have helped reduce the net profits. First, the delivery situation in the majority of small new-apparatus lines has become easier. Second, industrial plant owners who have a few extra motors on hand seem to be of the opinion that the motors they have should bring them prices which are approximately the list price new or better. This makes it hard for the second-hand merchant to pick up bargains. And, third, the high percentage of operating cost connected with the shops of reputable dealers has operated to cut down the net profits.

On account of these conditions second-hand merchants are not buying heavily now. They believe that the second-hand business has reached its peak and would, if peace were declared or any other similar event brought to pass, fall abruptly. These merchants believe, therefore, that it is time to take stock of their business and to guard against loading up with equipment on which they must take this loss. The state of the copper market after the declaration of peace of course will have a large bearing on the second-hand machinery market. If the price of copper is held at or near the present level by the after-the-war demand from Europe, secondhand machinery naturally will not experience so great a slump as if copper falls off rapidly. Second-hand dealers therefore are endeavoring to keep in touch with copper prices.

The price of copper, however, is only one factor in this complicated problem. When the present industrial boom is over, many manufacturing plants will have motors which were installed merely to take care of the temporary expansion in business. This equipment will be dumped on the second-hand market. The prices of much of this apparatus, in spite of the fact that it is very good machinery, will be probably not more than 10 per cent above the junk price, because the industrial plant owners undoubtedly will make every effort to rid themselves of it. Since most of it has already been written off, the present owners can better afford to take a loss on its sale than to carry it on hand.

When the industrial boom will end, of course no one can say. But even if conditions continue as they are now, for the next six months, it can be expected that second-hand merchants will buy sparingly. Indications are that they will feel their way along, attempting to take nothing but bargains. Already the practice of contracting for apparatus to be delivered in six or eight months has been discontinued. The dealer cannot see that far ahead at present, and the margin of profit in the business does not justify taking chances. Even when the munitions equipment, through the cessation of the war, begins to flood the market, the second-hand dealer will probably buy carefully. Nevertheless it is quite evident that he will buy, for he realizes that this machinery will be practically new, that it will be first-class machinery, and that if he can buy right, he will be able to offer his customers guaranteed machines at prices far below those at which the electrical manufacturers can produce them. When this condition occurs competition of the keenest kind will undoubtedly take place between the manufacturers and the second-hand merchants.

COPPER MARKET FIRM BUT QUIET

Transactions Mostly for June and July Shipments, with Some Interest in Third Quarter

The high prices of February continue for copper, but there is little buying activity, and but small amounts of metal offered. What buying there is is mostly for June and July shipments, although there is some interest being shown in third-quarter copper. Little interest is shown in March, April and May copper.

There have been some foreign inquiries for additional 1917 tonnage, but it is generally supposed that the high prices are holding up buying from abroad. There are also indications that the American Government will shortly be in the market for a large tonnage. Should the Federal Government place orders for all of the war material called for in the administration preparedness measures there would be a very great increase in the domestic demand. Production fell behind during January and February, but with warmer weather production will again be speeded up to the maximum. Shortage of freight cars has held up delivery, but warm weather will better this condition also.

The high prices for second half year delivery serve to indicate that producers, although not yet sold out, feel that productive capacity will not be sufficient to meet the demand. The feeling generally exists that higher prices can be expected before the end of 1917.

Quotations on electrolytic, on Monday, were as follows: March delivery, 36.25 cents; April delivery, 35.5 cents; second quarter, 34.5 cents; third quarter, 31.5 cents; and fourth quarter, 30.25 cents.

NEW YORK METAL MARKET PRICES

	Feb. 26 Selling Prices Bid	Asked	Mar. 5 Selling Prices Bid	Asked
Copper	£ s d		£ s d	
London, standard spot	139 0 0		139 0 0	
Prime Lake	35.00	to 36.00†	35.00	to 36.00†
Electrolytic	36.00	to 37.00†	36.00	to 36.50†
Casting	33.00	to 34.00†	33.00	to 33.50†
Copper wire base	42.50	to 43.50†	42.50	to 43.50†
Lead	8.50		9.00	
Nickel	50.00		50.00	
Sheet zinc, f.o.b. smelter	21.00		21.00	
Spelter, spot	10.67½	to 10.92½	10.80	to 11.05
Tin, straits	49.87½†		53.75†	
Aluminum, 98 to 99 per cent	51.00	to 53.00†	53.00	to 55.00†

OLD METALS

Heavy copper and wire	27.50	to 28.00†	28.50	to 29.50†
Brass, heavy	17.50	to 18.00†	17.50	to 18.00†
Brass, light	13.75	to 14.00†	14.25	to 14.75†
Lead, heavy	8.00	to 8.50†	8.00	to 8.50†
Zinc, scrap	8.00	to 8.25†	7.75	to 8.00†

COPPER EXPORTS

Total tons to March 5	3,498

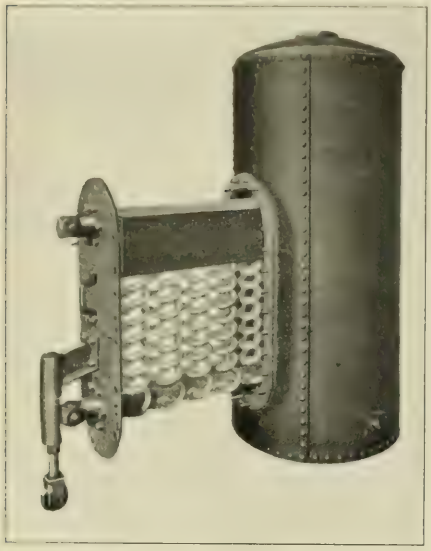
†Nominal.

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Submerged Type Evaporator

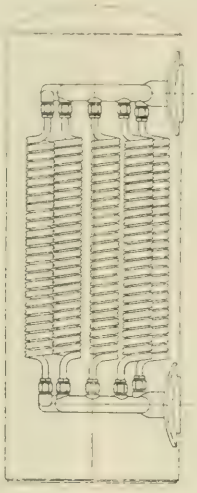
The Griscom-Russell Company of New York City has recently brought out a submerged-type evaporator which is fitted with a new type of coil that is said to be self-scaling. The evaporator is constructed of cast iron, steel, copper or composition shell, depending upon the requirements. In all types, the arrangement of coils and internal parts is identical. The standard shells are made either of close-grained gray cast iron or open-hearth boiler and flange steel with doors and frames to correspond. Copper or composition shells are furnished specially and to specification only. The manifolds to which the coils are attached are of special composition or cast iron. The coils are of seamless drawn brass tubing, tinned or plain, rolled to shape, without filling, in order to secure a uniform thickness of metal throughout. The coil ends are equipped with quickly detachable flanged joints, free from brazing, making a metal-to-metal cone-faced bolted joint. Practically indestructible baffles are arranged so as to increase circulation and prevent priming. The manifolds are securely bolted to the door, the coils being bolted to the steam and drain manifolds, thus permitting the entire nest of coils to be removed upon opening the door. The weight of the door is taken off the hinge studs by means of a jack roller. Attached to the upper manifold is a slotted standard which guides the door when it is opened by engaging with a fixed T track firmly attached to the interior of the shell. The weight of the coils and manifolds is carried by composition rollers inside the evaporator. Zinc plates are used in steel shell evaporators, and are conveniently arranged for replacement.



SUBMERGED TYPE EVAPORATOR WITH SINGLE MANIFOLD

Feed-Water Heater

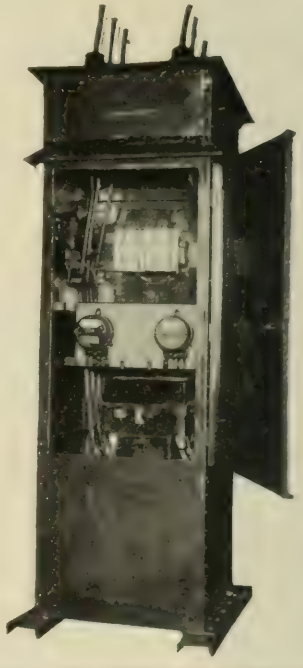
The feed-water heater shown in the accompanying illustration contains a group of helical coils connected in parallel between the inlet and outlet headers and in which water is heated by surrounding steam. The water to be heated does not come into contact with the steam and is therefore not contaminated with oil or other impurities suspended therein. The cylindrical shell, concave bottom and convex head are made of open-hearth boiler-plate steel, or cast-iron, as specified. The side of the shell is provided with an extra large inspection door of steel having the same radius as the shell. The manifolds, which are alike at inlet and outlet, are made of cast iron or bronze of a segmental type that permits a smooth flow, and are in contact with the shell only at the side where the connections are made. The coils are made of seamless drawn copper, are interchangeable, and have a helical form, which relieves the joints of practically all strain. Being corrugated in section, the coils present a large amount of surface for heat transfer. The helical form also permits a large amount of heating surface in a small space and yet permits free circulation of the steam. The heater is manufactured by the Whitlock Coil Pipe Company of Hartford, Conn., for Row & Davis, Engineers, Inc., 90 West Street, New York City.



ARRANGEMENT OF COILS IN FEED-WATER HEATER

Outdoor Meter-Houses

Meter-houses each containing a watt-hour meter with calibrating and testing terminals mounted on a slate base, two current transformers, and for higher voltages, two voltage transformers, are manufactured by the Westinghouse Electric Manufacturing Company of East Pittsburgh, one type of which is shown in the accompanying illustration. The standard meter-houses are constructed of steel and are designed for mounting on poles, walls, or towers. A large steel door permits ready access for reading or calibrating the meter. All internal wiring from the inlet to the outlet bushings is completed before the equipment leaves the factory, so the only wiring necessary to place the meter-house in service is to make the external connections to the power lines. Low cost and the ease with which the houses may be transported to any locality, and installed, are the chief advantages of the portable meter-house. Standard outdoor meter-houses of the type illustrated are manufactured in sizes suitable for currents up to 800 amp. and for pressures up to 7500 volts, both single-phase and polyphase, 25 and 60-cycle circuits. Equipments for high-tension transmission lines are often housed in a similar manner, the casing being equipped with a separate oil compartment for the transformer, choke coils, and high-tension outdoor terminals.



PORTABLE WEATHERPROOF METER-HOUSE FOR OUTDOOR SERVICE

Self-Aligning Ball Bearing Installation

Two distinct operations are performed in two seconds by the machine shown in the accompanying illustration that is used for making paper con-

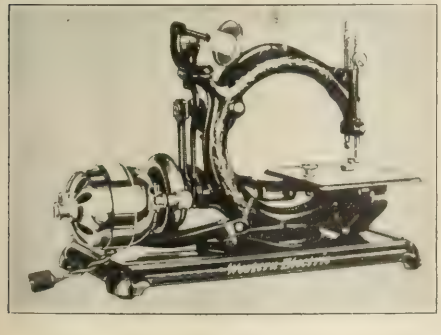


PAPER CONTAINER MACHINE WITH BALL BEARINGS

tainers. As there are continual vibrations and stresses due to wide variations in the materials fed into the machine, it is essential to use self-aligning ball bearings. The dies are made and standardized for materials 0.03 in. thick. However, it is common occurrence to pass through the machine material varying from 0.023 in. to 0.045 in., since the results are the same as with the standard thickness, due to the self-aligning ball bearings. As may be readily seen, it is essential that flexibility be obtained through these bearings. The bearings used are manufactured by the S K F Ball Bearing Company, Hartford, Conn.

Portable Sewing Machines

The Western Electric Company of New York has recently completed its line of portable sewing machines, consisting of three types—vibrator, rotary and automatic. Each type has a small

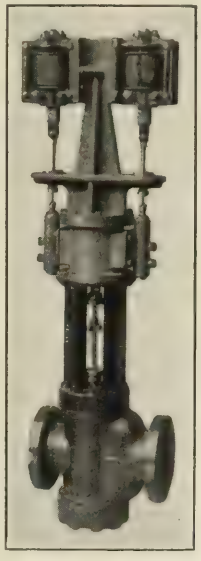


MOTOR-DRIVEN SEWING MACHINE

electric motor fastened permanently to the head. The motor will operate on either alternating or direct-current energy and has a foot control that gives any desired speed. The vibrator type makes use of the principle of the vibrating shuttle and is equipped with an automatic tension, an automatic stitch regulator and other desirable features. The rotary type differs from the vibrator in that it has a rotating bobbin, is geared higher, and runs one-third faster. The automatic type, shown herewith, is also known as the single-thread machine. It produces a chain stitch without a bobbin.

Automatic Regulator for Pulpwood Grinders

The automatic pressure regulator for pulpwood grinders shown in the accompanying illustration has been developed by the Westinghouse Electric & Manufacturing Company of East Pittsburgh. Among the numerous advantages claimed for this regulator are: Prevention of peak-load charges and overload on motors; elimination of underloads, so that motors may oper-



REGULATOR THAT AUTOMATICALLY PREVENTS PEAK-LOAD CHARGES ON PULPWOOD GRINDERS

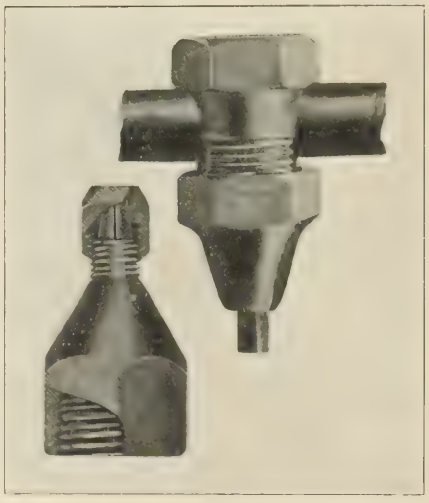
ate at practically 100 per cent load factor, and an increase in the production of groundwood with improvement in quality and uniformity of the pulp. It causes a reduction in the amount of splinters or "shives" and in the amount of short fiber carried away in the white water, is foolproof, and can be adjusted to control the grinder load only or the entire mill load. This causes a secondary relay or magnetic switch to operate, thereby energizing one of the solenoids of an hydraulic regulator valve. The core of the solenoid then raises, admitting hydraulic pressure to the upper end of the cylinder and subsequently opening the balanced regulating valve. This allows an increase in pressure in the grinder cylinders, increasing the load on the motor driving the grinders.

When the electric load has reached the point for which the primary relay is set, the primary circuit is broken, causing the secondary relay to break the secondary circuit. The core of the solenoid then drops, forcing the pilot valve piston to the lower position and preventing the admission or escape of water from the hydraulic cylinder. Consequently, the piston of the hydraulic cylinder is locked in the exact position it occupied when the pilot valve closed.

If the load should increase above the point for which the primary relay is set, the other switch of the secondary relay would close, energizing the other solenoid and opening the other pilot valve. Under these conditions pressure is applied to the lower end of the hydraulic cylinder through one of its ports and water is discharged from the upper end of the cylinder through its other port. Thus some of the pressure is applied to the grinder pockets and consequently the load on the grinder motor are reduced.

Solderless Grounding Devices

The Fargo Manufacturing Company of Poughkeepsie, N. Y., has recently developed several types of grounding devices which are shown in the accompanying illustrations. At the left is a ground device consisting of a ground point which has a standard pipe thread that may be screwed into the end of a pipe of any desired length. The cap has a solderless connection which can be easily removed for testing the ground and can be replaced after the tests have been completed. Another type of grounding device developed by this company consists of a ground point for the lower end of the pipe a cone-shaped cap and a bushing to be placed on the upper end of the pipe to support the cone. After the wire is placed in the cone, the cap is screwed to the pipe and a cold-weld connection is made which can easily be removed for testing purposes. At the right is a ground connection that is



TWO TYPES OF SOLDERLESS GROUNDING DEVICES

especially designed for making connections to water pipes in buildings as is sometimes required for electric-light and telephone service. This form of ground fits snugly around the pipe and forms a solderless cold-weld connection.

Trade Notes

ETHERAL SIGN SYSTEM (Electric) at the last meeting of the board of directors added the following to the board: Frank J. Baker, William A. Fox, John H. Gulick, Martin J. Insull and Charles A. Munroe. Samuel Insull as chairman of the board, and all of the other old directors were re-elected.

SOCKETS.—Pass & Seymour, Inc., of Solvay, N. Y., has been forced to temporarily withdraw No. 1715 pull chain candelabra sockets from the market.

LEWIS & ROTH COMPANY has changed its address from 311 Denckla Building, Philadelphia, Pa., to 1012 Liberty Building, Philadelphia, Pa.

THE DE LAVAL STEAM TURBINE COMPANY, Trenton, N. J., manufacturers of steam turbines and helical reduction gears, announce the opening of a district sales office in the Smith Building, Seattle, Wash., in charge of William Pullen.

HOME SPECIALTY MANUFACTURING COMPANY has changed its name to the Home Specialty Company.

THE CENTRAL CONSTRUCTION CORPORATION of Harrisburg, Pa., has acquired the business and property of the Central Construction & Supply Company. This corporation is equipped to design and construct manufacturing plants, power plants, railroad terminals and construction projects generally. The officers are: George B. Tripp, president, formerly vice-president United Gas & Electric Engineering Corporation; Joseph H. O'Brien, vice-president, formerly managing engineer Westinghouse, Church, Kerr & Co.; Charles E. Covert, secretary and treasurer, formerly treasurer of the Central Construction & Supply Company.

M. SARBINSKY, formerly city electrician and secretary of the department of public utilities of the city of Cleveland, has opened an office as consulting electrical engineer in the Citizen' Buildings, Cleveland, Ohio. Mr. Sarbinsky was recently president of the Service Electrical Company, an electrical contracting concern of Cleveland, and has since then been engaged in preparing plans and specifications for electrical installations in buildings, subways, bridges, hotels, etc. Mr. Sarbinsky would like to receive catalogs and be placed on the mailing list of manufacturers of such electrical equipment as is used in power houses, line, railway, and underground construction, in addition to that in building installations.

THE ESTERLINE COMPANY announces the appointment of James G. Biddle as district sales agent for Esterline efficiency instruments for the State of New York and the New England States, with the principal office for this territory at 90 West Street, New York City. The home office of James G. Biddle, 1211 Arch Street, Philadelphia, Pa., has for a number of years been the sales agent of the Esterline Company in eastern Pennsylvania and New Jersey, which is to be continued. This arrangement is the result of the increased business of the Esterline Company in the New York and New England territory and will result in increased facilities for handling the business in territory contingent to New York. The New York office is in charge of H. H. Sticht, resident sales engineer.

C. O. HALL, 147 West Thirty-fifth Street, New York City, New York representative of the Peerless Electric Company and the Kimble Electric Company, has recently secured the Eastern representation for the polyphase motors manufactured by the Howell Electric Motor Company and ventilating fans manufactured by the Batterman-Truitt Company of Chicago.

H. W. JOHNS-MANVILLE COMPANY'S Louisville, Ky., branch will be located after March 15 at the corner of Fourth Avenue and Guthrie Street.

B. J. GRIGSBY has associated himself with the Anderson Electric Specialty Company, 562-564 West Van Buren Street, Chicago, and will take his position as vice-president and general manager early in March. Mr. Grigsby was managing director of the Benjamin Electric, Ltd., London, England, from the date of its organization in 1908 until he resigned in December last to return to the United States.

THE ROTO COMPANY, Hartford, Conn., announces that J. D. Cherry has been appointed to the position of sales manager. Mr. Cherry is now in charge of sales of Roto tube cleaners. For a number of years he has been selling steam and fuel economy devices over a large territory in the middle West.

THE RAMEY COMPANY, Chillicothe, Ohio, is moving its plant to Columbus, Ohio, where the concern has found better manufacturing conditions and shipping facilities.

MR. C. E. INGALLS, who was formerly connected with the Chester Wheeler Company's Los Angeles office and has more recently been with the company in the East, has just been transferred to the San Francisco office.

SCHWEITZER & CONRAD, Chicago, Ill., announce that they have just moved their factory from 1470 Barbara Avenue to their new building at 1431-1439 Ravenswood Avenue. The new building is one story, sawtooth construction, 100 ft. by 150 ft.

MORAN & HASTINGS TO MAKE NEW FIXTURES.—Beginning March 1, 1917, the Raymo fixtures which were formerly marketed by John D. Raymond will be manufactured exclusively and sold by the Moran & Hastings Manufacturing Company, 16 West Washington Street, Chicago. John D. Raymond will be associated with this concern in handling the Raymo products and other specialties manufactured by it.

THE WASHINGTON PIPE & FOUNDRY COMPANY, Tacoma, Wash., manufacturers of machine banded and continuous wooden stave pipe, announces the opening of an Eastern office in New York City at 3904 Woolworth Building.

WASATCH OZOKERITE COMPANY, Soldier Summit, Utah, contemplates a change in method of treatment of crude material. A new plant will be erected which is expected to handle 1000 tons of crude ozokerite per day. Ozokerite, which is used extensively in the manufacture of insulators, was formerly imported almost entirely from Austria. The war has cut off this supply and the American material is now being used. This Utah deposit is the only known commercial deposit of ozokerite in the United States and there is every reason to believe that even after the war the American product will be able safely to compete in the domestic market with the Austrian product.

Trade Publications

METERS.—Alternating-current watt-hour meters, single-phase and polyphase, are described in Bulletin No. 46 recently issued by the Sangamo Electric Company of Springfield, Ill. This bulletin supersedes Bulletin No. 40.

AMPERE-HOUR METERS.—Bulletin No. 45, descriptive of Sangamo ampere-hour meters, has been prepared by the Sangamo Electric Company of Springfield, Ill. This bulletin supersedes Bulletin No. 36.

WIRE ROPE.—John A. Roebling's Sons Company, Trenton, N. J., is distributing a bulletin on its standard wire rope.

AIR STATION.—The Black & Decker Manufacturing Company, Baltimore, Md., is distributing an illustrated leaflet descriptive of its Lectroflater Free Air Station.

LIGHTING PLANT.—The Main Electric Manufacturing Company of Pittsburgh, Pa., is distributing a large four-page folder descriptive of its complete line of electric lighting and power plants.

VERTICAL ALTERNATORS. — "Bank Your Water Power" is the title of a carefully prepared and well-illustrated bulletin recently issued by the Electric Machinery Company of Minneapolis, Minn. This bulletin describes particularly an efficient type of installation for waterpowers of low head. The vertical alternator is direct-connected to a vertical waterwheel.

EVAPORATORS.—The Griscom-Russell Company, 90 West Street, New York City, has prepared bulletin No. 311, descriptive of its Reilly submerged type evaporator.

CONNECTORS.—The Fargo Manufacturing Company of Poughkeepsie, N. Y., has recently issued two bulletins descriptive of its solderless connectors and grounding devices.

MOTOR TRUCKS.—"Motor Trucks of America" is the title of the 1917 volume issued by the Truck Tire Department of the B. F. Goodrich Company of Akron, Ohio. This book treats the subject of lengthening the life of the motor truck. This volume will be of help to everyone interested in motor trucks.

CHEMICAL APPARATUS.—The J. P. Devine Company of Buffalo, N. Y., has recently issued miniature Bulletin No. 105, descriptive of Devine Apparatus for the Chemical and Allied Industries. This covers complete chemical, color and dyestuff plants, evaporating, concentrating and drying equipment.

New Incorporations

THE COSGROVE-COOK COMPANY, 53 Newark Street, Hoboken, N. J., has been incorporated with a capital stock of $50,000 by Charles F. Cosgrove, Edward Cook and George A. Enright. The company proposes to do a general electrical engineering and contracting business.

THE MARDELVA ELECTRIC & ENGINEERING COMPANY of Dover, Del., has been chartered by Daniel O. Hastings of Wilmington, Del., James P. Bryan, Robert M. P. Kenton and John B. Hutton of Dover, Del., L. LeRoy Gritzen of Baltimore, Md., and Frank C. Bancroft of Camden, Del. The company is capitalized at $150,000 and proposes to install isolated lighting plants.

THE BONNELL ELECTRIC MANUFACTURING COMPANY of New York, N. Y., has been incorporated by R. Wellman, H. F. and W. A. Bonnell. The company is capitalized at $50,000, and proposes to do a general contracting business, etc.

THE WHITESIDE MANUFACTURING COMPANY of New York, N. Y., has been incorporated with a capital stock of $30,000 to manufacture and deal in surgical, electrical, chemical and scientific apparatus, materials, etc. The incorporators are: O. Sampter, J. A. Anger and A. J. Sommer, 302 West 103d Street, New York, N. Y.

THE ELECTRICAL TESTING LABORATORY of New York, N. Y., has filed articles of incorporation with a capital stock of $10,000 to do a general electrical contracting business. The incorporators are: T. F. Gorman, W. Townley and J. F. Burns, Jr., 160 Flushing Avenue, Astoria, N. Y.

THE GREELEY ELECTRIC COMPANY of Brooklyn, N. Y., has been chartered by C. W. Hagen, E. E. Higbee and W. J. Killoch, 630 East Fourth Street, Brooklyn, N. Y. The company is capitalized at $5,000, and proposes to manufacture and deal in electric fixtures, telegraph, telephone supplies, etc.

THE ALLIED ENGINEERING COMPANY of New York, N. Y., has been chartered with a capital stock of $10,000 by M. Rettig, L. F. Ditthoefer and A. A. Wohlauer, 400 West 150th Street, New York, N. Y. The company proposes to manufacture and deal in electric lighting fixtures and equipment.

DANIEL R. DOUGLAS & CO. of New York, N. Y., has been incorporated by A. E. and D. R. Douglas and A. P. Sheridan, 136 Liberty Street, New York, N. Y. The company is capitalized at $15,000, and proposes to manufacture and deal in pipe, boiler covering and insulating materials.

THE MECHANICS' ELECTRIC SERVICE COMPANY of Chicago Ill. has been chartered with a capital stock of $1,000 by S. A. Rolf, G. E. Peterson and A. E. Stein.

THE TULSA (OKLA.) ELECTRIC SHOP has been incorporated by David Evans, G. E. Williams and R. L. Emler. The company is capitalized at $10,000, and proposes to manufacture electrical appliances.

THE SUPERIOR ELECTRICS of Pembroke, Ont., has been chartered with a capital stock of $100,000, to manufacture electrical machinery, etc. The incorporators are: John H. Reeves, Leonard S. Mackie, James R. Lockhart and others.

THE WILLIAM SLATER ELECTRICAL COMPANY of Memphis, Tenn., has been incorporated by W. Slater, Y. Slater, K. S. Cooper and J. L. McRee. The company is capitalized at $10,000, and proposes to do a general electrical business, steam heating, etc.

THE T. F. KEEGAN ELECTRIC COMPANY of Lewiston, Me., has been incorporated with a capital stock of $10,000 to do a general manufacturing business. The officers are T. F. Keegan, president and treasurer, and W. H. Clifford, clerk, both of Lewiston.

THE PEERLESS LIGHT COMPANY of Portland, Me., has been incorporated by Albert F. Jones, T. L. Croteau, P. B. Drew, A. B. Farnham and George S. Soule of Portland, Me. The company is capitalized at $506,000 and proposes to manufacture and deal in gas and electric lamps, fixtures, devices, equipment, etc.

STINSON & GOULD, INC., of Buffalo, N. Y., have filed articles of incorporation with a capital stock of $10,000, to manufacture storage batteries, electric machinery and auto equipment. The incorporators are: R. H. Templeton, C. F. Gould and J. E. Stinson, 27 Dorchester Road, Buffalo, N. Y.

New England

AUGUSTA, ME.—The Central Maine Power Company has petitioned the State Legislature for authority to purchase plants, franchises, etc., subject to the approval of the Public Service Commission, of Bath & Brunswick Light & Power Company, the Penobscot Bay Electric Company, the Waldoboro Water & Electric Light & Power Company, the Hartland Electric Light & Power Company, the Union Light & Power Company, the Newport Light & Power Company and the Wicasset Electric Light Company.

RAYMOND, N. H.—The Raymond Electric Company has purchased a water power site about 1 mile distant from the present steam plant, and contemplates the construction of a concrete dam and power house. The initial installation will include a 200-hp. water wheel and generator. C. F. Gardner is manager.

GRANBY, VT.—The property of the Granby Municipal Lighting Company is reported to have been purchased by Charles H. Thompson of Montpelier and associates, who have formed a company to be known as the Vermont & Quebec Power Company. Preparations are being made to connect the Granby plant with the one controlled by the same parties at Richford, Vt.

BOSTON, MASS.—Among the improvements contemplated by the Edison Electric Illuminating Company of Boston are included the erection and equipment of two substations and the installation of two 30,000-kw. generators in the main power station at L Street.

CHICOPEE, MASS.—The Board of Electric Light Commissioners contemplates the erection of new 3750-kva., outdoor substation to connect with the transmission line of the Turner Falls Power & Electric Company. Some changes are being made to the street-lighting system.

FALL RIVER, MASS.—Plans are being considered by the Fall River Electric Company for extensions to its plant this summer, which will include the installation of a 6250-kw., General Electric turbo-generator. During the year a 66,000-volt, double-circuit, steel-tower transmission line will be erected connecting the steam plant of the company with the transmission lines of the New England Power Company at East Providence, R. I. A substation will be erected on the Taunton River, which will be equipped with three 5000-kva. transformers. The company is also considering an extension of its lines to Dighton, 10 miles distant.

WEBSTER, MASS.—The installation of an ornamental lighting system in the business district is under consideration. The street-lighting service is supplied by the Webster & Southbridge Gas & Electric Company of Webster. H. S. Shaw is manager of the company.

Middle Atlantic

AUBURN, N. Y.—The Empire Gas & Electric Company is planning to install a 2000-kva. synchronous condenser at its power station in Auburn and also at its plant in Geneva. Ten three-phase automatic-feeder regulators will be installed in the substation and a water power will be developed (about 500 kw.) on the Canandaigua Outlet at Lyons. L. C. Reynolds is general superintendent.

BROOKLYN N. Y.—Bids will be received by Robert Adamson, fire commissioner, Eleventh Floor, Municipal Building, New York City, until March 14, for furnishing and installing one 8-section, 80-cell storage battery for engine house No. 217, borough of Brooklyn. Blank forms and further information may be obtained at the above office.

DUNDEE, N. Y.—Edward L. Bailey, owner of the local electric-light plant, is gradually extending the electrical service throughout the township of Starkey Township, reaching the small communities and summer colonies at Seneca Lake and intermediate farms and vineyards. The purchase of energy from the Elmira Water, Light & Railroad Company or the Taylor Chemical Company, which has a large hydroelectric development on the Keuka River, between Penn Yan and Seneca Lake, about 10 miles distant, is under consideration.

FORT ANN, N. Y.—Bids will be received by the Board of Trustees of Fort Ann, until March 15 for construction of water works system, including mechanical gravity plant, pumping station and equipment, and 250 tons of 6-in. and 8-in cast-iron pipe. Charles E. Perry, 36 State Street, Albany, N. Y., is consulting engineer.

FRANKLIN, N. Y.—The Delaware & Otsego Light & Power Company is contemplating the erection of an electric transmission line to Meridale, through the village of Treadwell, a distance of about 11 miles, and it may also build a line to Sidney Center, a distance of 5 miles. H. D. Mackey is manager.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

MECHANICSVILLE, N. Y.—The capital stock of the Halfmoon Light, Heat & Power company has been increased from $75,000 to $150,000, the proceeds to be used for expansion to business.

NEW YORK, N. Y.—The Sixth Avenue Association is considering the feasibility of using the elevated railroad structure for street-lighting purposes.

NEW YORK, N. Y.—Bids will be received by Robert Adamson, fire commissioner, Eleventh Floor, Municipal Building, New York City, until March 14, for furnishing 1500 terminal boxes for fire alarm posts. Blank forms and further information may be obtained at the above office.

NEW YORK, N. Y.—Bids will be received by Robert Adamson, fire commissioner, Eleventh Floor, Municipal Building, New York City, until March 16, for furnishing three portable insulation testing outfits. Blanks, forms and further information may be obtained at the above office.

NEW YORK, N. Y.—Application has been made to the Public Service Commission by the Interborough Rapid Transit Company, 165 Broadway, for permission to issue $16,436,000 in bonds, the proceeds to be used as follows: For alterations in power plants, $2,391,000; extensions and equipment, $2,533,000, and for third-track installation and equipment, $10,444,000.

NEW YORK, N. Y.—Bids will be received by Robert Adamson, fire commissioner, eleventh floor, Municipal Building, New York, N. Y., until March 13, for furnishing and installing subsidiary pipes and installing fire alarm posts from Eighty-second Street to Fort George Avenue, in the borough of Manhattan. Blank forms and further information may be obtained at the above office.

NEW YORK, N. Y.—Bids will be received by the Department of Charities, tenth floor, Municipal Building, New York City, until March 21 for furnishing material and installing fire signal systems in the various groups of buildings under the jurisdiction of the Department of Charities. Blank forms and further information may be obtained at the office of Porter & Himmelwright, engineers, Fifth Avenue Building, New York City, where plans and specifications may be seen. John A. Kingsbury is commissioner.

ROCHESTER, N. Y.—Tentative plans are being prepared by the Buffalo, Rochester & Pittsburgh Railway Company of Rochester with a view of constructing a power house, machine shop, blacksmith shop, storehouse, coaling station and additions to roundhouse, which if carried out will involve an expenditure of about $200,000.

TOMPKINSVILLE, N. Y.—The electric plant of the Tompkinsville Electric Light & Ice Company was recently destroyed by fire, causing a loss of about $8,000. Arrangements are being made for temporary service and also for rebuilding the plant.

ALLENTOWN, PA.—Extensive improvements are being made to the transmission system and distributing lines of the Lehigh Valley Transit Company over the entire system from Philadelphia to Slatington. About $110,000 has been expended and the cost of the proposed work is estimated at about $200,000.

HAZLETON, PA.—The Harwood Electric Company is contemplating installing an electric lighting system in Conyngham near Hazleton.

HAZLETON, PA.—The Harwood Electric Company is negotiating with different municipalities in this vicinity for the installation of electric distributing system. The company proposes to supply electrical service to all towns and cities within a radius of 25 miles.

HEREFORD, PA.—A company is being organized by A. E. Ward and W. H. Schubert to supply electrical service in Hereford and Washington Townships.

LANCASTER, PA.—The Edison Electric Company is considering the erection of a new boiler plant, 50 ft. by 82 ft., at its linoleum factory, to cost about $10,000.

MILLERSTOWN, PA.—The Perry Electric Light, Heat & Power Company of Newport is contemplating the installation of a street-lighting system in Millerstown.

PHILADELPHIA, PA.—The Philadelphia & Reading Railroad Company has awarded a contract to F. A. Havens & Company, 845 North Nineteenth Street, Philadelphia, for the erection of a power house, 49 ft. by 120 ft., at its local yards.

PHILADELPHIA, PA.—Bids are being received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the construction of a one and one-half story machine and electric shop, 150 ft. by 500 ft., at the navy yard, Philadelphia, to cost about $500,000.

PHILADELPHIA, PA.—The cost of the proposed subways and elevated lines is placed at $90,000,000, with additional $14,000,000 for necessary operating equipment. The present appropriation of $63,000,000 is to be used for construction of subways, delivery loops and work on Frankford elevated road. W. S. Twining, 754 Bourse Building, is director of transit department.

HILADELPHIA, PA.—Bids will be received by the Director of Department of Public Works and the Board of Trustees of the Free Library of Philadelphia, Room 201, City Hall, Philadelphia, until March 27, for erection of the building for the Free Library of Philadelphia. Bids will be received for this work under four separate proposals as follows: (1) For the entire work, excepting plumbing, heating and ventilating work and the electrical work; (2) plumbing work; (3) heating and ventilating work; (4) electrical work. Plans and specifications may be secured upon application to Horace Trumbauer, architect, 1406 Lankd Ttitle Building, Philadelphia. The amount available for construction of this building is $3,050,000.

POCOPSON, PA.—Application has been made to the Governor of the State of Pennsylvania by C. R. Maguire, J. C. Murtagh and Herman H. Wilson for a charter for the Pocopson Township Electric Company for the purpose of supplying electricity for lamps, heaters and motors in the township of Pocopson. Townsend, Elliott & Munson, 715 Walnut Street, Philadelphia, are solicitors.

POTTSVILLE, PA.—The Philadelphia & Reading Railway Company, it is reported, is planning to equip its system from Pottsville to Schuylkill Haven, and thence to Reading, a distance of 37 miles, for electrical operation. The cost is estimated at $750,000.

READING, PA.—The Reading Engineering works is reported to be in the market for a 70 to 100-kw., three-phase, 60-cycle generating unit, consisting of a generator and steam engine.

SELLERSVILLE, PA.—The engine house of the Rock Hill Industrial Company, near Sellersville, was recently destroyed by fire.

TILSONBURG, PA.—Plans are being considered by the Canadian Cereal Company for equipping its mills throughout for electrical operation.

WAYNESBORO, PA.—The Waynesboro Electric Light & Power Company is planning to extend its transmission lines to furnish electrical service in the Buena Vista Springs district.

WILKES-BARRE, PA.—The Public Service Commission has given its approval of the franchise granted to the Wilkes-Barre Light Company; also of the five-year contract for street-lighting recently awarded the company.

YEADON, PA.—The Theodore Presser Company of Philadelphia is contemplating the erection of a power station, 70 ft. by 70 ft., at its local printing plant.

ELMER, N. J.—The American Railways Company of Wilmington, Del., a subsidiary of the National Properties Company, is planning to install an electric-lighting system in Elmer.

GIBBSTOWN, N. J.—The Borough Council is considering the installation of a street-lighting system between Gibbstown and Paulsboro. A proposition to acquire the local street-lighting system is also under consideration.

IRVINGTON, N. J.—The Town Commission is considering awarding a contract to the Public Service Electric Company for street-lighting for a period of five years. An appropriation of $14,000 has been made for street-lighting.

NEWARK, N. J.—Bids will be received by the Board of Freeholders until March 13 for the installation of boilers and equipment at Overbrook Hospital, Cedar Grove. Plans and specifications are on file in the office of Runyon & Carey, consulting engineers, 845 Broad Street, Newark.

TRENTON, N. J.—To provide for the installation of the proposed ornamental street lighting system in the business section, a bill has been introduced in the legislature authorizing assessments of abutting

property holders profiting by the improvement.

NEW CASTLE, DEL.—The plant of the Delaware Water Improvement Company, including engine house, pump room and electric transformer station, was recently destroyed by fire, causing a loss of about $50,000.

BLUEFIELD, W. VA.—The Appalachian Power Company is contemplating extensions to its transmission lines during the coming year, but as yet definite plans have not been decided upon. At the present time an 88,000-volt transmission line, 26 miles long, is under construction. The company has decided to erect 20 miles of 13,000-volt transmission line at once.

KENOVA, W. VA.—The installation of a 10,000-hp turbine with condensers in the local plant is under consideration by the Consolidated Light, Heat & Power Company. The company is now erecting a high-tension transmission line from Kenova to Ironton, 12 miles long, and is also considering the installation of a pumping plant at the Big Sandy River.

WHEELING, W. VA.—The Wheeling Electric Company is planning to erect a 66,000-volt transmission line from Wheeling to Windsor, a distance of 12 miles, some time this year. A 66,000-volt transmission line from Wheeling to Moundsville, 10 miles long, is now being erected by the company.

WHEELING, W. VA.—The Sunnyside Electric Company is contemplating the extension of its 66,000-volt transmission line from Dillonvale, Ohio, to Amsterdam, Ohio, a distance of 25 miles, and from Fairport to Flushing, Ohio, 9 miles. The company will probably erect several short extensions of from 1 to 4 miles in length to furnish energy to the coal mines in the district it serves.

WASHINGTON, D. C.—Bids will be received at the office of the purchasing agent of the Post Office Department, Washington, D. C., until March 28 for furnishing electrical supplies, including motors, carbons and fuses, duplicating devices, rubber goods, computing, mailing, addressing, opening, adding (check writing) and perforating machines, time recorders, etc., as they may be ordered for use for the postal service during the fiscal year beginning July 1, 1917, and ending June 30, 1918. Blanks for proposal, with specifications and instructions to bidders, will be furnished upon application to the purchasing agent.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until March 21 for furnishing and installing lighting fixtures in the United States Post Office at Aberdeen, Wash.; Alliance, Ohio; Belton, Tex.; Douglas, Ariz.; Grinnell, Iowa; Little Falls, Minn.; Maryville, Tenn.; Minden, La.; Neenah, Wis.; Redfield, S. D., and St. Petersburg, Fla.; also at the United States Post Office, Custom House and Courthouse at Corpus Christi, Tex., in accordance with plans and specifications, copies of which may be obtained at the above office.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Brooklyn, N. Y., Schedule 786—166,000 ft. of telephone cord, 520,000 ft. bell wire, 47,000 ft. twin-conductor wire; Schedule 784—125,000 ft. rubber-covered single wire; Schedule 794—462 brass lamp feeders. Mare Island, Cal., Schedule 802—264 brass grease cups; Schedule 802—90 Klinger type gauge glasses. Philadelphia, Pa., Schedule 786—9300 plug fuses; Schedule 784—200 seamless steel boiler tubes. Newport, R. I., Schedule 778—150 air pressure gages, 120,000 ft. fiber rod tubing. Mare Island, Cal., and Brooklyn, N. Y., Schedule 776—miscellaneous steam sirens, whistles, etc. Brooklyn, N. Y., Philadelphia, Pa., Schedule 787—5300 steel wire casting brushes. Puget Sound, Wash., Schedule 802—90 electric soldering irons. Applications for proposal blanks should designate the schedule desired by number.

North Central

BALDWIN, MICH.—Grand Rapids and Muskegon capitalists, it is reported, are interested in a proposition to develop a water power on the Pere Marquette River, near Baldwin. Options have been secured on 16 miles of river lands above the site, as well as the purchase of 2 miles outright, it is said, have been secured by V. W. Montgomery of Reed City.

BENTON HARBOR, MICH.—The Superior Steel Casting Company is planning to build an extension to foundry, 140 ft. by 142 ft., and expects to purchase a 10-ton electric traveling crane, two 250-hp. motors, an electric furnace and an air compressor. The company, it is stated, will build in the near future a two-story pattern and office building, 50 ft. by 100 ft., and also erect a unit power house.

BURR OAK, MICH.—Franchises have been granted to the United Electric Company of Burr Oak to erect transmission lines through several townships in Calhoun and Branch Counties. The company is also seeking franchises to supply electricity in Athens, Tekonsha and other villages.

HOLLY, MICH.—Plans are being considered by the Consumers Power Company of Flint to supply electricity in Holly under a franchise granted to the Independent Power Company four years ago. The company, it is understood, has an option on the Holly plant and equipment.

LOWELL, MICH.—Bonds to the amount of $40,000 have been voted for rebuilding the municipal electric-light plant.

PETOSKEY, MICH.—Extensive improvements are contemplated to the municipal electric light and power plant. The upper dam is to be discontinued and the water flumed to the lower dams, where two water wheels will be installed.

SPRINGPORT, MICH.—The installation of a new 40-kw., direct-current generator this year for the municipal electric light plant is under consideration. L. E. Landan is manager.

DAYTON, OHIO.—Plans are being prepared for construction of a plant for the Dayton Rubber Manufacturing Company. The main building will be 150 ft. by 500 ft., one story. The power plant will be in a separate building.

HICKSVILLE, OHIO.—The local system of the North Western Ohio Light Company has been rebuilt for alternating current, energy to be obtained from the main station of the company at Delphos. The local (old) station will be remodeled and used as an auxiliary plant. P. W. French is local manager.

MILFORD, OHIO.—The City Council is considering the installation of a new street-lighting system in connection with the granting of a new franchise which expires in April. The street-lighting service is furnished by the Cincinnati, Milford & Loveland Traction Company. Charles C. Harris of Cincinnati is general manager.

QUINCY, OHIO.—Bonds to the amount of $4,500 have been voted for the installation of a municipal electric lighting system. Energy for operating the system will be supplied by the Allinger Milling Company.

SPRINGFIELD, OHIO.—The Springfield Light, Heat & Power Company has decided to install underground cables at a cost of about $20,000. Other improvements contemplated by the company include extensions to the boiler room of the power station, the erection of a high-tension substation and the installation of a 3000-kva. transformer.

INDIAN BOTTOM, KY.—Preparations are being made to establish a light and power plant at the Stuart-Robinson College at Blackey, Ky., work on which will start within 30 days. For further information address Rev. H. V. Tedlock, principal, Indian Bottom.

WHITESBURG, KY.—Arrangements are being made by W. W. Gibson & Son of Mayking for the construction of an electric-light and power plant in Whitesburg.

CONVERSE, IND.—The property of the Converse Light & Power Company has been purchased by the Indiana Railways & Lighting Company of Kokomo. The Indiana company was also authorized to issue $140,000 in capital stock.

INDIANAPOLIS, IND.—Work has been started by the Indianapolis Light & Heat Company on the construction of its new power plant to be located at Kentucky Avenue and South Street. The portion of the plant to be completed this year will provide space for the installation of ten 1000-hp. boilers, two 20,000-kw. horizontal turbines, with surface condensers and other auxiliary apparatus. A 15,000-ton underwater storage pit for coal will be built in connection with the plant. While the work has been started, all contracts have not yet been awarded.

RICHMOND, IND.—Improvements have been authorized by the Board of Public Works to the municipal electric light and power plant, involving an expenditure of about $50,000. Two 500-hp. boilers will be installed.

CHICAGO, ILL.—Improvements contemplated by the Commonwealth Edison Company during the coming year will include the installation of two additional units in the Northwest station, one 30,000-kw., 60-cycle, 12,000-volt turbo-generator, the other a 35,000-kw., 25-cycle, 9000-volt turbo-generator. The company is installing at its substation a total of 10,000 kw. in 250-volt synchronous converters for the direct-current district, and a total of 30,000 kw. in 60-cycle transformers for other substations, and 18,000 kw. in synchronous converters in railway substations.

PEORIA, ILL.—The capital stock of the Central Illinois Light Company has increased its capital stock from $5,500,000 to $20,000,000, the proceeds to be used for extensions to plants and for the purchase of additional equipment.

ROBERTS, ILL.—The citizens have voted to enlarge the municipal electric light plant.

ROCKFORD, ILL.—The Rockford Electric Company is contemplating extensive improvements to its plant, which will include the installation of a 12,500-kva. Curtis turbine, two 750-hp. boilers. The construction of a 15,000-ton coal storage pit, at a cost of $75,000, is also under consideration. Extensions and other work on its distribution system, involving an expenditure of about $98,000, is also contemplated by the company.

JUDA, WIS.—Preparations, it is reported, are being made by Charles Schwartzlow for the erection of a power plant to supply electricity in Juda.

NESHKORO, WIS.—The property of the Neshkora Light & Power Company has been purchased by the Wisconsin Power, Light & Heat Company of Milwaukee.

SEYMOUR, WIS.—The local electric light plant, owned by S. D. Newell, has been purchased by W. E. Daniels of Worthington, Ind.

WATERTOWN, WIS.—Extensions and improvements are being made to the local plant of the Wisconsin Gas & Electric Company, including the installation of a 2000-hp. motor-generator set with switchboard and other necessary substation equipment.

WAUPACA, WIS.—The property of the Waupaca Electric Light & Railway Company has been purchased by E. A. Aspnes of Montevideo, Minn., and Truman Hibbard of Minneapolis, Minn. The new owners, it is reported, contemplate improvements to the plant and system.

DETROIT, MINN.—Bids will be received by the City Council, City Hall, Detroit, Minn., until March 19 for furnishing and installing one switchboard complete. Plans and specifications may be obtained upon application to the Charles L. Pillsbury Company, engineers, Metropolitan Building, Minneapolis.

FOLEY, MINN.—The Public Service Company of St. Cloud, it is expected, will extend its high-tension transmission line from St. Cloud to Foley in the near future to supply energy to the local company. A. J. Hakes is superintendent.

PARKER'S PRAIRIE, MINN.—The Morrison Electric Company contemplates installing a 45 or 60-hp. engine to replace the 30-hp. engine now in use. If an electric transmission line is erected from Fergus Falls or Little Falls into Parker's Prairie, the company will change its system from direct to alternating current and secure service from the high-tension transmission system. L. J. Morrison is manager.

ROCHESTER, MINN.—Plans, it is reported, have been submitted by Hugh J. Cooper, consulting engineer, 101 Park Avenue, New York, N. Y., to the City Council, for the construction of a hydroelectric plant on the Zumbro River. The cost is estimated at about $600,000.

DEXTER, IOWA.—At an election to be held March 13 the proposal to grant a franchise to the Iowa Electric Company of Marengo will be submitted to the voters.

KANSAS CITY, MO.—The Southwestern Bell Telephone Company has appropriated $4,500,000 for extensions and improvements to its system in the states of Missouri, Arkansas and Texas. Details as yet have not been decided upon, but will include additions, reconstruction and new construction work in various exchanges and toll lines, etc. B. S. Read, 314 North Broadway, St. Louis, Mo., is second vice-president of the company.

MARYVILLE, MO.—The Maryville Electric Light & Power Company will erect an electric three-phase, 22,000 volt transmission line to Barnard, a distance of 15 miles, in the spring, and will also install a 300 to 350-kva. generator directly connected to a Corliss engine. The company may purchase a second-hand unit. Charles C. Hellmers is manager.

ST. LOUIS, MO.—Clyde B. Judd, Wainwright Building, St. Louis, is reported to be in the market for power plant equipment and excelsior making machinery.

ST. LOUIS, MO.—Extensive improvements will be made to the electric plant of the Laclede Gas Light Company during the coming year, which will include the removal of one 1000-kw. generating unit and the installation of a 4000-kw. General Electric generating unit with condensing equipment, increasing the output from 8000 to 12,000 kw. George B. Evans is chief engineer.

HEBRON, N. D.—The Hebron Electric Light & Power Company will make several short extensions to its transmission lines to connect about 20 to 25 additional consumers in outlying districts, material for which has been purchased.

CANBY, S. D.—The Citizens' Light, Heat & Power Company has secured franchises in Clear Lake, S. D., and Hendricks, Minn. Transmission lines will be erected to these places in the spring. Emil W. Erick is general manager.

DELL RAPIDS, S. D.—Plans are being prepared by the Electric Development Company, engineer, Omaha, Neb., for the construction of a municipal electric-light and power plant, to cost about $35,000.

IROQUOIS, S. D.—Improvements are contemplated by W. L. Jordan, owner of the local electric-light plant, including the installation of a new gas engine and generator (about 25 kva.), to pull the day load. Work will probably begin this summer.

PLANKINTON, S. D.—The purchase of the local electric-light plant, owned by F. Marso, it is understood, is under consideration by the City Council.

IMPERIAL, NEB.—Bids will be received by city of Imperial until March 14 for the construction of an electric-light plant. The work will include power house, reconstruction of dam, water wheel, vertical shaft generator, switchboard, 5 miles of transmission line, distributing system and series street-lighting system. The cost of the plant is estimated at $17,300. Grant & Fulton, Bankers Life Building, Lincoln, are engineers.

PLAINVIEW, NEB.—Improvements are contemplated to the municipal electric light, water and power plant, including the installation of an additional 150-hp. boiler, a 150-hp. generating unit (directly connected), a central heating plant in connection with lighting plant, a water supply tank for city water, and probably addition to power house, etc.

CHANUTE, KAN.—Arrangements have been completed by the Kansas Gas & Electric Company for the construction of an electric power plant on the Santa Fe River to cost about $1,000,000. The proposed plant will have an output of 10,000 kw. and will be used as a main generating station for the company's properties in this section. The smaller plants will be used as auxiliaries.

EUDORA, KAN.—Bids will be received by the Board of Commissioners of the First Water and Sewer Districts of Eudora, Ark., until March 21 for construction of a complete water works and sewer system, including oil engines, pumps, steel tower and tank, gates, water pipe, pump house and reservoir. Specifications, etc., may be obtained upon application to Xavier A. Kramer, consulting engineer, Magnolia, Miss.

LAWRENCE, KAN.—Bids will be received by F. D. Brooks, city clerk, Lawrence, Kan., until March 21 for improvements to water works system, including one 3,000,000-gal crank and fly wheel Corliss pumping engine, one 1,000,000-gal. Myer gear crank and fly-wheel pumping engine, boiler and boiler room equipment, one 150-hp. return tubular boiler and equipment for a 3,000,000-gal. rapid sand filter plant. Black & Veatch, Interstate Building, Kansas City, Mo., are engineers.

McPHERSON, KAN.—Plans are being prepared by Black & Veatch, engineers, Interstate Building, Kansas City, Mo., for improvements to the municipal electric-light plant, including the installation of a 250-hp. water tube boiler, a 300-kva. steam driven generating unit (directly connected), feed water heater, boiler feed pumps, necessary high pressure piping, etc.; a brick or concrete chimney, 54 in. in diameter and 90 ft. high, will be erected and necessary changes made to the present power house to provide space for the new equipment. Arthur Groesbeck is superintendent.

NEWTON, KAN.—The City Council is considering the installation of a municipal electric light plant.

WAVERLY, KAN.—Plans are being considered for improvements to the municipal electric light plant.

Southern States

CHARLOTTE, N. C.—Contracts have been awarded by the Southern Power Company for the construction of a hydroelectric plant at Watersee, S. C., to cost about $5,000,000. The new plant will be located 6 miles above Camden, and will connect with the other six plants of the company. The proposed plant will be completed by Nov. 1, 1918, and will have an ultimate capacity of 100,000 hp.

ROCKY MOUNT, N. C.—Extensive improvements are under way at the municipal electric-light plant, including the installation of two N. Y. Continental Jewell filters, two Worthington volute motor-driven pumps of 1500 gal. per minute capacity, air pipe connections for above apparatus and enlarging power house. Further improvements contemplated include the installation of an additional boiler, constructing intake for water supply and condensers and erecting two more circuits from power plant to city. A. S. Lyon is manager.

FOUNTAIN INN, S. C.—The City Council is considering calling an election to submit to the voters a proposal to issue $50,000 in bonds for the construction of electric-light plant, water-works and sewer system.

COPPERHILL, TENN.—The Home Light & Power Company has entered into a contract with the Tennessee Power Company for energy to operate its system, which will take effect as soon as a substation can be equipped. The company will discontinue its local plant and extend its transmission line to cover what is known as the Ducktown Copper Basin, which embraces a territory of 5 miles in diameter and a population of about 15,000. M. C. King is president.

MILLINGTON, TENN.—The electric system of the Millington Light & Water Works will be changed from direct to alternating current this spring and the electrical service extended to take in two small nearby towns. Meters will also be installed for more than a two-light circuit. W. C. Hill is manager.

SOMERVILLE, TENN.—Extensions and improvements to the municipal electric-light plant and water-works system is under consideration by the City Council.

GULFPORT, MISS.—Bids will be received at the office of John T. Connell, director of works, Gulfport, until March 27 for furnishing material and installing electrical system on the grounds and in buildings of the Mississippi Centennial Exposition. For details see proposal columns.

FORT RENO, OKLA.—The War Department has announced that funds are available for the installation of an electric plant at Fort Reno.

MAYSVILLE, OKLA.—The installation of an electric-lighting system in Maysville is under consideration.

SNYDER, OKLA.—The city of Snyder is contemplating extending an electric transmission line to Mountain Park, 2½ miles distant, in the near future. The line will consist of two wires and transmit energy at 2300 volts, 60 cycles. T. H. Kennedy is superintendent.

GOLIAD, TEX.—The Goliad Supply Company expects to erect a new engine room, 45 ft. by 50 ft., and install a 100-kw. generator and a 125-hp. oil engine before fall. Edward F. Glaze is president and manager.

HUBBARD CITY, TEX.—The Union Central Light & Power Company is in the market for second-hand transformers (in first class condition), marble or stone switchboards for 2300-volt, 60-cycle, three-phase electrical apparatus. W. A. Bass is president.

PILOT POINT, TEXAS.—The Pilot Point Ice & Power Company is considering the installation of new dynamos and establishing a day circuit soon.

Pacific States

CHEWELAH, WASH.—The City Council has signed a contract with the Stevens County Power & Light Company for electricity to operate the local system. The local plant will be discarded as soon as transformers are installed.

SULTAN, WASH.—Two notices of appropriation of water (1500 ft. of water per second each) from the Sultan River in the Sultan Basin have recently been filed with the county auditor. Dams, flumes, tunnels, etc., will be used for the diversion of the water. G. D. Hite of Sultan is interested.

VALLEY, WASH.—J. G. Kulzer, owner of the local electric system, will extend his transmission lines to a farming community, a distance of 4 miles. New equipment, including 2-kw. transformers and some 5-kw transformers, all 6600/110 volts, 60 cycles, will be required.

WENATCHEE, WASH.—The water power site known as the Purple property was recently purchased by the Chelan Electric Company, a subsidiary of the Great Northern Railway Company, for $135,000. The property will be used in connection with the electric development of the Great Northern Railway development on Lake Chelan.

BURNS, ORE.—The Electric Light & Power Company has just completed a transmission line to the plant of the Burns Flour Milling Company and has installed a 75-kw. General Electric generator. The company has also entered into a contract with the Burns company for its surplus power and will purchase a 35-in. Samson turbine and develop about 100 hp. additional, which will enable the Electric Company to extend its transmission lines to two or three outlying districts. Roy C Dwyer is secretary and manager.

CONDON, ORE.—The Condon Electric Company contemplates the installation of a 75-hp. oil engine in June to replace the 50-hp. engine now in use. A. B. Bower is secretary and manager.

FRESNO, CAL.—The proposal to issue $4,500,000 in bonds of which $1,000,000 will be issued immediately, will soon be submitted to the stockholders of the San Joaquin Light & Power Corporation. The proceeds of the first million dollars will be used entirely for additions and betterments to present plants of the company and for the purchase of new property.

BAKER, MONT.—The Baker Light & Power Company will install in August a 125-hp. boiler and one three-phase direct-connected unit. Ernest G. Heinrich is owner and manager.

GLASGOW, MONT.—The city of Glasgow contemplates the installation of a 500-hp. Diesel engine in the municipal electric-light plant. C. H. Blitman is manager.

MILES CITY, MONT.—The annual report of J. J. McGill, superintendent of the municipal electric-light plant, recommends improvements to the municipal electric-light plant, including the installation of a new 1000-hp. heater, new stokers for at least three of the five old boilers, the purchase of a new generator for direct connection to the 375-hp. Corliss engine now in use, raising roof of boiler house and remodeling coal conveyor.

ROCK SPRINGS, WYO.—The Union Pacific Coal Company contemplates extending its transmission lines from Rock Springs to Superior within a year to supply electrical service. It also proposes to install one more battery of boilers and a 3500-kw. alternator and the erection of a 33,000-volt, three-phase transmission line to Superior, a distance of 20 miles. B. L. Betcher of Rock Springs is local manager.

CARLSBAD, N. M.—Plans are being prepared by the Public Utilities Company for the installation of a new auxiliary steam or oil driven plant of 150 kw. capacity, to be used in case of emergencies or high water. E. A. Roberts is manager.

Canada

EDMONTON, ALTA.—Plans are being prepared by W. H. Gibson, 11,432 Seventy-ninth Street, Edmonton, for the construction of a lumber mill, to cost about $18,000. Two boilers of 100 and 150 hp., two engines, two high-speed planers, and equipment for an electric-light plant, etc., will be purchased.

WINNIPEG, MAN.—Plans are being considered by the City Council for increasing the output of the Point du Bois power plant to 100,000 hp. The cost is estimated at $150,000.

ST. JOHN, N. B.—The property of the St. John Railway Company, which includes the street railway system, electric-lighting and power and gas plants, has been sold to the New Brunswick Investment Company for $1,300,000. The purchasing company is a holding company for the New Brunswick Power Company and is interested in the development of water power sites near St. John.

CHIGNECTO, N. S.—The Maritime Coal, Railway & Power Company contemplates the purchase of electrically operated pumps, motors, etc., for its plant. R. J. Bell is manager.

MEADFORD, ONT.—The Georgian Bay Milling & Power Company is considering the installation of water wheels of 250 hp. capacity. W. J. Moore is manager.

ST. MARYS, ONT.—The Water and Light Commission is changing the primary voltage of all transformers on lines to 4000 volts grounded star; station transformers connected delta primary and star secondary, using one side of 110 volt secondary as a ground wire, where secondary does not extend; also installing three 50-kva. transformers for 250-hp. condenser and one 100-hp. motor for pump; one 25-hp. motor-driven centrifugal pump and automatic switch, and one 135-hp., six cylinder, high-speed gasoline engine directly connected to multi-stage centrifugal pump, electric and air starter, and also a motor-driven fire whistle. H. M. Miller is superintendent.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, Panama Canal, Washington, D. C., until March 15 for furnishing under proposal 2108, 72 self-lubricating blocks, cable clips, six electric heaters, one rod bender, 100 lb. copper wire, etc. Further information may be obtained at the above office.

1,216,183. Fastening Clip for Wire Terminals; Charles W. Beck, Detroit, Mich. App. filed Aug. 14, 1914. Improved device.

1,216,442. X-Ray Apparatus; Eugene W. Caldwell, New York, N. Y. App. filed July 15, 1914. May comprise polyphase high-potential transformers which may have their secondaries simultaneously connected to a polyphase supply circuit by an operating switch.

1,216,443. X-Ray Apparatus; Eugene W. Caldwell, New York, N. Y. App. filed Mar. 18, 1914. X-Ray tube may be arranged in series with a suitable current equalizing resistance.

1,217,175. Bedside Alarm; Albert O. Hilley, Waco, Tex. App. filed Oct. 15, 1915. New and useful improvements.

1,217,180. Door-Controlling and Signaling System; Marcus M. Hudsbeth, Chicago, Ill. App. filed June 13, 1914. From a remote point.

1,217,187. Synchronous Motor; Austin Kimble, Chicago, and John D. Nies, St. Charles, Ill. App. filed Jan. 2, 1914. Single-phase or polyphase type which are self starting by means of alternating current.

1,217,226. Electrically-Heated Embossing-Base; John H. Schussler, Chicago, Ill. App. filed Feb. 15, 1915. Provide means whereby an improved grade of embossing may be done in an ordinary printing press.

1,217,244. Automatic Starter and Lighter for Automobiles; William A. Turbayne, Niagara Falls, N. Y. App. filed Dec. 2, 1912. In which an electric motor of comparatively small horsepower may be employed.

1,217,229. Electric Air-Heating System; Elmer J. Smith, Detroit, Mich. App. filed Dec. 3, 1915. Heat is distributed by convection of air directly heated from the electric units.

1,217,241. Alarm Signaling Apparatus; Oliver H. Tracy, Minneapolis, Minn. App. filed Nov. 11, 1915. Improvements.

1,217,255. Telephone System; Charles S. Winston, Chicago, Ill. App. filed June 28, 1913. For controlling the ringing of a called-for substation.

1,217,289. Cartridge-Fuse; Alfred L. Eustice, Chicago, Ill. App. filed June 22, 1914. Renewable type.

1,217,301. Maximum-Demand Recorder; Chester I. Hall, Chicago, Ill. App. filed June 18, 1913. Improvements.

1,217,302. Electricity-Measuring Instrument and Timing Device Therefor; Chester I. Hall, Chicago, Ill. App. filed June 18, 1913. Mechanical gearing and rotating parts are entirely done away with.

1,217,306. Electric-Furnace-Wall Construction; Ingenuin Hechenbleikner, Charlotte, N. C. App. filed Sept. 27, 1915. For use in connection with the treatment of phosphate rock to expel phosphoric acid.

1,217,453. Static Protective Device; Ray P. Jackson, Edgewood, Pa. App. filed Jan. 10, 1916. Lightning arresters that are directly inserted in the transmission line conductors and are devoid of ground connections.

1,217,468. Electrode-Holder; John C. Lincoln, Cleveland, Ohio. App. filed July 22, 1916. For electric welding.

1,217,469. Time-Element Relay; Alexander J. Loguin, Norwood, Ohio. App. filed March 23, 1912. To be used in connection with protective devices for electric circuits.

1,217,472. Telephone-Exchange System; James L. McQuarrie, Oak Park, and Frederick H. Loveridge, Chicago, Ill. App. filed April 19, 1906. Interconnection of telephone lines.

1,217,473. Control Apparatus; Donald H. Mace, Edgewood Park, Pa. App. filed Aug. 29, 1916. Liquid rheostats.

1,217,477. Telephone-Exchange Supervisory System; Talbot G. Martin, Chicago, Ill. App. filed July 20, 1916. Semi-automatic systems.

1,217,482. Self-Regulating Dynamo-Electric Machine; Albert Henry Midgley and Charles Anthony Vandervell, Acton Vale, England. App. filed Oct. 30, 1911. Variable speed.

Record of Electrical Patents

Notes on United States Patents issued on Feb. 27, 1917

1,217,183. Transmitting Apparatus for Wireless-Telegraph Stations; Thomas B. Miller, Seattle, Wash. App. filed Aug. 22, 1914. To arrange well-known devices in connection with associated electric circuits whereby a greater proportion of the energy employed by the transmitting apparatus may effectively be utilized.

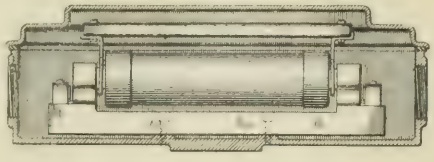
1,217,184. Magneto Ignition System for Internal Combustion Engines; John Lewis Milton, Tiffin, Ohio. App. filed March 18, 1911. For producing a spark which will be hotter and larger than the sparks produced by the systems heretofore.

1,217,497. Electric Furnace; Carl A. Pfanstiehl, Waukegan, Ill. App. filed July 11, 1914. For welding disks of tungsten to the heads of steel or iron tacks, rivets or screws.

1,217,508. Insulator; William Schaake, Pittsburgh, Pa. App. filed Feb. 19, 1914. "Strain" or "suspension" type.

1,217,510. Telephone Trunking System; Michael Schwartz, Chicago, Ill. App. filed March 3, 1913. Improved arrangement of the switches and trunks extending between these switches, whereby more efficient and effective service can be given.

1,217,511. Means for Minimizing Inductive Interference; Charles F. Scott, New Haven, Conn. App. filed Jan. 2, 1915. That may be caused by electromagnetic induction from other circuits located in proximity thereto.



1,217,741—Fuse Holder

1,217,513. Switching Apparatus; Karl A. Simmon, Wilkinsburg, Pa. App. filed Feb. 19, 1914. Pneumatically operated.

1,217,514. Control Apparatus; Karl A. Simmon, Edgewood Park, Pa. App. filed Nov. 6, 1914. Liquid rheostats.

1,217,516. Transmitting Apparatus for Wireless-Telegraph Stations; Frederick G. Simpson, Seattle, Wash. App. filed Nov. 24, 1915. Improvement.

1,217,517. Radio Telegraph and Telephone System; Frederick G. Simpson, Seattle, Wash. App. filed May 25, 1916. Transmitting apparatus.

1,217,529. Electric Power Transmission; John Godfrey Parry Thomas, Chiswick, London, England. App. filed June 26, 1913. Improvements.

1,217,534. Connector for Electrical Apparatus; Samuel Trood, Edgewood Park, Pa. App. filed Jan. 28, 1913. Plug-connector.

1,217,548. Telephone System; Charles Adams-Randall, Boston, Mass. App. filed Dec. 6, 1915. Improvements.

1,217,557. Electric Clock; John G. Blessing, Chicago, Ill. App. filed July 19, 1915. A unitary magnet and ratchet mechanism which can be applied as an attachment to different kinds of clocks.

1,217,558. Signal System and Control Therefor; Frank E. Boardman, Memphis, Tenn. App. filed June 22, 1916. In connection with elevators.

1,217,566. Distributer for Electric Ignition Systems; John F. Cavanagh, Meriden, Conn. App. filed June 14, 1916. Improvement.

1,217,573. Separator for Storage-Battery Couples; Walter A. Crowell, Chicago, Ill. App. filed Jan. 11, 1916. For interposition between the metallic elements of a storage battery.

1,217,604. Terminal for Electric Conductors; Frederick J. Johnson, Warren, R. I. App. filed Feb. 14, 1916. Improvement.

1,217,613. Automatic Magnetic Separator for Mills; Henry O. Little, Bridgewater, Mass. App. filed Nov. 4, 1916. Improvements.

1,217,628. Signaling Device; James Frank Perera, Trenton, N. J. App. filed July 22, 1916. Vehicles.

1,217,643. Electrical Water-Purifying Apparatus; George J. Schneider, Detroit, Mich. App. filed Aug. 23, 1915. Portable instrument.

1,217,670. Automatic Electric Generating Plant; Charles Bell Walker, Solihull, England. App. filed March 14, 1910. Improvement.

1,217,688. Electric Switch; Clarence A. Bates, Bridgeport, Conn. App. filed July 21, 1913. Remote control type.

1,217,701. Circuit-Closer for Drip-Pan Alarms; Henry Brunelle and Edward Brunelle, Turners Falls, Mass. App. filed March 21, 1916. Refrigerator drip pans.

1,217,707. Pull-Switch for Electric Mine-Signals; Carl Clausen, Bisbee, Ariz. App. filed April 19, 1916. Novel arrangement of contacts and actuating means for the movable contact.

1,217,715. Electric Sign; Samuel G. Crane, Toledo, Ohio. App. filed Feb. 17, 1913. Improvements.

1,217,720. Cut-Out for Electric Instruments, Glow-Lamps, and the Like; Alan John Downes, Croydon, England. App. filed Oct. 11, 1913. By-pass for electric lamps which are to be burnt in series on the ordinary low-pressure supply means.

1,217,738. Battery; Joseph M. Flannery, Pittsburgh, Pa. App. filed May 3, 1916. Storage batteries.

1,217,739. Battery; Joseph M. Flannery, Pittsburgh, Pa. App. filed May 3, 1916. Storage batteries.

1,217,741. Fuse-Holder; Oscar E. Forrest, Schenectady, N. Y. App. filed Dec. 26, 1912. Means for removing the fuse.

1,217,759. Direction-Indicator for Vehicles; Cameron G. Hamilton, Seattle, Wash. App. filed May 10, 1915. Improvements.

1,217,775. Electric Incandescent Lamp; Hugo Kiehl, Chicago, Ill. App. filed April 5, 1916. High illuminating capacity.

1,217,827. Capacity-Meter; Burchard P. Romain, South Orange, N. J. App. filed Jan. 2, 1915. Direct reading.

1,217,829. Lamp-Lock; Joseph Sachs, Hartford, Conn. App. filed Feb. 24, 1913. Improvements.

1,217,830. Lock for Incandescent-Lamp Structures and the Like; Joseph Sachs, Hartford, Conn. App. filed Feb. 24, 1913. Improvements.

1,217,831. Electrical Connecting Member; Joseph Sachs, Hartford, Conn. App. filed March 13, 1915. Plug such as is insertible into and removable from a socket.

1,217,842. Process for Carrying out Chemical Reactions; Ottokar Serpek, Paris, France. App. filed Jan. 26, 1914. Between solid bodies and gaseous bodies.

1,217,844. Safety Fire-Alarm Box; Lovro Shubatt, Centerville, Iowa. App. filed July 3, 1916. Prevents malicious tampering with the signal mechanism.

1,217,858. Electric Regulation; John L. Creveling, Auburn, N. Y. App. filed Oct. 24, 1914. Automatically governed in a predetermined manner.

1,217,877. Rectifier; Edgar J. Pace, Los Angeles, Cal. App. filed July 21, 1915. Effective means for rectifying such current at high efficiency and with great reliability.

1,217,882. Indicator-Alarm; Charles Roma, Memphis, Tenn. App. filed July 28, 1915. Connection with liquid containers.

1,217,890. High-Voltage Insulating-Bushing; Charles Le G. Fortescue, Pittsburgh, Pa. App. filed June 4, 1915. Electrostatic lines of force are precluded from concentrating upon the external surfaces thereof.

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The Habit of Preparedness

PREPAREDNESS is a good habit in business, not a practice for only emergency or crisis. There is vital need that central stations should look ahead to safeguard their plants. The physical property represents an outlay of tangible dollars, a plant that cannot be replaced except after fatal loss of time; but its product of power can be measured in terms of national defense and safety. If a machine is crippled, it is not the loss of the machine that causes concern, but the gap in service left by the non-performance. If a tiny part in a great turbine is fractured and the giant machine is made worthless for operation, the central station man worries over the effect on service. The executive of to-day teaches his men to understand the meaning of the catastrophe which loss of power imposes upon a factory. Multiply the effect until it becomes paralysis to the body industrial in a community stretching every effort for national protection. The result shows why the central stations in many communities exposed to easy attack are receiving the protection which promotes safety.

Determining Position at Sea by Radio

THE Hydrographic Bureau has established a directive radio transmitter at Fire Island, N. Y., and is prepared to transmit special signals to ships at sea according to a system which permits any receiving station to determine its bearing from Fire Island. The sender used is in many ways similar to the German "wireless compass," in which a series of directive aerials are successively energized so that, in effect, a beam of radio waves is swept completely around the horizon. The Fire Island transmitter sends out a series of short impulses at intervals of one second, the direction of maximum radiation changing automatically by one point of the compass for each impulse. Any receiving operator within maximum range can pick up the signals when they are sent in the direction of an imaginary line connecting his station with Fire Island. If he is at less than the maximum signaling distance he may hear signals other than those sent most strongly in his direction, but the impulses which sound loudest to him will of course be those by which his bearing can be determined. Manifestly, if a non-directional signal is first transmitted broadcast to mark the beginning of a series of directive impulses, the number of seconds which elapse between receipt of this first dash and the loudest dot heard thereafter will represent the number of points of the compass from a previously agreed-upon reference direction (as, for instance, North), by which the receiving station's bearing may be fixed. If two such radio compass transmitters are operated at points on shore some 50 or 100 miles apart, a ship within range of both can determine the bearing of each, and can thus, by a simple process of triangulation, fix its own position at sea. The new installation at Fire Island is in the nature of an experiment, and its continuance, as well as the erection of similar "radio lighthouses" at other points along the coast, will depend upon the use made of it by vessels off our shores. It appears to possess great potential merit, and should prove to be of much practical utility.

Scientific Research

SCIENTIFIC research is more than an occupation or form of activity. It is an attitude of faith made manifest through works; of hope undaunted by obstacles; and of helpfulness to humanity through the discovery of new phenomena and relationships. In the older European communities this attitude has long met with official and public recognition. As a result numerous centers of research have flourished there for many, many years. Results of scientific research in time led to important practical applications, which paid a hundredfold for the earlier encouragement of pure science, not to speak of its intangible cultural value upon the masses and of the delights of the exploration and interpretation of nature.

A scientific investigator is, in a way, a venturer, but of a type wholly different from the original settlers in this country. Indeed the rough, practical pioneer attitude toward life in America is not entirely over, even now, and so the reserved European scientist, not allured by gold, or by glorius dreams of democracy, still clings to the moss-covered walls of old universities and academies of science.

But a new spirit and riper judgment have sprung up in America. Buffalo Bill is gone, and scientific research finds a congenial place, with the approaching maturity of civilized life. The need for scientific research is felt even by that wide circle of men which only a few years ago sneered at all "theory." The great European war proved to be an additional stimulus and shows clearly the great practical importance of scientific research. But even without that grim accelerator, numerous timid centers of research have sprung up here and there like frail blades of grass among unhospitable track ballast.

Promises of assistance are being given to research on all sides: by Congress, by national scientific and engineering societies, by rich benefactors, by manu-

facturing and operating companies, by institutions of learning, and by the technical press. There is a certain amount of healthy enthusiasm in this upheaval, and certainly some permanent good will result. The Research Department which appears in the ELECTRICAL WORLD for the first time this issue aims to quicken interest in the subject and we trust will not be barren of accomplishment.

N. E. L. A. Pre-Convention Plans

THE secretary's office becomes busier each day, committee meetings tread closely one upon another, correspondence is heavier, conferences are more frequent, the manufacturers make new plans, it is the beginning of the active season which culminates in the National Electric Light Association convention. Fortunately for the N. E. L. A., its committees are workers. Their reports tax the capacity of the convention program. They appear in print because members have been considering the subjects during months of preparation. They are not thrown together at the last minute to save the faces of reluctant committeemen. They are looked for with eagerness because the business grows, its problems ever increase, its responsibilities are insistent. And besides the meetings to discuss the convictions formed by the committees we note with pleasure that the manufacturers will have a large part in the convention sum total this year. Exhibit space is almost double that obtainable in former years; hence more effective, attractive displays worth seeing.

Forces Acting on Disconnecting Switches

IT is a well-known fact that when an electric current flows around a loop of conductor, such as a loop of wire laid on the ground, the loop tends to enlarge its area. This is true whichever way the current flows around the loop. That is to say, electromechanical forces are brought into play tending to extend the boundary of the loop. By virtue of the current carried around the loop, the latter becomes ambitious for a larger place in the sun, and, unless restrained, expands with a force which increases as the square of the current. The facts may be explained either on the Amperian principle that each little element of conductor in the loop repels other elements with an electrodynamic force; or on the Maxwellian principle that the magnetic flux linked with the loop absorbs and contains a certain amount of energy. This flux depends upon the mmf. and permeance of the magnetic circuit of the loop in Ohm's-law fashion. The mmf. of a steady current of, say, 100 amp. in one turn will be 100 amp.-turns or 125.7 gilberts; but the permeance of the loop will increase with its area. If the area of the loop is doubled, the permeance of the magnetic circuit will ordinarily not be so much as doubled; but will nevertheless be considerably increased, with a corresponding increase in the total magnetic energy. The forces tending to enlarge the area of the loop are determined by the increase of energy per unit of outward linear displacement. If 1 cm. of outward movement will involve a large increase of energy, the outward tendency, or shove, will be correspondingly large. With a continuous current the shove will be continuous; with an alternating current it will be pulsatory but always in the same direction.

In the case of a switchblade opening outward from the bars or conductors to which it is attached, the current always tends to push open the switch. This is the ordinary mechanical arrangement. If on the contrary the switch were made to open inwardly toward the supporting busbars the current would tend to hold it tightly closed. The mechanical force involved increases with the square of the current and is greater with long than short knifeblades, other things being the same. Ordinarily the electromechanical force on an active switchblade is not very great and is seldom large enough to obtrude itself on the operator's notice; but in cases of powerful load currents, or of short-circuits, these forces may readily be large enough to open a tightly gripped switchblade.

The subject of this switch-opening force is dealt with quantitatively in an article of this issue by Julian Loebenstein which appears to present a satisfactory agreement between the results of theory and experiment.

Engineering Aspects of the Copper Situation

THE outlook for the electrical industries as regards copper, their prime necessity, cannot be regarded as particularly cheerful. Nobody was surprised that the price shot upward under the pressure of the European war, but its persistent adherence to the high level in spite of greatly increased activity in mining, smelting and refining, is a matter of grave import. To electrical companies, anxious to increase their service to meet public demands, copper at 40 cents a pound or thereabouts is a very grave matter and many a promising extension has been temporarily abandoned on account of the forbidding initial investment. The war shows no great prospects of cessation within a considerable period, and if the United States enters the fight there will be a still greater call for munitions and a demand for copper as yet unprecedented. In the face of these conditions remedial measures should be earnestly sought.

They can be looked for along three separate lines. First, one may go into substitution of aluminum or even iron for copper. The first named, owing to conditions surrounding its production, is kept at a price not far below the equivalent price of copper for conducting purposes. There is difference enough, however, to yield some encouragement for the installation of aluminum line wires wherever an overhead conducting system is used. However, since the war aluminum has been hard to obtain and many transmission companies have found it profitable to sell their aluminum lines and substitute copper ones. The second alternative has been discussed in our columns several times of late. It meets one requirement of the situation successfully, that is, the construction of long cheap

iron wire lines for picking up comparatively light loads which would be hardly profitable at the investment in copper which would be otherwise required. When it comes to heavier service, however, some difficulties are encountered. It must not be forgotten in this connection that pretty heavy inductance can be taken care of by synchronous condensers, and in cases where the load to be assumed is sufficient to justify this measure there would seem to be a good prospect of success in working out an iron line which would considerably improve the situation.

Then there is the natural recourse for saving of conductor material, by raising the voltage. As regards transmission lines this measure is already in active progress and should be pushed wherever the conditions begin to demand decrease of line loss. With respect to distribution systems the case is not so easy. Yet considerable relief can be gained in a very large number of cases by passing from the ordinary three-phase distribution to the star connection with neutral, a step which has already been taken in a few plants and which would pay in many more. Where four wires are not available one could fall back on aluminum or even iron for the neutral, and the process of changing over can be carried out with a good deal of facility. Such a rearrangement is far easier in fact than it seems to be when the suggestion is first made. The chief thing for which a keen eye must be kept out is interference by trees which is, of course, more severe at the increased voltage between phase wires.

Finally, one has to meet conditions where extensions are seriously interfered with by high cost of installation and something must be done to keep up the normal growth of business. Under such conditions intensive use of existing distributing system is the obvious step to be taken. The problem is to get every kilowatt upon the lines which it is possible to accommodate, and particularly to even up the use as far as possible so as to keep copper in full service. If there ever was a time when necessity called for activity in building up off-the-peak load that time is now. The subject indeed has been widely discussed in a general way, and the present enormously high price of copper makes it exceptionally pertinent. The sales department of every central station can do no better service than in getting busy and specializing so far as possible on the branches of service which will not tend to overload the lines. Perhaps the cost of conductors may prove a blessing in disguise by stimulating the growth of every kind of off-the-peak load. In the search for this desideratum care should equally be taken to go slowly on the assumption of load which will add to the peak, while making a determined drive to get the more desirable and profitable employment for the energy generated.

Part-Slot Fractional-Pitch Windings

IT is now generally admitted that an alternating-current generator should develop a pure sine wave of emf., as nearly as practicable, under all conditions of load. Departures from the simple sinusoidal wave form not only tend to produce weaknesses and cross-magnetizing currents between machines operating in parallel; but they also tend to set up serious induced disturbances in neighboring telephone systems.

At one time it was supposed that the best way to insure the production of a smooth sine wave of generated emf. was to provide a sine wave of magnetic flux density between the field poles and armature at no load; or to provide what designers call a sinusoidal field form. Any single conductor advancing through such a sinusoidal field form would develop a sinusoidal emf. in its own element. But under the distorted magnetic conditions of lagging or leading current delivery, the tendency of ordinary loads is to distort the field form, and with it the emf. wave in each conductor. In recent years, it has come to be recognized that by the use of fractional pitch windings it becomes possible to produce an approximately sinusoidal resultant generator wave, even although the field form was considerably distorted. Moreover, by the same procedure, the distorting influence of lagging current delivery on the generator emf. wave, under load, could likewise be reduced.

The article this week by Theodore Schou, on the subject, is a plea for the use of fractional-slot as well as fractional-pitch windings, in designing alternators for good wave form with the most economical utilization of materials. The oscillographs presented with the article give a good indication of what can be done in this manner, to keep the generated emf. wave smooth even when the field form is considerably distorted. Moreover, part-slot fractional pitch designs help to minimize the mechanical and magnetic vibration of the machine when in operation, and so to reduce the noise of running. The article should be carefully studied by those who are interested in either the design or operation of polyphase generators.

The Coming Issues

EMPHASIS will be laid in the next issue of the ELECTRICAL WORLD, March 24, on central station commercial problems of a managerial nature. Of special interest in that issue will be an article on "Shall the Central Station Maintain a Wiring Department?" Few problems are more pressing or receiving more careful attention by thinking managers than the wiring of buildings and residences. The ideas and experiences of a number of progressive central station companies have been analyzed with a view of ascertaining how great and how sincere is the co-operation existing between lighting companies and the local electrical contractors. The conclusion reached is one that every commercial manager may well ponder and consider. In the fifth issue in March the electrical layout and operating features of a large New England cotton mill will be described. ELECTRICAL MERCHANDISING for March, out this week, is replete with valuable suggestions for sales managers and contractors.

Part-Slot Fractional-Pitch Windings

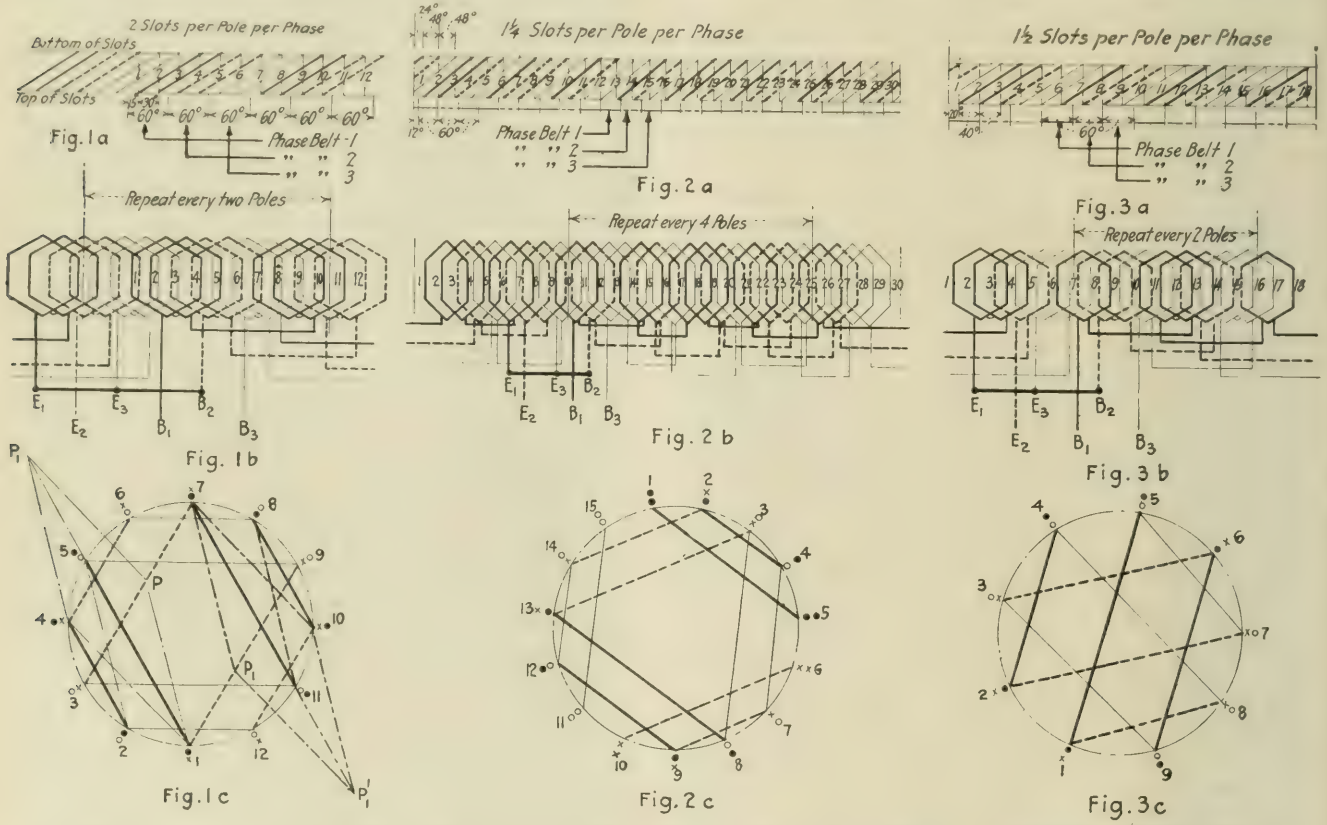
Effect of Armature Winding Distribution on the Electromotive Force Wave Shape as Generated by Non-Sinusoidal Field Forms, with a Discussion of Fractional-Slot, Fractional-Pitch Windings and Their Application

By Theo. Schou
The State University of Iowa

With a given pole or a certain fixed field form which is not sinusoidal, the distribution of the armature winding and the connection thereof has more or less effect on the wave form generated. It is also generally known that by using a "chorded" or fractional-pitch winding the wave form may be improved above that generated by a pitch winding, other things being equal.

In most cases of manufacture the number of armature slots per pole is a multiple of the phases. In order to use the same armature punching or the same armature for both two and three-phase windings, the number of slots per pole is made a multiple of two as well as since a well-designed machine of this nature will have a rather flat field form with a small air gap and poles embracing 70 to 75 per cent of the pole pitch, it is quite obvious that the generated wave will deviate more or less from a sine wave, depending on the connections of the phases as will be demonstrated later.

As mentioned before, "chording" or applying a fractional pitch winding may tend to improve the wave form, and a winding having a throw of about 83 per cent of the pitch or a chord factor of 0.966 seems to have the tendency, in case of star connection, to reduce the larger higher harmonics to a minimum. For both economical and technical reasons, disregarding the reduction in reactance, chording the winding is most desirable with high-speed machines, having a large pole pitch. Since the reactance of high-speed machines such as turbo-generators is inherently small, the high-frequency current in delta-connected machines may be serious if the third harmonic is in strong evidence. In the case of a low-speed machine, where the pole pitch is small and the armature core rather long in proportion to the pitch or "throw" of the coil, it might not be desirable to apply a chorded winding. This is evident since a chorded winding having the same number of effective conductors per slot as the pitch winding necessarily must have more conductors per slot.



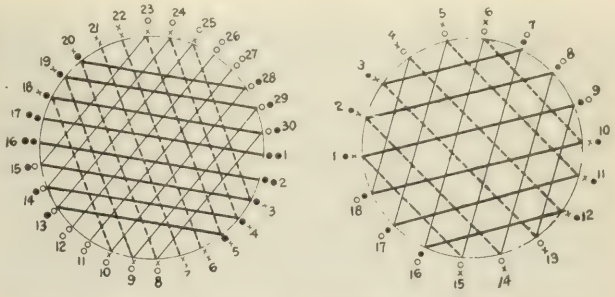
FIGS. 1, 2 AND 3—LAYOUT FOR PART-SLOT FRACTIONAL-PITCH WINDINGS AND METHOD OF CHECKING CORRECTNESS

Illustrations 1, 2 and 3 refer to three-phase star-connected windings with two, one and one-fourth and one and one-half slots per pole per phase and having coil throws of 1 and 4. The upper row of drawings are developed plans of the slots and represent the throws of the coils. The diagrams below indicate the corresponding winding connections. From these are worked out the circle diagrams below showing the voltage relations.

When sinusoidal waves are developed, chording the winding decreases the number of effective conductors, and thus the voltage induced in proportion to the sine of half the electrical angle embraced by the coil or the chord factor f_{ch} is a constant. The reciprocal of the latter gives the increase of total conductors per coil or per slot necessary to obtain the same voltage as with pitch winding, other things being equal. If there is more than one slot per pole per phase, a winding factor or "spread-factor" f_w is introduced which depends on the number of slots per pole per phase and compensates for the angular displacement of the slots per pole per phase. This factor is the ratio between the geometrical and arithmetical sum of the different emfs. induced in the conductors of the different slots per pole per phase. The product of factors f_{ch} and f_w may be found conveniently by a graphical method. For the benefit of readers not familiar with fractional-pitch or fractional-slot windings, a novel and practical method of laying out any winding of this description will be discussed in what follows.

Looking at the end of a three-phase armature having two coils per slot, two slots per pole per phase, and a coil throw of 1 and 4, the end connections of the coils may be represented as shown in Fig. 1a. The slots are represented as straight vertical lines and are located according to the electrical angles between them. Thus by laying out the three-phase belts 60 deg. apart (for three-phase windings) from any convenient point, say between two slots, and keeping in mind that coils of one phase can throw from its own phase belt only, the whole winding arrangement is really determined as soon as enough is laid out so that it begins to repeat itself (see Fig. 1a). From the diagram of end connections a wiring diagram can be developed as in Fig. 1b, which represents star connected phases, and is suitable for any number of pole pairs. If the number of slots in which a winding is complete be spaced in a circle and the distribution of phases in the different slots be designated, then by drawing parallel lines between slots containing corresponding phase windings and designating these parallel lines, the vector diagram (Fig. 1c) thus obtained will show balance if the winding is correct. For the minimum number of pole pairs possible with such a winding, there will be as many parallel phase lines as there are coils per phase.

Evidently the diameter of the circle (Fig. 1c) is proportional to the induced, pitch-coil voltage, and any chord between any two slots is proportional to the induced voltage of the chorded coil. For a winding repeating every two poles this chord may be scaled, but



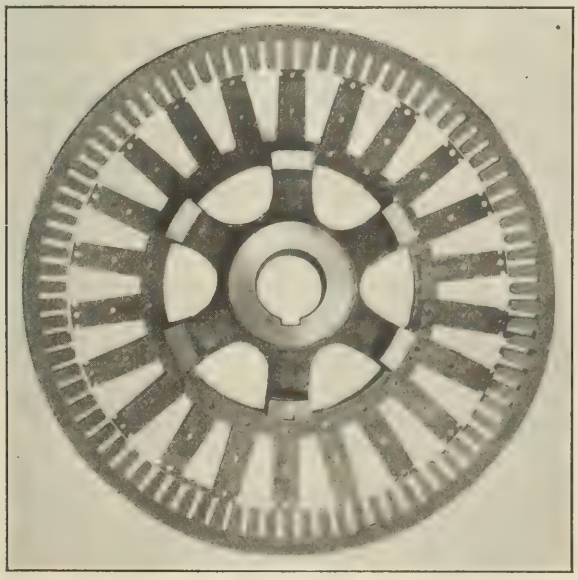
FIGS. 4 AND 5—VOLTAGE RELATIONS IN THREE-PHASE STAR-CONNECTED WINDINGS

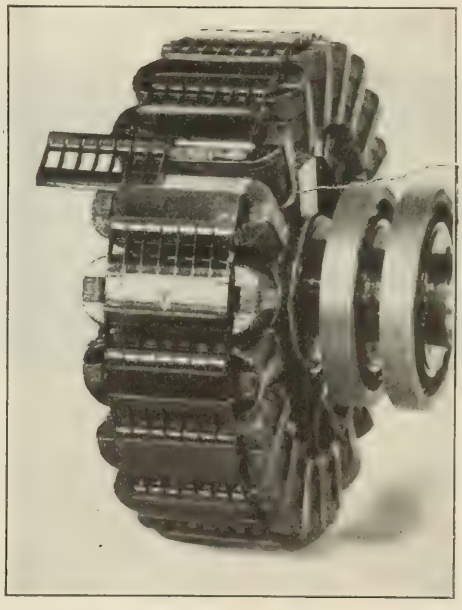
The diagram at the left represents conditions with five slots per pole per phase and the one at the right three slots per pole per phase. The five-slot winding has a coil throw of 1 and 13 and the three-slot a throw of 1 and 7.

if the winding does not repeat every two poles or, in other words, cannot be used for a two-pole machine, then the length of the chord must be calculated, using the proper electrical angle between slots embraced by the coil. The sum of the lengths of all parallel phase lines divided by the sum of as many diameters as there are phase lines taken gives the product of the chord factor and spread factor ($f_{ch} \times f_w$).

Referring to Fig. 1c, the combined induced voltage of coil 1 and 4 and coil 2 and 5 is proportional to the vectorial (geometrical) sum of vector 1-4 and vector 2-5 or vector 1-P_1. If the diameter of the circle is 1, then vector 1-4 = vector 2-5 = $1 \times \sin 1/2\ (3 \times 360/12)°$ $= 1 \times \sin 45° = 0.707$. Vector 1-$P_1$ = $2 \times 0.707 \times \cos 15° = 2 \times 0.707 \times 0.966 = 1.366$. But vector 2-4 + vector 1-5 = $1 \times \sin 30° + 1 \times \sin 60° = 0.5 + 0.866 = 1.366$. As vector 1-$P_1$ = vector 7-P_1', it follows that

$$\frac{\overline{8\text{-}10} + 7\text{-}11 + 5\text{-}1 + 4\text{-}2}{4 \times 1} = \text{geometrical sum of induced}$$





FIGS. 6 AND 7—ARMATURE PUNCHING, FIELD PUNCHING AND ASSEMBLED ROTATING FIELD OF LOW-SPEED SMALL-POLE PITCH REVOLVING-FIELD ALTERNATOR

This machine has eighty-four open armature slots, absolutely even field-pole spacing, 5/64-in. air gap and a pole pitch of only 4 in. measured on the armature surface. This construction was made possible by the use of part-slot fractional-pitch windings One of the "damper bridges" used between the pole tips is shown partly wthdrawn. This machine was designed by the writer.

voltage = arithmetical sum of induced voltage, or $\frac{0.5 + 0.866 + 0.866 + 0.5}{4} = \frac{2.73}{4} = 0.683 = f_{ch} \times f_w$.

As the chord factor f_{ch} can always be quickly determined, the spread factor can also be found. In this case f_{ch} = sin (90 2)° = sin 45° = 0.707 and f_w = 0.683 ÷ 0.707 = 0.966.

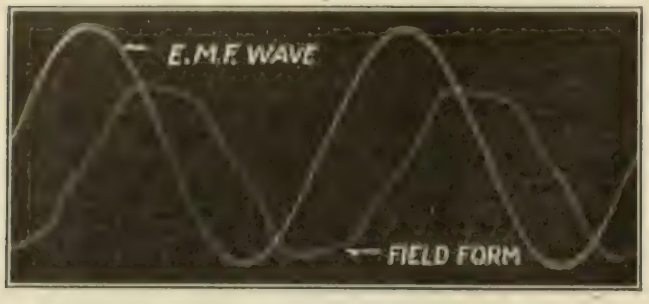


FIG. 8—FIELD FORM AND CORRESPONDING EMF. WAVE PRODUCED BY PART-SLOT* ALTERNATOR CARRYING NON-INDUCTIVE LOAD

These oscillograms refer to the alternator, parts of which are shown in Figs. 6 and 7. The curves show that a practically sine wave of emf. is produced even with a non-sinusoidal field form.

Figs. 2a, 2b and 2c show the method of laying out and developing the winding and applying the circle diagram for a three-phase, star-connected part or fractional-slot,* fractional-pitch winding with one and one-fourth slots per pole per phase and a coil throw of 1 and 4. As will be noted, this winding repeats every four poles and therefore can be applied only to a machine having four poles or a multiple thereof. Since there are three and three-quarter slots per pole, the electrical angle between the slots is 180 ÷ 3.75 = 48°.

The product $f_{ch} \times f_w$ will be equal to the sum of the five parallel phase lines divided by five times the circle diameter. (In Fig. 2c note that two-phase lines appear as one through slots 1-5, 6-10 and 11-15.) If the circle diameter = 1, then

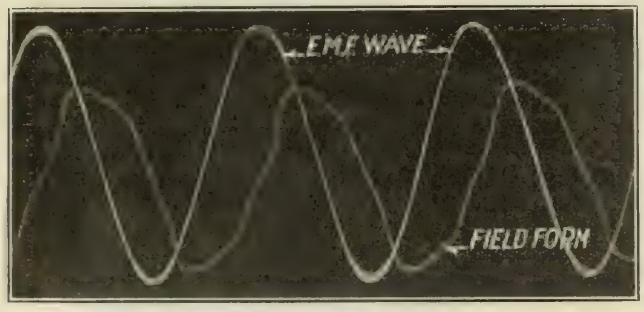


FIG. 9—EMF. WAVE AND CORRESPONDING FIELD FORM FOR PART-SLOT* ALTERNATOR CARRYING INDUCTIVE LOAD

These curves also refer to the alternator, parts of which are shown in Figs. 6 and 7. The oscillogram was taken with an inductive load as indicated by the crowding of magnetic flux to one side of each pole (see field form). Even with this non-sinusoidal field the emf. is a sine wave.

Vector 2-4 = 1 × sin 48 deg. = 0.743
2 × vector 1-5 = 2 × sin 96 deg. = 2 × sin 84 deg. = 1.989
vector 13-8 = 1 × sin 120 deg. = sin 60 deg. = 0.866
vector 12-9 = 1 × sin 72 deg. = 0.951
and their sum = 4.549

Therefore $f_{ch} \times f_w = 4.549 \div 5 = 0.91$.

Now f_{ch} = sin 0.5(3 × 180/3.75) deg. = sin 72 deg. = 0.951.

Therefore $f_w = 0.91 \div 0.951 = 0.957$.

The circle vector diagram for a three-phase, star-connected winding with five slots per pole per phase and a coil throw of 1 and 13 is shown in Fig. 4. From this diagram the following relation is obtained:

$$f_{ch} \times f_w = \frac{(20\text{-}28 + 19\text{-}29 + 18\text{-}30 + 2 \times 17\text{-}1) \times 2}{10}$$

But, vector 20-28 = sin 48 deg. = 0.743
vector 19-29 = sin 60 deg. = 0.866
vector 18-30 = sin 72 deg. = 0.951
2 × vector 17-1 = 2 × sin 84 deg. = 1.989
and their sum = 4.549

Therefore $f_{ch} \times f_w = \frac{2 \times 4.549}{10} = \frac{4.549}{5} = 0.91$.

And as $f_{ch} = \sin 0.5\left(\frac{180}{15} \times 12\right)° = \sin 72 \text{ deg.} = 0.951$,

$f_w = 0.91 \div 0.951 = 0.957$.

Thus the spread factor for a three-phase winding having five slots per pole per phase is equal to the spread factor of a part-slot winding having one and one-quarter slots per pole per phase.

Represented in Figs. 3a, 3b and 3c is a three-phase, star-connected part-slot winding with one and one-half slots per pole per phase and a coil throw of 1 and 4. This winding repeats itself every two poles and therefore can be applied to a machine having two poles or any multiple thereof. Referring to Fig. 3c,

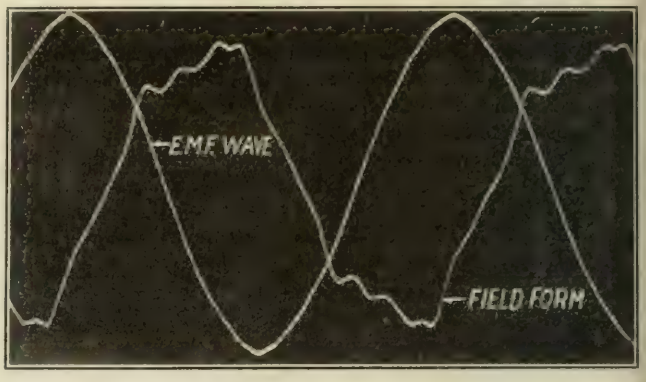


FIG. 10—EMF. WAVE AND FIELD FORM OF ALTERNATOR WITH PART-SLOT* WINDING

This oscillogram refers to a low-speed alternator having one and one-half slots per pole per phase.

$$f_{ch} \times f_w = \frac{\overline{2\text{-}4} + \overline{1\text{-}5} + \overline{9\text{-}6}}{3} \text{ (circle diameter = 1)}$$

Vector 2-4 = sin 40 deg. = 0.643
vector 1-5 = sin 80 deg. = 0.985
vector 9-6 = sin 60 deg. = 0.866
and their sum = 2.494

Therefore $f_{ch} \times f_w = 2.494 \div 3 = 0.833$.

The factor f_{ch} in this case = sin 0.5

$$\left(\frac{180}{4.5} \times 3\right)° = \sin 60 \text{ deg.} = 0.866.$$

Therefore $f_w = 0.833 \div 0.866 = 0.96$.

Referring to Fig. 5, which shows the vector circle diagram for a three-phase, star-connected winding with three slots per pole per phase and a coil throw of 1 and 7,

$$f_{ch} \times f_w = \frac{(\overline{3\text{-}7} + \overline{2\text{-}8} + \overline{1\text{-}9}) \times 2}{6}$$

But vector 3-7 = sin 40 deg. = 0.643 (circle diam. = 1)
vector 2-8 = sin 60 deg. = 0.866
vector 1-9 = sin 80 deg. = 0.985
and their sum = 2.494

Therefore $f_{ch} \times f_w = \frac{2.494 \times 2}{6} = \frac{2.494}{3} = 0.833$.

*A part slot winding is also a chorded winding.

Since $f_{ch} = \sin 0.5\left(\frac{180}{9} \times 6\right)\text{deg.} = \sin 60 \text{ deg.} = 0.866.$

Then $f_w = 0.833 \div 0.866 = 0.96.$

Thus the spread factor of a three-phase winding having three slots per pole per phase is equal to the spread factor of a part-slot winding having one and one-half slots per pole per phase. From this the conclusion may be drawn that the distribution of a part-slot winding having three and three-quarter slots per pole is, so far as distribution is concerned, electrically equivalent to fifteen slots per pole. A part-slot winding having four and one-half slots per pole is equivalent to nine slots per pole. Or, in general, a part-slot winding has the effect electrically of many narrow slots per pole, which is very desirable as the economical value of such a winding relative to the equivalent in a whole number of slots per pole is self-evident. Part-slot windings have the additional advantages (1) of enabling the building of low-speed machines with a frame bore, that would prohibit even six slots per pole, (2) of practically eliminating dead points at starting with synchronous motors, and (3) effectively reducing magnetic noise.

Effect of Armature Windings on Emf. Wave

In the following will be analyzed the effect of different armature windings on the electromotive wave form, when the same field form or flux distribution curve exists. Fig. 11 shows the field form of a low-speed alternator such as is often met with in practice except that the effect of tooth harmonics or of the armature slots on the field form has been omitted. This field form has been resolved into its fundamental and higher harmonics, including the third, the fifth, the seventh and the ninth drawn to scale. The maximum field strength of that part of the pole which has the minimum air gap is designated as 100. The harmonics above the ninth are not indicated since their effect compared with the lower frequency waves is very small, their values being

To demonstrate the effect of different windings on the emf. wave it will be assumed that conductors of different armature windings are moved through this field and the resulting instantaneous values will be plotted, giving the corresponding emf. wave shape. Only windings with two coils per slot will be considered in this discussion. Fig. 12a represents the emf. wave form gen-

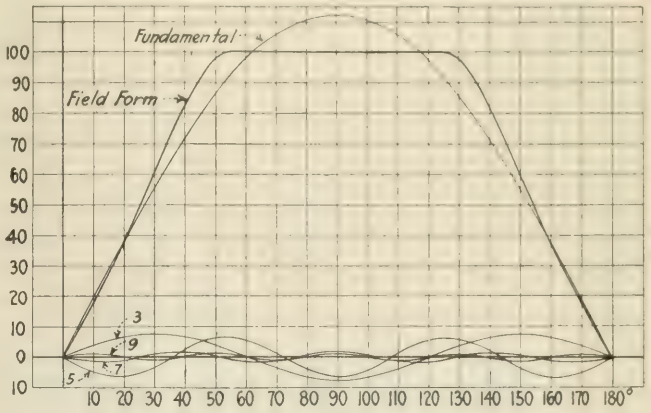
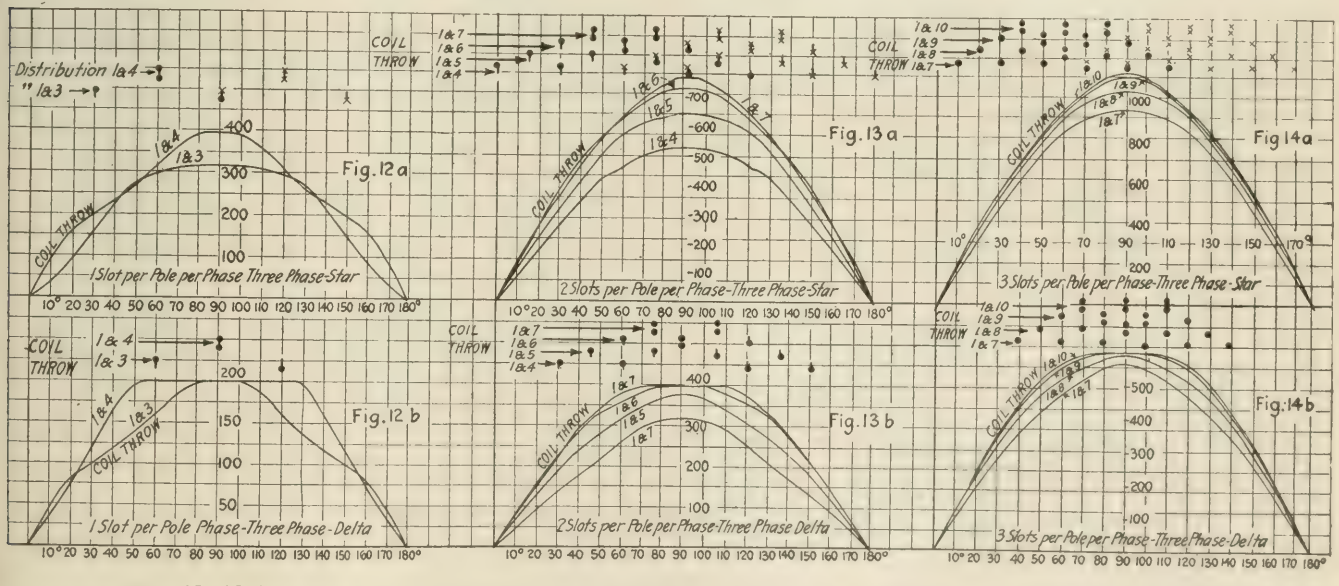


FIG. 11—FIELD FORM OFTEN OBTAINED WITH ALTERNATORS

erated under these conditions by three-phase, star-connected armature winding having three slots per pole, or one slot per pole per phase and a coil throw of 1 and 4, and 1 and 3 (chorded 66.6 per cent). The wave form resulting from a throw of 1 and 4 has a maximum deviation from the equivalent sine wave of 7.38 per cent. The effect of the third, ninth, fifteenth, etc., harmonics is eliminated by the connection of phases in star, but the other harmonics are in evidence. Slight improvement is shown by the use of throw 1 and 3 as the maximum deviation from the equivalent sine wave is 6.7 per cent. Chording the winding 66.7 per cent of the full pitch has reduced the fifth, seventh, seventeenth and nineteenth harmonics to approximately 87 per cent



FIGS. 12, 13 14—EMF. WAVES PRODUCED BY DIFFERENT THREE-PHASE WINDINGS WITH VARIOUS COIL THROWS

All the curves refer to three-phase windings. The diagrams at the left refer to windings with one slot per pole per phase, the middle set to windings with two slots, and the right-hand diagrams to three-slot windings. The winding connection and the coil throw are indicated near each curve

as follows: Eleventh, 0; thirteenth, —0.693; fifteenth, +0.0666; seventeenth, +0.1175; nineteenth, —0.158; twenty-first, +0.0476; twenty-fifth, —0.04; twenty-seventh, +0.037; twenty-ninth, +0.0345; thirty-first, +0.0194. The maximum deviation of this field form from an equivalent sine wave is 11.2 per cent and the form factor is 1.1.

of their full values. In order to obtain a good wave form with such a winding the pole could be so shaped as to give a field form which approximates a sine wave. However, this would require either a larger machine or an increase of about 12 per cent in the number of effective conductors per slot, provided the machine is operated magnetically the same with both field forms.

The voltage wave for the same winding and throw as shown in Fig. 12a, but with delta connected phases, is indicated in Fig. 12b. In this case the pitch throw (1 and 4) will produce a wave with exactly the same (amplitude included) harmonics as exist in the field form, therefore the voltage wave form is identically the same as the field form, having a maximum deviation of 11.2 per cent from the equivalent sine wave.

With a coil throw of 1 and 3 the wave form is exactly like that which resulted from a throw of 1 and 4, and star-connected phases, due to the fact that the effect of 66.7 per cent chording is equivalent to connecting the phases in star. This wave form, therefore, has a maximum deviation of 7.38 per cent. As the chord factor for 66.7 per cent of the pitch winding is 0.866, the crest value of the wave for a throw of 1 and 3 would be 86 per cent of that for a pitch throw, if the waves were sine waves. This condition does not exist, however, with the wave forms indicated in Figs. 12a and 12b, that show 80 per cent and 100 per cent respectively.

Figs. 13a and 13b represent the emf. wave forms of a three-phase winding having two slots per pole per phase with a throw of coil 1 and 7 (pitch), 1 and 6, 1 and 5 and 1 and 4, the connections being star in the first case and delta in the second. It may be noted that the wave for throw 1 and 7, Fig. 13a, is exactly like the wave for throw 1 and 5, Fig. 13b, as chording 1 and 5, or 66.7 per cent of pitch, is equivalent to connecting the phases in star.

The curves in Figs. 14a and 14b show the effect of three slots per pole per phase, with star and delta-connected phases and coil throws of 1 and 10 (pitch), 1 and 9, 1 and 8 and 1 and 7. Other discussions along this line will be presented in a later issue of the ELECTRICAL WORLD.

Forces Acting on Disconnecting Switches

Results of Tests to Determine the Forces Tending to Open Knife Switches When They Are Subjected to Excessive Current Overloads, with Calculations Based on Different Conditions

BY JULIAN LOEBENSTEIN, E.E.

TESTS were recently conducted by the writer to determine the forces tending to open disconnecting switches when carrying excessive currents. In what follows the results of these tests are given, together with calculations essential to the proper design and construction of catches for disconnecting switches. For an arrangement of switch and bus, as shown in

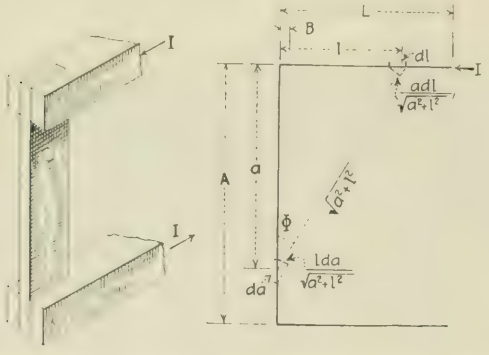


FIG. 1—FORCES ACTING ON A DISCONNECTING SWITCH

Fig. 1, with a current I flowing, the analysis of conditions follows:

Consider an element dl on the bus and an element da on the switch. If the various distances involved be assigned letters as shown in the diagram we may resolve the two elements da and dl into parallel elements perpendicular to the line joining their centers. These elements will be $\frac{a \times dl}{\sqrt{a^2+l^2}}$ and $\frac{l \times da}{\sqrt{a^2+l^2}}$ The repulsive force between these two elements will be proportional to the product of the currents and inversely proportional to the square of the distance between the elements.

$$dF = \frac{kI^2aldadl}{(a^2+l^2)^2}$$

The horizontal component of the force will be

$$dF_h = dF \sin \varphi = \frac{kI^2al^2dadl}{(a^2+l^2)^2\sqrt{a^2+l^2}}$$

and the torque due to the interaction

$$dT = \frac{kI^2al^2dadl}{(a^2+l^2)^2\sqrt{a^2+l^2}}(A-a)$$

$$T = kI^2\left[\int_0^L\int_0^A \frac{Aal^2dadl}{(a^2+l^2)^2\sqrt{a^2+l^2}} - \int_0^L\int_0^1 \frac{a^2l^2dadl}{(a^2+l^2)^2\sqrt{a^2+l^2}}\right]$$

It will be found easier to integrate by keeping the denominator in the form given than to put the entire expression under the radical. Integrating with respect to A

$$T = kI^2\left[\int_0^L \frac{Adl}{3l} - \int_0^L \frac{Adl}{3\sqrt{l^2+A^2}}\right]$$

In integrating the first integral of this last expression an infinite value would be obtained by taking the limit zero, hence a small but finite value B is used. This fits in with the physical consideration, for if there were an element on the bus not separated by a finite distance from an element on the switch blade there would be an infinite force.

TABLE I—TORQUE IN POUNDS AT ONE FOOT FOR I = 20,000 AMP., A = 12 IN.

L	B = .5 In.	B = 0.1 In.	B = 0.01 In.
2	2.1	4.2	7.2
6	3.9	6.1	9.1
12	5.1	7.2	10.2
20	5.7	7.8	10.8
30	5.9	8.1	11.1
40	6.1	8.2	11.2

Integrating with respect to L

$$T = \frac{kI^2A}{3}\left[\log \frac{AL}{B(L+\sqrt{L^2+A^2})}\right]$$

This, however, is the torque due to the reaction between the upper bus and the switch blade. The torque due to the reaction between the lower bus and the switch blade will be given by an integral similar to the second one in the original torque equation. This is $\frac{AL}{3\sqrt{L^2+A^2}}$. Hence the expression for the torque due to both buses is

$$T = \frac{kI^2A}{3}\left[\log \frac{AL}{B(L-\sqrt{L^2+A^2})} + \frac{L}{\sqrt{L^2+A^2}}\right]$$

where T = pounds at 1 ft.; $k = 0.1875 \times 10^{-8}$; and A, L and B are measured in inches.

To show the effect of assuming different values for B Table I was calculated and plotted (see Fig. 4).

It is probable that the value $B = 0.1$ in. represents most nearly the actual conditions, and therefor gives the correct values for the torque. On this basis the Table II showing variation of torque with current was calculated (see Fig. 2).

TABLE II—TORQUE IN POUNDS AT ONE FOOT FOR A = 12 IN. — L = 12 IN. — B = 0.1 IN.

Amperes Current	Torque
10,000	1.8
20,000	7.2
30,000	16.2
40,000	28.8
50,000	45.0
60,000	64.8
70,000	88.2
80,000	115.2
90,000	145.8
100,000	180.0

In order to determine the actual torque necessary to open a switch by hand, various switches were tested by means of a hand balance. The hook of the balance was attached in the hook hole of the switch and increasing tension applied in a direction normal to the switch until the switch started to open. This tension necessary to start the switch caused it to leave the "break jaw" after an application of one second or more.

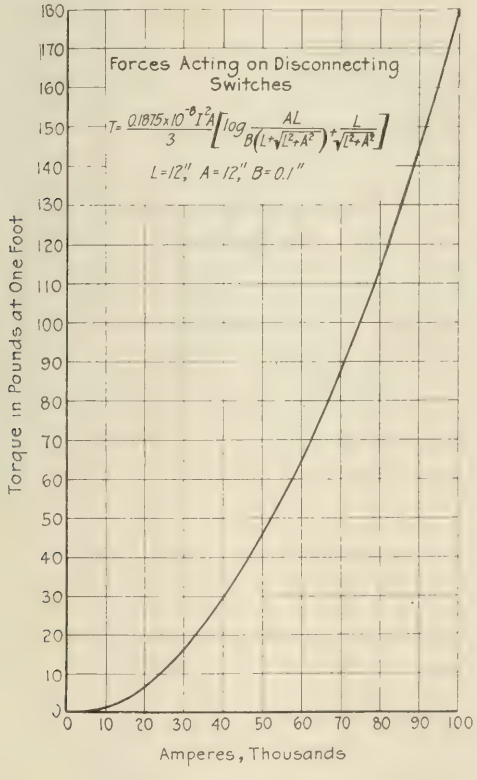


FIG. 2—VARIATION OF TORQUE WITH CURRENT

The following styles of switches were tested: Two 600-amp. single blade and a 1200-amp. double blade. Both styles have a distance of 12 in. between the center line of the jaws and the pivot and 9.75 in. between the center line of the hook hole and the pivot. The tests showed a tension of 20 lb. necessary to open the 600-amp. switch and 40 lb. to open the 1200-amp. switch. The torque necessary is therefore 16.25 lb. at 1 ft. for the 600-amp. switch and 32.5 lb. at 1 ft. for the 1200-amp. design.

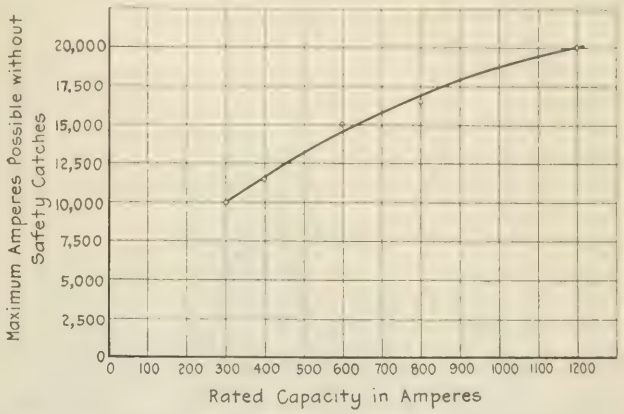


FIG. 3—APPROXIMATE RATING 15,000-VOLT SINGLE-POLE, SINGLE-THROW, BACK-CONNECTED SWITCHES

The General Electric Company recommends the ratings indicated in Fig. 3 with 15,000-volt single-pole, single-throw, back-connected switches. The pressure between the blade and the clips is the limiting feature, and these values must therefore be used accordingly.

These recommendations agree closely with the results found by the mathematical analysis. A root mean square current of 20,000 amp. would give a maximum current of 30,000 amp. with a corresponding torque of 16 lb. at 1 ft. The test showed that this was the torque required to open a single-blade 600-amp. switch, so that it may be assumed that a 1200-amp. single-blade switch would require a slightly higher torque, thus leaving a slight margin of safety. Hence the recommendation of 20,000 amp. as the limiting current for a single-blade 1200-amp. switch seems to be correct. Other switches could, of course, be estimated from the curves and data given.

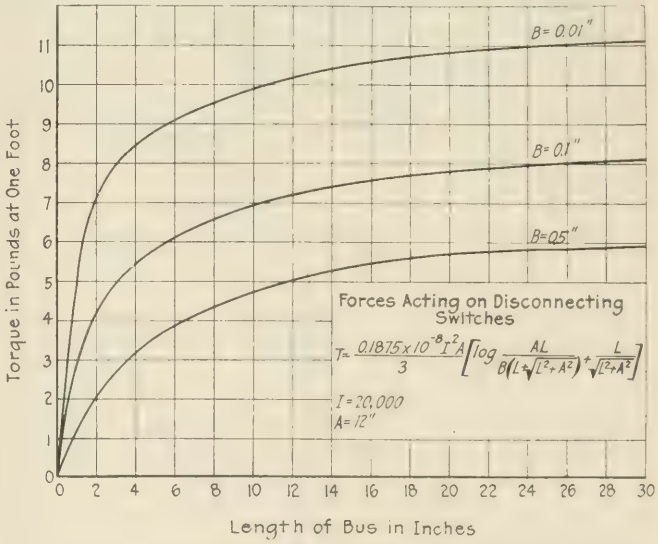


FIG. 4—TORQUE FOR DIFFERENT WIDTHS OF SWITCH BLADE AND LENGTHS OF BUS



Tieing Together Water and Steam Power

Completion of an Article on Arrangements Made by the Connecticut Power Company to Operate its Falls Village Hydroelectric Plant in Parallel with the Hartford Electric Company's Steam Plant

FEATURES of the Falls Village hydroelectric plant of the Connecticut Power Company were described in the March 3 issue of the ELECTRICAL WORLD. In this article the construction of the transmission system is described and data presented showing how the water and steam plants share the loads in typical wet and dry months.

The routes followed by the transmission lines and the locations of the substations and generating stations are indicated on an accompanying map. Between Falls

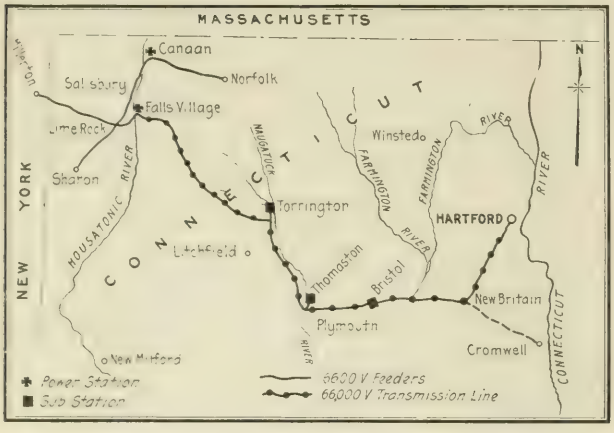


FIG. 1—TERRITORY COVERED BY HOUSATONIC DIVISION OF CONNECTICUT POWER COMPANY

Village and Bristol, which is about 40 miles, the 66,000-volt system consists of two three-phase circuits carried by double-circuit steel towers on a right-of-way 100 ft. wide. The circuits are arranged vertically on opposite sides of the tower 12 ft. apart with the middle conductors offset 3 ft. from the plane of the other two wires. This arrangement was considered advisable as wires in the same plane might come in contact due to sleet melting off them at different rates. The cross-arms are 8 ft. apart. Telephone wires are carried 9 ft. below the lower power conductors and transposed at every other tower. Along the apices of the towers runs a 5/16-in. galvanized-steel ground wire. The power conductors are No. 2 B & S gage copper, while the telephone wires are No. 6 B & S copper-clad steel.

The line was designed for 0.5 in. of ice on all conductors and ground wire and a wind pressure of 6 lb. per square foot occurring simultaneously at 0 deg. Fahr. Suspension towers are designed to withstand the pull of two conductors broken under this condition in the same span and on the same side of the tower in addition to a wind load of 22.5 lb. per square foot on two tower faces. Anchor towers are designed to withstand the breakage of all conductors and the ground wire in one span under the loading mentioned in addition to a wind pressure of 22.5 lb. per square foot on two tower faces. Lateral pulls at all conductor and ground-wire supports equal to the maximum tension obtained in each under extreme loading must also be withstood in addition to the wind load at all angle towers.

Both the suspension and anchor towers have 13 ft. by 13 ft. bases, the height to the bottom crossarm being 37 ft. for suspension towers and 34 ft. for anchor towers. Structural-steel pyramid-shaped foundations set 6 ft. in the ground are used in good soil. On ledges anchor bolts are grouted in the rock, while in swamps special anchorage is employed. Suspension insulators of the Pittsburgh and Locke types are used, five 10-in. disks being employed at suspension points and six disks at dead-ends. Anchor towers are located at angles and approximately every mile on tangent lines. The average spacing of towers is 430 ft., although spans as small as 200 ft. and as large as 1000 ft. are employed. Telephone booths are provided in the tower bases approximately every 4 miles.

From Bristol to Berlin, a distance of about 13.5

miles, somewhat higher towers with larger bases are used but are designed for the same loading as those on the Falls Village-Bristol line. This section carries only a single circuit. As mentioned in the first part of the article this line will be extended to Cromwell where, step-down connections will be made with the Middletown steam station of The Connecticut Power Company.

The Bristol-Berlin single-circuit line continues to Hartford on wood poles while a similar wood-pole line connects New Britain with the steel-tower line. Forty and 45-ft. chestnut poles spaced 180 ft. apart are used on these lines. They carry two 5-in. by 6-in. cross-arms, the lower being 8 ft. 8 in. long and carrying only one conductor, and the upper being 10 ft. long and supporting two conductors. A 5/16-in. ground wire runs along the tops of the poles and telephone conductors are supported below the power conductors.

Dead ends are provided at frequent intervals, the poles being head guyed in two directions at such points. Four 10-in. suspension insulators are used at suspension points and five disks at dead ends.

In connecting the system to that of The Hartford Electric Light Company, it was necessary in order to provide for exchange of power between the two systems in either direction, to install an induction regulator in series with the 11,000-volt tie-lines. This regulator has a 10 per cent range and can be set to "buck" or "boost" as desired, depending on the direction in which energy is sent. In addition, the low-tension winding of the 66,000/11,000-volt transformer is provided with taps for 11,000 to 12,500 volts.

Most of the energy is sold to the Torrington Electric Light Company, the Bristol and Plainville Tramway Company and to the Hartford Electric Light Company. For the period July to December, 1914, 1,907,170 kw-hr. were generated; from January to December, 1915, 11,623,514 kw.-hr. and from January to September, 1916, 23,898,675 kw.-hr. Demands for electricity are increasing rapidly, particularly in Bristol, where the New Departure Manufacturing Company, a subsidiary of the General Motors Company, is increasing its plant extensively. The Bristol Brass Company is also increasing its capacity in the same way. The industries throughout this territory are very stable, most of them having no direct connection with the present, so-called war business.

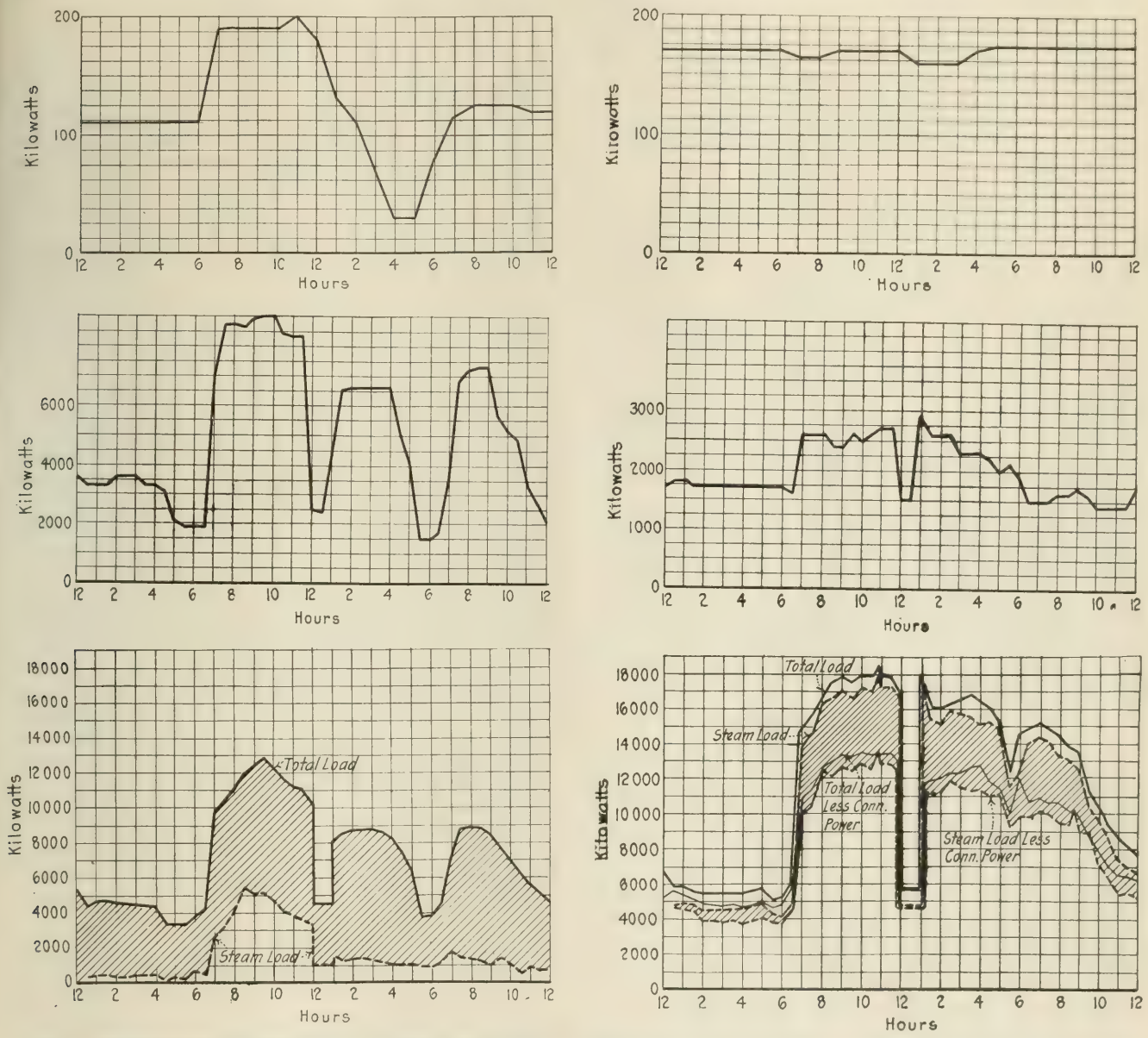


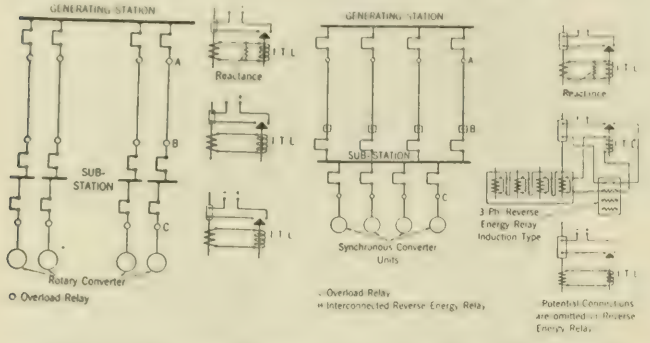
FIG. 2—PROPORTIONS OF TOTAL LOADS CARRIED BY WATER AND STEAM PLANTS ON TYPICAL DAYS OF WET AND DRY SEASONS

The left-hand set of curves indicate conditions on May 6, 1916, and the right-hand set on Sept. 26. The top row of curves represent the loads carried by the Canaan plant, the next lower row the loads carried by the Falls Village water power plant and the lower row the load of the Hartford plant. On May 6 the Connecticut Power Company delivered 73,000 kw.-hr. to the Hartford company, while on Sept. 26 conditions were reversed with the Hartford Electric Company supplying 60,000 kw.-hrs.

Relay Practice of Large Systems

Types, Arrangement and Settings of Instruments Used for the Protection of Distribution Networks, with an Account of the Discussion at the Chicago Meeting of the A.I.E.E.

TWO papers on relay protection were presented at the Chicago meeting of the American Institute of Electrical Engineers on March 9: one by Philip Torchio, chief electrical engineer of the New York Edison Company, and the other by R. F. Schuchardt, electrical engineer of the Commonwealth Edison Company. The first paper reviewed the most prominent systems of relay protection which are being employed in this country and pointed out the combinations which give



FIGS. 1 AND 2—RADIAL FEEDERS—NOT PARALLEL AND PARALLEL

the maximum degree of protection with a minimum expenditure, especially for conditions obtained on existing lines. The second paper dealt with the arrangement and setting of relays on one large interconnected system. Both authors pointed out that the function of the relay is no longer to protect apparatus against overloads but to disconnect any part of a system on which a fault occurs, and prevent extension of the disturbance to the remainder of the system.

New York Practice

In the paper by Mr. Torchio it was pointed out that overload relays of the inverse-time-limit type have been used extensively and successfully in this country for protecting radial feeders not operated in parallel at the substation. Several large companies have furnished the additional protection of a selective-ground relay to indicate a ground on the affected feeder. From experience obtained with this combination, it appears, said the author, that this system warrants further applications. Protection of radial feeders operated in parallel at the substation is best secured by the use of (a) the reverse-power relay in combination with overload relays, and (b) the balanced or Merz-Price system. The split-conductor system is especially suitable for new installations or systems where existing duplicate overhead lines can be arranged to give a split-conductor circuit.

For single lines in tandem, extensive use has been made of definite and inverse-time-limit relays, set for progressively longer time intervals the nearer they are to the generating station. Where there are two or more parallel lines in tandem very satisfactory results have been obtained by connecting inverse-time limit relays at the point where energy leaves the station or substation and using overload relays in combination with reverse-power relays at the points where energy enters the substation. The balanced system, previously mentioned, is also especially adapted to such conditions.

While the balanced system might be preferable for new installations of single-line ring systems, very good results can be obtained by using reverse-energy relays in combination with inverse-time-limit relays set for progressively longer time intervals the nearer they are the generating station. Results will apparently be very satisfactory in parallel-line ring systems if inverse-time-limit relays are used in the outgoing feeders at the generating stations and if a balanced inter-connected combination of reverse-energy and inverse-time-limit relays is employed at the receiving ends of the supply feeders. When energy is furnished to several parts of a system, interconnected through several substations by duplicate feeders, overload relays can be used on the outgoing feeders at each of the main receiving stations to eliminate the possibility of a complete shut down.

Where energy can pass in either direction between generating stations through tie lines, the Merz-Price or balanced system of relays is probably most advantageous. Any one of the following arrangements can be used: Split-conductor principle; combined interconnected reverse-power and inverse-time-limit relay, or relays with the plungers mechanically interlocked.

Relay protection is seldom applied to generators, but when it is, it can be secured by connecting differential relays to current transformers in both ends of each individual winding and also by means of reverse-power relays in connection with overload relays having tripping contacts in series. If a ground is connected to the generator neutral or to the neutral of one or more generators operating in parallel, the selective relay ground principle can be employed for protecting generators by having a transformer of the relay system in series with the ground lead. Transformer protection has been best obtained by means of differential relays.

Since the power factor of a short-circuit may vary from zero to unity, the reverse-power relay should be capable of selecting through a range of 180 deg. Excellent results have been obtained with the selective ground relay by the New York Edison Company for nine years. Where the feeders are paralleled in a substation, a grounding relay is used in conjunction with the balanced interconnected reverse-energy relay on the substation ends of the feeders. All feeders leaving the substations are also equipped with grounding relays.

Chicago Practice

An outline of the protective schemes employed by the Commonwealth Edison Company was given in the paper by Mr. Schuchardt. All of the newer generating units employed by this company and one of the old 20,000-kw. vertical units are equipped with balanced relays of the Merz-Price type. The other generators are not equipped with automatic relays at present. The generators, with their external reactors, when the latter are used, have reactances ranging from 7 to 12.5 per cent, depending on their ratings. The tie lines are protected with balanced relays, the connections being arranged so that the relays will operate only with a ground current. Tie lines between Fisk Street and Northwest station are about 8 miles long, therefore they are treated like ordinary lines. Uni-directional relays have been installed at each end to replace the bellows type and, in addition, an adjustable, definite-minimum, inverse-time-element relay will be installed to trip the 60-cycle switch in case of a sustained excessive overload. The uni-directional relays will be set to operate instantaneously on energy feeding inward and the inverse time-limit relays will be

set to trip in about three seconds with 10,000 kw. Bellows-type relays are also being rapidly replaced by induction-type adjustable, definite-minimum, inverse-time-element relays on the transmission lines leaving the generating stations. Where a line is a part of a ring and the time setting of the relay at the station end is more than one and one-half seconds, an additional relay of the same type is used but set to operate instantaneously. At the substation end of these lines as well as on the tie lines between substations are connected uni-directional inverse-time-element relays of the induction type, or balanced relays in some instances on rings.

Induction-type relays are used on all transmission lines except where their use requires too high a time setting, that is, one that exceeds two seconds. With ring-connected lines where consecutive relays in each link must have an increased time element, the nearer they are the station, the use of these relays would generally require more than a two-second setting, since the difference in time setting between any two consecutive relays in series must be equal to the time required for the oil switch to operate plus a safe margin, making the minimum time at least three-tenths of a second. To minimize the total number of relays connected in series in a ring of many links and thus prevent employing excessive time limits, the shortest sections in a ring are provided with balanced relays and pilot wires.

The bellows overload relays on the high-tension side of the substation units are set to operate in two seconds with three and one-half times rated current and instantaneously with five times rated current. Not more than 15 per cent overspeed is allowed in operating synchronous converters. Differential relays on the substation transformers and the relays on the 4000-volt feeders are of the instantaneous type.

Discussion on Relay Practice

Among those who participated in the discussion were H. R. Summerhayes, Schenectady, N. Y.; W. H. Cole, Boston, Mass.; E. B. Meyer, Newark, N. J.; L. N. Crichton, East Pittsburgh, Pa.; J. R. Craighead, Schenectady; O. C. Traver, Schenectady; A. A. Meyer, Detroit, Mich.; J. V. Taylor, Schenectady; H. L. Wallau, Cleveland, and J. S. Jenks, Pittsburgh.

Mr. Summerhayes pointed out that the papers presented indicate a tendency toward standardization of relay practice. He also expressed the belief that overload relays will make a system less selective for cable "shorts" than the system outlined in Mr. Schuchardt's paper, but the former will give better protection for a substation-bus short-circuit. Furthermore, he strongly recommended the use of balanced or differential relay protection for generators, and urged the installation of steam pipes for putting out fires and dampers for shutting off the draft.

Referring to the maximum time limits of 1.5 or two seconds mentioned in both papers, the speaker said that he had recently made calculations which show that for fifty times full-load current the temperature rise is at the rate of 55 deg. C. per second and for 100 times full-load current at the rate of 220 deg. C. per second. Since it takes a conductor several minutes to cool from a temperature of 220 deg. C. to the safe temperature of 100 deg. C., the effect is not merely momentary and the cable insulation may be permanently injured if the conductor rises to over 200 deg. C.

W. H. Cole said that the Edison Electric Illuminating Company of Boston had installed 60 miles of split-conductor cable protected by balanced relays. Part of the switch gear is English and part of it has been developed by the company's engineers. Experience to date indicates that the balanced type of protection is very satisfactory and that it permits extensions.

E. B. Meyer said that the Public Service Electric Company of New Jersey has installed about 7 miles of 350,000-circ. mil sector type, split-conductor cable on 13,200-volt circuits during the past year. During 1917 10 miles more will be installed.

At opposite ends of each split conductor are installed reactors which produce a reactance drop equal to 12 per cent of the resistance drop at rated current. With this arrangement the maximum voltage between "splits" during an end fault should not exceed 1000 volts. The cost of the cable is from 10 to 15 per cent higher than the ordinary type of cable and the cost of jointing is 25 per cent higher, but this additional expense appears warranted on important tie feeders. To be conservative the New Jersey company has rated split-conductor cables the same as solid-conductor cables.

Mr. Crichton called attention to the results of tests made several years ago which indicated that power should not be cut off from induction motors more than three seconds and then applied again, since the belts and clutches between the motor and the load could not stand the sudden increase in speed following the restoration of full voltage. Falling out of step is another limitation to the length of interruption of power which should be allowed.

A. A. Meyer of Detroit outlined a very simple scheme which the Detroit Edison Company has used successfully for more than a year, since it changed from a radial to a parallel system of operation. It was brought out later by Mr. Wallau that this scheme is particularly applicable where a number of feeders and substations lie between two power houses. He also said the Cleveland company, which operates its system in tandem with cables in parallel, had found sufficient protection by using overload relays at the sending end and reverse-energy relays at the receiving end.

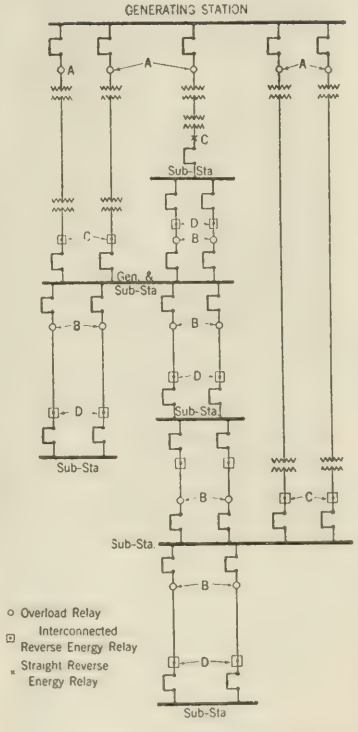


FIG. 3—PARALLEL FEEDERS—RING NETWORK

J. S. Jenks said that the West Penn Electric Company had estimated that with ordinary protective schemes the time for the operation of some of the relays would amount to as much as ten seconds. To avoid this delay a system has been devised in which all of the switch gear is normally locked closed. Should the voltage in any part of the system, however, fluctuate beyond pre-determined limits, the switches will be automatically unlocked so they become operative.

In closing the discussion Mr. Torchio expressed the opinion that large generators should be protected. Mr. Schuchardt remarked that the disadvantages of the balanced system are its complications, its high cost and the fact that it adds another element to the system. In line with Mr. Summerhaye's remarks, he said that one and a half seconds is as long as he should advise that a short-circuit be left on the line.

Motor Drives in a Screw and Bolt Plant

Convenient Arrangements of 184 Induction Motor Drives Which Represent an Average Load of 170,000 Kw.-Hr. per Month with a Monthly Load Factor of 30 per Cent and a Demand Factor of 45.5 per Cent

By L. J. Lamberger
Member of engineering staff, Duquesne Light Company

THE many advantages claimed for electric motor drives in various industries have likewise been realized in the screw and bolt plants. The machines used in the manufacture of this product consist principally of lathes, threading and tapping machines, punches, shears, hot and cold heading machines, blowers and power hammers. The flexibility obtained by a motor drive has proven advantageous since the machinery is located where it is easily accessible and the material can be quickly taken to and from the machine in the course of manufacture. Each machine or group of machines can be operated independently and the starting and stopping of one or another does not necessarily affect the others. Among the various other practical considerations involved in the operation of a plant of this kind is the human factor. It is generally agreed that the working conditions of the employee is of great importance and worthy of careful attention. The motor has also been found to have advantages in this respect.

The factory layout and operation at the plant of the Pittsburgh Screw & Bolt Company at Pittsburgh, Pa., from the standpoints of completeness of working equipment, power equipment and means of providing for employees first-class working conditions are of interest and described in what follows.

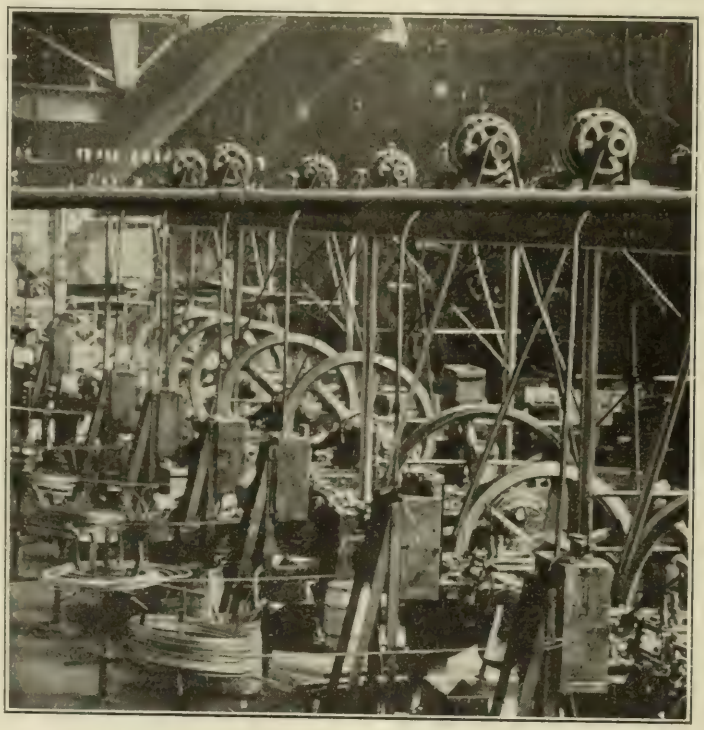


FIG. 1—SMALL COLD-HEADING MACHINES DRIVEN BY INDUCTION MOTORS MOUNTED OVERHEAD

For a number of years before this company moved to its present quarters, the old plant was driven by means of engines through a series of line shafts and belts. A part of the plant was, however, electrified, and it proved so successful that when the equipment was moved to its larger quarters, the old method of developing and transmitting power was entirely abolished and the modern, more efficient and flexible drive by motors was adopted. The capacity of this plant in the manufacture of bolts, nuts, screws, tie rods and rivets is about 8000 tons a month. The building, a one-story rectangular-shaped structure of steel and brick, with concrete floors, is about 400 ft. wide and 800 ft. long. Raw material is brought into the plant on a railroad siding extending along one side of the building for almost the entire length and is unloaded and distributed by means of electric traveling cranes from this point to the machines where it is to be used. The finished product leaves at the opposite side of the building, where it is loaded into auto trucks and railroad cars for shipment. Each operation or each class of work is confined to a certain section of the building. Under normal conditions the plant operates ten hours per day, excepting Saturdays, when it operates alternately five and eight hours. All machinery is electrically driven and all energy for light and power is purchased from the Duquesne Light Company.

The substation has an ideal location in the center of the plant. Three-phase, 60-cycle service is supplied through cables at a potential of 11,000 volts. For distribution to the motors, this is stepped down to 440 volts by means of three 375-kva., 11,000/440-volt, 60-cycle, single-phase oil-cooled transformers, which are delta connected. For lighting, the voltage is stepped down to 110 and 220 volts by means of a 100-kva. transformer. The substation equipment also includes a motor-generator set consisting of a 150-hp., 440-volt, three-phase, 60-cycle, 900-r.p.m. induction motor direct connected to a 100-kw., 240-volt, compound-wound, interpole direct-current generator which supplies current to cranes, elevators, deep-well pumps and Cooper-Hewitt quartz lamps. The switchboard consists of four alternating-current power panels bearing an integrating wattmeter and a curve-drawing wattmeter, two lighting panels with an integrating wattmeter, and two direct-current panels with an indicating ammeter and voltmeter, making a total of eight panels. All power and light circuits are protected by circuit breakers mounted on the switchboard.

In all 184 motors are used, ranging in size from 2 to 150 hp., with an aggregate rated capacity of 2322.5 hp. Of this number 174 are 440-volt, three-phase, 60-cycle induction motors, including the motor of the motor-generator set, nearly all of which are of the squirrel-cage type. The total rated capacity of these, which is the total connected power load on the alternating-current supply, is 2197.5 hp. The remaining ten are 220-volt, direct-current motors, the energy for which is supplied from the motor-generator set. Both the individual and the group drives are used, the former, however, being employed more extensively. Unless the motor is direct connected or geared to the machine driven, it is usually mounted overhead. In this way very little floor space is utilized for power purposes. All power

feeders are run in conduit underground. Switches are inclosed in metal boxes and carefully placed where most convenient to the machine operator.

In Fig. 4 is shown a group of three heavy cold-heading machines, each driven by a 20-hp. motor. This view was taken from the rear of the machines to show the relative position of the motors. The switch and

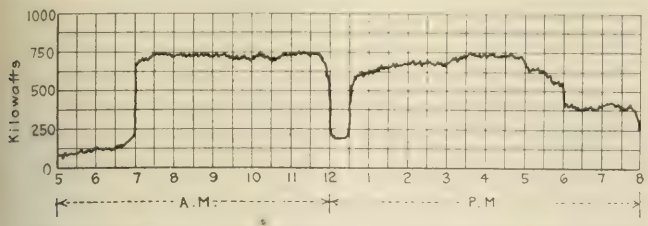


FIG. 2—AVERAGE DAILY POWER LOAD OF MOTORS INSTALLED

starter controlling the motor are located in front of the machine near the operator. These machines will produce bolts or rivets, 5/8 in. to 1 in. in diameter, from cold stock at an average rate of forty-five per minute. Raw material, in the form of wire, is automatically fed to the machines from reels. In passing through it is headed and cut into desired lengths in one operation. The finished bolt or rivet drops through a chute into a keg. When the keg has been filled and its contents weighed, it is put on an electrically driven conveyor and carried to another department for additional machine work or to the shipping department.

In Fig. 1 is shown a group of eight smaller cold-heading bolt and rivet machines, each belt driven by a squirrel-cage induction motor, mounted above on a steel frame support, where it occupies no valuable floor space and the belt neither interferes with the free handling of materials nor endangers employees passing about the machines. The switches controlling these motors are inclosed in metal boxes mounted on brackets of angle iron. The operation of these machines is similar to that of the machines shown in Fig. 3, except that the rivets and bolts made are of a smaller size and the number produced in a given time is somewhat greater. The larger sizes of bolts and rivets are preheated in furnaces and forged in so-called hot-heading machines.

TABLE I—ENERGY CONSUMPTION FOR PLANT COVERING A PERIOD OF SIX MONTHS

Month	Light, kw.-hr.	Power, kw.-hr.	Total kw.-hr.
August, 1915	4,881	133,350	138,231
September, 1915	5,682	137,120	142,802
October, 1915	9,739	168,550	178,289
November, 1915	11,735	160,740	172,475
December, 1915	13,922	173,150	187,072
January, 1916	16,615	185,120	201,735
Average	10,429	159,672	170,101

The nut presses are driven by 7.5-hp. 1200-r.p.m. squirrel-cage motors mounted similarly to those in Fig. 1. The switch boxes and starters are located within convenient reach of the operators.

The curve of Fig. 2 is a typical power load under normal conditions. The maximum demand is 750 kw. The curve is a fairly smooth one, this being due to the fact that the entire load consists of comparatively small motors, the largest motor being only a small part of the entire load, so that the sudden starting and stopping of a motor causes but a slight variation in the load. Besides this some of the motors, such as blower motors, are a steady load. There is very little load between the hours of 8 p. m. and 5 a. m.

The plant is lighted through a large amount of window space on the sides and top of the building. On dark days, when light from this source is insufficient, and at night general illumination is obtained by means of thirty-six Cooper-Hewitt quartz lamps. At machines, in the office and other places where a more concentrated light is desired incandescent lamps are used. The larger of these are of the gas-filled tungsten type. All incandescent lamps are connected directly to the alternating-current supply. The maximum load from this source is 45 kw. A three-wire, 110-220-volt distribution system is used.

The increase in power consumption is due to increased production. The increase in consumption for light is due to both increase in production and the dark

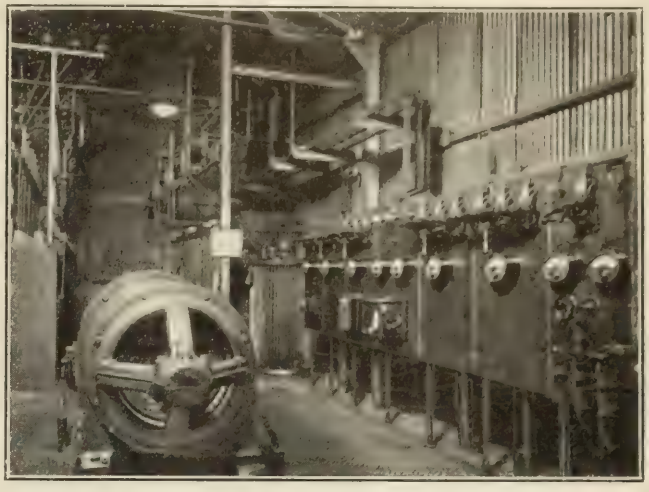


FIG. 3—SUBSTATION IN SCREW AND BOLT FACTORY

days of the winter season. Taking the maximum demand on light and power as 795 kw., the load factor, based on the average energy consumption as shown above and 720 hours per month, is 29.7 per cent. During the month of January, 1916, the output was close to 5000 tons. This number divided into the total number of kilowatt-hours for the month shows an energy consumption of 40 kw.-hr. per ton of product. The average power consumption per month per horsepower of connected load for the six months was 72.6 kw.-hr. The demand factor or the ratio of the maximum demand to the total connected power load is 45.5 per cent.

A complete record is kept of the performance of each

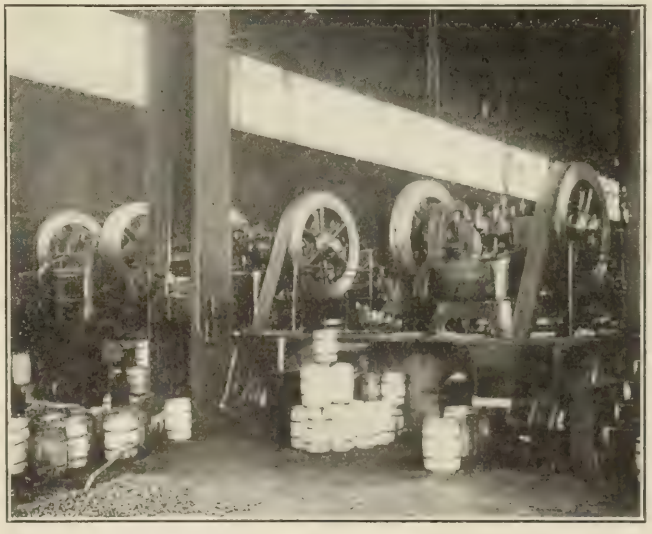


FIG. 4—COLD-HEADING MACHINES GEARED TO MOTORS BELOW

motor. When a motor is repaired, the date and extent of such repairs are carefully recorded in a systematic way. These records are gone over regularly, and in this way the electrician knows when a motor is due for an inspection. With this method in use, very little inconvenience due to motor trouble is experienced. A similar plant is operated by this company at Gary, Ind.

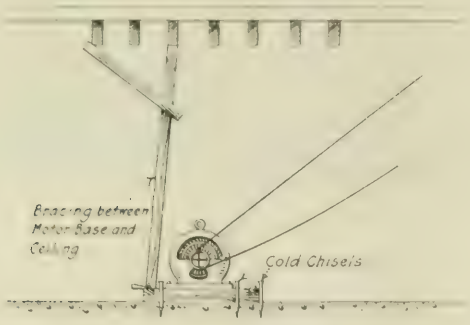
STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Temporary Installation of Motors on Concrete Floors

BY H. S. RICH

To install a motor temporarily on a concrete floor where no secure anchorage is available the writer has found the following method effective and easy to follow: A square frame is bolted together for the motor to set



METHOD OF INSTALLING MOTOR TEMPORARILY ON A CONCRETE FLOOR

on, and in place of driving spikes through it into the concrete floor two or three cold chisels are driven in with a sledge along the side of the frame nearest the apparatus operated by the motor. Between the other side of the wooden frame and the ceiling are wedged two 2-in. by 4-in. posts. These posts are nailed, wedged and braced as shown. The posts hold the motor down and the chisels prevent it from twisting out of line. The motor is attached to the frame with lag screws.

SYSTEM MAP AND CARD FILES

How a Wall Map of a Distribution System Is Used in Conjunction with Transformer Records in Securing Line Information

On a wall space that measures about 12 ft. square the Indiana & Michigan Electric Company at Elkhart, Ind., has placed a complete map of the electric system in its city, the territory represented being about 2 miles

LOCATION NO 430 LOCATION Rear — 1626 Franklin St West CIRCUIT NO 4

TRANSFORMER RECORD PLACED	OUR NO	SIZE K.W.	REMOVED	TRANSFORMER RECORD PLACED	OUR NO	SIZE K.W.	REMOVED	TRANSFORMER RECORD PLACED	OUR NO	SIZE K.W.	REMOVED
5 6 16	10	5									

METER RECORD PLACED	OUR NO	SIZE AMP.	REMOVED	CUSTOMER NAME AND ADDRESS	CONNECTED LOAD ARC LAMPS	INCAND. LAMPS	MOTORS TOTAL WATTS	MOTORS NO.	MOTORS H.P.
5 31 16				John Day — 1170 Rice St		16		1	½
			6 8 17	Harry W. White 1170 Rice St		10			
				E. M. Jones — 1628 Franklin St		15			

FIG. 1—HISTORY OF TRANSFORMER, METER RECORD AND CONNECTED LOAD

square. From this map and the card record systems used with it, it is possible to obtain practically all information required regarding lines and their equipment. Every primary circuit from the power house to its terminus is shown along the streets and alleys it traverses by a colored string. These strings are held in place by wood screws with special heads, like the one shown herewith. Strings held in this manner rather than painted or inked lines were used, since their locations can be easily changed if necessary. Although the string holders look like miniature poles with crossarms on them, they do not mark pole locations. Records of the

RECORD OF TESTS

DATE OF TEST	CORE LOSS IMPRESSED VOLTS	CORE LOSS EXCITING CURRENT AMPS	CORE LOSS WATTS LOSS	POLARITY TEST	RATIO TEST	W O NO	COST OF TEST MATERIAL	COST OF TEST LABOR	COST OF TEST EXP.	COST OF TEST TOTAL

RECORD OF REPAIRS

DATE ORDERED REPAIRED	DATE RETURNED	REPAIRED BY	OUR PURCHASE ORDER NO	COST OF REPAIRS MATERIAL	COST OF REPAIRS LABOR	COST OF REPAIRS EXP	COST OF REPAIRS TOTAL

FIG. 2—RESULTS OF TRANSFORMER TESTS AND COSTS OF REPAIRS ENTERED ON THIS CARD

poles are kept in a book containing maps of the different sections of the city drawn to a much larger scale than the wall map. The locations of all streets and alleys, transformer banks and street lamps, however, are marked on the wall map.

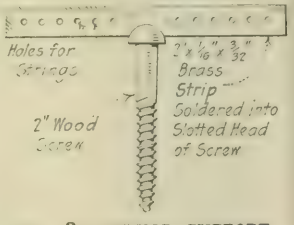


FIG. 3—STRING SUPPORT FOR USE ON MAP

According to representatives of the Elkhart company, not a day goes by but what the map is consulted. It is used to provide information on line extensions, trouble calls, street-lamp locations and sizes, transformer locations (the load conditions of which are kept on indexed cards), and on three-phase power-circuit locations. As an aid to the contract department it is also of value. Moreover, it possesses some advertising value, since it is visible from a large window on the street. People passing stop to look at it, and customers in the office often consult it for general information.

OUR NO 10 TRANSFORMER CARD CONDEMNED 19 SCRAP VALUE

PURCHASE RECORD

OUR ORDER NO	DATE	MFG. INV. NO	DATE	PURCHASE PRICE	F.O.T.	CARTAGE	TOTAL COST

DESCRIPTION OF TRANSFORMER

MAKE	SIZE K.W.	TYPE	VOLTS	SERIAL NO	STYLE NO
Westinghouse	5	OD	400	34567	2369

DATE PLACED	W.O. NO	PLACED ON POLE NO	LOCATION NO	LOCATION	DATE REMOVED	W.O. NO
5 6 16	27942	JM-361	430			

FIG. 4—DESCRIPTION OF TRANSFORMER AND RECORD OF PURCHASING INFORMATION

For more detailed information than the map gives the card records previously referred to may be consulted. Each transformer shown on the map bears a

number. Corresponding to this number in a convenient file are 4-in. by 6-in. cards, which give the entire history and rating of the unit and also its location number. Knowing the latter anyone can learn where the unit is situated, when it was set, what circuit it is on, what its rating is and what load it is carrying by referring to a set of 5-in. by 8-in. cards numbered to correspond. This map and record system, which cost originally about $400, is said to be worth that amount as a time-saver alone.

TWO-PHASE MOTOR TROUBLE

How Trouble Due to Starter Connections Was Corrected by the "Cut and Try" Method

BY HENRY MULFORD

Owing to indistinct lines and erasures on a manufacturer's wiring diagram the writer had to try several two-phase motor connections shown in the accompanying illustration before arriving at the proper connections shown by the solid lines. At first the connections

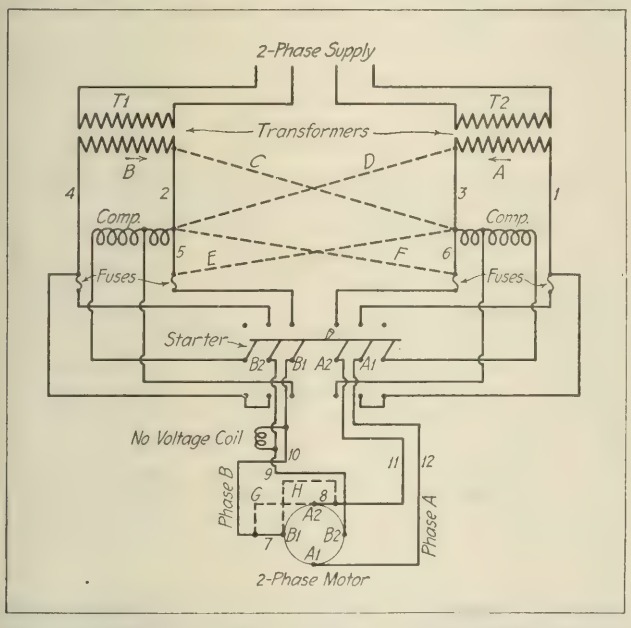


FIG. 1—STARTER CONNECTIONS WHICH CAUSED MOTOR TROUBLE

on the supply side of the compensator were made as shown by lines 1 and 4, and dotted lines *C* and *D*, lines 2 and 3 being disconnected. With the remaining connections made as shown by full lines and the compensator switch in the starting position this crossing of wires placed the transformer secondaries and entire compensator windings in series besides connecting each motor phase across a portion of a compensator winding. When the switch was placed in the running position the transformer secondaries, alternate compensators and motor windings were placed in series. Since these connections did not permit operation, the connections of motor leads 7 and 8 were transposed, as shown by dotted lines *G* and *H*. This change permitted starting the motor and operating with the switch in running position, and might have been accepted as the solution to the problem if the no-voltage release coil had not failed to magnetize when the switch was in the starting position. As shown, the coil was across leads 9 and 10.

An attempt was made to correct this trouble by disconnecting wires 5 and 6 and reconnecting as shown by lines *E* and *F*. This gave full potential across the trip coil with the switch in running position. With these connections, however, a peculiar condition existed. The motor started, but when the switch was thrown to the running position the motor phases were connected in series and the machine operated as a single-phase unit running on the resultant field produced by the motor coils. This condition would not have been noticed if heating had not occurred at a load which was within the rating of the motor. To remedy this trouble

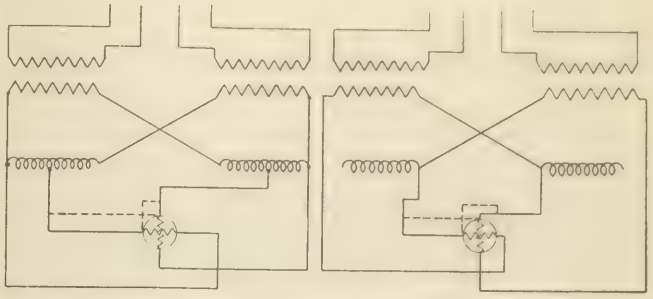


FIG. 2—CONNECTIONS EXISTING WHEN STARTING AND RUNNING

the wiring diagram was more closely examined by means of a magnifying glass which showed the connections indicated by continuous lines. After these were made starting, running and operating with rated load were permitted without any objectionable conditions arising.

This experience indicates the need of "making haste slowly" when connecting machines according to maker's diagrams, for seldom are mistakes made in them.

Maintaining Constant Draft Over Furnaces in Buffalo Plant

Provisions have been made at the new steam plant of the Buffalo General Electric Company for automatically maintaining a constant draft over its furnaces. The particular draft selected was found by trial with each boiler, the governing factor being that it should permit the most efficient results at all rates of combustion. To prevent possible "flare backs" from momentary furnace pressure, the draft is usually maintained at about 0.05 in. of water. As a result of the furnace conditions thus maintained a variable rate of combustion is obtained economically and quick response to sudden changes in load is secured without dampers. In addition widely different grades of fuel may be utilized, uniform steam pressure may be maintained and the life of the boiler and its setting prolonged.



APPARATUS FOR MAINTAINING CONSTANT FURNACE DRAFT

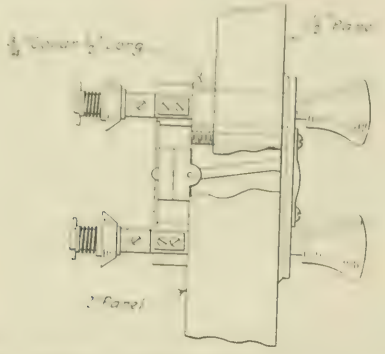
The apparatus consists of a draft regulator furnished by the Engineer Company of New York City, the forced draft being controlled by the steam pressure varying the fan speed. This draft is maintained constant by the adjustment of a damper in the smoke connection from the boiler. The damper is operated by 30-lb. water pressure through the medium of a hydraulic cylinder and a system of levers. Built in one side wall of the boiler setting is a large iron pipe across which is a

movable vane, held in a definite position by a weight. Since one side of the vane is subjected to furnace pressure and the other side to atmospheric pressure, change in the draft condition over the fuel bed will change the location of the vane and operate the pilot valve controlling the hydraulic cylinder previously mentioned.

Method of Adapting Pull Switch to Thin Panel

BY F. O. WOODWARD

Certain types of pull-button switches intended for mounting on 2-in. panels are unsuitable for use on 1.5-in. panels. Since the latter size panel is coming into extensive use, it is therefore necessary to make allowance for the difference in thickness of panels when the 2-in.



TWO-IN. PULL SWITCH MODIFIED FOR USE ON 1.5-IN. PANELS

switch is used on a 1.5-in. panel. It is possible to shorten the shanks of the pull rods, but this necessitates turning the rods in a lathe, shortening springs, etc., and is therefore a rather expensive process. This modification also unfits the switch for future mounting on 2-in. panels if it should be desirable to do so. A very convenient and effective method of overcoming the difficulty is to cut (preferably in a lathe) 0.5-in. collars from 0.75-in. steel conduit, thus requiring no boring. The collar is then slipped over the pull rod in the position shown herewith, thereby making a solid mounting which does not occupy much space and will maintain its place. There is no opportunity for shrinkage with consequent loss of alignment that sometimes results with a fiber spacer. The switch to which the modification applies is a General Electric, catalog No. 62557.

Operating Company Prefers Wood Boxes for City Construction Crews

After experimenting with steel boxes for tools and material a central station company operating in a large Middle Western city has decided that they are not as good as wooden boxes. The steel boxes which were used were made of heavy sheet metal and were fairly well reinforced. Reinforced oak boxes weighing 24 lb. each are now being used.

Besides being 7 lb. lighter in weight the wooden-type construction box has other advantages over the steel box. First, it costs only about one-half as much to build; second, it does not rust; third, it is not a conductor of electricity and can be used sometimes as an insulating stand. With the steel box it was found that a rope attached to the handle could not be used for lowering the box into a manhole; the weight of the box and the material in it sprung the end out so that the lid did not fit. With wooden boxes this trouble does not occur.

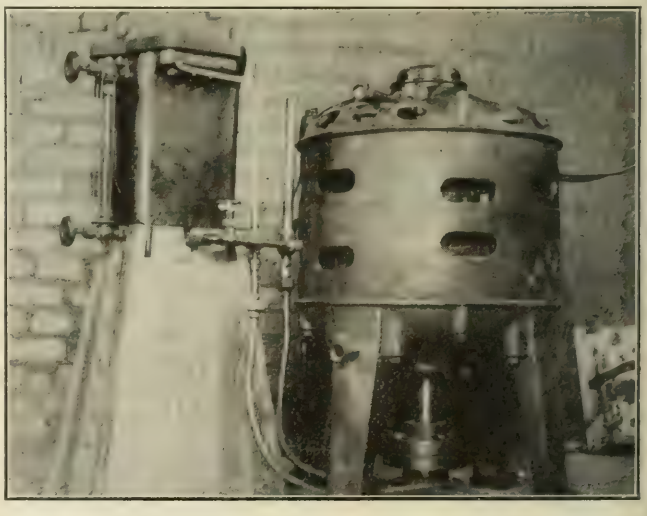
Protection for Padlocks Used on Outdoor Meter and Switch Houses

It is a common practice to equip the gates to outdoor substations, doors of meter houses, transformer vaults and kiosks, switching houses and the like with padlocks in preference to other types of locks, probably because they are more accessible under all circumstances, and especially when a key is missing they can then be easily cut. Padlocks used in this class of work are exposed to the elements—rain and dampness—often directly but in any case indirectly, and under the influence of the weather soon corrode and rust, making them difficult to manipulate and often requiring strenuous efforts which result in a damaged lock.

To overcome this it has been found worth while, where padlocks are subjected to outdoor conditions, to wrap the lock with several layers of friction tape. This will very largely prevent water trickling into the mechanism or condensing therein. A little oil or kerosene poured into the lock before applying the friction tape will also prove beneficial. This practice even on locks made of so-called moisture-resisting materials will save much time and annoyance in opening padlocks that have to be opened sporadically, and will in many instances extend the life of the padlocks as well.

A Home-Made Oiling Arrangement for a Motor-Driven Pump

In an accompanying illustration is shown a home-made automatic oiling device for a motor-driven centrifugal water-pump installation operated from the lines of the Osage County Light & Power Company of Lyndon, Kan. An old transformer case mounted as shown herewith serves as the oil reservoir. Two lengths of 0.25-in. tubing connect this with the bearings of the 3-in. Morris centrifugal pump 14 ft. below in the well pit. The needle valves leading from the transformer case were made of cream separator parts. The lever operating these valves above is prevented from grounding the meter by a piece of fiber board 4 in. long at-



OILING ARRANGEMENT FOR MOTOR AND PUMP IT OPERATES MADE FROM TRANSFORMER CASE

tached to the end of the lever. When the motor starts this lever is raised, thus allowing the oil to flow. The transformer case holds sufficient oil for three weeks' supply. The motor is started at the power house 0.5 mile away, so that it is not necessary to make a trip to the pump house until time to replenish the supply of oil.

CENTRAL STATION SERVICE

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COMPRESSING COTTON BALES BY ELECTRIC POWER

Results of a Test on the Electrically-Driven Hydraulic Compress of the Alabama Warehouse Company of Attalla, Ala.

Cotton is compressed into 500-lb. bales at an average cost of 8 cents per bale in the electrically-driven hydraulic cotton press installed for the North Alabama Warehouse & Compress Company of Attalla, Ala.

A recent electrical test of this equipment was made by inserting standard portable meters in the incoming power circuit to the motor to read the kilowatt input and power factor.

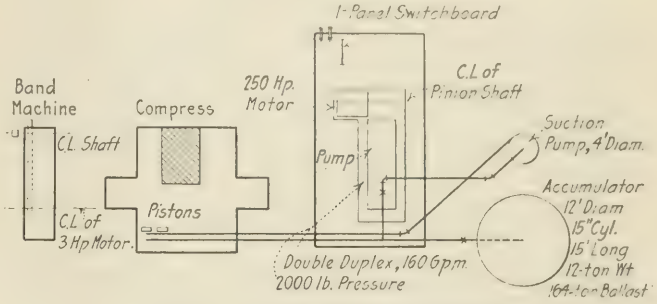
The accompanying diagram shows the layout of the compress, pump, accumulator and motors. The motive power is supplied by a 250-hp., 500-r.p.m., 220-volt alternating-current slip-ring motor. This motor is geared to a duplex double-acting pump of 160-gal. per minute capacity with a working pressure of 2000 lb. per square inch. The water is first pumped into an accumulator, from which it is supplied directly to the hydraulic press. The accumulator is loaded with scrap iron weighing 176 tons. Readings were taken once a minute during the test and the curves show the readings as charted. The maximum load noted on motor was 182.4 kw. and the average no-load reading was 14.4 kw.

The average load during the test of 100 minutes was 155 kw. The power factor on the motor ranged from 16 per cent at no load to 87 per cent at the maximum load. The energy consumed during the test was 260 kw.-hr., including an idle period of twenty minutes in which part of the time the motor was running at no load and the balance of the time the compress cylinders were being operated for demonstration purposes.

During the electrical test on the motor the different operations of the press were carefully noted and timed to secure the average time required for the actual compressing of a bale. Observation shows that six distinct operations were required at the press, the average time being:

1. Putting bale in press (by hand), five seconds.
2. Closing doors of press (by hand), three seconds.
3. Side and end compression (power), nine seconds.
4. Vertical compression (power), eight seconds.
5. Tying bale (by hand), fifteen seconds.
6. Taking bale out of press (by hand), five seconds.

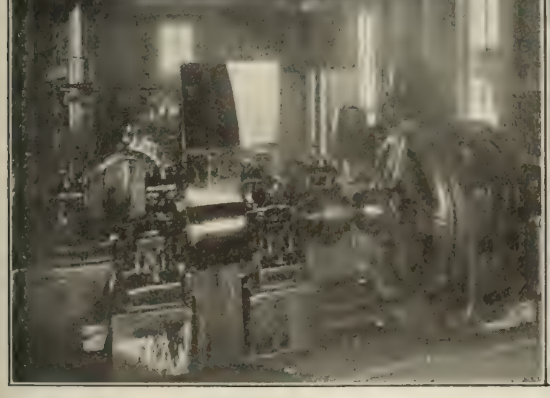
This makes a total of forty-five seconds for the actual compression process. During the test of 100 minutes 100 bales of cotton were pressed, or sixty bales per hour, but as about twenty minutes of the period was required to take photographs of the different stages of compression and in demonstrating the compress, the actual working time was only eighty minutes, and the bales were actually pressed at the rate of seventy-five bales per hour.



LAYOUT OF COMPRESSOR APPARATUS

Of the 260 kw.-hr. used during the test, 245 kw.-hr. were used for the actual operation of the compress, or 2.45 kw.-hr. per bale compressed.

Figuring the energy at 2 cents per kw.-hr., the cost for energy per bale compressed would be 4.9 cents, or 5 cents approximately.



MOTOR-DRIVEN DOUBLE DUPLEX COMPRESSOR PUMP

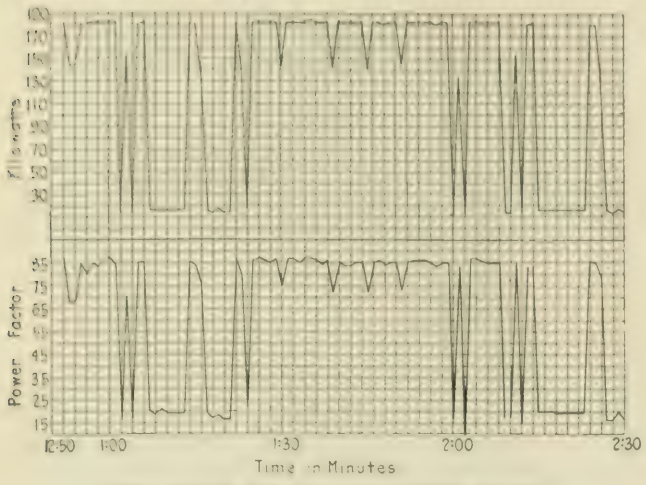


COTTON COMPRESS, SHOWING BALE OF COTTON AT END OF COMPRESSION

The average size of a plantation bale is 27 in. wide, 48 in. thick and 54 in. long. The weight being 500 lb. gives a density of 12 lb. to the cubic foot. Owing to their large size and irregular shape it is only possible to load nineteen of these bales to the average box car. When it is considered that the minimum freight must be paid on a car regardless of weight, the mere shipping of the plantation bale becomes an expensive mat-

ter. A large area of valuable storage space is also occupied, as these bales must either be stacked and held in place by wood bracing or each bale allowed to occupy its own floor space.

The average size of an electrically compressed bale is 24 in. wide, 21 in. thick and 54 in. long. The compression of these bales to such a small size is an important factor in shipping, as each bale will only occupy



TEST CURVES FOR LOAD AND POWER FACTOR

40 per cent of the space required by an ordinary bale and the average box car will then easily accommodate 100 bales. While not compressed to as high an initial density as would be the case with the old steam compress, yet it actually makes a smaller bale, and the size being absolutely uniform permits stacking in cars in regular tiers, does not require bracing, as is the case with irregularly compressed bales, and does not require the handling or moving of bales for checking shipments.

Seven men are required for the operation of the compress. These men are paid at the rate of $1.25 per day, and the total labor charge is, therefore, $8.75, or 1.5 cents per bale when compressing at the rate of sixty bales per hour or 600 bales per day.

Including power and labor, the average cost per bale compressed is 8.2 cents.

TOTAL LABOR COST FOR OPERATION OF COMPRESS

During the test, the following men were employed:

2 men wheeling bales to rack, at $1.25	$2.50
3 men untying bales, at $1.25	3.75
1 man wheeling to press, at $1.25	1.25
7 men operating press, at $1.25	8.75
3 men wheeling bales to car, at $1.25	3.75
3 men loading bales in car, at $1.25	3.75
1 man, general machine man, at $2	2.00
Total	$25.75

At an average daily output of 600 bales, the above total cost of $25.75 represents a labor cost of approximately 4.3 cents per bale.

STANDARD OF LIGHTING IN TEXAS TOWNS RAISED

Texas Power & Light Company Employs Illuminating Engineer for This Purpose with Idea of Giving Customer What He Ought to Have

Few central-station companies operating in the smaller towns and cities have devoted much attention to supervising the lighting service obtained by their customers. In certain sections the resulting objectionable conditions are especially apparent, and although in some localities steps have been taken to correct the tendency to install bare lamps without regard to the illumination neded, there still exists a very broad field for intensive work along this line.

Recently the Texas Power & Light Company has employed a competent illuminating engineer to devote his entire time to raising the standard of illumination in the various towns and cities where the company operates electric properties. Although this man has been in the field only a short time, results are already apparent, and the public is receiving the idea with hearty approval. Primarily the idea is to give the customer what he ought to have. This is being done even though it decreases the actual wattage installed. In most cases, however, changes result in increased wattage, so that the company profits in this way, and also from the fact that the customer will be a satisfied booster.

SERVICE TO THE "LESS THAN MINIMUM" CONSUMER

A Plan in Effect in Southern California Devised to Encourage the Individual to Use All the Energy He Pays For

On the lines of every central station that has a minimum monthly charge there is a class of consumers by no means small in number to which there is an opportunity of furnishing a better service, at the same time adding to the income. This is the "less than minimum" consumer, the consumer who uses less than the minimum amount of energy per month. Any way by which this class of consumers can be made to use the full amount of energy paid for would undoubtedly be welcomed by managers for (1) by showing the customers how to use all they are paying for complainers are turned into boosters, and (2) since a large part of the less than minimum accounts occur during the summer months by increasing the use of energy in these months means an increased use throughout the year.

Such a plan is in effect in the communities served by the Southern Sierras Power Company, which has a monthly minimum charge of $1. Customers using less than the minimum have this fact called to their attention.

With each month's bill for the minimum amount there is now sent out a printed slip headed "Additional Service Without Expense," under which the following is printed in bold face type: "We note that during last month you did not use all of the energy to which you were entitled under your minimum charge. You might have used more lights, larger lamps, an iron or other convenient appliance, without additional expense. We like our customers to receive a full measure of service for a given sum and hope you will plan to utilize an additional quantity this month. Let us help you to improve your service."

A report from each local superintendent is turned in to the general agent each month, showing the number of these minimum consumption slips which have been sent out. For the last nine months of 1916 these reports from eleven towns came in as listed in the tabulation on page 517.

The general decrease of the "minimum consumers" which was noted after the plan had been in effect a few months is thought to be partly due to the natural increase in lighting requirements as the days shorten. A part of the increase, however, is believed to be the result of directing the consumers' attention to "getting his money's worth."

The fourth town on the list illustrates a tendency which local superintendents have reported, namely, that after a month in which the effect of the printed slips was very noticeable, there occurred a marked tendency in the opposite direction. That is, when acting on the suggestion of the company the consumers carried the idea too far and exceeded the minimum considerably, so that their monthly bills were larger than usual. This re-

sulted in a reaction so that in the following month an unusually large number of "minimum consumer" slips were required. A remedy that has been suggested for this is the use of a meter dial diagram on the printed slips, so that the consumer will be encouraged to check up the consumption of current from time to time during the month. In connection with the printed slips it is also the policy to send circulars describing socket appli-

NUMBER OF CONSUMERS USING LESS THAN MINIMUM CONSUMPTION EACH MONTH

Total Customers	April	May	June	July	August	September	October	November	December
7	2	2	4	...	...	4	...	...	...
128	...	...	...	42	38	31	36	27	25
1299	183	247	353	429	332	211	114	70	77
772	147	169	...	267	253	201	163	...	142
9	2	4	3	4	4	3	2	...	...
148	7	39	52	57	55	57	35	8	21
245	105	94	110	167	170	155	150	130	65
223	76	77	87	...	...	82	45	60	52
1076	451	561	566	556	578	490	275	325	263
1116	528	573	589	638	632	424	470	338	281
227	60	106	84	80	60	55	50	51	55

ances which the consumer would find useful and which he might still operate so long as the minimum charge is in effect. Inasmuch as the territory served by the company has been generally supplied with electric irons, care has been taken to feature other appliances, using percolators, vacuum cleaners, disk stoves, electric fans during the hot weather, etc. This work is under the direction of E. B. Criddle, general agent of the Southern Sierras Power Company, Riverside, Cal.

RANGE SALES, LIKE CHARITY, SHOULD BEGIN AT HOME

St. Louis Company Opens Comprehensive Electric Cooking Campaign, with Sales Effort Directed Toward Officers and Department Heads

An electrical dinner given by the electric range department of the Union Electric Light & Power Company on St. Valentine's day to the officers, heads of departments and their wives was the first gun in a comprehensive range campaign. The object of this campaign is to sell electric ranges, first, to the employees of the Union Electric Light & Power Company; second, to the employees of other electrical concerns in the city of St. Louis, and third, to the general public. In commenting upon this program, C. E. Michel, manager of the company's office sales department, said: "We are very much inclined to believe that, like charity and babyhood, real knowledge and real praise of the electric range should begin at home."

Proof that the first gun had a real "kick" to it is to be found in the fact that each department head of the company who was not already the possessor of an electric range signed a contract on the evening of the party. The name of Charles S. Ruffner, vice-president of the company, headed the list. There are now twenty-one electric ranges in use by the employees of the company and the real campaign among the company's workers had not started at the time this was written. Plans for it have been laid, however, and during the spring months active solicitation of each employee is to be undertaken.

FLOOD-LIGHTING IN DENVER'S THEATER DISTRICT

Motion Picture Houses, Restaurants and Other Buildings Have Adopted Brilliant Façade Illumination

That a better appearance may be obtained by flood-lighting building fronts than by using projecting signs has been appreciated by the proprietors of motion picture houses in Denver, Col. Most of the large movie theaters of that city are concentrated on Curtis Street, within two or three blocks in the heart of the business district, and their proprietors have taken up enthusiastically the idea of brilliantly illuminating the fronts of their various buildings. A visitor to Denver cannot fail to be considerably impressed by their efforts in this line.

This flood-lighting is not entirely confined to the motion picture houses. With three or four exceptions the three blocks on Curtis Street from Fifteenth to Eighteenth are solidly illuminated. Within these boundaries there are ten large movie houses and two large vaudeville houses. All of these places of amusement have adopted brilliant façade illumination. In the same three blocks there are half a dozen restaurants, two candy stores, and one or two penny arcades which are lighted in the same manner.

The lamps used vary in size from 15 to 500 watts, the rows on the actual fronts of the buildings of course being of small size, while the larger lamps are used mainly for high-power entrance lighting. The illumination of the Isis Theater is estimated to be 40,000 cp., the Rialto 50,000 cp., the Paris 35,000 cp., and so on proportionately for the others. The number of individual lamps used on this street for front illumination is stated by the power company to be 40,000.

The illumination lasts from dusk to midnight, an average of about six hours. The power company estimates the cost of this display illumination on Curtis Street to have cost $100,000 to install. Several theater owners are reported as having said that they would expect business to fall off 50 per cent if they were to return to ordinary lighting.



ON THE LEFT IS SHOWN THE BRILLIANTLY LIGHTED FAÇADE OF ONE OF THE THEATERS AND ON THE RIGHT IS A NIGHT VIEW OF ONE OF DENVER'S STREETS IN THE AMUSEMENT DISTRICT

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MEASURING FLUX DENSITY AND PERMEABILITY

The Use of a Differential Measuring System for Determining Flux Density and Permeability Up to Any Desired Density

A NEW method for determining the flux density, *i.e.*, the number of lines of magnetic induction per unit cross-section, up to any desired frequency is described by Prof. August Hund of the University of Southern California in the February issue of the *Proceedings* of the Institute of Radio Engineers. The same arrangement may also be conveniently used for obtaining the magnetic permeability and for investigating the total loss of a coil containing a ferro-magnetic core, or the core and copper losses separately.

The suggested arrangement is shown in Fig. 1, and

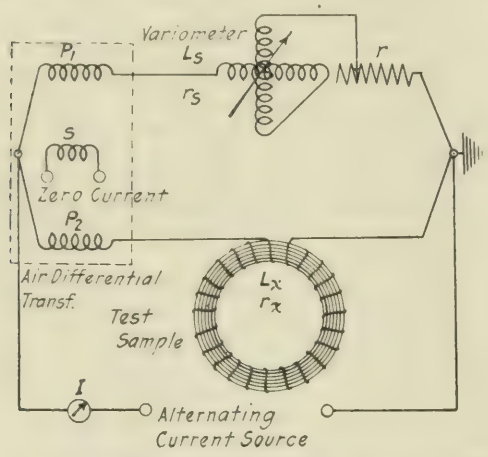


FIG. 1—APPARATUS FOR MEASURING FLUX DENSITY BY DIFFERENTIAL METHOD

is based on the application of a differential system, which was described by the author in the ELECTRICAL WORLD of May 22, 1915, page 1800.

One differential branch contains the test sample which has a definite coefficient of self-induction, L_x, for a particular current at a fixed frequency. The test sample is investigated by means of balancing its effect against a standard variable self-induction, L_s (variometer, air-core coils), in series with a non-inductive resistance, r.

The performance of such a differential system is briefly as follows: When the currents in the two branches of the system are equal in effective value and in phase, their inductive effects on the secondary coil of the differential transformer (shown to the left of Fig. 1) will exactly neutralize each other, and no voltage will be induced in the coil. This is based on the assumption that the two primary coils, P_1 and P_2, are symmetrically placed with reference to the secondary coil, S, and have exactly the same number of turns which are wound in opposite directions. Any kind of alternating-current detector connected across the terminals of the secondary coil will then give a no-current indication when the currents in P_1 and P_2 are equal and in phase.

A no-current adjustment is established when the coefficient of self-induction of the variometer is equal to the effective coefficient of self-induction of the test coil, and when the effective resistance of the test coil is exactly balanced by the resistance of the variometer and the series resistance r. An absolute disappearance of the differential field, however, can generally not be obtained since the wave form in the one branch is somewhat distorted due to the presence of the ferro-magnetic substance. In most practical cases, however, the minimum of the differential field can be very readily and accurately detected. For very precise measurements, it is advantageous to insert a condenser in series with the indicator in the secondary circuit of the differential transformer and tune this circuit to resonance with the required frequency. (This is especially recommended at higher frequencies since a tuning is then readily obtainable.) For frequencies up to about 2000 cycles, a Wien vibration galvanometer may be used as a current indicator, and the condenser may accordingly be dispensed with.

With this arrangement the maximum flux density is

$$B_{max} = 0.7075 \frac{L_s \text{ (henrys)}}{NS(Cm^2)} I \text{ (amp.)} \times 10^8$$

where L_s is the self-induction read on the variometer, I is the current measured by the ammeter in the main branch of the differential arrangement, N is the number of turns of the test sample, and S is the cross-sectional area of the iron core.

One way of exploring the magnetic properties of a ferro-magnetic substance by means of this method is to use a circular ring on which is uniformly wound a coil of wire of comparatively low resistance. The author shows that for a standard test ring of given cross-sectional area, length of magnetic path and number of turns, the maximum flux density, B_{max}, the maximum resultant field intensity, H_{max}, and the permeability μ can be calculated from observed data by means of the three following formulas:

$B_{max} = k_1 L_s$ (henry) I (amp.) lines of induction per square centimeter.

$$H_{max} = k_2 \frac{fL_s \text{ (henry) } I \text{ (amp.)}}{Z \text{ (ohms)}} \text{ gilberts per centimeter.}$$

$$\mu = k_3 \frac{Z \text{ (ohms)}}{f}$$

Where z is equivalent to the resistance operator of the test sample and the constants k_1, k_2 and k_3 of a definite dimensioned sample are given by the relations:

$$k_1 = \frac{0.7075 \times 10^8}{NS(cm)^2}$$

$$k_2 = 5.57 \frac{N}{l(cm)}$$

$$k_3 = 1.27 \frac{l(cm)}{N^2 S(cm)^2} 10^7$$

In these formulas N is the number of turns of the coil, S the cross-sectional area of the iron core, and l the mean length of the magnetic path.

Notes on the true magnetizing current and the determination of the iron losses follow and valuable practical hints are given on important details of the differential arrangement.

Generators, Motors and Transformers

Extra Copper Losses in Slot Windings.—R. RICHTER.—In previous articles the author has treated of the extra copper losses occurring in the windings of alternators through the uneven distribution of current over the section of the windings. He has shown how the eddy-current losses may be minimized by suitable arrangement of the conductors in the slot so as to insure that the copper losses shall be divided as evenly as possible between the various layers of the winding. The methods indicated fail in the case of bar windings with few or even one conductor per slot. In single-bar windings the alternating-current resistance of the whole winding decreases with the depth of the conductor in the slot, but not in proportion to the volume of copper required. For instance, a winding with bars of 6 cm. depth would give at 50 cycles per second copper losses inside the slot that are not less than the losses on direct current with bars of 1.1 cm. depth, and the copper losses in the whole winding would be equivalent to the losses in a direct-current winding with bars of 1.9 cm. depth, if half the total length of the winding were embedded in the slots. This shows that solid conductors may not be used with single-bar windings and deep slots. The present article is concerned with the mathematical discussion of the copper losses in subdivided conductors and coils wound in special manners with the object of decreasing the copper losses. The investigation differentiates between the cases of windings carrying alternating current of sine form and direct-current windings that carry alternating current of very different wave form, also between the cases of single-layer and double-layer windings. The arrangements described include the use of multiple conductors twisted in the slots so that individual strands occupy varying positions in the slots, the use of twisted end connections between the conductors in the slots and the constructing of former-wound coils in such manner that individual conductors and strands occupy the most advantageous positions in the slots. The technical constructions are fully described and illustrated by photographs and sketches. It is concluded that additional copper losses may be practically eliminated in alternating-current windings with at least two, and in direct-current windings with at least four layers of conductors per slot. Twisting of the end connections at both ends of the armature should be adopted very generally.—*Archiv. f. Elektrotechnik,* Vol. V, page 1, 1916; abstracted in *Science Abstracts,* Section B, Jan. 31, 1917.

Generation, Transmission and Distribution

Faults to Earth in High-Tension Networks.—W. PETERSEN.—The magnitude of the current to ground occasioned by a fault in a network is of prime importance in influencing the reliability of that network. If the current to ground is too great, breakdowns are likely to occur in the shape of damage to insulators, opening of switches, short-circuits, melting of fuses in the circuits of the line transformers and appearance of excess voltages. An illustration is given of the interconnection of two small networks that operated satisfactorily separately, but were subjected to excessive disturbances when running jointly with the addition of a small extension. Experience shows that safe maximum values for the current to ground are 3 amp., or 2.5 amp. per 100 km., and 10 kv. for lines with or without guard wires respectively. In the case of underground cables the currents to ground may reach values lying between 40 and 100 amp. per kilometer and kilovolt. Arcing grounds die out of their own accord if the current is not greater than about 5 amp. in 10-kv. to 20-kv. systems and the destructive effects increase with the current, reaching a maximum violence at about 15 amp. The magnitude of the current to ground may be limited by subdivision of the network into a number of separate sections fed by transformers, so that the sections are not in direct electrical contact. If the high-tension mains cannot reach outlying sections conveniently, such sections may be isolated by being coupled to the system by 1 to 1 transformers. Automatic grounding switches afford a good protection in cases where a sufficient reduction of the current to earth is not attainable by the above-mentioned subdivision, *i.e.*, in systems above about 20 kv. The operation of such switches transfers the arc to a point where it can be interrupted without destructive effects. The grounding switches open shortly after closing, and if the fault is removed they then remain open. In case the ground persists the switch remains closed after opening several times. An appendix contains calculations of the magnitude of the capacities between conductors and between conductors and ground and of the resulting currents to ground in various systems of transmission with various line voltages. In the case of three-phase overhead lines the currents to ground, when one line is grounded, are of the order of twice the charging current per line when the ground is not present. In the case of underground cables the current to ground under these circumstances is only about 50 per cent greater than the charging current.—*Elek. Zeit.,* Sept. 14 and 21, 1916; abstracted in *Science Abstracts,* Section B, Jan. 31, 1917.

Installations, Systems and Appliances

Depreciation of Plant.—F. GILL and W. W. COOK.—A paper presented before the (British) Institution of Electrical Engineers on the principles involved in computing the depreciation of plant from an engineering standpoint. The general conclusions are as follows: There is only one common method for the financier, the accountant and the engineer. This common method is best studied in the annual charges for plant, determined in advance of construction. To determine the amount in the annual charges for depreciation it is necessary to estimate the first cost, residual values, and the physical and economic lives of the various classes of plant. It is also necessary to fix the treatment of the capital amount and to estimate the charge for return on capital. The interest to be earned by the reserve funds must be credited to its source. The reserves are preferably handled by means of two funds as follows: (a) A renewals fund for providing the necessary money at the end of the physical life; that is, the end of the period during which the plant will give its service satisfactory under all conditions outside the owner's control. (b) An improvement fund for providing sufficient additional money to enable the plant to be taken out of commission for reasons within the owner's control and while it is still giving its service satisfactorily. The calculation of the amounts to be contributed to these two funds must include the interest which should be earned by the money before it is required at the end of the life. The amount, calculated as above, which should be in the renewals fund, gives the correct diminution in value, when considering the value to the owner, of the plant in place and working, at any period in its history. The amounts, calculated as above, which should annually be put to the two funds for renewals and improvements determine the correct depreciation charge against the undertaking for the purpose of assessing profits, fixing rates, and, under certain conditions, assessing the value of an undertaking as a going concern. The sinking fund method fulfills all the requirements. The straight line method does not. All estimates, such as first cost, physical and economic lives, and interest earned by funds,

will require revision from time to time, either as a result of experience or of changes in conditions.—London *Electrician*, Jan. 12 and 19, 1917.

Wires, Wiring and Conduits

Electric Porcelain.—Before the war most porcelain articles for electrical purposes used in France were imported from Germany, but since the beginning of the war a French industry has been started for the manufacture of electric porcelain. The present instalment deals with the raw materials required for the porcelain and the glaze. The article is to be continued.—*Revue Gen. de l'Elec.*, Jan. 6, 1917

Porcelain Suspension Insulators.—HARRIS J. RYAN.—A paper in which the fundamental requirements in satisfactory insulators for high-voltage lines are summarized, and particular emphasis is placed upon the need for co-ordinated study of service durability. The general conclusions are as follows: Appreciably porous porcelain should not be employed for suspension insulators. Under the action of the elements their failure must occur in due course of time. Cement used for setting up cap and pin type suspension insulators should be non-porous or rendered non-porous. Recognition of porosity as a contributing cause of suspension insulator failure has not lessened the importance of design features that reduce cracking through differential thermal expansions and failure through electrical overstresses and the heat of heavy flash overs. Defective materials in otherwise well-designed and manufactured insulators have been responsible for most of their service-durability failures. Clear fused quartz appears, technically, to be a desirable substitute for porcelain in the construction of suspension insulators. The same issue contains papers by J. Cameron Clark and J. E. Woodbridge on the same subject.—*Proceedings* Amer. Inst. Elec. Engrs., January, 1917.

Units, Measurements and Instruments

Errors of Direct-Current Ampere-Hour Meters.—A theoretical discussion of the errors of ampere-hour meters, both of the mercury and commutator meter type. Considering first an ideal meter of either type, without solid or fluid friction, in which the same field is used for braking and driving, we have, C being current, B flux, ω angular speed, a and e constants, equating torques, $e\omega B^2 = aCB$, hence $\omega = aC/eB$, showing that the speed of a meter for a given current is inversely proportional to the flux. In the case of a meter with solid friction only, f being the fractional torque, the fundamental equation is $aBC = eB^2\omega + f$, hence $\omega = aC/eB - f/eB^2$. The error is accordingly $-f/eB^2$, varying inversely as B^2, which emphasizes the advantage of powerful magnets. For a meter with an armature at rest and with a current infinitesimally less than the starting current we have $F = aBC_s$, where C_s is the starting current and F is the standing-still friction. If f is the friction when the rotor is moving, we may take as a rough approximation $F/f = n = 3$ for a mercury meter and $= 1\frac{1}{4}$ for a commutator meter. We have accordingly $f = aBC_s/n$. The error can now be written $-aC_s/neB$. The percentage error η is, therefore, $\eta C - 100C_s/nC$. This error is the difference between the actual and ideal speeds of the meter. The results obtained apply with close approximation to a commutator meter, and also to a mercury meter at low speed. The case of a meter with both solid and fluid friction is next taken up and the assumption is made that fluid friction introduces an error proportional to ω^2 or approximately proportional to C^2. The error may be written $-f/eB^2 - gC^2$, g being a constant, the percentage error $\eta = 100C_snC - mC$, m being a constant. The shape of the curve is now altered. There is now a minimum arithmetical error for a finite value of C. The curve can be constructed by adding the ordinates of the original curve to those of a straight line $x = mC$. The shape of the curve is very little modified for the lower speeds of the meter. The result of the correction for fluid friction by weakening the flux by an amount proportional to the current may be investigated as follows: The speed, neglecting errors, without the correcting device is $w = aC/eB$. The increased speed due to correction is $\omega' = aC/e(B - SC)$, S being a constant. We therefore obtain very approximately, SC being small, $\omega' - \omega = aSC^3/e^2B^3$. The result of the correction as regards the errors of the meter is of the second order of smallness and may be neglected. As the result of the correction of the meter is proportional to C^3, its effect is to diminish the constant m in the equation, giving the error of a mercury meter, and in no way to alter the nature of the curve. By increasing the number of turns in the correcting coil, it will be possible almost exactly to counteract the effect of fluid friction, or even to overcompensate the meter. This is rarely done, and it is advisable slightly to undercompensate the meter. Fig. 2 will make these results clear. The

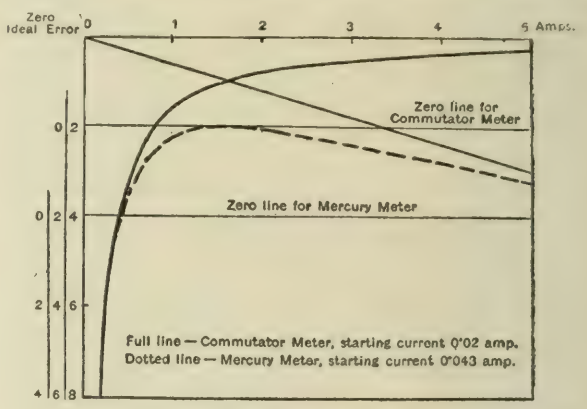


FIG. 2—RELATIVE ERRORS OF MERCURY AND COMMUTATOR-TYPE AMP.-HR. METER

full-line curve is a rectangular hyperbola and represents the performance of a commutator meter. The straight line represents the effect of uncompensated fluid friction, and the dotted curve represents the effect of both solid and fluid friction as found in a mercury meter. A consideration of these curves will show very clearly why a mercury meter gives greater accuracy at low loads than a commutator meter. With a commutator meter the full-load speed is relatively the greatest, and the zero inaccuracy line has so to be adjusted that at this load the meter is not more than 2 per cent fast. With a mercury meter, the speed at full load is relatively much smaller, and the zero inaccuracy line can be adjusted to a lower position, as shown. It will be seen from the diagram that, although the ideal error of the two meters at 0.25 amp. may be the same, the inaccuracy of the commutator meter will be 2 per cent greater than that of the mercury meter. It will also be clear that it is advantageous for the curve of the mercury meter to drop slightly at the higher loads, as this allows the zero inaccuracy line to be shifted to a lower position than otherwise. For a mercury meter the smallest arithmetical error occurs when C equals $\sqrt{p/m}$. The three criteria necessary to determine the accuracy of a mercury meter are tests at full load, at load of minimum arithmetical error, and starting current. If these criteria are satisfactory, other tests are superfluous. In the case of a commutator meter two tests are sufficient to determine its accuracy, starting current and full-load speed.—London *Elec. Rev.*, Feb. 2, 1917.

Scientific and Industrial Research

A Department Devoted to Interchange of Ideas, Investigations Contemplated, Research Facilities Available, and Suggestions for Co-operative Work.

Conducted by PROF. VLADIMIR KARAPETOFF
Cornell University

FOREWORD ON THE SCOPE OF THE RESEARCH SECTION

This section is started without preconceived ideas, but with a sincere desire to serve the interests of electrical research and of investigators. In it will be embraced:

1. Interchange of ideas among investigators in the electrical industry and in pure science on some important problem to be solved.

2. Questions regarding some topic in research to be undertaken.

3. Suggestions and answers to questions from those who are in a position to advise.

4. Brief reports on some electrical research in progress or results obtained.

5. Information regarding facilities available for electrical research in private, federal, technical-school or public service company laboratories.

6. Discussions and tabulations of some important research problems in the various branches of electrical industry and science with the idea of concentrating the attention of the investigators on those problems.

7. Suggestions and arrangements for co-operative research where it is superior to uncorrelated individual efforts.

Short contributions bespeaking the support of electrical research, or that tend to enhance its dignity and show its importance in the cultural standing, prosperity and safety of the country, will also be welcome.

A few experienced, skilled and competent investigators cannot of themselves accomplish much, any more than a few generals without an army. A large number of young electrical engineers and physicists must be encouraged and interested in research, because from their ranks future great investigators will arise. Many will become useful assistants in research, still others will at least realize the importance of research and will encourage it when they reach positions of authority. Above all, a circle of sympathetic readers must be created who will follow research, delight in new achievements, and lend moral and material support to faithful workers. Otherwise the section will be like a major league team playing a spirited game before an empty grandstand.

This, then, is a request for co-operation from those who are interested in research, be it practical or theoretical. Let the profession know what you are doing and how you are doing it. Let us all rejoice in your triumphs, and let us lighten your difficulties or disappointments if possible. If the task is too large for you, others may be willing to co-operate and help achieve results.

Following are some suggestions as to how you can do your share in this great and important work of inventorying and stimulating electrical research:

1. Indicate the most important problems in the branch of electrical engineering in which you specialize. These may be problems on which you are working, or suggestions for investigations by others.

2. Give a brief account or at least titles of investigations that you are conducting, or of the research recently done under your supervision. This information will be published for the purpose of bringing together those working on some problem now, and also those who may take it up later.

3. Describe briefly the experimental facilities at your disposal and the kinds of problems for which they are particularly suitable; also other facilities that you may possess, such as a large amount of data on file, a collection of pamphlets on some topic, natural advantages of location, etc.

4. Ask questions, if you have any, or express a desire to get in touch with other investigators on some topic.

5. Give your general views on electrical research and on how to encourage it and make it more productive.

Investigations Planned or Under Way

A thesis is being prepared by the writer on phenomena accompanying the rupture of electric circuits. References on the subject and suggestions as to the method of treatment would be welcome. M. J. IDAIL.
Washington, D. C.

Three investigations are now in progress at Washington University:

1. A study of pole-face losses. For this work there has been designed and constructed a special piece of apparatus, which will make it possible to determine the pole-face losses in terms of each of the variables upon which the loss depends.

2. A study of the effect of artificial illumination during daylight hours.

3. A study of the non-synchronous rotary gap. Some interesting results have been obtained, showing that there is an energy component in the charging current of the condenser. The derived mathematical expressions have been satisfactorily checked by experimental determinations. A. S. LANGSDORF.
Washington University, St. Louis.

The electrical strength of air is being investigated with a view toward explaining the nature of the breakdown of air. The work that is under way at present includes an accurate investigation of the conditions governing the formation of corona in the constituents of air, and also in several other well-known gases.

In addition a corona voltmeter is being perfected, the work under way at present being the development of a method for directly measuring the crest voltage of a high-tension circuit.

The object is to determine, beyond all question, the constants which enter into the formula for the inherent calibration of the corona voltmeter. In conducting these experiments it is hoped to demonstrate that the corona voltmeter constitutes a standard for high voltage measurement and also a convenient measuring instrument which surpasses anything that is now available.

A new method for measuring iron losses up to 3000 cycles is also being developed. In doing this comparative determinations are being made by present methods.

Within the past three years considerable information has been secured on the laws governing the formation of corona in air, a corona voltmeter has been developed, and an exhaustive study of the errors arising from improper connections of polyphase watt-hour meters, has been made, with the proposal of a method for avoiding these errors. Incidentally a portable gold-leaf electroscope has been developed. J. B. WHITEHEAD.
Johns Hopkins University.

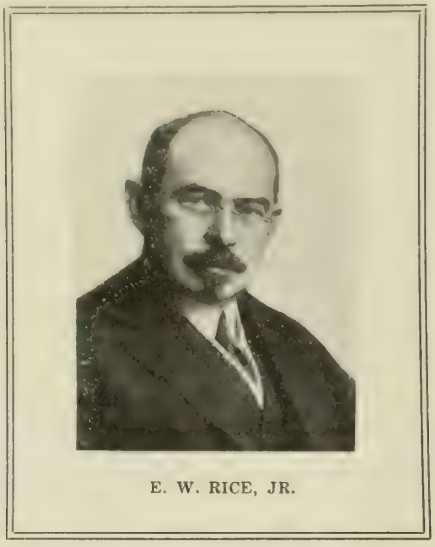
NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

E. W. RICE, JR., IS NOMINEE FOR A. I. E. E. PRESIDENT

Inventor and General Electric Company Executive Named by Directors of the American Institute of Electrical Engineers

The nominee of the board of directors of the American Institute of Electrical Engineers for president in the next year is E. W. Rice, Jr., of Schenectady, N. Y. The nomination of the directors is virtually equivalent to election. At the meeting of the board held in Chicago



E. W. RICE, JR.

on March 9 the report of the committee of tellers on its canvass of the nomination ballots cast for candidates for the offices falling vacant on July 31, 1917, was presented. Following the requirements of the institute constitution, the board then selected by ballot its list of "directors' nominees" as follows:

For president:	E. W. Rice, Jr., Schenectady, N. Y.
For vice-presidents:	Frederick Bedell, Ithaca, N. Y. John H. Finney, Washington, D. C. A. S. McAllister, New York, N. Y.
For managers:	Walter A. Hall, West Lynn, Mass. E. H. Martindale, Cleveland, Ohio. William A. Del Mar, New York, N. Y. Wilfred Sykes, Pittsburgh, Pa.
For treasurer:	George A. Hamilton, Elizabeth, N. J.

Regular ballots will be mailed to the members before April 1.

TECHNICAL CAREER OF MR. RICE

Edwin Wilbur Rice, Jr., inventor, pioneer in the electrical industry, president of the General Electric Company, has been successful in many lines of engineering activity.

Because of his early devotion to the fortunes of the infant electrical industry Mr. Rice has had an exceptional relation in its initial struggles and the crowning epochal development of later years. Born at La Crosse, Wis., on May 6, 1862, he attended the Central High School in Philadelphia. In 1880 he decided to forego the college education upon which he had set his heart and give himself to the work of assistant and confidant of Prof. Elihu Thomson in the newly organized American Electric Company, New Britain, Conn. Professor Thomson, who had been teaching mechanics and chemistry in the high school, had been attracted by the skillful work of his pupil. In 1882 the company was acquired by H. A. Pevear, C. A. Coffin and Silas A. Barton, and its headquarters were moved to Lynn as the Thomson-Houston Company. With rapid growth, greater capital and confidence Mr. Rice combined in rare degree the practical ability of the business man with the untiring resource and penetrating research of the inventor searching for the answer to problems that pressed rapidly upon the advanced workers in those early days. With the duties of superintendent of the works, which fell logically upon his young shoulders, he combined continuous attention to the technical questions which first attracted him. Their growth and ramifications drew his fascinated study, and he contributed greatly to the technical steadiness and progress of the industry.

The General Electric Company, combining the Thomson-Houston Company and the Edison General Electric Company, was formed in 1892, with Mr. Rice taking the responsibilities of technical director. His close association with the advance of this company is illustrated by his official positions in it. Becoming third vice-president in charge of technical and manufacturing departments in 1896, he was the senior vice-president later. Upon the election of Mr. Coffin as chairman of the board of directors in 1913 Mr. Rice was made the president. He has been an active co-worker and supporter in the affairs of the institute and in many large and important movements has been of distinct service to it, laboring in a quiet way for its welfare and wholesome influence.

INSULL ADDRESSES THE PITTSFIELD SECTION A. I. E. E.

President of Commonwealth Edison Company of Chicago Predicts Great Development of Low-Head Water Powers in Middle West if Coal Continues High

About 275 people were present at a dinner given for Samuel Insull, president of the Commonwealth Edison Company of Chicago, by the Pittsfield Section of the American Institute of Electrical Engineers, at the Wendell Hotel, Pittsfield, Mass., on the evening of March 14. The toastmaster was V. E. Goodwin, chairman of the local section. Among those present were Ex-Senator Crane, E. W. Rice, Jr., C. C. Chesney, W. A. Hall of Lynn, and G. Faccioli.

Mr. Rice introduced the speaker of the evening, Mr. Insull, whose subject was "Some Developments in Electric Utility Operations."

In his address Mr. Insull showed by a number of curves and views the rapid development of the Commonwealth Edison System, emphasizing the value of the concentration of generating capacity and of distribution as well as the engineering methods of disposing of the power. He directed particular attention to the need for further improvement in the operating characteristics of boilers and turbines and predicted

that there will be great development of low head water powers in the Middle West if the present high price of coal is permanent.

Mr. Insull also stated that the uses of electricity will increase enormously in the future, and that many more of the steam roads will be electrified.

HALFORD ERICKSON BEFORE WISCONSIN ASSOCIATION

Former Chairman of Railroad Commission Addresses Meeting at Milwaukee—Affiliation with National Electric Light Association

Fair rates of return on utility investment, rural electrical service, affiliation with the National Electric Light Association, methods of levying taxation on utilities and the Railroad Commission's methods of rating utility service were the topics discussed at the first day of the ninth annual meeting of the Wisconsin Electrical Association at Milwaukee on March 14. The feature of the convention was the paper on "Rate of Return," by Halford Erickson, the former chairman of the Wisconsin commission. He pointed out forcibly that, to be willing to supply additional capital, the investor must be able to see that the plant has net earnings which altogether amount to not less than 8 per cent on the face value of the plant, its equities and business. With a much lower net income than about 8 per cent, concluded Mr. Erickson, on the face value of its plant and its business the property could not in the light of the facts very well be placed in the investment class.

The report of the committee on rural service by A. C. Babson, Watertown, shows that this part of the business is on the increase in Wisconsin and that it is generally thought profitable under the conditions imposed by operating companies.

Affiliation with the National Electric Light Association was referred to the executive committee with power to act and with the recommendation that the Wisconsin Electrical Association become a geographic section. A committee report, favoring legislation to eliminate the local assessor and replacing his work by that of the state Tax Commission, was approved.

MARGIN BETWEEN COPPER AND ALUMINUM PRICES

Lessening of the Difference Between Costs of the Two Metals Suggests New Possibilities in Substitution

Aluminum continues to be quoted at the purely nominal market price of 58@60 cents per pound. The outside market, upon which these quotations are supposed to be based, represents only a small volume of trading, as the factors of supply and demand are influenced so largely by war conditions. Actual prices are fixed by the conditions prevailing at the time of a sale.

Much interest is shown by authorities in the trade in the action of various central station companies which have scrapped aluminum transmission lines because of the high value of the metal, substituting therefor copper wires. It is felt, however, that the lessening of the margin between the prices of the two metals substantially reduces the profit obtainable and that it has made such substitutions unlikely under present conditions.

The future price of aluminum is bound up so closely with the question of war that ordinary commercial considerations disappear, but some authorities are suggesting the possibility that if copper continued to be high, aluminum, if obtainable, may look inviting.

NEW BUSINESS COMMITTEE MEETING AT DAYTON, OHIO

Many Timely Subjects Discussed and Good Suggestions Developed at Successful Gathering of the Ohio Committee

The amount of "free service" which a central station should give to its customers received special attention at the new business co-operations committee meeting of the Ohio Electric Light Association, Dayton, Ohio, on March 14. O. A. Acuff, of the Massillon Electric & Gas Company, who presented this paper, specially emphasized the importance of instructing consumers as to proper handling of appliances, and thought that central stations should not give free repair service. Mr. Reemelin, of Dayton, outlined the liberal Dayton plan of investigating all trouble on customers' premises, replacing fuses quickly, repairing all appliances, and charging customers only for material. He thought that labor should be given gratis. C. E. Yacoll, J. L. Stone and E. R. Kelsey offered further discussion.

Another important subject which excited great interest was "The Manufacture of Raw Water Ice," by R. C. Hayes, of Cincinnati. Mr. Hayes pointed out that the manufacturers of electric driven refrigerating apparatus are offering the services of their sales engineers to assist all central stations in securing ice and refrigerating business.

F. J. Woltz, power engineer of the Union Gas & Electric Company, of Cincinnati, in his paper, entitled, "Financing Motor Installations," detailed the advantages of trial installations of motors which have proven so successful in Cincinnati. F. B. Steele stated in the discussion of this subject that this method of power sales had given 100 per cent returns in Dayton. Mr. Craft, of Columbus, suggested that the financing of the motor installation was entirely a local problem. Mr. McGregor, of the Merchants' Light, Heat & Power Company, of Indianapolis, thought that it would be inadvisable to establish a policy of financing motor installations, but considered the problem analogous to that of financing heating appliances.

E. P. Hollingsworth presented for discussion the subject of commercial rates which aroused considerable interest.

The closing paper of the afternoon was by F. H. Hooper, new business manager of the Northwestern Ohio Light Company, with the caption "Motion Pictures as an Aid to New Business." It was especially interesting and presented a moving picture story, showing the housewife changing from the old style of cooking to the modern electric method.

The new business committee was entertained in the evening by a program and banquet at which the members were guests of the Dayton Jovian League.

EXTRA SESSION OF CONGRESS OPENS WAY FOR LEGISLATION

Opportunity for Action on Water Power and Export Combination Bills as Well as on International Matters

The Senate having revised and altered its archaic rules by a method which will permit two-thirds of those present to force a vote on measures before it, President Wilson has called an extra session of Congress to meet April 16. It is understood that there will be more than sufficient opportunity during the summer for the transaction of other business than that pertaining to international matters, such as the passage of the water power bills, the Webb bill, etc.

CREATIVE WORK OF THE ASSOCIATED MANUFACTURERS

Annual Report of Robert K. Sheppard, the President, Sets Forth the Unity of Purpose and Ideal of Usefulness Which Characterize It

What powers for national usefulness are within your control through the co-ordinating forces of this association!—President Robert K. Shepppard.

The annual meeting of the Associated Manufacturers of Electrical Supplies, the culminating feature of a year of highly successful constructive effort and accomplishment, was held at Delmonico's, New York, during the afternoon of March 15. It was followed by a banquet in the evening.

It was a disappointment to the members that Robert K. Sheppard, sales manager of the Simplex Wire & Cable Company of Boston, who has served as the president of the association since its organization, was prevented by illness from attending the meeting. He, however, prepared his annual report, which was presented for him in his absence. An abstract of the address of Mr. Sheppard is published below, and it will be followed in next week's issue of the Electrical World by a report of the proceedings:

Address of Robert K. Sheppard, the President

"At the close of this second year we have sound reasons to be glad that we are banded together in this association. Enduring friendships have multiplied. Trusting our comrades, our trust has been reciprocated. Contributing frankly and freely from the discoveries of our manufacturing past to remedy mistaken or uneconomical practices, we still have not given more than we have received from all our associates.

"Many as are the material benefits derived from the work of our sections, not all of them together can equal in intrinsic value the worth of that spirit of mutual helpfulness which has permeated all of our activities.

"And so, at this anniversary time we have unity of purpose, an ideal of usefulness, a scheme of activities, and the machinery with which to work out that scheme for the common weal.

"At this stage in the terrible war under which the world suffers, what powers for national usefulness are within your control through the co-ordinating forces of this association! How much more fit to-day is this group of nearly eightscore manufacturers to work together for great ends than those same manufacturers were two years ago before sensible co-operation had become a habit and this mechanism for concerted effort had been well tested!

"Your organization into sections has laid permanent foundations, while your work together these many months has begun to raise the superstructure of a veritable hive of industry in which good-will and mutual confidence are the binding mediums.

"You have been willing to consult, to collaborate, to search out the essentials, to surrender the non-essentials; you have determined to harmonize individual aspiration with fair dealing; each of you has helped the rest of us to broaden our visions until we can see our common problems from the differing standpoints of the others interested with us.

"Recently, by unanimous vote, one of your sections recommended to the Underwriters' Laboratories that an adequate method should be provided whereby approval under the installation rules of the National Fire Protection Association should be given without unreasonable delay to new products, when such products had been thoroughly tested by the Underwriters' Laboratories and found to be safe and suitable for the intended service. That competing manufacturers should thus unitedly indorse a sound principle, which makes for fair dealing between competitors and toward the consumers of electrical products, is to my way of thinking a splendid testimonial to their unselfishness and the integrity of their purpose to deal justly by one another.

A Basic Industry

"The promotion era of the electrical industry is over. Now the industry must be classed as one of the basic industries of the country like steel production, cotton manufacturing, machinery building, railroading, mining of coal and minerals. For it the age of wonders still holds some secrets, but when disclosed they will constitute refinements of the art, rather than fundamental forces in this enormous business.

"In the last thirty years electric power, light, transportation, the telegraph, the telephone could not be provided too fast. The world was quick to speed up proportionately in the race for domination of nature's forces and the achievement of wealth and material comfort. Magical expansion was accompanied by almost uncanny prosperity, in which phenomenal profits completely buried the unsuspected losses due to waste and a total disregard of the ratio of cost to selling prices.

"But that period has passed. The spendthrift manufacturer, the blind adopter of his competitors' market values and methods, can no longer find shelter from the financial cyclone.

"Our industry has trodden the same historic path which has forced every other basic industry to a closer and closer study of the costs of production and the costs of distribution.

"Under appointment by the Electrical Manufacturers' Council, a committee led by C. E. Patterson of the General Electric Company has prepared a comprehensive, yet flexible, plan of accounting and cost estimating which, ere long, will be available.

Beneficial Relations with Underwriters' Laboratories

"With the Underwriters' Laboratories the relations of our members have been increasingly harmonious and mutually beneficial. The laboratories have established many industry conferences which are integral parts of the organization of the Underwriters' Laboratories. In those industry conferences representative manufacturers advise and consult with the officials and engineers of the laboratories concerning suitable test methods and requirements for the laboratories to adopt, and desirable changes in standards to be recommended to the electrical committee of the National Fire Protection Association. When standards are to be discussed or adopted, surely men are wise to combine with laboratory theory and findings the practical experience obtainable only in the factories which produce the goods that are supposed to compare favorably with the desired standards.

"The founding of industry conferences was a wise act, which has so related the activities of the Underwriters' Laboratories to the necessities of the manufacturers, that the rulings of the laboratories, promulgated from time to time, generally find hearty indorsement by the manufacturers whom they affect. It is desirable that other governing bodies throughout the country should realize how greatly the policy of the laboratories has promoted the adoption of reasonable and attainable standards for the ultimate benefit of our entire people.

"As an association we are a member of the National Fire Protection Association. We have asked for representation on the electrical committee of that body and are confident that such representation will help the

manufacturers of electrical supplies to co-operate rationally, although directly, with the fire underwriters doing business in the United States, to the end that losses of property and life by fire may be lessened.

Work Ahead

"Have you yet discovered the usefulness of accurate statistics collected by industries? Have you considered what kind of statistics will be most useful to the manufacturers of porcelain; what kind are helpful to those who make such varied products as the members of the molded or Formed Insulation Section or the Wire and Cable Section?

"Tonnage data may be useful to one group of manufacturers; payroll data to another. The kind and number of materials for manufacturing certain products, and to be found in one industry, may give some group of manufacturers useful information. Other manufacturers may be able to utilize to better advantage statistics which tell the gross business in dollars or the ratio of direct labor payroll to gross billings. A knowledge of the number of men and women employed at direct labor, if recorded month by month, or quarter by quarter, may give statistical data of great value to some of your groups.

"Through your central organization, the board of governors, you may employ expert certified accountants to whom confidential data may be delivered with assured secrecy. Such accountants would combine the individual reports of a group of manufacturers and subsequently distribute to each the totals, or the averages, or such other details as the members of that group might require. Your board of governors might use the same accountants for the work of several different sections, segregating to each section its rightful proportion of the charges of those accountants. In that way the financial burden would be as little as possible for each group of manufacturers.

"From time to time, as one group after another discovers a special need, the methods for meeting that situation need only be submitted to your counsel and your board of governors to receive their hearty indorsement, if the procedure is lawful and expedient for such an organization as ours."

EMPIRE STATE ELECTRIC DISTRIBUTION COMMITTEE MEETS

Fifty-five Delegates Gather at Buffalo, Discuss Important Topics and Visit New Generating Station

The electric distribution committee of the Empire State Gas and Electric Association held a meeting in the auditorium of the Buffalo General Electric Company, Buffalo, on March 9. Fifty-five delegates were present.

F. A. Alcott, Rochester Railway & Light Company, read a paper on "Methods for Selecting Size of Transformers to Prevent Over-transformering or Under-transformering on a.c. Lighting and Power Systems, and the Testing of Transformers for Overload, Defective Oil, etc." This paper was prepared in accordance with the plan of the committee to have a complete and detailed report prepared during the year on one subject which would be of interest to a majority of the members. W. C. Blackwood, chairman of the committee, explained the purpose of the committee in following this plan.

Connection of consumers to high tension transmission lines was the next subject. Much discussion took place on satisfactory methods of grounding secondaries where water piping systems cannot be used. Methods of improving regulation and control of primary circuits outside of station apparatus were discussed before the end of the morning session.

F. B. Van Doren of the Utilities Mutual Insurance Company spoke on accident prevention work at the afternoon session. Methods of reducing the amount of overhead construction to avoid agitation for underground construction were then discussed. The use of fir arms versus pine arms, treated and untreated, was the last subject. It was pointed out that either is strong enough for average loads.

A number of the delegates visited the new generating station of the Buffalo company.

SAMUEL SCOVIL ON COAL SHORTAGE IN CLEVELAND

Seriousness of High Cost and Heavy Financial Losses a Greater Problem Than Actual Shortage of Supply

Samuel Scovil, president of the Cleveland Electric Illuminating Company, states to the Electrical World:

"The coal situation in Cleveland has been more a matter of price which has had to be paid for it than an actual shortage. There have been some short periods when the supply caused us more or less anxiety. During these special periods the congestion of traffic on the railroads became so accentuated by reason of storms and severe weather that embargoes on the shipments of coal as well as other commodities were resorted to by the railroads, but the periods did not last long enough to cause the general inconvenience which some other less happily situated centers seem to have suffered.

"The large users of natural gas during the severe weather found the supply was somewhat inadequate, due partly to the fact that the gas company was unable to get a new supply line to Cleveland.

"As stated above, while there has been no actual shortage of coal, the users of it have, however, suffered heavy financial losses by reason of the price which it was necessary for them to pay for the coal. The normal price of steam coal in Cleveland for many years past has been less than $1.80 per ton. About the middle of October coal began to go above this price, and by the end of November the price for it ranged from $3 to $5.65; in December from $3.25 to $5.80; January $4.50 to $5.60, and February $4.55 to $6.20. At this writing the market is about $1 a ton less than the maximum price. As the time for more favorable weather for transportation operations approaches, there is more disposition on the part of the coal companies to make contracts covering periods of from one to five years. These contracts, however, are made on the basis of coal f.o.b. cars at the mines, the purchaser having to take all the chances of car supply, freight rates, and transportation delays. If the purchaser is willing to accept these contingencies, producers will consider contracts on a basis of about $3 a ton at the mines for one year, and from $2.55 to $2.75 for three years, and for something less than these figures for longer periods. The freight rate to Cleveland from the mines which usually supply it with coal runs from 70 cents to $1.25 per ton.

"The users of central station service in Cleveland have been asked to pay no part of the additional operating cost which these high prices for fuel have occasioned. None of the manufacturing or commercial establishments depending for their power on central station service were inconvenienced in the slightest, nor was there any suggestion made to them at any time that they need curtail their operations, thereby saving all the anxiety which those who were depending upon their own independent plants were subjected to."

LARGE OPPORTUNITIES STIR THE N. E. L. A. ELECTRIC RANGE COMMITTEE



As reported in last week's issue of the ELECTRICAL WORLD, a two-day meeting of the electric range committee was held at the New York headquarters of the National Electric Light Association on March 5 and 6. Twenty members were present and Chairman Michel presided.

ELECTRICALLY-EQUIPPED FURNITURE DEVELOPMENT

Merchandising Committee of the N. E. L. A. Finds a Fertile Field for Cultivation and Urges Exhibit at Atlantic City Convention

A feature of the present work of the merchandising committee of the Commercial Section of the National Electric Light Association is its study of electrically equipped furniture. As stated in last week's issue of the ELECTRICAL WORLD, the principal topic under discussion at the meeting of the committee, held in New York on March 6, was the promotion of such furniture and arrangements for a display of it at the Atlantic City convention.

The committee sent a letter early in the year to several hundred manufacturers of furniture in this country and Canada asking for information of what they had done in the design of electrically equipped furniture, and calling attention to the possibilities of development in this direction. It is found that the manufacturers are greatly interested.

EXHIBITION PLANS FOR THE N. E. L. A. CONVENTION

Committee Has Obtained Nearly Double the Space Occupied in Former Years and Promises Unusual Displays

The exhibition committee of the National Electric Light Association, of which H. G. McConnaughy is secretary, has completed all details in connection with the exhibition to be held in conjunction with the convention of the National Electric Light Association at Atlantic City during the week of May 28.

The floor plan shows an unusual layout, not only for the manufacturers, but for the association as a whole, as it will be necessary to pass through the exhibit space to get to the meeting rooms. This condition has not existed at other conventions in recent years. The meeting rooms are all together, which is another feature of importance. The lamp committee will have an unusual exhibit located at the rear of the hall of exhibits and next to the meeting rooms. In addition is the fact that the pier will be the only headquarters, not only for the meetings and exhibits, but also for all entertainments during the day and evening, as well as for registration and work of the committees.

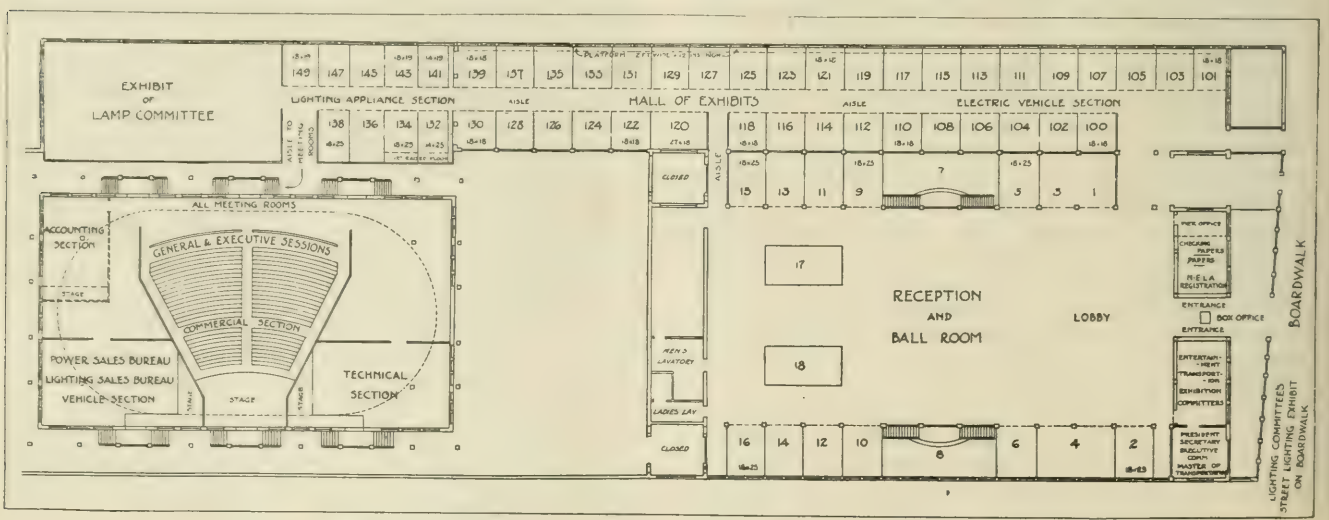
The exhibition committee announces that it has been able to secure almost double the space occupied in former years, which will enable it to take care of the many Class D members who have been unable to secure space during the last few years. The committee has also been able to reduce the cost of space by less than one-half of any previous exhibit.

The plans of the lamp committee, mentioned above, include an unusually attractive and educational exhibit which should be valuable to all central station members. This committee has been assigned 5000 sq. ft. of space. The lighting sales bureau and other bureaus are greatly interested in this exhibit.

The lighting appliance section is located in the same room as the lamp exhibit. This will give an opportunity to manufacturers of lighting appliances to make a unique exhibit in connection with the lamp committee.

The Electric Vehicle Section will be located in front of the exhibition hall near the main entrance, and will be an exceptional location.

The exhibition committee urges all Class D members to forward applications on receipt of its notices. While it has been able, as stated, to secure much additional space, the advance requests and the interest being taken in the exhibits by the association, as well as the committees and bureaus, assure the use of all space.



THE PLAN OF EXHIBIT BOOTHS FOR THE N. E. L. A. CONVENTION

ENTERPRISING CAMPAIGN OF N. E. L. A. MEMBERSHIP COMMITTEE

Strong Intensive Effort to Enlist 1200 Central Stations, Concluding with Extended Tour by Walter Neumuller, the Chairman

Much interest is felt in the extensive campaign inaugurated by the membership committee of the National Electric Light Association, under the leadership of Walter Neumuller of the New York Edison Company, chairman of the committee. Preparations for this campaign have been under consideration for several months. During this time the committee has been making a thorough study and analysis of the central station industry of the United States in its relation to N. E. L. A. membership. It has found that there are approximately 1200 central stations located in various parts of the country which are not members of the association. Most of these are in small towns, approximately 300 being in cities of a population of 2500 or over.

With this information as a basis, the campaign will develop in three phases. The first is a letter written to each of these non-member companies, accompanied by a pamphlet setting forth clearly the association's aims and activities and the benefits to be derived from affiliation with it. This is to be followed by supplementary letters.

The next phase is the setting aside of a week, March 26 to 31, during which an intensive effort will be made by central stations throughout the United States which are already members of the N. E. L. A. to secure those who are not.

Mr. Neumuller is communicating with nearly 500 executives of member companies asking them to call upon their non-member neighbors within convenient traveling distance of their offices, during the week designated. This personal invitation to join, it is believed, will have a decidedly favorable effect.

The third phase of the campaign is an extended tour of the country which Mr. Neumuller will make, and which will bring him into touch with the greater part of the central station industry of the country. He will visit all of the geographic section centers, where meetings and conferences have been scheduled, likewise many of the smaller cities where it is felt a personal visit of the chairman of the membership committee will bring about the desired results. He left New York on Sunday, March 11, and will return to this city about the middle of April.

ELECTRIC VEHICLE PLACE IN THE N. E. L. A. CONVENTION

Plans and Work of the Executive Committee of the Section to Further Progress and Co-operation Between Central Station and Manufacturer

A meeting of the executive committee of the Electric Vehicle Section of the National Electric Light Association was held at the headquarters, New York, on March 8. The following were present: E. S. Mansfield, chairman; E. P. Chalfant, F. M. Feiker, representing James H. McGraw; R. L. Lloyd, W. W. Sellew, representing Arthur Williams; H. G. Thompson, P. E. Whiting, E. R. Whitney, and A. Jackson Marshall, the secretary.

Chairman Mansfield reviewed the successful special electric vehicle conference held on Feb. 14. It was decided to arrange for a somewhat similar conference of electric vehicle, battery, tire and accessory manufacturers at an early date, and Mr. McGraw was appointed the chairman of a committee on arrangements.

BALTIMORE COMPANY EMPLOYEES, RETURNING FROM MEXICO, GUESTS AT DINNER



The Consolidated Gas, Electric Light & Power Company of Baltimore gave a dinner on March 1 at which the guests of honor were employees who responded to the call of the President of the United States last June to protect our rights on the Mexican border.

CHICAGO MEETING OF THE CENTRAL DIVISION JOBBERS

Profit on Heating Devices, Volume of Dry Battery Business and Association Co-operation Discussed —Frank N. Bernardin Elected Chairman

The profit on heating devices, the volume of dry battery business and association co operation were among the topics discussed at the meeting of the central division of the Electrical Supply Jobbers' Association at the Hotel La Salle, Chicago, on March 13.

Analyses of the heating device situation showed that a large percentage of jobbers' orders from the trade for appliances are in very small lots. One jobber analyzed 200 consecutive orders and found that 50 per cent were for a single appliance. The average sale amounted to less than $3 and the profit per sale was not enough to cover the expense for handling. This analysis covered only sales made to the trade and it was pointed out that the analysis showed that profits on the heating device line are inadequate for the jobber.

Each member was urged to analyze his heating device figures to learn if his profit on this line is satisfactory. It appeared in this discussion that manufacturers have contended that poor salesmanship by the jobbers' men is responsible for the small orders. The jobbers do not agree with this viewpoint.

The situation in the dry battery field is that the jobbers' volume of business is not satisfactory, there being too many distributors.

The election of officers resulted in the choice of Frank N. Bernardin, of Kansas City, as chairman of the central division, for the ensuing year. Practically all of the committee chairmen were re-elected.

At the next meeting of the central division four committees will lead a discussion on the condition of jobbers' stocks as to staple products.

N. E. L. A. Rate Book

The "N. E. L. A. Rate Book," published by the rate research committee of the National Electric Light Association, has been issued. The book is edited by Norton, Bird & Whitman.

LARGE PLANS FOR TELEPHONE CONSTRUCTION IN 1917

Absorption of Surplus Plant Capacity by Unprecedented 1916 Business Necessitates Greatest Construction Program Ever Undertaken by Bell System

With unprecedented volume of business, facilities taxed to the utmost and rapid increases in facilities necessitated by heavy traffic burdens the American Telephone & Telegraph Company and associated properties had a year of great accomplishments in 1916. Total operating revenues of the Bell system were $264,600,000, an increase of 12.9 per cent over 1915.

Heavy Construction Requirements for 1917

Theodore N. Vail, the president, says in the report to stockholders that without the provisions for future growth and demands, the companies could not have provided for the traffic which was offered. Raw material prices averaged almost double their normal cost and at times it was impossible to get them in the quantities required.

"As it was," Mr. Vail says, "the quality of the service was at times and in some places not quite up to the high standard set in recent years, yet at no time and at no place did it break down, and by the end of the year it was on substantially a normal basis.

"In consequence of this absorption into service of the surplus plant, the program of construction during 1917 must not only meet the expected growth in stations, but must also provide for the restoration of the normal plant surplus in whole or in part.

"The prospects for the current year indicate a continuing station gain and a heavy traffic. To provide for growth and restore normal surplus plant and necessary advance construction our estimates of additions to plant during the year aggregate about $90,000,000, by far the largest program ever undertaken, but necessitated by the conditions as we now see them."

Relations with Western Electric Company

A section of the report is devoted to the Western Electric Company.

"The relations with the Western Electric Company have been attacked from various quarters, and always from the questionable standpoint of self-interest," says Mr. Vail. "This relation is substantially that of a 'manufacturing department' of the business, indispensable to every enterprise which requires the manufacture for its own use of such a variety and magnitude of apparatus and equipment of 'special,' highly technical and continually changing character, which cannot be procured or provided for in the open market.

"While it is a positive fact that it is impossible to procure from others the same character of manufacture or goods at less cost than from the Western Electric Company, or many of them even at any price, yet first cost cannot be made the deciding factor in the purchase of equipment so delicate and perishable as the telephone equipment. Depreciation and high maintenance will soon offset a very considerable saving in original expenditure. High-class service and low-class equipment do not co-ordinate.

"These relations are considered by impartial and well-qualified experts to be the most effective for their purpose, which is the production of apparatus of high efficiency, reasonable first cost, and low cost of maintenance. This can be accomplished only by the close co-operation between the operating companies, the technical departments, and the manufacturing company.

"What is there unfair about any enterprise requiring the expenditure of large amounts of money for highly specialized machinery and equipment vital to its operation maintaining its own manufacture? Why should not the ideas and suggestions originating within the system be worked out within the system itself?"

Engineering Matters

Attention is called to the value of improvements in intracontinental and transcontinental telephonic transmission of speech from the standpoint of national defense. The experimental mobilization last year demonstrated the complete readiness of the Bell plant and organization to respond to an emergency.

"The further adoption of electric traction by railroads and the continued extension of electric power lines," the report adds, "have been the occasion of great activity on the part of our engineers in studying the difficult problems of telephone operation in the neighborhood of these circuits. Important field investigations were conducted in connection with power lines in Iowa, the electrification of the Pennsylvania Railroad, that of the Chicago, Milwaukee & St. Paul Railway, and others.

Regulation

A part of the report dealing with legal matters says:

"In valuations, the present disposition of the commissions is to allow, without serious controversy, the items which are susceptible of direct and certain proof. The so-called intangibles represent elements of value which must be recognized as of large importance. The disposition has been to recognize them as elements of value and to allow them, in one form or another, so far as they have been clearly established.

"An especial effort has been made to draw attention to the distinction between regulation and management, because it is felt that a failure to recognize it would result in serious embarrassment not only to the utilities but to the public as well."

The Telephone and Public Questions

Other points characteristic of the attitude of Mr. Vail and the companies on public questions were:

"The qualities which created the Bell system were self-interest subordinated to public spirit, initiative, vision, imagination, courage and energy in creating a new, serviceable utility, developing all its potentialities, and making all possible improvements.

"The only advantage the Bell interest ever had was through creative work in developing the potentialities of the telephone service by incorporating with advance construction advanced ideas; placing those facilities for service before the public in advance of all others.

Off-Peak Traffic Needed

"If in any utility some plan can be devised which will create, for the sparse hours, a new traffic and thus increase the average by utilizing facilities otherwise idle, for such service large reductions could be made; but such traffic must not occupy the plant during the busy hours, only during the otherwise idle hours. It must be a new character of traffic not requiring any addition to either facilities or operating force.

Employees' Bonus

"In addition to the strain on our facilities, there was a corresponding strain on all the personnel of the system. Having due appreciation of this extra exertion, faithfulness, loyalty and prompt response to the demands of the service, on the part of our employees, as well as the extra demands upon their earnings in these abnormal times, it was deemed not only proper but advisable to share with them this surplus. Accordingly a distribution throughout the system of a very considerable part of it was made."

REMODELLED HYDROELECTRIC PLANT NEAR BRATTLEBORO

Operation Resumed After Reconstruction and Strengthening of Twin State Gas & Electric Company Building at West Dummerston, Vt.

Service has been inaugurated at the West Dummerston (Vt.) hydroelectric plant of the Twin State Gas & Electric Company, which has been undergoing reconstruction for a year. The plant is located on the West River, about 7 miles from Brattleboro, and although it is small it is utilized effectively in connection with the transmission system of the New England Power Company. The present maximum load in Brattleboro is about 510 kw. The plant was first established in 1902 as an auxiliary to the old steam generating station serving Brattleboro, its original equipment being a Stanley inductor alternator of 11,000 volts potential, driven by a Leffel water wheel, the rated output being 350 hp. The original station was designed to accommodate two units, but only one was installed. The station was run as an auxiliary about nine months of each year.

In the fall of 1915 the foundations of the plant became undermined by high water and the conditions



REMODELLED HYDROELECTRIC PLANT NEAR BRATTLEBORO RESUMES OPERATION

threatened the destruction of the station, the generator having settled about 2 ft. below its original level. Reconstruction was decided upon, with the addition of a second unit of 425-hp. rating, this machine being a General Electric generator direct driven by a Leffel turbine. About $15,000 has been spent in improving the plant. Before the changes were effected all the equipment was removed. A cofferdam was built around the power house, the foundations being excavated to a further depth of from 6 in. to 4 ft. below the former level and carried down to bed rock. A raceway wall 150 ft. long was built between the spillway discharge on the downstream side of the dam and the tailrace proper, to eliminate troubles due to ice formation. The old inductor alternator was rewound for 2300-volt service, this being the potential of the new unit, and connection with the high-tension system is made through appropriate transformers.

The power plant, originally a wooden structure, has been fireproofed by lining the walls inside and out with concrete and metal lathing, and new headgate hoists, which may be operated by one attendant, have been installed, together with a new rack at the intake. The head on the wheels is 18 ft., and the dam is a crib and stone structure 261 ft. long. When the river is at a stage permitting utilization of the water, the station carries the normal load, peaks being handled by the New England Power Company connection with the Vernon station of the latter. In case of trouble on the latter system the West Dummerston station will handle the Brattleboro load entire at such times as the river is available. A new switchboard equipped with one line and two generator panels was installed in connection with the above improvements.

PUBLICITY AND SALES METHODS FOR CENTRAL STATIONS

Speakers Before New England Section of the N. E. L. A. Say That Manufacturers' Circulars Should Be Used More Widely by Local Companies

At the question box convention of the New England Section of the National Electric Light Association in Boston, Mass., March 8, an extended discussion of publicity methods from the central station standpoint took place under the chairmanship of Willard Hall, Narragansett Electric Lighting Company, Providence, R. I. This was mentioned briefly in the report published in last week's issue. During the discussion speakers pointed out that wider use should be made by local companies of publicity matter supplied by manufacturers, but there was general agreement that this material would meet local requirements better if the manufacturer's stamp was less conspicuous. Any diversion of interest from the local company was considered objectionable. It was conceded by most speakers that national publicity relative to appliances should be supplemented by local circularizing, motion picture films, bill inserts and local newspaper advertising.

Much criticism was leveled against misunderstandings arising from price discrepancies in circulars issued by central stations and those issued by manufacturers. W. F. Abely, Western Electric Company, Boston, suggested that in general advertising the price should be inserted at the option of the central station, provision being made for its insertion in all electrotypes of electrical conveniences.

The convention generally favored maintaining manufacturers' price in retail sales. Several speakers recognized that the present period of high prices is an opportune time to advance sales prices to a fair level of profit. C. R. Hayes, manager of the Fitchburg (Mass.) Gas & Electric Light Company, said that although gas appliances are to-day being sold at 65 per cent above cost, a rise above the former scale, no reduction in sales volume has occurred.

Closer co-operation from manufacturers relative to methods of selling their products was desirable, according to several speakers. It was the general opinion that the expenditure of say $75,000 in the co-operation of the manufacturers' advertising and sales specialties would produce more sales than the devotion of this sum to fifteen insertions in a well-known national weekly.

Wagner Electric Dividend Increases Outstanding Stock

Directors of the Wagner Electric Manufacturing Company, of St. Louis, have declared a special dividend of 80 per cent on the stock. Shareholders have the option of taking new stock at par or cash. The authorized amount of stock was increased recently from $2,000,000 to $5,000,000. The special dividend and the regular quarterly dividend of 2 per cent are payable April 2.

Commission Rulings

Important Decisions of Various State Bodies Involving or Affecting Electric Light and Power Utility Operation and Practice.

California Commission Considers Rates Charged by One Company to Another.—Rates charged by the Napa Valley Electric Company to the Calistoga Electric Company are under consideration by the Railroad Commission of California. Previously the Napa company charged the Calistoga company 2.4 cents per kilowatt-hour for electrical energy used for lighting and 1.75 cents for energy used for heating. After a hearing the commission made rates of 2 cents per kilowatt-hour for the first 15,000 kw.-hr. and 1.7 cents for all in excess of 15,000. The Napa company complains that these rates are unremunerative and asks restoration of the former schedule.

Division of Territory Ordered by California Commission.—The complaint of the Coast Counties Gas & Electric Company that the Sierra & San Francisco Power Company is illegally building, against the commission's order, a line in San Benito County to supply a consumer near San Juan Bautista, and also the application of the Sierra Company for authority to build this line and to sell energy in San Benito County under a franchise granted by that county, have been dismissed by the Railroad Commission of California. The commission directed the Sierra and Coast companies to submit a plan relative to service in the part of the county now served by the Coast company. The commission finds that the Sierra company should operate in part of the county under a franchise to be granted by the county and should be permitted to serve part, provided that it does not duplicate the facilities of any other electrical corporation in the district.

Duplicated Telephone Property Not Entitled to Return, Ohio Commission Says.—In an order issued on March 9 the Ohio Public Utilities Commission stated that property of telephone companies which is unused on account of duplication is not entitled to earnings. The case is that of the Lima Telephone & Telegraph Company. In July, 1916, the commission reopened its valuation, made as of Jan. 1, 1915, when it found the reproduction valuation to be $845,404, depreciation $144,686 and present value $700,718, and deducted the value of duplicate property found to be not used and useful. This property had a reproduction value of $109,528 and a present value of $56,621, according to the commission engineers. An allowance was made for betterments made between Jan. 1, 1915, and Aug. 31, 1916, and the value of the property actually used for the public was found to be: Reproduction, $768,655, and present, $677,222. The duplication came through the purchase of Central Union property. Following this, new rates were announced, effective on March 1, 1915. They were challenged by the city. The company insisted upon a valuation of $900,000, necessary to maintain a proper relation between the value and the outstanding securities. Under competitive conditions the independent company charged $36 for single-line business service and $30 for two-party service; the Bell rates were $42 and $27, respectively. After consolidation, the rates were advanced to $54 and $42, respectively. The commission finds that reasonable rates are $48 and $36, and that all collections in excess thereof since March 1, 1915, are unlawful.

Complaint Against Sale of Power by Los Angeles.—The Southern Sierras Power Company has filed with the Railroad Commission of California a complaint asking that the city of Los Angeles be compelled to apply to the commission for authority to do business in the territory about Owens Lake and to file a schedule of rates for that territory. Pending a final determination, the company asks that the city be restrained from contracting to supply the Natural Soda Products Company or the California Alkali Company for operating their manufacturing plants. Los Angeles built two generating plants near Owens Lake in 1907 to provide power for excavating the Owens River aqueduct. Since the completion of the work four years ago the city has been selling power in competition with the private company, according to the complaint of the latter and is now bidding for new business in competition. The complaint states that the city has not obtained a certificate of public convenience and necessity from the commission, as the company was required to do, and has never filed rates with the commission as public utilities must.

Public Utilities Commission of District of Columbia Modifies Accounting System.—An order has been issued on the application of the Potomac Electric Power Company for a modification of the methods of keeping the store expenses and the stable and garage expense accounts so as to permit the distribution of expenses included therein to the accounts that should properly carry such expenses. It appears that the stores and stable departments are maintained entirely for the use of construction work, either for new construction or for maintenance. It is very important that the items under discussion be considered in an entirely different light than the subject of general overheads. These expenses represent in great part charges that could be distributed to specific construction work, but in order to avoid the complicated bookkeeping involved, the company has suggested that such distribution be made on a percentage basis as outlined in the revised description of the accounts. It is the opinion of the commission that this method is not only proper but would result in much better accounting and would more clearly reflect the true cost of the various operations if the changes as suggested be permitted.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public-utility companies.

Remedy for Damages from Flowage.—The Supreme Court of Wisconsin held in McDonald vs. Apple River Power Company (160 N. W. 156) that since the power company was authorized to construct a dam in a river, it had the right, by law, to acquire flowage rights, and therefore the plaintiff, whose land was flooded by the water raised by the company's dam, had a remedy pursuant to the milldam act, so that it was an error to entertain the action against the company for damages from flowage as one in equity to abate a part of the company's flashboard used as a part of the dam. In such a case, the action need not necessarily be dismissed, but may be treated as a civil action, under the milldam act, to recover damages and the acquisition of flowage rights, with a trial before a jury to ascertain the company's liability.

Contributory Negligence in Jerking Street Lamp Chain.—Whenever a person walking along the street sees an arc lamp that has gone out, the first impulse is to vigorously pull the cord or chain by means of which the lamp is raised or lowered. Frequently such action has resulted in serious injuries and sometimes death to the person who pulled the cord. Such a case is discussed by the Supreme Court of Alabama in Bloom vs. City of Cullman (73 S. 85) in which a pedestrian was electrocuted by contact with a chain used to raise and lower such street lamps owned and controlled by the city. The court held that the degree of care resting upon a municipality operating electric street lamps, as to means of transmitting its electric current over public thoroughfares, is high and exacting, commensurate with the very dangerous agency employed. And, furthermore, that in the action for death of the pedestrian the burden of proving contributory negligence rests upon the city. In regard to the negligence of the deceased, the court stated that if a pedestrian on a public street, warned or having reason to know that a chain used to lower electric light was charged with energy from feed wires, carelessly touched the chain, he was negligent barring recovery for his death. If, on the other hand, he undertook to improve the light by shaking the chain, not knowing that the chain was charged, and having no knowledge that it would deter a reasonably prudent man from touching it, or if he had recently done so, or had seen others do so in safety, his touching the chain was not negligence barring recovery for his death. Whether such pedestrian's act was negligence depended on whether it was the act of a reasonably prudent man.

Arizona Power Contract.—F. S. Viele, president of the Arizona Power Company, reports that the company has made a contract with the Consolidated Smelting Company for a three-year term with a minimum of 1000 hp. It is expected that actually from 1200 to 1400 hp. will be used. This is about double the amount used at present.

Securities Acceptable Under British Mobilization Plan.—Consolidated Cities Light, Power & Traction Company first lien 5 per cent bonds have been added to the British treasury list of securities acceptable for deposit under the plan to mobilize securities. This action follows the inclusion of Cities Service Company preferred stock on the list, announced in July, 1916.

Low Cooking and Heating Rate in Uruguay.—Alan C. Towers, Montevideo, Uruguay, writing to the ELECTRICAL WORLD on low cooking rates, says: "It may be of interest to you to hear that the electric light company of this city (owned by the government) has just announced a new rate of 2 cents per kilowatt-hour for cooking and water heating. As coal in this city is costing at present between $25 to $30 a ton and as electric cooking has hardly been done at all in the past this ought to be a good opportunity to install electric ranges. The electric light has about 30,000 connected customers. I may add that 2 cents Uruguayan is about the same as 2 cents American money."

Water Power Legislation Recommended in New York.—In a report to the Legislature relating to the water power situation, Attorney General Woodbury of New York State suggests the desirability of a careful study of the problem. "The rapidly increasing cost of producing electrical energy by steam power," he says, "seems to emphasize the necessity for the development of all of the water powers of the State as rapidly as possible, in order that such electrical energy can be used instead of steam produced electrical energy, and thereby aid in the development of manufacturing and transportation enterprises which either now exist or which may easily come into existence as a result of such development."

Consumers in the Borough of the Bronx, New York, Ask That Rates Be Maintained.—The New York Public Service Commission, First District, recently had the unusual experience of consumers appearing to request that no reduction in rates be ordered as the result of an investigation being conducted by the commission regarding electric rates of the Bronx Gas & Electric Company. The investigation covers rates of both the Bronx Company and the Westchester Lighting Company, which, respectively, have maximum charges of 12 cents and 10 cents per kilowatt hour. The attitude of the consumers was based, they stated to the commission, upon their fear that if rate reductions were ordered and the company's income thus reduced, the company would find it impossible to make needed extensions of lines.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Electrolysis Survey Proposed in Montgomery, Ala.—The Bureau of Standards has been asked to make an electrolysis survey in Montgomery, Ala.

Power Commission Proposed for Maine.—A bill creating the Power Commission has been introduced in the Maine Legislature. It provides for investigation and utilization of such of the undeveloped water powers of the State as seem to be most advantageous.

Private Water Power Development Recommended by New York Conservation Commission.—The annual report of the New York State Conservation Commission to the Legislature says that the time has not arrived when the State should develop its water power to supply power for the people, but it should permit development by private means and take any revenues accruing over an adequate return to private investors.

Electric Products at Actors' Fund Fair.—Planned as a series of trade expositions in which electrical supplies will have a part, the Actors' Fund Fair, to be held at the Grand Central Palace, New York, from May 12 to 21, asks the co-operation of many important industries which are to be represented by donated merchandise. An attempt will be made to bring some return to business establishments for their generosity. A large section of the bazaar space has been set aside for the display of many varieties of electrical merchandise. Every opportunity will be offered for publicity through display cards, advertising literature, etc.

Customers' Information Books of Byllesby Companies.—The publicity department of H. M. Byllesby & Company, Chicago, has prepared customers' information books, electric, for practically all of the Oklahoma properties. Except for the rate schedules the material contained in the booklets has been standardized so that the booklets could be used to place in the hands of customers general information concerning service. The pages carry considerable educational matter. The following subjects are considered: The company's general policy, how to obtain service, function and duty of the sales department, service, advance deposits, pulmotor service, free fan and toaster service to indigent invalids, incandescent lamps, service trouble and adjustments, badges worn by employees, disconnecting and moving, electrical contractors, the meter as the company's measuring device, the basis of rates, electrical terms defined, rate schedules, and explanation of rates. "Personal Attention to Every Customer," is printed across the top of each page.

Wisconsin Campaign for Better Factory Lighting.—The Wisconsin Industrial Commission has inaugurated an educational campaign to secure better lighting in factories.

Annual National Household Gas and Electric Show at St. Louis, Mo.—Arrangements are being made by Manager Frank M. Robinson for the annual household show to be held at the Coliseum, St. Louis, March 19 to 31. The electrical department, under Miss "Kilowatt Kate," will demonstrate how cooking, baking and cleaning can be made a pleasure by means of the up-to-date contrivances.

Wisconsin Companies Combined.—The Eastern Wisconsin Electric Company, with an authorized capital of $10,000,000, has been incorporated in Wisconsin to acquire the properties of the Eastern Wisconsin Railway & Light Company, Fond du Lac; the Wisconsin Electric Company, Oshkosh, and the Sheboygan Electric Company. The president is Joseph H. Brewer, president of the American Public Utilities Company.

Public Utilities Commission Bill in Michigan.—A bill providing for the creation of the Michigan Public Utilities Commission has been drafted by Commissioners Glasgow and Kaiser of the Railroad Commission. Five commissioners, ten-year terms, and annual salaries of $6000 are stipulated. Departments are created, including one for gas and electric companies. An engineering and statistical bureau is included.

Commonwealth Edison Power Business Gains Rapidly.—From Jan. 1 to the middle of February, the power business of the Commonwealth Edison Company of Chicago amounted to about 11,000 hp., which is practically double the first six weeks of last year. A large proportion of this business came from concerns which are shutting down isolated plants. Among these are the Monroe building, with 400 hp.; Sherwin-Williams Paint Company, with a 1000-hp. turbine station; Gottfried Brewing Company, with 1000 hp.; Bauer & Black, with 800 hp.; the new Regan Printing Company building, with 700 hp., and, in addition, five new ice plants, making twenty-five artificial ice plants now electrically operated in the city.

Electrically Heating Cars in Unheated Garages in Detroit.—The Detroit Edison Company has made a number of tests with different methods of electrically heating cars stored in unheated garages. Various means of heating insulated and uninsulated garages have been tried and experiments made with nearly all of the heaters sold for heating the engine itself. The results of these tests are now being worked up, and they will probably be presented in a paper at one of the conventions during the coming summer. Means are available by which an automobile engine and appurtenances can be maintained at a temperature of 50 to 60 deg. Fahr. in a cold garage with electrically generated heat, at an expenditure of 1 to 2 kw.-hr. per night in the coldest weather.

March Meeting of the Electric Club of Toronto.—At the March 9 meeting of the Electric Club of Toronto, E. P. Heaton, provincial fire marshal, discussed "Fire Waste from Electric Causes." Frank T. Groome is secretary of the club.

Pittsburgh Section, A. I. E. E.—A. R. Cheyney, engineering department of the Westinghouse Electric & Manufacturing Company, addressed the Pittsburgh section of the A. I. E. E. on March 13, on the subject, "Power Limiting Reactances and Service Protection." F. E. Wynne is secretary of the Pittsburgh section.

Philadelphia Electric Company Section N. E. L. A.—On March 6 Robert Glendinning, a Philadelphia banker and aviator, spoke before the Philadelphia Electric Company's section of the National Electric Light Association on the progress which has been made in airplane construction and also regarding its application.

Electrical League of Cleveland.—W. W. Freeman, president of the Union Gas & Electric Company of Cincinnati, addressed the Electrical League of Cleveland on March 8, on the subject of co-operation. Paul M. Lincoln of the Westinghouse Electric & Manufacturing Company addressed the society on March 15. His topic was "The extent to which electricity has entered into our modern life."

Mercury Ell C. Bennett Addresses Houston Jovians.—Houston Jovians and guests gathered in the city auditorium on March 2 and heard a discourse on "Jovianism and Its Relation to the Electrical Industry," by Mercury Ell C. Bennett. Mr. Bennett, accompanied by representative Jovians from northern Texas, who have volunteered to escort him through the State, is engaged in the work of stimulating interest in the order among electrical people who have not yet become affiliated therewith. In addition, he is endeavoring to revive the enthusiasm of old members.

California Association of Electrical Contractors and Dealers. — At the monthly meeting of this association in Sacramento, Cal., on Feb. 24, a committee was appointed to bring to the next regular meeting of the association a definite recommendation for action on the trade-acceptance plan. Since a course in cost accounting is being conducted under the auspices of the University of California extension course, the secretary was directed to keep in close touch therewith to the end that accurate statistics in overhead costs, methods of accounting, etc., might be compiled and rendered accessible to association members. According to an announcement made at the meeting, the annual convention of the British Columbia Association of Electrical Contractors and Dealers will be held in Vancouver Aug. 20 to 25. Santa Rosa was selected as the city in which the California association would hold the annual convention for 1917. At the evening session short talks were made by M. A. DeLew, J. C. Holbrecht, D. E. Harris and A. H. Halloran.

Associations and Societies

A complete Directory of Electrical Associations is regularly printed in the first issue of each month on the next to-last text page.

Institute of Radio Engineers.—"The Determination of the Audibility Current of a Telephone Receiver" was the subject of an address by Prof. Edward W. Washburn of the University of Illinois before the Institute of Radio Engineers, New York City, on March 7.

Toronto Engineers Visit Telephone Exchanges.—W. J. Clarke, plant superintendent of the Bell Telephone Company, piloted members of the Toronto section of the A. I. E. E. through the Adelaide and Main exchanges of the Bell Telephone Company on March 2. Wills MacLachlan is secretary of the Toronto Section.

Chicago Meeting—A. I. E. E.—The 330th meeting of the A. I. E. E. was held in Chicago on March 9 and 10 under the auspices of the Chicago section and the protective devices committee. The morning and afternoon of the first day was devoted to various committee meetings, to a number of inspection trips, and to a board of directors meeting. A technical session was held at night, the general subject of the session being "Methods of Relay Protection." The papers presented are discussed on page 508 of this issue under the heading, "Relay Practice of Larger Systems."

San Francisco Section, A. I. E. E.—At a meeting of the San Francisco Section of the American Institute of Electrical Engineers, held on Feb. 23, W. A. Hillebrand presented an illustrated paper on "The Maximum Demand Meter." The paper contained the results of an exhaustive study of problems involved in measuring current under varying demand conditions. Discussion on the paper indicated agreement on the point that the meter problem is not yet solved, that rate making is in advance of meter manufacture and that an urgent demand now exists for a meter that will answer the demands of service.

Association of Iron and Steel Electrical Engineers.—The regular monthly meeting of this society was held to-day (March 17) at the Fort Pitt Hotel, Pittsburgh, Pa., the electrical development committee presenting papers on the latest practices in the application of electricity to the iron and steel industry. S. C. Coey is chairman of this committee. The next meeting of the Pittsburgh section will be held April 21 under the auspices of the standardization committee, of which W. T. Snyder is chairman. The next meeting of the Philadelphia section will be held at the Majestic Hotel, April 7. Karl A. Pauly of the General Electric Company will present a paper entitled "Variable Speed Control of Alternating-Current Motors."

Cleveland Electrical League. At the regular weekly meeting on March 1 the league showed the patriotism of its members by sending telegrams to their representatives in Congress, asking them to neglect no means or measures that will uphold the honor and dignity of the United States. Dr. Charles S. Howe, president of Case School of Applied Science, addressed the 225 members present on "Undeveloped Sources of Power," and under this head considered the possible development for commercial purposes of electric energy through the use of the tides, waves and the sun.

E. N. Hurley Speaks on Business Problems at Chicago.—At the meeting of the Electric Club-Jovian League of Chicago, on March 8, E. N. Hurley, ex-chairman of the Federal Trade Commission, said: "With central stations rapidly developing their efficiency along the lines of familiarizing themselves with their actual cost, which enables them to give service at reasonable rates, it is necessary that the manufacturers, jobbers and retailers in the electrical industry also be keenly interested in the development of better methods of doing business. They also should aim to give service and realize that they must co-operate and organize along sound, practical lines, so that they may be able to sell their product at a reasonable figure. It is recognized that a business man must be concerned not only with the efficiency of his own business but with the efficiency of his competitor's business, and realize that unhealthiness anywhere in his industry will react seriously on him. I predict that within five years there will be very little money loaned by any banker in the United States to any merchant or manufacturer who does not present a statement showing detailed information not only regarding his true assets and liabilities, but also indicating that he is conducting his business in an efficient manner and that he absolutely knows what his true costs are.

"One of the real needs among American business men to-day is a broad view of business and a comprehensive grasp of industry as a whole. The men who realize this principle, who are studying our economic problems from this point of view, are the men who will do the big things and be the real leaders of American business. The problems now before the business men and government are not so complicated but what they can be worked out, and in a reasonable length of time. The Government has shown that it is willing and anxious to co-operate with business. It is now the duty of the business men of this country to do their part. Successful co-operation requires a friendly spirit on both sides, if we are to accomplish real constructive work. When business men request advice in advance as to some particular step they wish to take, they should present to the government an intelligent statement of the facts; then the government should give advice in advance as to what busines men should or should not do. This applies to legal questions, as well as to economic ones."



JULIAN C. SMITH

Julian C. Smith, who was recently awarded the Gzowski medal of the Canadian Society of Civil Engineers for his part of a paper on the Cedars Rapids Manufacturing & Power Company's development, is one of the youngest and best-known engineers in the province of Quebec. He is a member of the British Institution of Electrical Engineers and of the Canadian Society of Civil Engineers and a fellow of the American Institute of Electrical Engineers. Besides being general manager of the Shawinigan Water & Power Company, Mr. Smith is connected with the many subsidiary companies as executive officer or director. He was born at Elmira, N. Y., 1878, and was educated at Cornell University. After taking the degree of mechanical engineer in 1900, he began work as a draftsman with Wallace C. Johnson, consulting engineer at Niagara Falls, N. Y., where he remained two years. He subsequently became assistant engineer to Mr. Johnson at Shawinigan Falls, Quebec. In 1903 he was made superintendent of the Shawinigan Water & Power Company of Montreal and in 1906 was advanced to general superintendent becoming general superintendent and chief engineer in 1909. The Shawinigan Water & Power Company operates the largest generating system in the province of Quebec and is now delivering power to all of the larger cities and towns in the province. Taken in connection with the Cedars Rapids Manufacturing & Power Company, operated by the same interests, and the Laurentide Power Company, the output of which is purchased by the Shawinigan Water & Power Company, the generating system over which Mr. Smith exercises both engineering and managerial supervision is the largest in the Dominion of Canada. The developments are all new and represent the largest hydroelectric work undertaken within the last few years in the whole of North America. Besides taking a keen interest in engineering societies Mr. Smith has made numerous contributions to engineering literature. He was awarded the Gzowski medal in 1913 also for his paper on "Design of High-Voltage Transmission Lines" covering the new Shawinigan-Montreal line.

Men of the Industry

Changes in Personnel and Position— Biographical Notes

W. F. Anderson, former superintendent of the Effingham Waterworks Company, has been appointed secretary and general manager of the Eastern Illinois Utilities Company at Effingham, Ill., succeeding W. G. Austin, who has resigned.

W. G. Austin, who for the past twenty years has been connected with the Effingham electric plant, has resigned from the position of secretary and general manager of the Eastern Illinois Utilities Company at Effingham to take charge of personal business interests.

M. J. Healy, formerly in charge of the meter department of the Lockport (N. Y.) Light, Heat & Power Company, has been appointed commercial manager of that property.

H. M. Kohn, for the past year commercial manager of the Birmingham (Ala.) Railway, Light & Power Company, has resigned his position with that company and will enter business for himself in Birmingham.

Walter Neumuller is starting on an extended tour of the country in connection with the systematic membership campaign inaugurated by the membership committee of the National Electric Light Association, of which he is chairman. His itinerary will take in as far west as the Pacific coast and will bring him in touch with the greater part of the central station industry



WALTER NEUMULLER

of the United States. While the National Electric Light Association includes in its membership 90 per cent of all the central station companies in the country, representing an investment of approximately $3,000,000,000, there still remains a considerable number of companies, especially in the smaller cities, which have not availed themselves of the benefits of affiliation with that organization.



C. S. COOK

C. S. Cook manager of the railway and lighting department of the Westinghouse Electric & Manufacturing Company at East Pittsburgh, on March 1, was selected as general manager of the Duquesne Light Company to fill the vacancy created by the death of Robert S. Orr. Mr. Cook was born in Massachusetts, educated at the Worcester Polytechnic School, from which he graduated in 1887. He was first employed in the old Westinghouse Electric Company's plant in 1887. At that time the electric company shared a very small building in Garrison Alley with the Union Switch & Signal Company. Mr. Cook served in the shops and testing room and in 1888 was made construction engineer of building, lighting and power plants. In 1889 he became engineering superintendent of construction in the Chicago office, and in 1895 he returned to Pittsburgh to take charge of special sales engineering work in the Pittsburgh district. In 1899 he became manager of the Pittsburgh office of the Westinghouse Electric & Manufacturing Company, which position he retained until 1904, when he assumed the position at East Pittsburgh from which he has just retired. In this department he had control of all commercial operations relating to power machinery for public service corporations.

A. P. Ramstedt, former president of the Public Utilities Commission of the State of Idaho, has resigned as a member of the commission to accept the position of general auditor and comptroller of the Day Mining interests, including among others, the Hercules Mining Company, Tamarack & Custer Consolidated Mining Company, and other mining companies in Idaho and British Columbia; the Northport Smelting & Refining Company at Northport, Wash.; Pennsylvania Smelting Company at Pittsburgh, Pa., and various banking interests in Idaho and Washington.

Trav Smith, for the past six years assistant manager of the light and water department of Elberton, Ga., has been elected to the position of superintendent of light and water at Toccoa, Ga.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

MANY GLASS MAKERS FORCED TO SHUT DOWN PLANTS

Weather Conditions in the Natural Gas Fields Are Worse Than Usual—Higher Prices Are to Be Expected

Owing to the unusual weather conditions that have existed lately in the natural gas fields a large number of glass makers have been forced to close down their plants, some of them entirely. All who have been dependent upon natural gas for fuel have suffered to a great extent this winter. Those who have not had to shut down their plants have had to curtail operations considerably. Conditions this year were fully 50 per cent worse than ordinarily.

There is reason to expect, therefore, that in the near future another rise can be expected in the price of electric glassware. Prices on window glass went up last week to the extent of 15 per cent, and it is not unreasonable to suppose that electric glassware will advance fully as much.

With a production greatly curtailed and with the congested conditions of freight terminals and the shortage of rolling stock, jobbers' stocks of electric glassware, never very large, have been seriously depleted.

CREDIT CONDITIONS IN THE ELECTRICAL TRADE

Collections Larger at Present than Ever Before—Industrial Plants Borrowing Heavily from Banks on Short-Term Notes

Credit conditions are probably better to-day in the electrical industry than they ever have been. General business is better, everybody is busy and earnings are increasing, money is easy and plentiful, with the result that buyers are paying their bills promptly. Reports from different sections of the country indicate that the daily collections in January and February of this year set a new high record.

There is no doubt but that credit managers have generally exercised more care in extending credit in the past year and a half. The market has been distinctly on the sellers' side and he therefore has been in a position to dictate terms as favorable to his business as he could wish. In a number of cases sellers have taken advantage of the general business situation to shorten up the time of credit.

On the Pacific coast there is a notable tendency to shorter terms on which credit is extended by jobbers, and to bring cash discounting down to a ten-day limit instead of the usual thirty-day terms.

The fact that business is being selected by the seller with greater care is also reflected in the state of business among commercial lawyers. They complain that their business has fallen off 50 per cent. One electrical firm doing a business in the Middle West running into millions of dollars is said to have had losses in 1916 amounting to only $96.

As a result of the fact that for some time increased caution has been exercised in the extension of credits, dealers and contractors on the Pacific coast have found it necessary to keep business affairs in better shape in order to secure desired credits. This, coupled with the co-operative and educational movement that has been noted on the coast of late, has materially improved the general business situation among dealers and contractors.

The feeling is that a much more healthy condition results when the man who is entitled to a certain amount of credit for a certain time is required to keep within both sum and time. Until comparatively recently, conditions in this regard have been neglected somewhat by the manufacturers, or at least they were not rigidly enforced. The present tendency is to come back to the strict interpretation of terms, and this is regarded as having a very healthy effect upon credits and collections.

Among manufacturers a strict watch over the affairs of industrial plant customers is maintained now for signs of over-expansion. These concerns have been found prone to buy beyond their logical limit on a rising market. This is discouraged. A study of industrial company statements such as are regularly made at this time of the year shows a considerably greater debt. It is practically all of the short-term variety and represents cheap money borrowed from the banks for a few months to pay for supplies and materials against earnings. So long as earnings keep up, this situation will probably provoke little more than comment. These statements are being carefully watched by credit men and should it become evident that industrial concerns are borrowing too heavily and taking too great a chance some action will undoubtedly be taken to produce a safer margin between debt and anticipated earnings.

The uncertainty regarding the probability of the United States engaging in hostilities with Germany still has a grip on the market, although it is not so apparent as it was a month or two ago. In placing contracts some buyers have taken the precaution to stipulate different arrangements for payment in the event of this country entering the war. There is some belief that collections would be still larger were it not for the uncertainty about the future action of this country. In Texas especially has this been noticeable.

Trade acceptances are continually finding a wider use in the electrical industry, more so, however, by jobbers than by manufacturers.

In Portland, Ore., the trade acceptance plan has been put into effect and the use of thirty-day acceptances is being tried. On these terms the purchaser really gets sixty days' credit; that is, January purchases are paid for in the middle of March. There are also being used on the coast a few sixty-day acceptances, which means an actual credit term of ninety days. The trial of this system is in the nature of a substitute for the four-month term, which has heretofore been the usual accommodation.

Some changes are said to be needed in the trade acceptance plan as now being tried in the Northwest, and these will probably be effected before the plan spreads into more general use along the Coast. It is agreed by several jobbers, however, that the trade acceptance plan will likely be used throughout the West Coast before long. The point is made that the jobber operates on narrower margin and therefore should secure shorter terms than other interests in the electrical field. This points to the jobber as the agency through which the trade acceptance plan would most naturally be introduced.

The general tie-up in east-bound railroad traffic and the consequent embargoes has caused a number of manufacturers to make a change in the method of handling foreign credit. Formerly a foreign customer was billed f.a.s. New York cash on receipt shipping documents. With the scarcity of bottoms, tie-ups, embargoes, delays in delivery, it is apt to be a long time after the goods have been manufactured before they actually leave the United States. For these reasons some manufacturers have begun to bill foreign consumers f.o.b. factory, cash on receipt bill of lading. This method, while by no means general, is being used rather widely by large American exporting corporations.

An attempt at the classification of buyers as credit risks under the existing conditions brought out that the large industrial plants and railroads and the municipalities are considered the best risks. Just now the first-named class are considered exceptionally good risks and prompt pay.

The municipalities, while they are a trifle slow at times, are considered gilt-edged risks. Most manufacturers and jobbers who expressed opinions placed central station companies third on the list of desirable credit risks, largely because of the long time they sometimes take in meeting bills. The electrical contractors are still the least desirable, and from year to year it is difficult to see much improvement in them. Taken over a period of years, however, educational efforts in this direction can be seen to be taking effect.

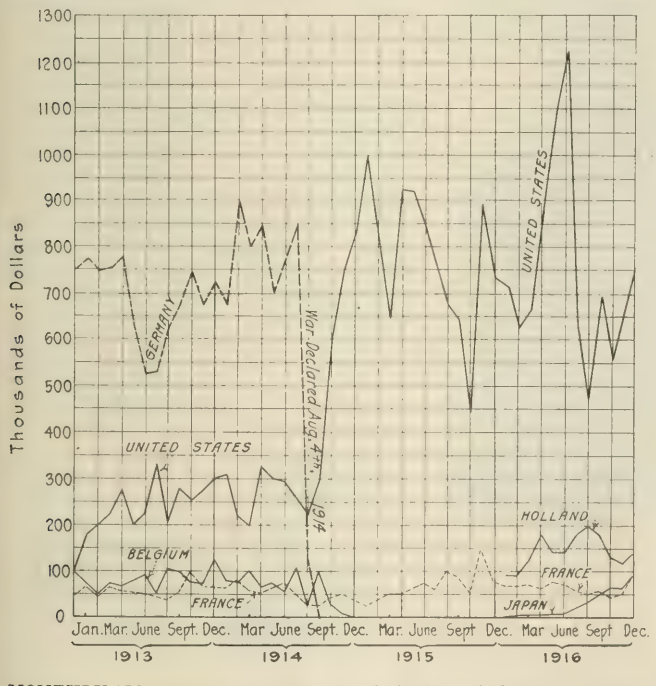
No one seems pessimistic regarding the future. So long as war is averted there seems to be a consensus of opinion that collections will keep up. A good many concerns that formerly required long credit terms are now taking advantage of discounts, paying from earnings. That earnings should be so large and continue so is put forth as a reason for expecting the immediate future to hold up. Indications so far are that the collections for March will be very large.

It is recognized, of course, that the tide will turn and that collections will slow up some day. But the belief is that this will not be during the present year. With the slow and unsatisfactory accounts reported to the Electrical Credit Association falling off both in number and amount of money represented, with the present tremendous momentum of business, and with at least a year of "reconstructive period" to look forward to even after the cessation of the European war, no breakers are seen immediately ahead.

AMERICAN ELECTRICAL GOODS IN BRITISH MARKET

Over 60 Per Cent of Electrical Material Imported Into United Kingdom in 1916 Manufactured in the United States

During 1916 the imports of electrical goods into the United Kingdom were valued at $13,650,000, as compared with $13,250,000 in 1915, $13,850,000 in 1914 and $14,750,000 in 1913, according to a compilation made by the *Electrical Review* of London. In 1915 France and the United States



MONTHLY IMPORTS OF ELECTRICAL GOODS INTO GREAT BRITAIN, SHOWING RELATION OF AMERICAN GOODS TO THOSE OF OTHER COUNTRIES

were practically the only exporters of electrical goods to England in any large quantity, French goods forming roughly 10 per cent of the British electrical imports. Last year, however, Dutch and Japanese goods began to enter the British markets in considerable volume. The Dutch merchandise, which amounted to about 12 per cent of the total imports, was over 90 per cent incandescent lamps. French goods representing about 6 per cent of the total imports showed a smaller total than in 1915. Three per cent of the imports were from Japan, and while the total was not large, nevertheless the quickness with which Japanese electrical goods established a footing in the British market has been very noticeable.

American goods constituted roughly 63 per cent of the British electrical imports in 1916, a high point being reached in June with a total of over $1,200,000. The total 1916 figures, however, are less than those for 1915. In 1916 the total American electrical goods imported into the United Kingdom was roughly $8,500,000, as compared with $9,275,000 in 1915, $4,500,000 in 1914, and $3,000,000 in 1913.

Prior to the war over half of Great Britain's electrical imports were of German manufacture. In a large measure, but not entirely, has this market been absorbed by American manufacturers.

While the 1916 imports of American goods showed a decrease in value of practically 8.5 per cent over 1915, the actual decrease was probably much larger owing to the greatly increased value of electrical goods in 1916. A considerable part of the decrease can be attributed to the import restrictions placed on a number of domestic appliances by the British government.

It is quite true that the demands of the British market on American manufacturers was much larger than is indicated by the 1916 figures. The domestic market, however, was so great and the factories so crowded with work that much of the foreign business had to be refused. In addition the price and delivery of American goods were frequently prohibitive. A by no means inconsiderable part of the Japanese electrical trade with Great Britain, it is known, can be attributed to this latter cause.

CONDITIONS IN COPPER MARKET REMAIN UNCHANGED

Market Still Quiet, Although Sellers of Second Quarter Metal Make Offerings with Greater Freedom

Copper prices remain practically unchanged over the week in a market that is still quiet. There has been a greater freedom of offering of second quarter copper manifested during the past week than has been evident since the beginning of the current year. In fact, the trade is by no means convinced, now that so much nearby copper is being offered for sale, that the supply has been sold up as tightly as has been reported. There seems good reasons to believe that buyers, by paying the price, can procure substantial amounts of nearby copper.

Nominal prices as quoted on Tuesday last for electrolytic were as follows: March shipment, 36.25c.; April 36.5c.; second quarter, 34.5c.; third quarter, 31.5c.; fourth quarter, 30.5c.

NEW YORK METAL MARKET PRICES

	Mar. 5 Selling Prices Bid	Asked	Mar. 13 Selling Prices Bid	Asked
Copper	£ s d		£ s d	
London, standard spot	139 0 0		136 0 0	
Prime Lake	35.00 to 36.20†		35.00	to 36.00†
Electrolytic	36.00 to 36.50†		36.00	to 36.50†
Casting	33.00 to 33.50†		32.00	to 32.50†
Copper wire base	42.50 to 43.50†		42.50	to 43.50†
Lead	9.00		9.00	
Nickel	50.00		50.00	
Sheet zinc, f.o.b. smelter	21.00		21.00	
Spelter, spot	10.80 to 11.05		10.82½	to 10.92½
Tin, straits	53.75		53.37½	
Aluminum, 98 to 99 per cent.	53.00 to 55.00†		53.00	to 55.00†

OLD METALS

Heavy copper and wire	28.50 to 29.50†	28.50	to 29.50†
Brass, heavy	17.50 to 18.00†	17.50	to 18.50†
Brass, light	14.25 to 14.75†	14.25	to 14.75†
Lead, heavy	8.00 to 8.50†	8.25	to 8.75†
Zinc, scrap	7.75 to 8.00	7.75	to 8.00†

COPPER EXPORTS

Total tons to Mar. 13 12,506

†Nominal.

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Automatic Pole-Type Constant-Current Transformer

An automatic pole-type constant-current transformer that requires practically no care or attention after it has been properly installed is shown in the



WEATHERPROOF AUTOMATIC CONSTANT-CURRENT TRANSFORMER FOR POLE-MOUNTING

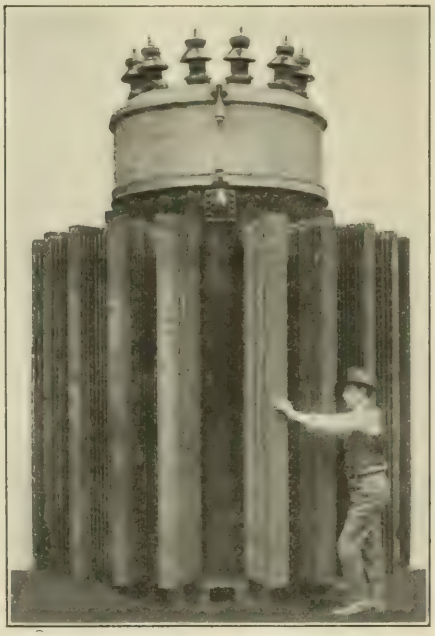
accompanying illustration. For indoor use, this transformer is constructed for mounting on the station wall or ceiling if floor space is at a premium. One feature of this type to which the maker calls attention is that the transformer can be operated by an oil-immersed time switch. The transformers also regulate as close and through as wide a range as the best type CC station transformer made by this company. The current from full load to no load is maintained within 1 per cent of normal. The efficiency is the same as for the station-type transformer and the power factor is high.

Several advantages are claimed for this transformer. For instance the high initial reactance serves to protect lamps connected therewith when first energizing and serves instantaneously to check surges on the line which would shorten lamp life. The moving secondary coil with its high repulsion force gives almost perfect regulation from full load to "dead" short-circuit. It not only protects the lamps from changes in current due to changes in secondary load but also protects the lamp from fluctuations in primary voltage.

Since the theory of operation is identical with that for the station-type constant-current transformer, the design differs only in the construction employed to make the transformer automatic. A tap is provided in the 2300-volt primary winding so that the transformer will carry full load and regulate satisfactorily when operated on a 2000-volt circuit. In addition, the 2300-volt transformer is designed so liberally that it will give good regulation on a 2400-volt circuit. These transformers have an ultimate temperature rise by resistance not exceeding 55 deg. C. based on a surrounding temperature of 25 deg. C. The transformer is a recent product of the General Electric Company, Schenectady, N. Y.

Mammoth Radiator-Type Regulator

In the accompanying illustration is shown the largest self-control induction feeder voltage regulator that has



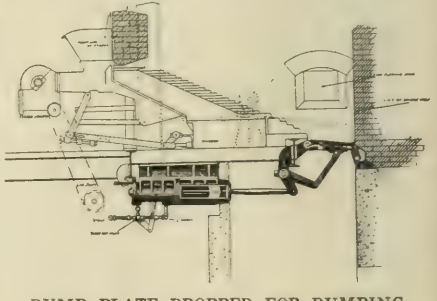
INDUCTION FEEDER VOLTAGE REGULATOR RATED AT 600 KVA.

ever been built. The regulator, which is of the oil-insulated, self-cooling type, was made by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa. It is rated at 600 kva., three-phase, 60 cycles, 13,200 volts, with 10 and 20 per cent regulation at 262 and 131 amp. respectively. The regulator is designed for operation outdoors with full-automatic control self-contained. It was built for the Southern Power Company and is to be connected to the low-voltage side of a 6000-kva. bank of 44,000/13,200-volt transformers on the power company's line at Spray, N. C. By the use of this regulator power will be delivered to the Thread Mill Company's mills owned by the Marshall Fields interests, at constant voltage.

Steam-Operated Dumping Plate for Stoker

The dumping plate shown in the accompanying illustration is operated by a steam cylinder located underneath the stoker. The dump plate is hinged so it will operate as a single unit. At its free edge the plate is supported by a series of pawls set directly in the bridge wall, to prevent sagging under load. By rocking these pawls, the dump plate is dropped. Opening a steam valve will raise it not merely to its normal position but considerably higher. Regardless of the rate at which the boiler is operated, the complete process of dumping, including the removal of clinker, can be performed in a relatively short time, possibly twenty seconds on an average, because the dump plate is comparatively wide from back to front and because slag does not adhere readily to the bridge wall just above the dump plate and reduce the effective area of the discharge opening. Furthermore, clinkers are scraped off at every dump by the action of the dump plate. With ample steam power to operate it, the dump plate can be made as heavy as desired. It is deeply ribbed to assist radiation, and to minimize warping and consequent need of renewal.

The control apparatus is located by the side-wall door, or elsewhere if desired, suitable linkages being run to the rocker shaft carrying the pawls on which the edge of the dump plate rests, and to the three-way valve actuating



DUMP PLATE DROPPED FOR DUMPING

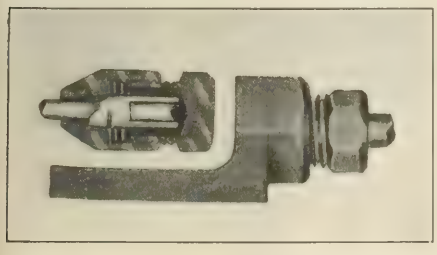
the steam cylinder. The pawls are rounded, so they do not have to lift the dump plate before releasing it. In dumping material collected on the plate the pawls are rocked and the dump plate allowed to drop. If the fuel con-

tains little or no clinker, no other operation is required. To raise the dump plate the steam valve is opened, the pawls are rocked again, and the dump plate is lowered on them by cutting off the steam. The whole operation takes five or ten seconds.

If the fuel contains clinker, as most soft coals do, part of the clinker forms big porous masses on the dump plate and lower grate, which tend to adhere and "hang" when the ashes are dumped. Part of the mass existing as liquid particles is thrown against the face of the bridge wall, down which it runs, to harden on the brick just above the dump plate. This is easily removed however, as the heavy dump plate, with ample steam behind it, acts as a hammer and scraper when raised above its normal position. A second blow may be delivered, but it is rarely necessary. Since the crust is formed between dumps, or say during a period of four or five hours, it is usually porous and is confined to a narrow band in easy reach of the dump plate. Raising the dump plate has another result. It loosens and tends to crush the clinker masses on the dump plate and lower grate. If some of these have escaped the first fall of ash, they are detached by the upward movement of the dump plate, and are carried down by dropping it again. Since the clinker can be kept loose in this way air can always reach the combustible on the lower grate, and there no unburned residue is liable to remain in the ash. This power dump is embodied in the Taylor stoker manufactured by the American Engineering Company of Philadelphia, Pa.

Solderless Connectors

Solderless connectors manufactured by the Fargo Manufacturing Company of Poughkeepsie, N. Y., for joining solid or stranded wires and cables are shown in the accompanying illustration. These connectors are used for splicing conductors of all sizes end to end, and forming a cold-weld solderless connection. The type shown on top grips the wires, cables or solid rods the full length of a 15-deg. taper and is firmly compressed about them. The conductors are held in place by a nut with a 15-deg. taper which insures a good contact



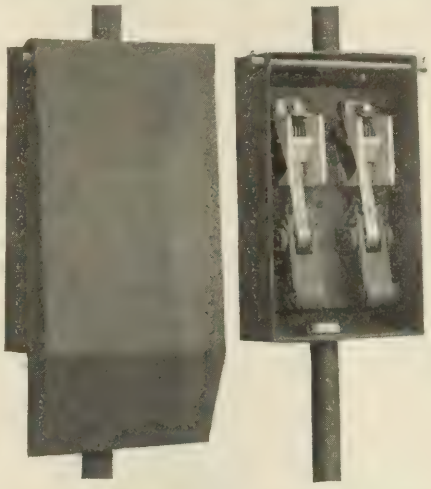
TOP—TWO-WAY SOLDERLESS CONNECTOR; BOTTOM—TERMINAL SOLDERLESS CONNECTOR

over its entire surface.

Terminal connectors like the one shown on the bottom are made for connecting cables and wires to flat busbars or front-connected switches.

Double-Pole Main-Line Switch for Elevators

The Warner Elevator Manufacturing Company of Cincinnati, Ohio, has developed a double-pole main-line switch to be used in connection with its elevators. Two of the switches are intended for installation in the elevator hatchway—one at the top and the other at the bottom. Energy delivered to the elevator machinery passes through the switches in series, so that in case either switch is opened the power supply is cut off from the elevator motor. The switch is inclosed in a covered iron box, the lid of which is cam shaped and is so placed that it engages with a corresponding cam or shoe on the elevator car. In case the car overruns, either at the top or bottom of the hatchway, the shoe on the car forces the lid inward, thereby opening both poles of the switch. The contacts are of the metal-to-metal shoe



LIMIT SWITCH THAT PREVENTS ELEVATORS FROM OVERRUNNING

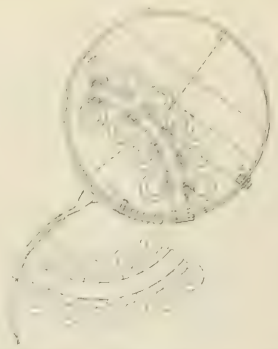
type, having a rolling slide action. Magnetic blow-outs are provided.

While the wiring for this type of limit switch is more expensive than that required for small pilot switches used in conjunction with circuit breakers, this switch has the advantage that it is absolutely positive in action. The switch is especially suitable for alternating-current equipments, because it is noiseless. The switch consumes no energy while the elevator is idle.

Water Evaporator

An evaporator which is said to provide a supply of distilled water for boiler feeding, drinking, culinary and such other purposes has been developed by Row & Davis, Engineers, Inc., 90 West Street, New York City. The apparatus consists of a shell with a door, to which is attached manifold and heating coils, the heating element also being mounted on a hinged door, which enables it to be swung outside for convenient inspection, cleaning or repair. This construction eliminates the necessity for supporting rollers, tracks or other handling devices. The position of coils forms an ebullition compartment without the use of baffles and permits complete circulation without conflicting currents. A simple but effective form of baffle in the top of the vapor space is said to eliminate all possibilities of priming.

The cylindrical shell and its concave and convex heads are made of open-



EVAPORATOR THAT CAN BE EASILY CLEANED

hearth boiler steel or cast-iron, as specified. The top and bottom manifolds for steam inlet and condensation drain respectively are similar and consist of cast iron or bronze bolted to the door. The coils are made of seamless drawn copper and are helical in form so that practically no stress is exerted on the joints. This construction permits the scale to be removed by suddenly flooding the evaporator with cold water and blowing down at intervals, the expansion and contraction stresses within the coils loosening the scale. The joints between the coils and manifold are made by slightly flaring the tube end and locking it between a tapered nipple on the manifold and a corresponding brass bushing. The latter is made secure by screwing it into a brass lock nut that in turn screws onto the nipple. Where a flanged joint is preferred to a locked one, the lock nut can be replaced by a pair of two-bolt flanges.

Rust-Proofing Material and Method of Using

"Eppicassit," a rust-proofing material sold by Hess & Son, 1033 Chestnut Street, Philadelphia, Pa., consists of a powdered metal, usually either tin, lead, zinc or their alloys. After the powder is mixed with a suitable fluxing carrier to the consistency of a smooth, creamy paint, the article to be treated is well cleaned and the paint applied thereto. Heat is applied to melt the coat down.

The cold paint may be applied with a brush, just like ordinary paint, or the article may be dipped into it, drawn through it or tumbled into it. Heat may be applied to the coating in whichever way is most convenient. Cold painted articles may be placed on shelves or on racks in an oven, similar to an enameling oven. Small articles may be placed in heated tumblers that are stationary, until the coating is melted down and then tumbled to prevent sticking. Tanks, etc., that are made of leaded or galvanized sheets and that are too large to be dipped are rust-proofed where exposed by applying the protective coating with a brush and melting it with a blow torch.

Overfeed V-Type Stoker

The V-type stoker shown in the accompanying illustrations is the latest development which the Detroit (Mich.) Stoker Company has made in the overfeed inclined grate type of stoker.

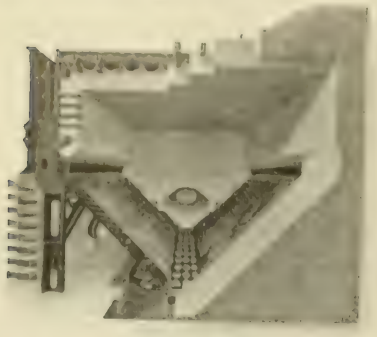


FIG. 1—REAR VIEW OF "V"-TYPE STOKER AND FLAT SUSPENDED ARCH

Among the special features claimed for this stoker is the exceedingly large coking surface, which extends the full length of the furnace on each side and under the firebrick arch, producing an even distillation of the gases at a high temperature and eliminating the smoke. The stoker is operated on natural draft, which eliminates the necessity of fans or blowers and does not subject the stoker to a shut-down due to the failure of any of the auxiliary appliances. The steam required for the operation of the stoker is said to be less than 1 per cent of the total amount generated in the boiler, and this is one of the causes of its low operating cost.

In connection with this stoker the manufacturer has recently developed the Detrick flat suspended arch, which is said to have several advantages over the old type of sprung arch. Although the first cost is considerably more than for the sprung arch, the lower maintenance cost will offset this disadvantage, it is claimed. The suspension is of the pendulum type and permits of free expansion and contraction, which eliminates stresses and strains common to some types of arches. Repairs or renewals to the arch are easily made by replacing as many tiles as are necessary without disturbing the remainder of the arch. The side walls below the

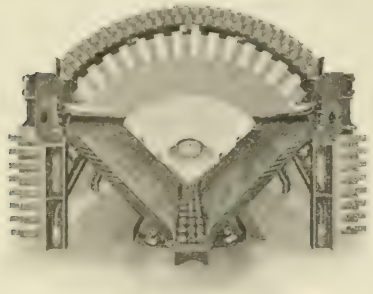


FIG. 2—REAR VIEW OF HEAVY-DUTY "V"-TYPE STOKER WITH SPRING ARCH

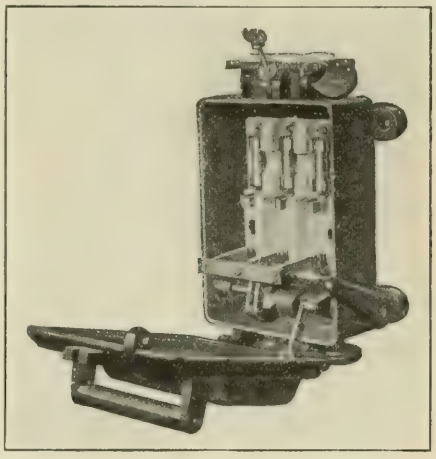
arch can be replaced or repaired without disturbing the arch or any of the iron work. The supporting beams and hangers are ventilated by the air, which is admitted through the stoker fronts, passing between the arch tile and the arch roof, thus preventing them from overheating.

Buckstays are not required, there being no side thrusts, as the whole weight of the arch rests on the stoker iron work entirely independent of the brick work. With this type of arch it can be placed at any height to supplement the boiler baffles in forming an unrestricted path for the travel of the gases. After being drawn in through the stoker fronts the air passes downward through the tuyere openings, where it mixes with the gases distilled from the coal. This mixture of combustible gas which, coming in contact with the highly incandescent furnace arch, is completely burned.

Coal is stored on top of the stoker and feeds by gravity through the magazine on both sides to the grates. The fuel bed moves down toward the center of the furnace and the ash and clinker are ground through the clinker crusher and drop into the pit below. The continuous movement of the vibrating grates and the constant operation of the clinker crusher keep the fire clean.

Fused Switch Boxes

Switch boxes particularly adapted to 250-volt, direct-current mill service have been brought out by the D. & W.

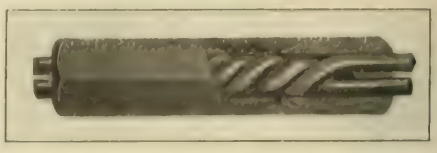


COMBINED SWITCH AND FUSE BOX

Fuse Company, Providence, R. I. They may be permanently locked after the fuses are installed, thereby preventing any tampering with the connections or increasing the capacity of the fuses. The circuit can be opened or closed at will without opening the cover by moving the lever at one side of the box. By referring to the illustration, it may be seen that when the cover is opened, the circuit is likewise opened. This arrangement makes it impossible to refuse the circuit when the switch is closed. These boxes are provided with rubber gaskets, which make them waterproof provided the terminal wires are taped at the bushings or protected by outlet hoods when conduit connections are made. To facilitate installing these boxes, removable porcelain bushings may be used through which the cable terminals may be readily passed.

Straight Connector

A straight connector that is simple and makes a firm twisted joint has been developed by the Fargo Manufacturing Company of Poughkeepsie, N. Y. The air space has been made as small as possible, while the area of

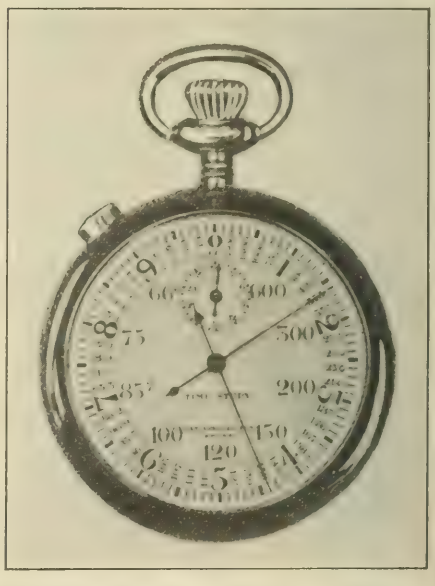


METHOD OF USING STRAIGHT CONNECTOR

contact is large. The large contact surface, together with twisting the wires, forms a joint of low resistance. This connector is made for wires of sizes ranging from No. 4 to 14. In the accompanying illustration is shown the method of using this connector.

Motion-Study Watch

The watch shown in the accompanying illustration has been brought out by Mortimer J. Silberberg, 122 South Michigan Avenue, Chicago, Ill., and is said to be an improvement on previous time-study watches and stop watches, in that a dial calibrated in decimals of a minute has been combined with a high-grade split-hand watch. The dial figures are spaced 0.02 of a minute apart, so they will indicate exactly what the corresponding hourly production would be after any elapsed period of time. With this arrangement both the productive and non-productive time of an operation can be obtained in one observation, whereas on single-hand instruments two readings are said to be neces-



SPLIT-HAND MOTION-STUDY WATCH WITH DECIMALLY DIVIDED DIAL

sary to obtain this result. Of the two hands one is controlled by the side plug and the other by the crown, or if it is desired to use both as a unit, both hands may be controlled by the crown. The crown-controlled hand may be used to

determine the gross time, and the plug-controlled hand to deduct the non-productive time, or delays, thereby at one reading giving an observer both the gross and net time required for an operation.

Oil Testing Cup

The oil testing cup shown in the accompanying illustration consists of a graduated glass cylinder containing two testing terminals, each a brass sphere



CUP FOR MAKING DIELECTRIC TESTS OF OIL

0.5 in. in diameter. The outfit has been placed on the market by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., for convenience in making dielectric tests of insulating oil. The upper sphere may be moved up or down by hand or engaged with a micrometer screw for making fine adjustments of the gap. All parts are readily accessible for cleaning, and the zero point of the gap may be quickly adjusted for each test. The gap may be fixed and an increasing voltage applied until breakdown occurs, or a constant voltage applied and the gap gradually shortened until rupture takes place.

Air Compressor Control Panels

The practice of protecting air compressor motors against overload by means of fuses still prevails among some railroads and manufacturing companies, but the General Electric Company is recommending protection by inverse time limit overload relays. The compressor control outfit comprises a panel adapted to floor or wall mounting for controlling a 50-cu. ft. air compressor driven by a three-phase, 60-cycle, 220-volt form K (squirrel-cage rotor) induction motor. One-phase wire is connected to the line through one pole of the triple pole lever switch, and the other two-phase wires through a double-pole contactor to the other two poles of the switch. The coil of the contactor is energized from one phase through contacts on the relays and the governor in series, so that the coil is energized when the relays are in their normal position and the contacts on the governor closed.

The governor is essentially a single-pole, single-throw, pneumatically-operated switch piped to the air receiver. It can be fitted with any one of three springs for a range of 40 to 60, 65 to 100 or 100 to 140 lb., and may be adjusted to cut in and out on 10 lb. variation in pressure with any of the springs. The equipment may be varied slightly for the control of two-phase, single-phase and direct-current motors.

Combined Vacuum Cleaner and Carpet Sweeper

The vacuum cleaner shown in the accompanying illustration contains a revolving brush and a fiber gear drive which, it is claimed, makes the machine both noiseless and efficient. The machine really acts as a combined vacuum cleaner and carpet sweeper. The switch



VACUUM CLEANER THAT HAS A FIBER GEAR DRIVE

for controlling the cleaner is located directly under the curve in the handle, where it is protected from damage should the handle be allowed to fall. The curved part of the handle is made of highly polished fiber tube closed at the end. This cleaner is the product of the Ramey Company of Columbus, Ohio.

Three-Wire Composition Cord Connector

Harvey Hubbell, Inc., of Bridgeport, Conn., has added to its three-wire line of apparatus a 10-amp. cord connector shown in the accompanying illustration. This connector is used for permanently linking up installed wall or flush receptacles with portable machines, appliances and laboratory apparatus wired for three-wire service. The composition cap of this connector is interchangeable with all of the three-wire attachment plug bases, wall receptacles



10-AMP. CORD CONNECTOR

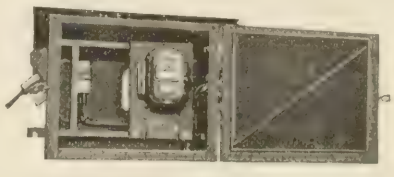
and flush receptacles made by this company. A small composition cord connector of durable construction has also been brought out to be used in connection with the Hubbell line of interchangeable attachment plugs, wall and flush receptacles. The cap of this device is interchangeable with both polarized and non-polarized Hubbell wall and flush receptacles, as well as the line of small attachment plugs.

Outdoor Switch Houses

Standard switch houses built by the large electrical manufacturing concerns are in general of two forms—ground-mounting and pole-mounting. They are constructed of steel throughout and are provided with a large door that gives easy access to the interior and that can be locked, thus protecting the apparatus from tampering by unauthorized persons. These houses are usually designed to contain an oil circuit breaker, a watt-hour meter with current transformers, and voltage transformers, besides calibrating and testing terminals and the usual wiring.

The chief advantages ascribed to the type of switch house shown herewith by the Westinghouse Electric & Manufacturing Company, its manufacturers, are low cost and ease with which it can be conveyed to localities where it is needed. With this equipment small communities and plants can be served by transmission lines that could not be reached economically from ordinary substations due to the high cost of construction. The houses are weatherproof.

The standard types of switch houses made by this company are built in capacities up to 600 amp. at 7500 volts, both single-phase and polyphase. The usual dimensions of such houses are 3 x 3 x 10 ft. high, although some special houses are being built in much



INTERIOR VIEW OF SWITCH-HOUSE

larger sizes. A contract has recently been taken by the Westinghouse company for a house 10 x 10 x 10 ft. high to contain the switching equipment for a 4000-kva., 13,200-volt, three-phase, 60-cycle installation.

New Incorporations

THE ALTLE LIGHT & FIXTURE COMPANY of New York N Y, has been incorporated with a capital stock of $15,000 by H and L Altlech and L Levelan, 585 Fifth Street, the Bronx. The company proposes to manufacture gas fixtures, chandeliers, electroliers etc

THE UNIVERSAL GAS COMPANY of New York, N Y, has been incorporated by M B Bernstein, N Messinger and M Ash, 61 Broadway, New York, N Y The company is capitalized at $25,000, and proposes to manufacture and deal in electrical devices, development of lamps, electrohers and chandeliers

THE GENERAL OMNIBUS COMPANY OF AMERICA, of New York, N. Y., has been chartered with a capital stock of $10,000 to manufacture and deal in street cars, omnibuses, electric devices, car equipment, etc The incorporators are, B Grossman, H J Latt and S. Brand, 602 West 157th Street, New York, N. Y

THE REDFIELD-KING COMPANY of Ogden, Utah, has been incorporated with a capital stock of $10,000 to conduct a general electrical service and sign business. The officers are, F. W. Redfield, president, Cleveland Redfield, vice-president; Carl Redfield, treasurer, and William G. King, secretary.

THE ORRVILLE (OHIO) ELECTRICAL & STORAGE BATTERY COMPANY has been organized by C. A. Waite and F. E. Welty. The company will deal in electrical supplies, and charge, repair and rebuild all makes of storage batteries.

THE PERFECT ELECTRIC BATTERY COMPANY of Brooklyn, N. Y., has been chartered by S. Fischer, J. Levy and H. Ratener, 490 Warwick Street, Brooklyn. The company is capitalized at $10,000 and proposes to manufacture and deal in electric batteries.

THE KLUNDER ELECTRIC COMPANY of Chicago, Ill., has been incorporated by John T. Janette, George H. Stellman and Eugene A. Monas. The company is capitalized at $10,000.

THE A. J. DOTTERWEICH COMPANY of Buffalo, N. Y., has been incorporated by A. J., G. J. and A. Dotterweich, 5 Hughes Avenue, Buffalo, N. Y. The company is capitalized at $15,000, and proposes to do a general electrical contracting business.

THE MUTE-A-PHONE COMPANY of Dover, Del., has been chartered with a capital stock of $100,000 to manufacture mute-a-phones for use on telephones. The incorporators are: Ferris Giles, K. M. Dougherty and E. Lynch of Wilmington, Del.

THE RO-CO BATTERY COMPANY of Brooklyn, N. Y., has been incorporated by William G. H. Kilpatrick, 154 Nassau Street; David Morris, 26 Oliver Street, New York City ,and others. The company is capitalized at $1,500, and proposes to manufacture all kinds of batteries and auto supplies.

THE KING ELECTRIC COMPANY of Canton, Ohio, has been incorporated with a capital stock of $30,000 to take over a Pittsburgh electrical manufacturing plant, which will be transferred to Canton in the spring. The company will engage in the manufacture of extension telephones and electrical novelties. Wendell Herbruck is attorney for the company.

CHARLES DUCHMAN, INC., of Buffalo, N. Y., has filed articles of incorporation with a capital stock of $10,000 for the purpose of dealing in lighting fixtures, etc. The incorporators are: C. C. A. and C. Duchman, 37 Filmore Aenue, Buffalo. N. Y.

THE BRENT ELECTRIC COMPANY of Tulsa, Okla., has been incorporated by W. A. Brent, T. C. Lichty and D. L. Thomas, all of Tulsa.

CHARLES H. PAGE & CO. of New York, N. Y., have been incorporated with a capital stock of $15,000 by P. C. Baer, C. H. Page and I. H. Levy, 135 West 179th Street, New York. The company proposes to deal in autos, motor cars, electric and mechanical supplies.

THE NO-GLARE STAR-LIGHT COMPANY of Jersey City, N. J., has been incorporated with a capital stock of $50,000 by Clem B. Sears, William H. Dickinson and Charles H. Dickinson, of Jersey City, N. J. The company will take over the establishment operating under the same name at Johnston Avenue and Grand Street, Jersey City.

THE ROWAN ELECTRIC MANUFACTURING COMPANY of Baltimore, Md., has been chartered with a capital stock of $1,000 to manufacture and deal in automatic starters, electric switchboards, remote control switches and all kinds of machinery The incorporators are Benjamin H Crane, D Meredith Reese, John S. Rowan, Evan Rinehart and A Bradford McElderry Mr. Rowan will be resident agent of the company, with offices in the Garrett Building

THE MILLHEIM (PA.) ELECTRIC COMPANY has been chartered with a capital stock of $5,000 A J Musser of Clearfield is one of the incorporators

THE EASTERN WISCONSIN ELECTRIC COMPANY of Fond du Lac, Wis., has been incorporated with a capital stock of $10,000,000 The company has taken over the properties of the Eastern Wisconsin Railway & Light Company at Fond du Lac, the Wisconsin Electric Company at Oshkosh, and the Sheboygan (Wis.) Electric Railway Company. The officers of the company are: Joseph H. Brewer of Grand Rapids, Mich., president; Raymond H. Smith of Sheboygan, vice-president and general manager; Blaine Gavett of Grand Rapids, Mich., secretary, and Willis J. Ripley of Grand Rapids, Mich., treasurer.

THE FRENCH CREEK ELECTRIC COMPANY of St. Peter's, Pa., has been granted a charter with a capital stock of $10,000 to supply electricity for lamps, heaters and motors in Warwick Township. The incorporators are D. J. Knaue, treasurer; Guy W. Knau and W. Frank Noble.

THE LIBERTY & CAMDEN POWER COMPANY of Camden, Ohio, has been incorporated with a capital stock of $15,000 by William H. Glenn and others.

Trade Publications

HIGH-TENSION EQUIPMENT. — Outdoor substations, lightning arresters, pole top switches, choke coils, etc., are described and illustrated in bulletin No. 30, just issued by the Delta-Star Electric Company, Chicago. A unique feature is the showing of actual outdoor high-tension installations from 13,200 volts to 88,000 volts. There are 178 illustrations ,of which ninety-nine show commercial substations, etc., the remainder being devoted to equipment. Operating and construction engineers will find this publication of especial value.

HEATING DEVICES.—The American Electrical Heater Company, of Detroit, Mich., has issued price list No. 33 giving revised prices on its electrical heating devices.

STORAGE BATTERIES.—Bulletin No. 163, descriptive of the installation of the "Chloride Accumulator" for the Ford Motor Company of Detroit, Mich., has been prepared by the Electric Storage Battery Company of Philadelphia.

PLUGS.—Harvey Hubbell, Inc., of Bridgeport, Conn., is distributing a leaflet descriptive of its Hubbell slots in use ,on Hubbell plugs and receptacles.

DRYING MACHINES.—The Gordon Engineering Corporation, 96 Broadway, New York City, has recently prepared an illustrated bulletin descriptive of the Gordon standard compartment dryer.

MARINE ENGINES.—The Buffalo Gasolene Motor Company of Buffalo, N. Y., has prepared a catalog descriptive of its four-cycle marine engines.

RAILWAY MATERIAL.—The General Electric Company of Schenectady, N. Y., is distributing bulletin No. 44,001-K, which is a price list on renewal parts and supplies for car equipments, mine locomotives and railway and mine line material.

MINERS' LAMPS.—Bulletin No. 43,702 is being distributed by the General Electric Company of Schenectady, N. Y. This bulletin is descriptive of its miners' electric lamp.

METERS.—Portable test meters, types IB-5 and IB-6, for alternating-current circuits are illustrated and described in bulletin No. 46,291A recently issued by the General Electric Company of Schenectady, N. Y. This company has also issued bulletin No. 46,112 descriptive of its deflection potentiometer, and bulletin No. 46,208 descriptive of its single-phase prepayment watt-hour meter, type IP-5.

EXPANSION BOLTS.—The U. S. Expansion Bolt Company of New York City has just brought out a new 1917 catalog, which covers its line which represents a number of new styles brought out with a view toward rendering more efficient service to certain specialized branches of the building trade.

Trade Notes

SIEMENS BROTHERS DYNAMO WORKS, LTD., and SIEMENS BROTHERS & COMPANY, LTD., have removed their offices from Caxton House, Westminster, to Palace Place Mansions, Kensington Court, London, W

COL. H. B. RAMEY, who for the past two and one half years has been district manager of the storage battery division of the American Ever Ready Works' Chicago branch, has been appointed sales manager of the entire storage battery division He took up his headquarters at the company's main office in Long Island City on March 1, and will direct the Every Ready storage battery sales organization throughout the United States. Colonel Ramey has been connected with the electrical industry for many years, first with the interests of the late E. W. Gillmer at Warren, Ohio, whose companies afterward were taken over by the National Electric Lamp Company. After a number of years' service with the latter organization he resigned to become sales manager of Robbins & Myers at Springfield, Ohio, and was later made assistant general manager.

THE GLOBE STOVE & RANGE COMPANY has issued its new price list on Globe electric ranges and heating devices. The highest priced range lists at $220 and the lowest price on any range is $65.

THE MARQUETTE ELECTRIC ENGINEERING COMPANY, INC., announces the opening on March 1 of a new switchboard department under the management of Paul Augustinus, vice-president of the company. This concern is now prepared to design and manufacture any form of power switchboard, panel-board and switch apparatus. Its office and factory is located at 212-216 West Austin Avenue, Chicago.

AMERICAN ELECTRIC TOOL COMPANY, Petersburg, Va., will manufacture and push the sale of the Paulero electric hammer. At a recent meeting a new board of directors was elected. The officers of the company are as follows: President, I. C. Shore; vice-president, B. Mason Hill; secretary and treasurer, David A. Lyon Jr.; general manager, Louis Paulero. The officers together with the following gentlemen compose the board of directors: W. G. Andrews, William L. McGill, Sol Cooper, J. H. Faber.

BARBER-JAMES-DWINNELL ELECTRIC & MANUFACTURING COMPANY announces that at the end of March it will move its factory to Topeka, Kan., where the company will have a modern factory building that will enable it to work more efficiently. About half of the company's business is in stationary storage batteries, which the company states are finding a large sale west of the Mississippi and in Canada. From present indications 1917 will be a better year for the company than 1916, which was a very prosperous one.

EMPIRE ELECTRIC SUPPLY COMPANY is the new corporate name of the Empire Fixture Works, Muskogee, Okla. In its announcement the company stated that there has been no change of management and that there will be no change in policy. The former name created the impression that the company manufactured fixtures only. It is announced that the electrical supply, fixture and gas supply departments are all being increased to better serve the trade.

INDUSTRIAL EXPOSITION AND EXPORT CONFERENCE. Change in the date of the Industrial Exposition and Export Conference at Springfield, Mass., to June 23 to 30 has been made to meet the wishes of a number of manufacturers who required more time than the earlier date (May 26 to June 2) permitted to make ready for such representation as they desired to have. Since the announcement of this commercial and industrial congress the Eastern States Exposition, which will conduct the affair, has developed its plans rapidly. A striking little booklet giving in brief space a concrete idea of what the exposition and conference will be is going to manufacturers, exporters and importers. A large general committee representative of the wide variety of American business interests is giving its services to the management in an advisory capacity,. and is planning a series of small meetings in manufacturing centers to acquaint the trades generally with the opportunity to reach a great home market as well as to co-operate for a united front in the foreign field. F. H. Page, president of the National Equipment Company, has been made chairman of this general committee, to have charge of the exposition. John C. Simpson is the general manager.

New England

CASTINE, ME.—At a special town meeting held recently it was voted to install an electric-lighting system in Castine.

ST. ALBANS, VT.—The Public Service Electric Light Company is erecting an electric transmission line to Milton, a distance of 6 miles, and also a line to Cambridge and Jeffersonville, 9 miles long. The company has also purchased two General Electric 750-kva. generators, to be installed at the hydroelectric plant at Fairfax Falls within six months. The generators will be directly connected to Leffell waterwheels. A. W. Peterson is superintendent.

BOSTON, MASS.—A petition signed by merchants and property owners on Tremont Street, between Boylston and Pleasant Streets, asking for an ornamental lighting system and new pavement has been presented to Mayor Curley.

PLYMOUTH, MASS.—The State Gas and Electric Light Commissioners have authorized the Plymouth Electric Light Company to issue $130,000 in capital stock, the proceeds to be used for improvements.

Middle Atlantic

DUNKIRK, N. Y.—Plans have been completed by the Atlas Crucible Steel Company for the erection of an electrical building, 69 ft. by 100 ft.; also an addition to its gas producer building. J. H. Hegeman is manager.

MONROE, N. Y.—The Orange & Rockland Electric Company is erecting a high-tension transmission line to Highland Falls to supply energy to the Buttermilk Falls Electric Company. R. W. Smith is president.

NEW YORK, N. Y.—Plans, it is reported, have been prepared by the Interborough Rapid Transit Company for the erection of a transformer station, one story, 49 ft. by 99 ft., at 77-79 Murray Street; also for construction of a transformer station and telephone exchange, 49 ft. by 108 ft., two stories high, at 122-126 Park Row; and also a transformer station, one story, 49 ft. by 108 ft., at 150-154 East Fifty-seventh Street. The cost of the stations is estimated at about $45,000 each. George H. Pegram, 165 Broadway, is chief engineer.

NEW YORK, N. Y.—Bids will be received by the Department of Public Charities, Tenth Floor, Municipal Building, New York City, until March 22, for furnishing material and labor required for contract No. 4 in the construction of 21 pavilion buildings, a group building and a dining hall at Sea View Hospital, borough of Richmond, city of New York. Blank forms and further information may be obtained at the office of Renwick, Aspinwall & Tucker, architects, 8 West Fortieth Street, New York City, where plans and specifications may be seen.

SYRACUSE, N. Y.—Bids will be received by the State Fair Committee, 428 South Salina Street, Syracuse, until April 2 for construction of horse exhibit building, including electrical work and plumbing, at the New York State Fair, Syracuse. Drawings and specifications, etc., may be obtained at the office of Lewis F. Pilcher, state architect, State Capitol, Albany, N. Y.

UTICA, N. Y.—Plans are being prepared by the Bosser Corporation, 1019 Hickorty Street, for the construction of a power plant, to cost about $50,000. J. S. Schneider is architect.

CONESTOGA, PA.—Plans have been prepared by the Conestoga Traction Company for improvements to its plant and system, which will include the installation of new rotary converter equipment in the Orange Street station and a 15,000-kw. transformer bank installation at the Engleside power plant, to cost about $125,000.

PHILADELPHIA, PA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until April 2 for construction of a steel frame building for machine and electrical shop at the navy yard, Philadelphia, Pa.

PHILADELPHIA, PA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until April 2 for furnishing and installing one 150-ton, two 15-ton, one 20-ton, and one 5-ton electric traveling bridge cranes at the navy yard, Philadelphia, Pa. Drawing and specifications (No. 2330) may be obtained on application to the above bureau or the commandant of the navy yard named.

POTTSVILLE, PA.—The Philadelphia & Reading Coal & Coke Company is planning to install a power plant to supply energy to operate its Knickerbocker Mine. It is also proposed to erect a distributing system to neighboring sections to supply electricity for domestic purposes.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

SOUTH BETHLEHEM, PA. — Bids will be received at the Chamber of Commerce Rooms, South Bethlehem, until March 26 for furnishing and installing an ornamental street-lighting system for the Third Street Lighting Association. For details see proposal columns.

PERTH AMBOY, N. J.—The Board of Aldermen plans to make the street-lighting system proposed for Smith Street a municipal enterprise, with service supplied from the city plant.

TRENTON, N. J. — Repair shops, equipped to handle electrical and automobile repair work, will be installed in the electrical bureau and garage now under construction by the City Commission on West Hanover Street, at a cost of about $78,000.

BALTIMORE, MD. — The United Railways & Electric Company contemplates the construction of a new substation for the Sparrows Point line. The new substation will be similar to the one recently erected on Belvidere Avenue.

WASHINGTON, D. C. — Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until April 9 for furnishing and installing two electrically operated locomotive jib cranes of 50 gross tons capacity at the navy yards, Norfolk, Va., and Philadelphia, Pa. Plans and specifications (No. 2332) can be obtained on application to the above bureau or to the commandants of the navy yards named.

WASHINGTON, D. C. Bids will be received by the General Supply Committee, Treasury Department, Washington, D. C., until April 3 for furnishing as may be ordered during the fiscal year ending June 30, 1918, as follows: Class 15, incandescent electric lamps; Class, 16, incandescent gas lamp supplies for use in Washington by the executive departments and other establishments of the government. Proposals with instructions may be obtained upon application to the General Supply Committee, Auditors' Building, Washington, D. C.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Washington, D. C.—Schedule 808, 20 portable anemometers, or airmeters. Puget Sound, Wash.—Schedule 818, four water tube boilers; Schedule 839, 500 steel wire casting brushes; Schedule 839, 300 lb. packing for condenser tubes, 700 scoop type coaling shovels; Schedule 819, miscellaneous air, main, feed, fuel oil, etc., pumps; Schedule 817, one air compressor. Norfolk, Va.—Schedule 823, 1800 ft. vitrified conduit, 5150 ft. 3-conductor cable, miscellaneous electrical, wire, switches, fuses, blocks, etc., supplies. Portsmouth, N. H.—Schedule 807, one locomotive crane. Brooklyn, N. Y.—Schedule 834, miscellaneous flexible copper steam hose, 11,000 ft. plain single-conductor cable; Schedule 825, 50,000 ft. 4-conductor cable; Schedule 829, 8000 lb. weatherproof wire; Schedule 815, miscellaneous twin conductor. Philadelphia, Pa., and Norfolk, Va.—Schedule 823, 4940 ft. single-conductor cable. Brooklyn, N. Y., Mare Island, Cal.—Schedule 815, 12,600 ft. 4-conductor cable. Philadelphia, Pa.—Schedule 829, 8000 ft. flexible cord for portables; Schedule 833, miscellaneous iron or steel black wire. Charleston, S. C.—Schedule 813, one each, electric, welding and cutting outfit. Mare Island, Cal., Puget Sound, Wash.—Schedule 838, miscellaneous soft galvanized iron or steel wire. Applications for proposal blanks should designate the schedule desired by number.

North Central

BANGOR, MICH.—The Village Council has decided to submit to the voters the proposal to issue bonds for improvements to the municipal electric-light and water plant. P. M. Gross is superintendent.

GRAND RAPIDS, MICH.—Plans are being considered by the Board of Public Works for the installation of a new street-lighting system, to cost about $55,000. If the necessary money can be secured it is proposed to replace the arc lamp now in use with nitrogen-filled lamps of 600 cp. The proposed change will require the purchase of a new generator, which will cost about $30,000.

CINCINNATI, OHIO.—Bids will be received at the office of the director of public service, City Hall, Cincinnati, until March 21 for the installation of a lighting system for the Hopple Street Viaduct. Plans and specifications can be obtained at the office of the city electrician, City Hall. Charles F. Hornberger is director of public service.

CINCINNATI, OHIO.—Bids will be received by the New Longview Hospital Buildings Commission of Hamilton County, at the office of the Board of County Commissioners, Court House, Cincinnati, until March 21 for furnishing material and constructing of new women's receiving cottage, including heating, ventilating, electric work, elevator, etc., at the Longview Hospital and also power house and power plant equipment. Plans and specifications may be obtained at the office of Elzner & Anderson, architects, Ingalls Building, Cincinnati.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, until March 27 for furnishing and installing stokers for the division of light and heat. Bids will also be received at the same time and place for furnishing waterproof copper wire for the division of light and heat. Specifications may be obtained at the office of division of light and heat, Room 204 City Hall.

COLUMBUS, OHIO.—The Ohio Utilities Commission has granted the Columbus Railway, Power & Light Company permission to issue $508,200 in capital stock and $1,846,000 in bonds, the proceeds to be used to pay for improvements already made and new construction work, which includes the erection of a large power plant on Big Walnut Creek, to cost about $700,000; the purchase of ten new cars, $60,000; other car house and associated equipment, $90,000; for the erection of additional circuits, including meters and equipment, $300,000.

DAYTON, OHIO.—The County Commissioners of Montgomery and Preble Counties have decided to issue $90,000 in bonds, the proceeds to be used for purchase of boilers, pumping equipment and other equipment for the new tuberculosis hospital to be built jointly by the two counties.

EAST PALESTINE, OHIO.—The general contract for construction of power plant and pumping station for city of East Palestine was awarded to J. E. Madden of East Palestine.

MOGADORE, OHIO.—Plans have been prepared for the construction of two factory buildings, one 162 ft. by 60 ft., two stories high, the other 34 ft. by 80 ft., and power house 60 ft. by 64 ft., one story, for the India Rubber Company, to cost about $100,000. J. M. Alderfer, 60 Cherry Street, Akron, president, it is understood, is now asking for separate bids for the work.

MURRAY KY.—Bids will be received by the Mayor and City Council of Murray until March 29 for furnishing material, equipment, etc., in connection with improvements to water-works system, including furnishing oil engines, pumps, well-working equipment and pumphouse; also construction of an electric-lighting system, which includes furnishing alternators, switchboard, street-lighting equipment, wire, poles and line material. Specifications, plans, etc., may be obtained upon application to Xavier A. Kramer, Magnolia, Miss., consulting engineer.

PADUCAH, KY.—The City Council has engaged F. G. Proutt and A. L. Dabnay of Memphis, Tenn., engineers, to prepare plans for extensions to the municipal electric-light plant.

TOMPKINSVILLE, KY. — The electric plant of the Tompkinsville Electric Light & Ice Company was recently destroyed by fire, causing a loss of about $8,000. Arrangements are being made for temporary service and also for rebuilding the plant. By mistake this item appeared under Tompkinsville, N. Y., in the issue of March 10.

GEORGETOWN, IND.—A franchise has been granted to Robert Hurst of Pekin to construct and operate an electric-light and power plant in Georgetown for a period of 25 years. The proposed plant will be equipped with oil engines.

LA SALLE, ILL.—At an election to be held March 20 the proposal to issue $23,000 in bonds for improvements to water and light systems will be submitted to the voters.

MONMOUTH, ILL.—Bids will be received by the Sixth Regiment Armory Commission, Illinois Infantry, National Guard, in the office of James B. Dibelka, 130 North Fifth Avenue, Chicago, until March 26 for erection of Sixth Regiment Armory Building at Monmouth, Ill. Separate bids will be received for general work, plumbing and sewerage, heating and electrical wiring. Plans

and specifications may be obtained at the office of the state architect upon deposit of $10.

SAVANNA, ILL.—We are informed that the People's Gas & Electric Company does not contemplate the erection of an electric transmission line to Mount Carroll, as reported in the issue of Feb. 3, as this line is already completed.

CLINTONVILLE, WIS.—Bids, it is reported, will be received by the Water and Light Commission, Clintonville, until March 19 for furnishing two 250 hp. fire or water tube boilers and one 1000 hp. cast-iron or open feed water heater.

MILWAUKEE, WIS.—Plans are being considered by the Hummel & Downing Company for the construction of a power house. C. C. Uehling, First National Bank Building, Milwaukee, is architect.

MILWAUKEE, WIS.—Plans are being prepared by the Evinrude Motor Company, 2-9 Walker Street, Milwaukee, for the construction of a complete new gas and oil engine and motor manufacturing plant, to cost about $250,000. The company, it is reported, is in the market for the purchase of tools, machinery and power equipment.

MILWAUKEE, WIS.—Arrangements have been completed by the Northwestern Bridge & Iron Company, 127 South Water Street, Milwaukee, for construction and equipment of a new structural fabricating plant, to be located at Twenty-seventh and Hopkins Streets. The building will be 100 ft. by 180 ft., two stories high, and will be equipped throughout with electrically operated machinery.

ROCHESTER, MINN.—Bids will be received by the Common Council of the city of Rochester, Minn., until April 2 for construction of a hydroelectric power plant and dam on the south fork of the Zumbro River, separate bids to be submitted as follows: For details see proposal columns. Hugh L. Cooper & Company, 101 Park Avenue, New York, N. Y., are consulting engineers.

ST. PAUL, MINN.—Plans have been completed by the Twin City Rapid Transit Company of Minneapolis for the erection of a new substation, 200 ft. by 240 ft., in St. Paul, to cost about $25,000.

ST. PAUL, MINN.—Franchises have been granted to the Northern States Power Company, 206 South La Salle Street, Chicago, Ill., to supply electricity for lamps and motors in Heron Lake, Bingham Lake and Okabena.

ALBIA, IOWA.—The Albia Light & Railway Company is rebuilding its entire plant. Ralph W. Boyer is manager.

REPUBLIC, MO.—A continuous electric service will be established by the Republic Lighting Company in April. H. L. Pennoyer is secretary.

VERSAILLES, MO.—Bonds to the amount of $6,000 have been voted for improvements to the municipal electric-light plant.

HARVARD, NEB.—The installation of a 75-hp. oil engine directly connected to a 220-volt, direct-current generator, is under consideration by the Harvard Electric Company. A. W. Person is manager.

LOVELOCK, NEB.—Preliminary work has begun on the construction of a hydroelectric power plant for the Nevada Valleys Power Company of Lovelock on the Truckee River, a short distance below Vista, where about 2500 hp. will be developed.

AGRA, KAN.—An election will soon be called to submit to the voters the proposal to establish a municipal electric light plant to the voter.

BONNER SPRINGS, KAN.—The Bonner Springs Electric & Manufacturing Company is negotiating with the city of De Soto relative to furnishing energy in bulk to that city. J. E. Straus is manager of the electric company.

BRONSON, KAN.—At an election to be held April 2 the proposal to establish a municipal electric light plant in Bronson will be submitted to the voters.

WHITE WATER, KAN.—The Kansas Gas & Electric Company of Wichita is contemplating extending its transmission lines to White Water and making improvements to the local plant.

Southern States

CHARLESTON, S. C.—Bids will be received by Todd, Simons & Todd, architects, 63 Broad Street, Charleston, until March 29 for the construction of a four-story hospital building complete; also for building complete except heating, plumbing, electric wiring and elevators, bids for which will be received separately. Plans and specifications may be obtained upon application to the architects upon deposit of $25, of which $15 will be refunded upon return of plans.

EMERSON, GA.—The Georgia Railway & Power Company of Atlanta is contemplating the installation of a power station and the erection of electric transmission lines in the Emerson district.

CENTERVILLE, TENN.—The installation of an electric light plant and waterworks system is under consideration.

ROANOKE, ALA.—At an election held recently the proposal to sell the municipal electric lighting plant to the Alabama Power Company was carried.

AGRICULTURAL COLLEGE, MISS.—Bids will be received by W. H. Smith, president of the Board of Trustees, Agricultural College, until March 24 for construction of addition to dormitory, separate bids to be submitted on plumbing, heating and electrical wiring. Plans and specifications may be obtained upon application to Xavier A. Kramer, consulting engineer and architect, Magnolia, Miss., upon deposit of $25.

GILLHAM, ARK.—The B. & A. Mining Company of Okmulgee and Gillham is contemplating the construction of a hydroelectric plant.

STEPHENS, ARK.—The installation of an electric-light plant in Stephens is under consideration. J. R. Whaley is reported interested.

BILLINGS, OKLA.—The City Council has engaged Mackintosh-Walton Engineering Company, 1023 National Bank Building, Oklahoma City, as engineer in connection with the installation of an electric-light plant, water-works and sewer system, to cost about $50,000. The proposal to issue bonds for the above work will be submitted to the voters.

GRANDFIELD, OKLA.—The local electric-light plant and ice factory, owned by Maple & Green, which was recently destroyed by fire, it is reported, will be rebuilt.

MOUNTAIN PARK, OKLA.—The city of Mountain Park is contemplateing the installation of an electric-lighting system.

OKLAHOMA CITY, OKLA.—The Oklahoma Gas & Electric Company contemplates extending its transmission lines to El Reno and Enid.

WEST TULSA, OLKA.—The City Council will soon call an election to submit to the voters the proposal to issue bonds for improvements to electric-lighting system, construction of water works and fire protection.

COLUMBUS, TEX.—A franchise has been granted to E. C. Guilmartin, manager of the Texas Motor Company, to construct and operate an electric-light plant in Columbus.

DENISON, TEX.—It is announced that as soon as the United States Bureau of Indian Affairs approves the proposal of the Texas Power & Light Company and the Texas Electric Company to build an electric power plant on the north bank of the Red River in Oklahoma, 5 miles north of Denison, construction work will be started. Authority has already been granted by the State of Oklahoma.

PANHANDLE TEX.—The City Council is considering calling a special election for the purpose of submitting the proposal to issue bonds for the installation of a municipal electric plant to the voters.

Pacific States

SHELTON, WASH.—Application has been made to the Commissioners of Mason County by Frank MacKean, president and manager of the Mason County Power Company, for a franchise to erect transmission lines for the distribution of electricity from a power plant now under construction on the North Fork of the Snohomish River near Hoodsport on Hoods Canal.

PORTLAND, ORE.—The City Council has authorized the city attorney to prepare a charter amendment authorizing an issue of $1,776,000 in bonds to cover the cost of establishment of a municipal electric plant on the Bull Run reservation to supply electricity for lighting the streets and public buildings.

FRESNO, CAL.—In connection with the proposed bond issue of $4,500,000 of the San Joaquin Light & Power Corporation, the immediate issue of $1,000,000 will be used as follows: Increasing the output of the Kern River power station by about 4000 kw.; construction work and installation at power house No. 2 on North Fork River, Madera County; extending transmission and distributing lines, installation of new transformer stations, new meters and other equipment. A. G. Wishon of Fresno is general manager.

LOS ANGELES, CAL.—The construction of four hydroelectric plants on Whitewater River and Snow Creek is reported under consideration. Marcus Pluth, 111 West Nineteenth Street, Los Angeles, is reported interested.

MONROVIA, CAL.—The Southern California Edison Company has submitted a proposal to the City Council offering to install a new electrolier system on White Oak Avenue, consisting of 101 ornamental lamp standards, equipped with 16-in. globes, for $7,500.

OROVILLE, CAL.—Plans for the construction of a large hydroelectric power plant at a point of the Feather River, 3 miles from Oroville, have been announced by the Great Western Power Company, 14 Sansome Street, San Francisco. The proposed plant will have an output of 75,000 kw. and will cost about $6,000,000. The plans call for the construction of a cement canal 15 miles long.

SAN FRANCISCO, CAL.—Appropriations amounting to $575,000 have been asked for improvements, etc., for the Yosemite Park, of which $150,000 will be used for construction of power plant.

SAN LUIS OBISPO, CAL.—Plans are being considered for the installation of an ornamental street-lighting system in the business section. New suspension lamps will be erected in the residential section.

WATTS, CAL.—Plans are being considered by the City Trustees for the installation of an ornamental street-lighting system, consisting of about 50 standards, on Main Street.

CASA GRANDE, ARIZ.—Contract for the installation of the proposed municipal electric-light plant has been awarded to the Schweiter Machine Company of Tucson, at about $25,000.

LIVINGSTON, MONT.—The City Council is considering the installation of a new street-lighting system. The Montana Power Company furnishes electrical service in Livingston.

OSWEGO, MONT.—The County Commissioners have adopted a resolution authorizing the town of Oswego to issue bonds for the installation of an electric-light and power plant. The cost of the plant is estimated at $8,500.

COWLEY, WYO.—The Cowley Electric Light Company is contemplating installing, in the near future, a new power plant to meet the increasing demands for electrical service. Natural gas will be used for power. C. S. Vaterlaus is owner and manager.

Canada

EDMONTON, ALTA.—The City Council is considering improvements and alterations to the municipal telephone system, involving an expenditure of about $38,899. W. T. Lowney is superintendent of telephone department.

LETHBRIDGE, ALTA.—The purchase of a new auxiliary motor for the turbo-generator, to cost $7,000, at the municipal electric-light plant has been authorized by the City Council.

NELSON, B. C.—The City Council is considering the installation of a third generating unit in the municipal electric plant.

WIARTON, ONT.—The Town Council is negotiating with the Ontario Hydro-Electric Power Commission for the installation of an electric distributing system.

COATICOOK, QUE.—The construction of a power plant, including power house and concrete dam, is under consideration by Penman's, Ltd. A 180-hp. turbine to be directly connected to generator will be installed. T. Pringle & Son, Coristine Building, are engineers.

DESCHAMBAULT, QUE.—The Portneuf Hydraulic Company contemplates the erection of 5 or 10 miles of electric transmission lines next spring. Henri Paré is manager.

SWIFT CURRENT, SASK.—Tenders, it is reported, will soon be asked for a 615-hp. oil engine for the city electrical department. J. N. Calder is electrical engineer.

Miscellaneous

PANAMA.—Bids will be received at the office of the Panama Canal, Washington, D. C., until March 31 for furnishing steel, galvanized pipe, boiler tubes, chain, steel rolling door, brass tubing, trolleys, geared blocks, electroplating apparatus, turbine oil, etc. Blanks and information relating to this circular (No. 1130) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York City; 614 Whitney-Central Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

1,217,902. MINER'S BLASTING BOX; Joseph S. Beeneck, Nanticoke, Pa. App. filed Dec. 31, 1915. Safety.

1,217,924. CONNECTOR; Harry A. Douglas, Bronson, Mich. App. filed May 22, 1914. Employed for effecting circuit connection between the lighting bulbs or reflecting lamps and the source of current for such lamps.

1,217,928. GOVERNOR MAGNET; Thomas Farmer, Jr., New York, N. Y. App. filed Sept. 5, 1913. Device for opening and closing an electric circuit containing a governor magnet for an electric switch.

1,217,943. COIL SUPPORT; Ole M. Holst, Wilkinsburg, Pa. App. filed Dec. 28, 1912. For field coils.

1,217,964. ELECTRICAL CONTACT DEVICE; Joseph Frederick Lamb, New Britain, Conn. App. filed June 23, 1916. Socket contact device suitable for use with cord connections.

1,217,967. WATER HEATER; Antonio Longoria, Cleveland, Ohio. App. filed July 15, 1915. Self-contained unit.

1,217,982. ELECTRIC-CIRCUIT CONTROLLER; Will C. Neahr, Denver, Col. App. filed Oct. 21, 1915. Thermostatic means.

1,217,994. THERMOSTAT FOR ELECTRIC HEATING AND COOKING APPARATUS; Roderick J. M. Parke and Edward D. Brand, Toronto, Ontario, Canada. App. filed Dec. 19, 1913. Easily calibrated and set.

1,218,015. METHOD AND SYSTEM OF SELECTIVE CHARACTER DISPLAY; John P. Tarbox, Washington, D. C. App. filed Feb. 2, 1914. Flashing signs.

1,218,016. DISPLAY-REGISTERING SYSTEM; John P. Tarbox, Buffalo, N. Y. App. filed Sept. 15, 1915. Keyboard-operated type.

1,218,022. ELECTRIC MACHINE; Reinhold H. Wappler, New York, N. Y. App. filed Jan. 4, 1916. For developing electrical currents and impulses of high potential and high frequency, and particularly to such machines adapted for therapeutical purposes.

1,218,026. X-RAY TUBE; Fred A. Wiggin, Lawrence, Mass. App. filed Oct. 5, 1916. Improvements in targets.

1,218,035. TELEGRAPH SOUNDER; Roy M. Allen, East Orange, N. J. App. filed Sept. 25, 1915. Improved electromagnetic structure.

1,218,037. ELECTRIC SWITCH; Harry N. Alter, Chicago, Ill. App. filed Jan. 17, 1917. Snap switches.

1,218,042. TERMINAL FOR ELECTRIC FURNACES; Thaddeus F. Baily and Frank T. Cope, Alliance, Ohio. App. filed April 27, 1915. Prevent the electrode from oxidizing at the point where it enters the furnace.

1,218,048. AUTOMATIC SELECTING SWITCH; John G. Blessing, Chicago, Ill. App. filed March 29, 1912. Automatic telephone system.

1,218,058. ELECTRIC FURNACE; Frank T. Cope, Alliance, Ohio. App. filed April 27, 1915. Resistance trough is so located within the heating chamber that air spaces are provided around the trough allowing the air to circulate around the trough for the purpose of preventing excessive overheating of the same.

1,218,059. SELECTIVE OIL-BREAK SWITCH; Frank T. Cope, Alliance, Ohio. App. filed May 13, 1915. For use in raising or lowering the voltage through a transformer.

1,218,061. AUTOMATIC SAFETY DEVICE; David F. Crawford, Pittsburgh, Pa. App. filed Feb. 11, 1913. Railway service.

1,218,062. ELECTRIC SWITCH SUITABLE FOR USE IN TELEGRAPHY; Frederick George Creed, Croydon, England. App. filed Aug. 24, 1914. For use in transmitting systems.

1,218,076. COMMUTATOR; Alfred C. Gilbert, New Haven, Conn. App. filed June 23, 1916. Armatures of toy electric motors, and in connection with reversing switches for such motors.

1,218,099. SIGNALING DEVICE; Ray H. Manson, Elyria, Ohio. App. filed Aug. 14, 1911. Employed upon self propelled vehicles.

1,218,106. ELECTRICAL FUSE CONNECTION; James J. Mullen, St. Louis, Mo. App. filed March 16, 1915. High voltage.

1,218,123. ELECTRIC SWITCHING DEVICE; Melvin L. Severy, Arlington Heights, Mass. App. filed July 8, 1913. Circuit opening and closing devices.

1,218,151. ELECTRIC INDUCTION FURNACE; Parvin Wright, Vancouver, British Columbia, Canada. App. filed May 11, 1914. Continuous in its operation and constant in its current consumption.

Record of Electrical Patents

Notes on United States Patents issued on March 4, 1917

1,218,162. PORTABLE LIGHT; Edmund H. Becker, Washington, D. C. App. filed May 29, 1916. Self contained.

1,218,165. TELEGRAPH TYPEWRITER; Allen D. Cardwell, Brooklyn, N. Y. App. filed April 10, 1915. May be operated over an ordinary Morse telegraph line or any other desired circuit..

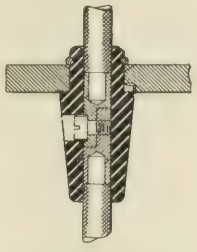
1,218,167. THERMOSTAT; Harold J. Carmody, Brooklyn, N. Y. App. filed Nov. 16, 1915. For service upon automobile radiators.

1,218,177. METALLURGICAL PROCESS; William E. Greenawalt, Denver, Col. App. filed Jan. 17, 1917. Cheap recovery of copper from its ores with a simultaneous recovery of the sulphur combined with the copper when precipitated as the sulphid.

1,218,181. INSULATOR KNOB; John W. Homer, Greencastle, Pa. App. filed Feb. 24, 1915. For holding together the two parts of a porcelain insulator or knob.

1,218,182. TELEPHONY; David S. Hulfish, Toronto, Ontario, Canada. App. filed Aug. 7, 1915. Application of methods and apparatus for telephone exchanges.

1,218,195. SYSTEM FOR TRANSMITTING COMMUNICATIONS; Charles V. Logwood, New York, N. Y. App. filed Jan. 22, 1916. High-frequency continuous oscillating electrical waves.



1,218,216. Connector

1,218,198. ALARM BOX; Charles A. Mahla, Jersey City, N. J. App. filed April 15, 1915. Receptacle for valuables.

1,218,205. ELECTRICAL RESISTANCE UNIT; Horace N. Packard, Milwaukee, Wis. App. filed July 29, 1913. Electrical resistance thermometers.

1,218,216. CONNECTOR; Rudolf Schmid, Jr., West Allis, Wis. App. filed May 17, 1912. Readily assembled and taken apart.

1,218,221. FUSE BLOCK; Charles H. Smith, Chicago, Ill. App. filed July 21, 1913. Improved means for constructing the mounting devices for holding removable fuse units.

1,218,230. FIRE-ALARM BOX; Anthony C. Vanadia, Flint, Mich. App. filed Aug. 11, 1916. Improvement.

1,218,236. POWER-DRIVEN TOOL; Frank J. Backschneider, Cincinnati, Ohio. App. filed Oct. 17, 1912. Portable electric tools.

1,218,237. METHOD AND APPARATUS FOR DETERMINING THE DIRECTION OF A HERTZIAN LIGHTHOUSE; Andre Blondel, Paris, France. App. filed Nov. 4, 1913. New method of signaling.

1,218,265. ELECTRIC WELDING; Otis Allen Kenyon, New York, N. Y. App. filed June 28, 1916. Improvements.

1,218,266. ELECTRIC WELDING; Otis Allen Kenyon, New York, N. Y. App. filed June 28, 1916. Adjust and control the heating effect of the arc by a combination of a voltage limitation and the power limitation.

1,218,267. ELECTRIC WELDING; Otis Allen Kenyon, New York, N. Y. App. filed June 28, 1916. Improvements.

1,218,268. ELECTRIC WELDING; Otis Allen Kenyon, New York, N. Y. App. filed June 28, 1916. Adjust the current in the arc by means of a combination of resistances.

1,218,269. ELECTRIC WELDING; Otis Allen Kenyon, New York, N. Y. App. filed June 28, 1916. Improvements.

1,218,274. QUADRUPLEX TELEGRAPHY; Isidor Kitsee, Philadelphia, Pa. App. filed June 3, 1912. Quadruplexing lines with great capacity, such, for instance, as submarine cables.

1,218,281. INDICATOR; Max O. Kuhn and Harold C. Shoolbread, Montreal, Quebec, Canada. App. filed Jan. 28, 1916. May be mounted upon street cars, railway cars or the like.

1,218,299. GAS VALVE; Maximilian J. Myszker, Buffalo, N. Y. App. filed Oct. 10, 1911. Sounding an alarm when the gas pressure is reduced.

1,218,324. SOUND-PRODUCING DEVICE; Melvin L. Severy, Arlington Heights, Mass. App. filed March 22, 1913. Sonorous vibrations are produced electromagnetically by the movement of phonograms of magnetic material past electromagnetic sound producing mechanism.

1,218,329. RETAINING ENVELOP OR COVER FOR STORAGE-BATTERY ELECTRODES; Edward W. Smith and Edward G. Steinmetz, Philadelphia, Pa. App. filed July 1, 1911. New and useful.

1,218,341. ELECTRIC OVEN; Clarence Truitt, Pomona, Cal. App. filed July 11, 1914. Loss by conduction being practically eliminated.

1,218,397. ELECTRIC CHAIN-WELDING MACHINE; Jacob Ross Grove, York, Pa. App. filed July 12, 1916. Welded by compression or by compression and swaging.

1,218,401. PUSH SWITCH; Henry G. Hillman, New York, N. Y. App. filed Sept. 11, 1916. Contacts have a straight edge and long sliding engagement to obviate the effects of arcing.

1,218,407. ELECTRICAL APPLIANCE FOR PANELBOARDS; Ralph E. Jones, Syracuse, N. Y. App. filed June 23, 1914. Push-button switch.

1,218,413. QUADRUPLEX TELEGRAPHY; Isidor Kitsee, Philadelphia, Pa. App. filed Dec. 30, 1916. May be applied to overhead as well as underground lines.

1,218,423. ROENTGEN-RAY TUBE; Julius Edgar Lilienfeld, Leipzig, Germany. App. filed July 25, 1916. Improvements.

1,218,465. TERMINAL FOR RESISTANCE MEMBERS AND METHOD OF PRODUCING SAME; Ludwig Reichold, Pittsfield, Mass. App. filed Dec. 5, 1914. Relates to electric heating devices.

1,218,475. ELECTRICAL-CONDUCTOR CONNECTOR; Hugh Douglas Rothwell and Gordon Kribs, Toronto, Ontario, Canada. App. filed March 25, 1916. Means for positively connecting the terminal ends of electrical conductors so as to make a perfect electrical contact between the parts.

1,218,480. INSULATOR; John Sayer, Flagstaff, Ariz. App. filed May 26, 1916. For strengthening or reinforcing various forms of fragile insulators.

1,218,485. SOCKET PIECE FOR ELECTRIC LAMPS; Jason C. Stearns, Worcester, Mass. App. filed June 19, 1916. For use in mounting a lamp in a reflector for a motor vehicle.

1,218,509. ARC LAMP; John T. Beechlyn, Lynn, Mass. App. filed May 8, 1912. Focusing type.

1,218,538. METERING DEVICE FOR ELECTRICAL DISTRIBUTING APPARATUS; Evan Evans, Berlin, Germany, App. filed Feb. 10, 1914. Electric meter operatively connected to the secondary winding of a transformer for registering the total electric energy supplied to the transformer at any and all times, whether the transformer is loaded or not.

1,218,552. SWITCHING DEVICE; Edward F. Hamill, Chicago, Ill. App. filed March 18, 1915. Silent call wall switches for hospitals.

1,218,553. FUSE CARRIER; William A. Harvey, Scranton, Pa. App. filed Oct. 3, 1912. Plug fuse.

1,218,555. TROLLEY WHEEL MOUNTING; Henry Holland, Cleveland, Ohio. App. filed Jan. 11, 1915. Improvements.

1,218,563. SIGNALING SYSTEM; Morton L. Johnson, Chicago, Ill. App. filed Dec. 4, 1915. For use in a department store.

1,218,570. MINER'S SAFETY ELECTRIC LAMP; Richard Koch, Pittsburgh, Pa. App. filed Aug. 17, 1916. Impossible for the workmen to tamper with the lamp.

1,218,571. WIRE TERMINAL; Burton L. Lawton, Meriden, Conn. App. filed Feb. 25, 1916. Tubular handle into the open end of which the end of a wire is inserted and mounted on the opposite end of said handle a terminal clip.

1,213,882. Electric Furnace. Carl A. Frenchfield, Wilmington, Ill. App. filed April 15, 1915. Improvements.

1,213,884. Electrode for Generating Pure Oxygen. John F. Sanders, Roseburg, Ore. App. filed Aug. 4, 1915. In such quantities as may be required on board a submarine boat while under the water.

Record of Electrical Patents

ISSUED ON FEB. 27

Continued from March 10

ELECTRICAL WORLD

1,216,946. Acoustic Multiplier. Edward E. Clement, Washington, D. C. App. filed March 16, 1912. Improving transmission through an ear trumpet, improving the reproduction of phonographic records, and improving the action of telephonic transmitters.

1,216,947. Method of Electric Arc Welding, Heating and Metal Working and Apparatus Therefor. Charles L. Coffin, Parks, Ga. App. filed April 5, 1916. Improvements.

1,216,960. System of Suspension for Tramway and Railway Cars. Celestin Delmez, Antwerp, Belgium. App. filed Aug. 2, 1916. Relates to a car suspension combined with ball bearing and motor suspension.

1,216,961. Electric Furnace. Hector de Nolly, St. Chamond, France. App. filed Jan. 31, 1914. Electric furnace suitable for all purposes in the electro-chemical industry.

1,216,982. Railway Signal. Albert Ernest Gauthier, Bay City, Mich. App. filed Jan. 6, 1915. Arranged upon a train in such manner as to operate an alarm in the cab of the locomotive of the train should one of the cars of the train become detached.

1,217,000. Stationary Electric-Iron Heater. Abraham S. Iserson, N. Y. App. filed Sept. 9, 1916. Electric connection for a flat iron which will be independent of the iron when the iron is in actual use for laundrying purposes.

1,217,032. Insulator for Electric Wires; Cody Lyon, Emmett, Idaho. App. filed Aug. 11, 1915. So constructed that the wire when turned at right angles to the entrance kerf or when the insulator is turned at right angles with relation to the wire, the wire will be held securely in position upon the insulator without the necessity of binding wires.

1,217,036. Rain-Signal; Edwin J. McManus, Cazenovia, N. Y. App. filed Aug. 6, 1915. Indicating a coming rain storm.

1,217,069. Safety and Signal Apparatus for Fire-Alarm Boxes. Michael Rugel, Milwaukee, Wis. App. filed July 5, 1916. Automatic means for imprisoning the person sending in an alarm.

1,214,591. Antenna for Radio Telegraph Stations. G. Reuthe, Sayville, N. Y. App. filed April 29, 1916; issued Feb. 6, 1917. For transmitting, the sending apparatus is connected between a tall antenna structure and a low counterpoise, while for receiving, the instruments are connected between separate portions of the counterpoise, or between the counterpoise and earth. Thus the tall sending antenna acts as a screen to protect the counterpoise from charges, and the counterpoise itself is used, either in whole or in part, as the ground connection of the transmitter and the antenna connection of the receiver.

1,214,620. Means for Producing Electrical Oscillations with the Aid of an Auxiliary Oscillation Circuit; G. Von Arco and A. Meissner, Berlin, Germany. App. filed Sept. 17, 1912; issued Feb. 6, 1917. Control of the spark tone or spark operation of a powerful working circuit by impressing high-frequency oscillations, generated in a separate ignition circuit, upon the main working circuit itself. The ignition circuit uses comparatively small power, and its periods of operation determine the time of sparking in the main circuit, thus giving control for Morse signaling, or alternatively, enforced regularity of spark production to give a pure singing tone in quenched-gap operation.

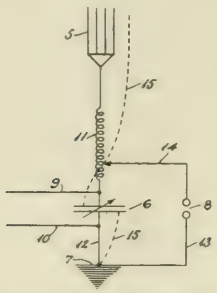


Fig. 1—Simpson's Transmitter

1,214,655. Wireless Telephone Apparatus; B. V. Deitz, Slingerland, N. Y. App. filed Oct. 15, 1913; issued Feb. 6, 1917. A crystal detector for radio-telephony or radio-telegraphy, in which a lump of silicon is clamped between pieces of zinc oxide and chalcopyrite. The triple crystal combination is said to form a minute voltaic cell, which produces a direct current when radio-frequency current is applied to the detector.

1,216,538. Means for Producing Electrical Oscillations; G. G. Arco and R. M. Rendahl, Berlin, Germany. App. filed March 18, 1909; renewed Jan. 8, 1917; issued Feb. 20, 1917. A spark gap for radio-telegraphic transmitters, comprising one or more short gaps between electrodes having high heat conductivity, such as silver plates having parallel faces. The construction described is that commonly known as the "quenched gap."

1,216,615. Apparatus for Producing Powerful Electrical Oscillations; G. Seibt, New York, N. Y. App. filed Dec. 27, 1909; issued Feb. 20, 1917. A spark transmitter for radio-telegraphy or radio-telephony, in which the coupling between primary and secondary is adjusted to cause a rapid decrease of the primary oscillations, and to produce substantially zero value of current amplitude in the primary circuit at the end of the first beat of oscillations. The gap cools rapidly, and therefore the primary circuit is opened at the end of the first beat. The antenna circuit thereafter oscillates freely, in accordance with quenched-gap practice.

Recent Radio Patents

Notes and Comments on United States Patents on Radio Signaling and allied topics issued during February, 1917.

1,216,646. Method of Producing High-Frequency Oscillatory Currents; J. C. Armor, Ingram, Pa. App. filed Oct. 14, 1911; issued Feb. 20, 1917. A radio-frequency oscillator, for use in radio-telegraphy, telephony, etc., in which radio-frequency currents are produced in a condenser circuit by impulses from a coupled driving circuit which contains a short spark gap having a high velocity fluid jet passing between its electrodes. The spark gap is so arranged that the currents in the impulse circuit are unidirectional or dead-beat.

1,216,647. Means for Producing High-Frequency Oscillatory Currents; J. C. Armor, Brooklyn, N. Y. App. filed Nov. 23, 1911; issued Feb. 20, 1917. Details of a spark gap for testing patent 1,216,646. One form comprises a pair of axially aligned hollow electrodes spaced apart to form a narrow annular gap, between the edges of which a stream of insulating fluid is radially projected.

1,216,720. Wireless Telegraph Transmitter of the Portable Type; M. A. Mulrony, Randwick, Australia. App. filed Jan. 23, 1915; issued Feb. 20, 1917. Uses a small rotary transformer of the inductor type, giving an output of about 200 watts at a voltage of about 18,000, with a frequency of from 50 to 100 cycles per second. The output of this small transformer-alternator is applied to a spark gap and radiating oscillation circuit in the usual way.

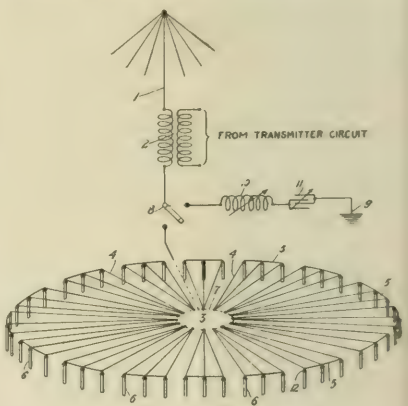
1,217,483. Transmitting Apparatus for Wireless Telegraph Stations; T. B. Miller, Seattle, Wash. App. filed Aug. 22, 1914; issued Feb. 27, 1917. A radio-telegraphic sender in which two condensers of a primary oscillation circuit are charged in parallel, through needle gaps and choke coils, and discharged in series at radio-frequency. The object is to increase the efficiency of production of radio-frequency current in the antenna.

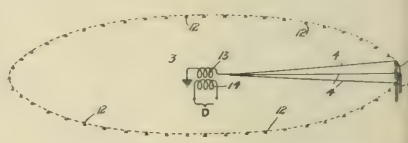
1,217,516. Transmitting Apparatus for Wireless Telegraph Stations; F. G. Simpson, Seattle, Wash. App. filed Nov. 24, 1915; issued Feb. 27, 1917. A sending apparatus for radio-telegraphy, in which the alternating-current output of a power transformer is rectified by the use of a mercury valve, and the rectified pulsations applied to the radio-frequency circuit condenser through a controlling resistance. The rate of charging the condenser is determined by its capacity and the resistance, and after full charge the condenser discharges with oscillations across the spark gap. Radio-frequency oscillations are thus set up in the antenna and ground circuit.

1,217,517. Radio-Telegraph and Telephone System; F. G. Simpson, Seattle, Wash. App. filed May 25, 1916; issued Feb. 27, 1917. A transmitter in which the antenna is connected serially to ground through an inductance and a condenser. The condenser discharges across the spark gap, which is connected between ground and a mode of potential on the inductance coil. Thus no potential exists between the electrodes of the spark gap while oscillations occur in the aerial circuit.

Discussion

Of the eleven radio patents issued during February, 1917, all but two are on inventions having to do with the transmitting station. Among the nine, No. 1,216,538, issued to Messrs. Arco and Rendahl, and No. 1,216,615, issued to Mr. Seibt, are of extreme interest in view of the present-day wide application of the so-called "quenched spark" method of transmitting. Radio engineers interested in this particular development who desire to read over these two specifications in full can secure copies from the Patent Office, consequently no further digest of them will be made here.





Figs. 2 and 3—Reuthe's Combined Antenna System

Patent No. 1,214,591, issued to G. Reuthe for an antenna arrangement, is also one of the most interesting of this month's group. Fig. 2 is reproduced therefrom, and shows a tall vertical antenna 1, coupled by means of transformer 2 to the transmitting apparatus. At the base of the transformer is a switch 8 which alternately connects the antenna between the counterpois 3, and to a series inductance 10, capacity 11, and the ground 9. When the switch is in its vertical position, the transmitter may be used. When the switch arm is in a horizontal position, the large antenna is connected to ground and in the condition used for receiving. The receiving apparatus is not, however, coupled to the inductance 10 nor is the main antenna 1 used for receiving. As shown in Fig. 3, a portion of the counterpoise, such as the wires 4, 4, which are supported on the posts 6, is led to the primary of the receiving tuner 13. The other terminal of the receiving primary is grounded, and the secondary 14 leads to the oscillation detector system as usual. Thus a portion of the counterpoise itself is used as the receiving antenna. By means of inductance 10 and condenser 11

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Western Water Powers

THE Supreme Court has just rendered a decision affecting the use of public lands for water-power purposes which settles, in favor of the government, the contest which has been waged for several years past between the public land states and the departments in Washington as to whether or not the congressional act of 1866, giving rights-of-way over government land for the use of water for beneficial purposes, has been repealed. A number of the public land states intervened in the test case which has just been decided, setting up the material interest of the public land states in the question at issue and claiming that under the congressional act of 1866 the holders of water rights under state law were entitled to a permanent easement over any government land necessary for the beneficial use of the state's waters.

Contrary to the popular impression, the decision of the Supreme Court does not at all touch the question of the control or use of the waters of any state, but merely decides that the so-called act of 1866 was, by clear implication, repealed by the congressional act of 1896, and that a right-of-way over government lands for water powers cannot be obtained except under the act of 1896 and subsequent acts covering such matters.

Now that it is settled that the act of 1866 is no longer in force the power developments in the public land states in all cases where the use of government land is necessary can only be made under the more recent acts of Congress, which do not give permanent tenures and compel the companies using rights-of-way over government lands to take out right-of-way permits or easements and to pay such rental charges therefor as the federal government may reasonably demand. In other words, until there is further legislation the effect of this decision is to deny fee title to rights-of-way over government land and to restrict the use of such rights-of-way to revocable leases or easements issued by the Department of Interior or Agriculture.

During the past session the administration strongly favored the passing of new laws so as to give safe tenures to rights-of-way over government land for power companies operating under the state laws. The present federal laws on this subject are unworkable and the growth of the public land states is greatly retarded by their application, and it is the hope that these laws will soon be changed so as to make it practicable for Western power companies to obtain safe tenures to rights-of-way over government lands.

The far Western states need and must have hydroelectric power. Coal as a fuel is virtually unknown to them, and oil is now so costly that steam raised by this means cannot compete with water power. The public wants and should have cheap electricity, and cheap electricity in all Pacific Coast States means hydroelectric energy.

Are We Doing Our Duty?

IT is our duty as business men that Mr. Hurley meant when he discussed the question before the Associated Manufacturers of Electrical Supplies. As business men we admit an obligation toward business. Not merely to draw salary or profits, but to realize that there is, as he said, a statesmanship of business. Most people express contempt for their public representatives, yet they give power to men whom they afterward regard as misrepresentatives. Or if they do not by voluntary vote give the power they do not by vote, interest and effort withhold the power which they say ought not to be given. In general, the cheerful attitude which Mr. Hurley would have business take is that there are good men on both sides of the fence. In co-operation they will get results. The representatives are holding office. They are the "ins." They are in a position to do what the "outs" cannot do. But if those who are outside will explain their point of view to the chosen leaders there cannot be afterward a claim by the leaders that they did not know what they were doing. An eleventh-hour telegram does not meet the need. Much of the mischievous legislation of recent years has gone upon the statute books precisely because some one did not know what he was doing. A positive, not a passive, attitude is a right as well as a duty.

What Co-operation Does

IF the manufacturer of supplies had been told four years ago that he would have in 1917 a strong, effective, growing co-operative organization serving his part of the industry alone he would not have believed it. The record of the Associated Manufacturers of Electrical Supplies is unique. The conception of it which joined the founders together was able and far-sighted, the execution and evolution of time have brought it to great usefulness. The general officers, Messrs. Sheppard, Debevoise and Dustin, have consistently developed a broad, liberal, exact plan for welding the interests in legal co-operation. Behind them have been the members, meeting on common ground to discuss common problems. Differences have been swept aside in the larger aim. Small contentious points gave way before the strong purpose which underlies the organization. There is a spirit of mutual helpfulness, of willingness to yield something for the attainment of a great end.

Coal Economy

WHEN a commodity stays at a fixed price, our consumption of it at a normal rate is a routine matter; when the price goes up to a staggering height, we count the cost, we look for economies, we think ahead to see what it means in future operation. Copper, generating apparatus and coal are possibilities of revolutionary character. Copper is indestructible, apparatus has long life, but coal consumed is gone forever. We optimistically assert that coal is foolishly and unwarrantedly high, but the prudent inner voice tells us that here is a mighty issue which is worthy of our best and clearest thinking. The man who does not agree with us overlooked the very interesting figures which Mr. Gilchrist gave in an interview published in the issue of March 10, 1917.

Seven thousand tons a day is the coal consumption of the great Commonwealth system of Chicago. It doubles every four years; glance onward to 1929 and think a moment of the estimated daily requirement of 56,000 tons for this one public servant. To-day the real conservationist is not popular; his day will be in a later year. The question that the public will ask then is whether exhaustible coal resources are being conserved. From the central station industry the answer will be a loud, proud "yes." First, because the facts of high price and shortage will mean redoubled effort to attain economy in coal-burning apparatus. Second, for the reason that the central station, by virtue of its production on a large scale and low cost of distribution of power, is the most economical agency. It stands for, embodies and practices conservation.

Electrically Equipped Furniture

AMONG the many interesting pieces of work undertaken under the auspices of the N. E. L. A. is a campaign directed toward the encouragement of electrically equipped furniture. At present this is rarely seen outside the high-class hotels in which it is not infrequent to find dressing tables, bureaus, beds and other pieces of furniture fitted with electric lamps and other connections ready to be plugged in to any convenient baseboard outlet. It is a matter of common experience that in furnishing a room it is quite usually found that the architect, being obsessed with some notion of symmetry, or entirely negligent of the proper use to which the room is to be put, has caused his fourth acting subassistant draftsman to locate outlets where they are of the minimum possible service.

By mounting the furniture itself with electrical equipment located in exactly the proper place and with connections to be plugged in to a baseboard or lighting circuit these particular difficulties can be avoided. The cost of electrical equipment for furniture when it once becomes reasonably common is so slight as perhaps even to result in ultimate economy by the abolition of unnecessary and useless fixtures elsewhere. And the result upon the whole should have favorable effect on the cost of wiring. Incidentally, we might add that inasmuch as the standardization of electrically equipped furniture will probably be a rather slow job, much more than is now common ought to be done in the way of special furniture fixtures. If designed in light and efficient form furniture fixtures ought to find a very wide field of usefulness in giving greater convenience to the utilization of electric light in ordinary living rooms.

Electrical Equipment of Coal Mines

A VERY instructive paper by Mr. Weber in the current issue deals with the practical results of substituting complete electric equipment for the old shaft power plant in coal mining operations. The data given are doubly interesting inasmuch as they give the results of an actual change from the older to the newer drive. The initial state of things was the usual distribution of compressed air for mining tools and equipment and a mechanical haulage plant for the coal cars. Besides the central power plant thus constituted steam engines were in use elsewhere for crushing, hoisting, loading and ventilation. In the particular case described the actual expense for material and labor, apart from all overhead charges, rose to more than $7,500 a month. The first stage of rejuvenation of this old-fashioned plant did not include the electrification of the haulage plant, which subsequently proved to be a rather important matter. Leaving this out there were still a very material saving in operating electrically, both in the reduction of labor and in the cost of the coal consumed, although this latter was estimated on a basis of only about $1 a ton. A detailed study of an electric haulage plant, which has not yet been installed, showed a saving due to it alone of more than $1,000 a month. Incidentally, an opportunity was given in this plant of comparing the cost of a small electrically operated mine with the older equipment. The result was an advantage in coal consumption of more than 400 per cent and in power plant labor expense of 40 per cent. The total expense for energy in the electrically operated mine was less than one-third that on the older system.

The comparison brought out, however, some of the weaker points in the electrical equipment which designers and inventors should bear in mind. The conditions in this particular case forbade the use of chain cutters, so that electrically-driven coal punching machines and rock drills had to be used in the mine. It turned out on investigation that with the electric drive the machine operator could not do quite as much work as with the air-driven machines, in spite of the fact that the total expense of operation was lower with the electric system. The electric pick is a relatively light machine with a fixed stroke which very considerably lessened the speed of feeding, there being no automatic adjustment of the stroke length. On the other hand, the electric rock drill proved to be less convenient to set up and move around than the air drill, and Mr. Weber makes a plea for the oscillating type of drill. The efficiency of the latter need not be cause for worry in view of the performance of the average air drill. On the whole, the

discussion shows very plainly the large general economies to be reached by the use of electric drive and incidentally points the moral that when there is to be a change in the motive power system, it should be made at once and completely rather than piecemeal and with hesitation. It should be added that in this instance the electrical energy was purchased at a low price, 1 cent per kilowatt-hour a figure which, however, can be matched in a case of many large consumers situated on transmission systems.

Testing Automobile Engines Electrically

THE use of the generator for engine testing is in itself an old device, yet our readers will find in the account of the testing room of the Willys-Overland Company much that is of novelty in the technical applications of this familiar process. The point of the matter is that an automobile engine has to be subjected to several testing processes before it is finally installed. To begin with, the engine must, so to speak, be licked into running shape mechanically in order to secure the best running conditions. No matter how carefully the parts of the machine and the engine are assembled, friction at the first turn-over is a somewhat serious matter, and the machine must be settled to its bearings before it is given its formal load test. Then it is ready to operate at its various running speeds with a full connected load. As a result of this double requirement the testing room here described is fitted for operation of the engines by the electric machines as motors, and for the reverse process, the first requiring energy from the lines, the second turning it back into them. It is worth noting that the direct current machines proved most advantageous for the work on account of the speed variation required.

In the testing process the first step is to mount the engine on the testing block with the help of a motor-operated hoist, and then to work the electric machine as a motor with all the armature resistance out, to drive that engine at 500 r.p.m. merely as a mechanical load. This ordinarily overloads the driving motor by some 300 per cent for a very brief period, say from one to three minutes, at the end of which time the engine is down to business and the load drops to normal. Then follows a half-hour run at the same speed with a further decrease of load to about 20 per cent of its full value. At this point the speed is still further increased to 700 or 800 r.p.m., at which it is kept for an hour to an hour and a half, until the engine is fairly down to its proper friction load. Following this the operation is reversed. The engine is set in operation of its proper function, driving the electric machine as a generator and pumping energy back into the line. Next it is throttled, for from half an hour to an hour, to about half load on the generator, then the speed is sent up to full load for an hour. By this duplicate process it is made certain that the engine is fully down to its normal performance before it is assembled in the car, and the load of some of the engines is utilized to supply mechanical power for breaking the others to their bearings.

The operation is facilitated by several highly ingenious switching appliances. In the first place the resistance in the armature circuit, which is cut into at the initial running speed, is utilized in the shunt-field circuit for increasing the speed in the latter part of the power run. By using duplicate circuit breakers, one set high, to protect against short-circuits, and the other set at a moderate overload, it is necessary for the testing operator to hold in the latter circuit breaker during the period of severe overload when the static friction of the engine is being worked off and thus stay vigorously on his job. Associated with these breakers, too, is an automatic cut off for the engine magneto, so that if the electric load goes off the engine is automatically stopped. The great practical advantage of this ingenious testing system is not only to save power, owing to the double use of machines, but particularly in the rapidity and facility in which the tests can be executed. The working is much steadier than with a brake equipment. The output of the testing room can be doubled and the quietness of the operation resulting from the abolition of belts and brakes gives the testers a much better opportunity to watch for any lack of precision in the working of the engine. From the great simplicity of the system it has turned out that the testing costs also are greatly reduced. A similar testing equipment has been installed in another factory and with like favorable results. For low cost of installation and operation coupled with great working efficiency the electrical testing machine seems thoroughly to have made good, and its advantages ought to appeal to all other automobile companies which have similar testing problems to face.

The Coming Issues

NEXT week an article will appear, dealing with the electrical features of a New England cotton mill, in which reasons will be given for selecting certain equipment and arrangements instead of others. The second section of Prof. Alfred Still's articles on design of high-tension transformer insulation will also be presented in that number. In the first issue of April, which is the public policy number, there will be published articles showing the trend of court and commission decisions on utility questions. The regular monthly compilation of central station earnings and energy output will also appear in that issue. In addition the April 7 number will contain the statistics gathered every year by the ELECTRICAL WORLD, showing the output, peak load and time of peak on the largest generating systems in America for the year 1916. For the sake of comparison similar data where available for 1915 will be given for each company so as to show the extent of the growth during the year. Every generating system having an output of 100,000,000 kw. hrs. and over will be included. Subjects of interest to station and operating engineers will be discussed in the second issue of April. The ELECTRICAL WORLD for April 21 will take up methods of making direct-current network calculations and effects of adding new conductors.

Should Central Stations Wire Houses?

A General Discussion of This Question Through the Medium of Letters from a Number of Central Stations, of Which Some Do and Others Do Not Maintain a Wiring Department

By Earl E. Whitehorne

Is there any justification for a central station wiring department? Some say "yes"; some say "no." Who is right according to the best experience?

The fact that so many central station companies still continue to wire houses in competition with local contractors shows that this is still a mooted question. Many are doing wiring because they evidently consider it profitable or necessary; while many others have abandoned the practice as fundamentally wrong.

Should the central station operate a wiring department? Does it do more harm than good, through alienating the good will of the contractor? It is an important issue and the diverse opinion and experience cited in this article is more than interesting. It is worth a little careful study.—The Editors.

SOME time ago the writer sent letters to a large number of central stations, widely scattered over the states, and differing no less in size of city served than in the general conditions encountered. He put the problem, "Is is good for the central station to maintain a wiring department?" and received a very large number of replies in which opinion differed all the way from yes to no, and men gave evidence to prove that they were right. It is interesting to see how attitude has grown out of local experience and how the local experience has been induced by conditions, that repeat themselves so generally throughout the industry. These letters seem to offer much good counsel and the writer will briefly quote from those that carry such suggestions—withholding the names to avoid causing any feeling locally.

"It Brings More Business"

The advocates of central station wiring are very definite in their reasons. "We believe we are justified in having a wiring department," says an Indiana company. "Before we established this department there were very few new houses wired, and as for old houses they were at a minimum which was entirely due to the fact that the contractors, having no competition, exacted exorbitant prices for the work. Since establishing this department every new home has been wired complete and the number of old houses wired has been very satisfactory."

A Wisconsin company writes: "In our judgment, we should go after this business energetically, and maintain an organization to that end for the same reason that in the operation of our gas department we solicit house piping work in competition with the plumbers. Possibly some little feeling is stirred up in connection with central stations and gas departments doing this class of work, but still the utility is held responsible for the results at all events, and for that reason, if for no other, should handle this business."

Another Western man believes that central station wiring is essential until the territory is well saturated, but not beyond that point. He says: "The central station should maintain house-wiring departments and do the work as reasonably as possible until the connected load is developed and a very large majority of the old houses on the lines are wired up. I have in mind one town where we were forced to do house wiring. The contractors had maintained a very high price for such work and, repeated efforts on my part to have them reduce these prices being unavailing, it forced us into the house-wiring game. Up to that time about the only thing that was being connected to our lines were new houses. We established a house-wiring department, wiring houses at a small cost, our per cent of profit being from 15 to 20. In two years we had wired and connected to our lines more than 600 houses in a town of approximately 1000 people. On the other hand, I could name several other towns under my jurisdiction where we do not wire houses and the matter is handled entirely by the contractors, where the development is very, very slow. Therefore I am very much in favor of the central station maintaining a house-wiring department and doing the work as reasonably as possible up to the point where the lines are fairly well saturated. After that point is reached I believe the wiring game should be dropped by the central stations and given to the contractors."

The Time to Start?

In almost contradiction to this view, however, is the argument in a letter from a general manager who operates a chain of properties in a state a little farther west. He says: "As long as conditions in this town, or any other, as regards the saturation point of electric light users, are as at present, I believe a company can get along quite as well in the matter of increasing its number of customers without being in the wiring business as it could if it did maintain a wiring department. Whenever such a point is reached, however, where new customers are difficult to get the entire matter hinges on the prospect's being able to get his wiring done at a low price. Then there is nothing for a company to do but to embark in the business, since an electric lighting company is the only person or corporation that can afford to do wiring without charging a percentage to cover all overhead in connection with the wiring business, and to make only a small per cent on the capital tied up in stock of supplies."

In other words, this man would wait until his lines are loaded, while the previous manager contended that at this point central station wiring becomes no longer necessary. Each bases his opinion on the experience he has personally met—which is evidence enough that it is well to know the other fellow's views.

An entirely different reason follows the testimony of another medium-sized Western city. "In our situation," writes this commercial agent, "we consider it both profitable and necessary to continue this department. There are a large number of small, one-story houses here which are occupied mostly by the foreign element, and we have put a flat rate into effect which enables our salesmen to quote prices for wiring these houses without first getting an estimate. The average price of wiring a house of this character amounts to $16 (excluding fixtures) and it has been our experience that the local contractor will not try to get this business for the reason that there is not sufficient profit to pay him to spend any time in promoting the sale.

"Our increase in meters last year amounted to about 700, and of this increase we estimate that fully 150 meters were secured from the small houses tenanted mostly by the foreign element. If we were to discon-

tinue house wiring I estimate we would lose at least 100 new consumers per year. Therefore, although we do compete with the local contractors, it is a fair competition and there exists the best of feeling between the contractors and the company."

Protect the Standard of Work

This same situation affects a good many cities and seems to have caused the institution of a large number of central station wiring departments, while in some cases the active competition of the gas company is given as the reason. But by far the most numerous among these letters is the statement that the central station competition protects the standard of the work done in that town. It is well expressed by one manager this way:

"We believe there is justification for the central station wiring department because it insures wiring installations at a cost not excessive. We bid on all wiring jobs, but are not disappointed when outside men secure the contract. In this way we can give our personal attention to a great many cases where the installation would not be properly made except for the supervising jurisdiction exercised by bidding on each wiring job. There is no hard feeling between the wiring contractors and ourselves. They know we will not underbid them to secure the job and we do no wiring except at a price that justified us in doing the work."

Experience has proved again and again that the electrical men can be brought together as a family, that such contact produces harmony and common purpose and that such common purpose welds a working unit that soon puts an end to bickering and wasted opportunity. There is no doubt but that this problem of who should do the wiring can be solved in the average city as it has elsewhere if the central station manager is willing to do his part. The answer then is, "Let the central station cultivate the right 'conditions' so that it may keep out of the wiring field except for proper temporary purposes."

But in a Kansas city, apparently they have found a way to bring about the same desired result on another basis, and the sales manager writes: "It is my opinion that this business should all be turned over to the contractors, providing they are members of a contractor's association, and are recognized as able to do the proper kind of work. We have tried both systems in the various companies with which I have been connected in the past four years, and there is only one successful plan, and that is to co-operate with the contractors, providing they are desirous of working with the central station. We find that we cannot depend on them to sell or push the sale of appliances, but we derive considerable benefit from turning over all wiring business to them, and carrying the accounts."

This letter points the value of co-operation with the contractors, and a further argument on the point is well put by a manager in Arkansas. He says: "My experience teaches me that it is absurd for a central station to do wiring, for the central station can co-operate with contractors, and thus insure that only a reasonable profit be earned and first-class work done. And there are many advantages in having good, live contractors in the field, for more business will be secured and a live contractor is practically as good as, and sometimes better than, a salesman employed by the central station. If you encourage him he will certainly get the business."

"Offends the Public"

The bad influence on public opinion of a lack of harmony in the local electrical family is dwelt upon by many companies in discussing this question. For instance, this from North Carolina: "I know it is a fact," says this general manager, "that some enterprising central stations do house wiring in competition with local contractors and justify their action by claiming that it means a greater increase in business to the central station. I question this very much, as I believe that it brings about a bad feeling between the local contractor and the central station. It also produces a feeling with the public that if the central station does the wiring it should, for ever and a day, maintain the work which it has put in. I believe that it is very important for a central station to live in very close harmony with the public as well as with all branches of business, and it does not do for a central station to produce the impression locally that it is trying to monopolize too much."

And this same point is covered in further detail by an Illinois company that operates in a large number of communities. This man writes: "It has been my experience that in such towns where we have maintained an interior wiring department that the company not only has alienated the contractor's affections, but created a false field of competition and public prejudice. I find that in towns where central stations maintain the wiring department that the company itself has secured more contracts than in towns where no such department exists, but that in such towns the number of contracts secured by both the outside companies and the central station is less than where all of the wiring is done by the outside contractors. We have at the present time actual figures embracing several years that prove this condition in several of our towns."

High Prices and Collection Troubles

"Among other things," says another man in Illinois, "if the light company is asked to submit bids on a job, it will naturally figure on the best material possible and of sufficient capacity to take care of the expected increase in heating appliances, whereas the local contractor will figure to make as much as he can and still get by. The result is that the light company's figures are largely in excess of those submitted by the local man and the local man gets the job and the light company adds another item to the charge that it tries to hold up the customer."

And there are many more who express the same opinion. Also it is claimed that such central station wiring departments are usually an actual source of expense because of the wasted labor, the cost of overhead and supervision and through the losses in collection.

As a Nevada manager puts it: "Our main reason for discontinuing this department was on account of the difficulty in collections. Consumers would pay their electric bills, allowing the wiring account to ride, and while this might be considered to be our own fault, we have found it very difficult to make collections just the same, and of course it was not possible to discontinue service on account of non-payment of wiring accounts. Such disputes in regard to wiring bills lead to ill feeling on the part of the consumer." And another man in North Dakota adds: "It is undoubtedly a fact that where the central station does the wiring the consumer is more apt to allow his account to become delinquent than if the wiring is handled by a local contractor."

The opponents of central station wiring are therefore quite as decided and as specific as its advocates, and yet there is a point dwelt upon in the majority of the letters received, the dominating factor of local conditions —caused unquestionably to some considerable degree by the very policy of the central station itself. As a

Georgia man says: "This is a matter which should be governed entirely by local conditions. If satisfactory conditions cannot be obtained from the contractors, then it is the duty of the central station, in justice to itself and its customers, to go into the wiring business."

Or, looking at it from the other angle, as this Middle Western man does: "If contractors will solicit wiring and co-operate with the companies in campaigns to secure new customers, it would be much better if the companies stayed out of the wiring business. I find, however, in many cases where the companies do not do wiring that contractors become independent, do not solicit business, and increase their charges to such an extent that prospective customers will not wire their houses. In such cases it becomes absolutely necessary that the companies do wiring."

"Only Two Good Reasons"

One more letter from another Kansas manager seems to sum it up rather well. He says:

"I believe that there are two causes which may force a central station to do wiring. First: If the central station finds it impossible to make a fair increase without taking wiring and fixture contracts, then it is certainly up to it to do this work, regardless of the effect on the contractor. Second: If it becomes necessary, in order to take on more consumers, to install wiring on a monthly instalment basis the central station may be forced to finance and operate the entire campaign. Often the contractors in smaller cities and towns have no or very little competition. They have all they can attend to without spending any time rustling business, and this naturally causes them to pick the plums, and charge a very high figure for their installations. The increase of the number of electrical consumers is thus greatly minimized, especially residential consumers. In a case of this kind it is up to the central station to induce another contractor to come in or get into the business itself. On the other hand, if there are plenty of contractors in a town, and they are in lively competition for business, and are still holding the standard of wiring up to where it should be, I can see no reason why the central station should get into the business. Apart from the one idea of gaining consumers, the central station has no business in the wiring game. I seriously doubt that one ever yet cleared any money in it. So I would say to every central station: Keep out of the wiring and fixture business, if possible, but if it is absolutely necessary to take wiring and fixture contracts, in order to secure new business, I should think the wiring in turn should be sublet to the contractors on a competitive basis, if it can be satisfactorily arranged."

This Matter of "Conditions"

Surely it would seem from reading these letters that central station men are very strongly divided in opinion on a very basic question of policy. And yet there doesn't seem to be the slightest doubt in anybody's mind which way is right. Theoretically and in practice it is better for the utility to leave the wiring business to the wiring contractor, provided that conditions in the town are right. The utility knows that if the contractors are good men who do good work and maintain the proper standard of construction, it is far better to have the valuable aid and influence of these independent workers actively co-operating in the development of the business. For everybody has agreed that a few good contractors are a powerful selling force and bring a lot of new consumers to the circuits and find a market for appliances that would otherwise long remain unsold. And the men who advocate a wiring department admit that it was bad conditions in their towns that forced them into it. Therefore, it all boils down to this: that the first and most important thing of all is to make "conditions" right and keep them so. And who can say that if the central stations now engaged in wiring had put the same amount of thought and time and money that they have invested in their wiring department, into the problem of perfecting these "conditions," it would not have brought about the organization of a corps of contractors of far more productive value to the companies?

It must be realized, of course, that there are small towns where no good contractor could make a living and the lighting company must wire up the houses. Also, there are situations where a monster wiring campaign develops more business than all the contractors can possibly take care of, and the central station is compelled to lend a hand, and organize a wiring force of its own to help keep up with the selling force. But these are cases not considered in this article. The point the writer wishes to make is this: Too many central station managers seem to have this idea that they are powerless to combat these "conditions" that they talk about.

What Experience Proves

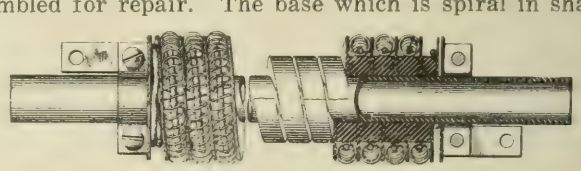
Experience in other cities has proved again and again that the electrical men can be brought together as a family, that such contact produces harmony and common purpose and that such common purpose welds a working unit that soon puts an end to bickering and wasted opportunity. There is no doubt but that this problem of who should do the wiring can be solved in the average city in this same way if the central station manager is willing to do his part. It may not come at once. It may take several years, depending on how long it takes him to make new friends. But it can be done.

Cities are very much the same. And contractors are much the same. They must be prosperous to be contented and productive, and the central station and the manager of the utility must realize that he is under no small obligation to make possible this prosperity and to protect it. It pays him better than a wiring department, so it seems that the answer to the problem is this: Let the central station cultivate the right "conditions" so that it may keep out of the wiring field—except for proper temporary purposes.

OPEN RESISTANCE UNIT

Compact and Flexible Device with Spiral Base That Can Be Formed of Any Number of Sections

Spirally arranged resistance wire exposed freely to the air is embodied in a device (patent No. 1,209,568) patented by George H. Dorgeloh and Eugene Pons of Schenectady, N. Y. The resistance unit is compact, flexible and may be conveniently assembled, or disassembled for repair. The base which is spiral in shape



SPIRALLY ARRANGED EXPOSED RESISTANCE UNIT

is made of insulating material, such as asbestos compound or the like, and is formed of any number of sections. These sections are cut away so as to form less than one turn of the spiral. The base is mounted on a tube of insulating material, such as mica. Partitions of insulating material, such as mica, are provided between the spiral turns of the insulating base. With the base these partitions form a spiral groove in which the resistance element is wound, the partitions thus spacing the adjacent turns of the resistance element.

Memphis' 600,000 Kw.-Hr. Vehicle Load

Confidence in the Electric Automobile, Liberal Policy Toward Users, Operation of a Central Garage, and Co-operation with Manufacturers Factors That Have Put 300 Electrics on Lines of Central-Station

BY O. H. CALDWELL

FOLLOWING up with energetic sales effort its conviction that the electric-vehicle charging load offers better business for the central station than any other class of energy-consuming appliance used by the private customer, the Memphis Consolidated Gas & Electric Company has in the last five years developed a vehicle-charging load that now annually consumes 600,000 kw.-hr., practically all of which is off-peak energy.

Three hundred electric vehicles are already in use on the streets of Memphis, a city with a white population of 90,000. Two hundred and forty-five of these are passenger cars and fifty-five are trucks. Users of electric passenger vehicles are met with on every hand, and the shopping district, residence streets and park drives of the city are to be seen filled with electric cars in all kinds of weather, for at Memphis as elsewhere the electric's convenience and comfort is demonstrated best of all on rainy and chilly days.

Moreover, in Memphis, where enthusiasm for the electric automobile is unconcealed, the belief among central station men, vehicle men, and vehicle users is that the electric passenger car has only begun to realize on the great opportunity for development before it, and it is confidently expected that a few years more of intensive work in Memphis will put the number of electrics there at 1000, with an energy consumption reaching 2,500,000 kw.-hr. per year.

GARAGE AND SERVICE POLICY

Several liberal development policies carried out by the Memphis central station company have led to this growth of the vehicle charging business from 30,000 kw.-hr. a year, as it was in 1910, to 600,000 kw.-hr., the consumption for 1916.

First of all, of course, electrics and electric-vehicle



A SERIES OF ROAD RUNS TO NEARBY TOWNS HAS PROVED TO THE MEMPHIS PUBLIC THE DEPENDABILITY OF THE ELECTRIC PASSENGER CAR UNDER ALL ROAD CONDITIONS

performances have been kept in the public eye by energetic advertising in newspapers and on theater programs and motion-picture slides, in co-operation with the manufacturers.

In particular, however, every facility has been afforded the prospective customer to make it easy for him to buy his car and to provide for charging it, either in his own private garage (there are now 115 of these private charging outfits on the Memphis lines), or in the central garage operated by the company.

So successful has this policy of operating a vehicle garage proved as a practical means of stimulating vehicle growth, that the Memphis company last year doubled its garage investment and added more than 100



ELECTRIC TRUCKS ARE USED TO HAUL COTTON BALES ON THE MEMPHIS LEVEES

per cent floor space. The present garage represents an investment of about $12,000, an amount which, it is pointed out, equals roughly the investment in meters required to serve a group of small residence consumers taking approximately the same amount of energy as the present vehicle load.

"PAY-FOR-WHAT-YOU-GET" SYSTEM OF GARAGE CHARGES

The *a la carte* system of rates in use at the Memphis central station garage, where each customer pays only for the character and amount of service he wants, has been an important factor in the development of the vehicle load at Memphis. Expert battery and mechanical men, and careful garage attendants, also, are all essential factors in the plan to make the operation of customers' cars the success that they are to-day on the streets of Memphis.

The new garage of the Memphis Consolidated Gas & Light Company has a floor space of 25,000 sq. ft. and space for garaging 125 cars.

Under the *a la carte* plan of garage rates the truck or vehicle owner pays a "garage service" charge of $10 per month, which includes stabling, inspection of batteries and mechanical parts, flushing, cleaning, oiling and greasing, and the making of any adjustments in which actual replacement of parts is not required.

KILOWATT-HOURS METERED TO EACH VEHICLE

Direct-current energy to charge the car is separately metered by a watt-hour meter on each circuit, and the customer is billed monthly at 5 cents per kilowatt-hour for the energy consumed. Customers who have fleets of five cars or more are supplied with energy at 4 cents per kilowatt-hour.

For car-washing service a charge of $10 per month is made, which provides for washing up the car or truck each time it is returned to the garage from a run.

For $5 per month the garage management will send a boy to call for or deliver the customer's car to any



THREE ELECTRIC TRUCKS USED BY THE MEMPHIS CITY WATER DEPARTMENT

location in the city at any time of the day or night, as often as the customer may want to make use of his car.

Flexibility of Expense to Car User

Any owner of an electric may contract for as much of this garage service as he needs or wishes; as a result the cost to a customer who drives his car 100 miles or less a month, may be, for example, only $15 a month, while other users who run 900 miles or so, a month, have monthly bills in the neighborhood of $40.

Such a charge for electric-vehicle service represents, it is pointed out, probably about one-half the cost of operating a good gasoline car for the same service. The flexibility of the Memphis garage rate, it is emphasized, has brought the electric vehicle within the means of a large range of users, making of each an enthusiastic booster for the electric car.

The private owner who does not regularly use the company's downtown electric garage can, however, stable



THE CENTRAL STATION PRACTICES AS WELL AS PREACHES THE USE OF ELECTRICS

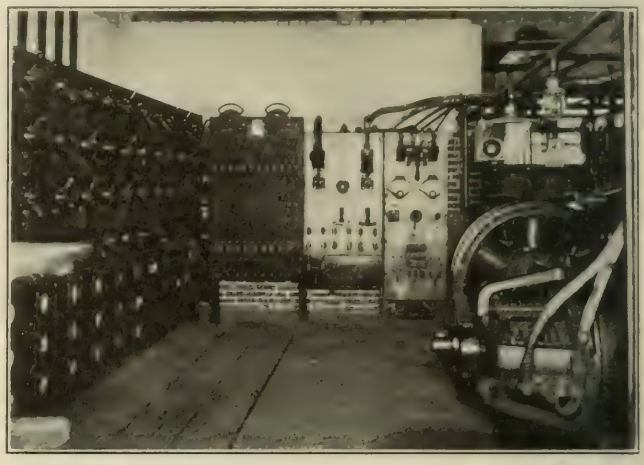
his car at the garage whenever he wishes, at a cost of only 25 cents for twenty-four hours. If the car is placed on charge the owner pays for energy at the rate of 5 cents for each kilowatt-hour consumed. Other items in the regular schedule of prices for such one-time service include flushing, 25 cents; washing, 50 cents to 75 cents, etc.

Batteries and electrical and mechanical parts are inspected and necessary adjustments are made without charge for any local electric vehicle owner whether a customer of the downtown garage or not, although it is the aim to render a nominal charge for any repair work which involves an outlay for labor or material. Such repair work must in each case be previously authorized by the owner, to whom a full report is made before such repairs are started.

Vehicle Inspection Service for Customers

Under the liberal policy of furnishing service to the owner, a great deal of minor repair work is rendered gratis. The aim is, above all, to see that the vehicle owner gets satisfactory operation from his car. The Memphis company also extends this free inspection service to customers who have private garages at their residences, and on call will send a man to inspect rectifier outfits, vehicles, etc., making adjustments or simple repairs necessary to restore service.

The garage represents an investment of about $12,000, although it is doubtful if it could be reproduced for that amount to-day. The central station garage has a monthly income of about $3,000 from regular garage service, repairs, etc. Fourteen men, including one clerk, are



CHARGING EQUIPMENT AND INDIVIDUAL RHEOSTATS IN MEMPHIS CENTRAL GARAGE

now employed in the garage department. The payroll amounts to $1,100 a month, and the monthly bill for electricity for charging averages $600. Water, and gas for heating the distilled-water generator, each average $50 a month.

It has been the aim throughout the operation of the Memphis garage plant to have the garage simply pay its own expenses, and as soon as a surplus is shown, service charges are adjusted to re-establish the balance. During the first year that the garage was established, a loss of $1,600 was sustained, but the next year the income balanced the expenditures. In 1915 the garage showed a profit of $3,000, and last year it again broke about even.

The garage charging equipment consists of one 75-kw. motor-generator set and one 75-kw. rotary converter. Charging energy is supplied to the forty charging plugs through an equal number of graphite-compression rheostats mounted on a switchboard in the generator room.

Co-operation With Manufacturers

One corner of the garage structure has been equipped with show windows and fitted up as a display room for Detroit Electric cars, manufactured by the Anderson Electric Car Company, with which the Memphis central station co-operates. Besides furnishing this display room, with telephone, light and heat, the central station

maintains and garages the demonstrating car used by the Anderson company's salesman at Memphis, pays one-third of the cost of the newspaper advertising, runs an advertisement in the program of the best theater, and advertises on the screen of the best motion-picture house. In return for this co-operation the manufacturer pays the central station 5 per cent on all local sales.

Along with the campaign to sell electric vehicles to new users, an effort has been made to bring up to date the electric car equipment already in use on the streets of Memphis, by substituting new cars for those already in use. Cars of the latest model are demonstrated to users who already know the advantages of electric vehicle operation, and the old but serviceable cars taken in on trades of this kind are then overhauled and disposed of to less discriminating purchasers, or to those who have still older models. This plan of overhauling and refitting used cars has also been very successful in modernizing and getting into service any cars that, through indifference or other causes, had been abandoned. In one instance, an early electric was removed from a hen coop where it had for some months served as a roost for the owner's chickens, and after being cleaned up, painted and overhauled in the company's garage, is to-day giving good service on the streets of Memphis. Dozens of other electric vehicles have been reclaimed by the central station garage in the same way and made into useful conveyances, each producing a regular income for the central station.

Carl K. Chapin, engineer for the Memphis Consolidated Gas & Electric Company in charge of commercial development, who organized the company's garage department and has supervised its operation from the beginning, believes that the vehicle load provides one of the most valuable classes of business the central station can obtain, its off-peak demand and large energy consumption making it, in his opinion, more desirable than even equivalent electric cooking business.

The operation of an electric vehicle garage, Mr. Chapin points out, is good central station business compared with the average residence, which uses its maximum demand the equivalent of barely fifty minutes daily. A private charging station for an electric vehicle averages a consumption equivalent to three hours' use of the maximum, while the public garage takes energy equivalent to ten hours' use.

Compared on a basis of energy consumption the installation cost of serving a residence having 250 watts demand and a monthly consumption of 40 kw.-hr. per kilowatt of maximum demand, is $190 per kilowatt; a private vehicle charging outfit consuming 66 kw.-hr. per kilowatt of maximum demand, $75 per kilowatt; and public garage consuming 360 kw.-hr. per kilowatt of maximum demand $15 per kilowatt.

GIVING ELECTRIC VEHICLE FAIR SHARE OF DEVELOPMENT EFFORT

In Memphis the central station company is proving its belief that the electric vehicle is justified in having as much or more effort concentrated on its development as upon any other branch of new business.

If the average electric car consumes 200 kw.-hr. per month, this means for the central station five times the amount of electricity sales that the same private-residence user would take for all other purposes. And in spite of the low rate offered for electric charging service, as a result of its off-peak and all-night character, the presence of the vehicle usually actually triples the revenue derived from the household as a whole.



THE CENTRAL STATION ELECTRIC GARAGE AT MEMPHIS AFFORDS SPACE FOR TAKING CARE OF 125 VEHICLES AND TRUCKS

At the present time, therefore, there seem to be no other current-consuming mediums which offer such opportunities for expansion and development in the residence field.

Manufacturers of electric passenger cars, it is pointed out, are willing to go farther in their co-operation with the central station than most other manufacturers of electricity-consuming appliances or apparatus, and they should be encouraged to the end of securing for the central station and for themselves all possible results from this condition of co-operation.

The future of the electric automobile in a city like Memphis need concern no one when there is in evidence such a satisfactory development as that at present, on which to base expectations for the future. On the other hand, it is pointed out, the central station, in the face of constantly lowering average rates, must depend on utilizing every possible natural advantage to increase its output in a greater proportion than the investment in the business is increased, and in this development of better load-factor business, the electric vehicle, according to the Memphis view, is bound to offer a more valuable opportunity than any class of residence load.

Associated Manufacturers Meet and Work

Annual Gathering in New York, Followed by a Banquet, Reviews the Extensive Co-operative Effort of the Makers of Electrical Supplies and the Growth and Bright Prospects Ahead

PRIDE in their successful co-operation and enthusiastic and cordial support in the work of the Associated Manufacturers of Electrical Supplies were in the atmosphere of the second annual meeting, held last week at Delmonico's, New York. The business session was held in the afternoon of March 15, and the banquet, with 185 present, was in the evening.

As stated in last week's issue of the ELECTRICAL WORLD, President Robert K. Sheppard was kept at home by illness. In his absence his report was read by the vice-president, H. B. Crouse, Crouse-Hinds Company, Syracuse, N. Y. An abstract of the address of Mr. Sheppard was published in the ELECTRICAL WORLD of March 17, 1917, page 524. Mr. Crouse asked Thomas M. Debevoise, general counsel of the association, to preside over the meeting. A telegram, expressing regret at the sickness of Mr. Sheppard and hope for his speedy recovery, was sent to him.

J. F. Kerlin, National Carbon Company, presented the report of the finance committee, which showed all indebtedness paid and a cash balance on hand. The committee felt that it was indicative of the efficiency of the treasurer, J. W. Perry of the Johns-Manville Company, as well as of the interest of members in the welfare of the association, that there were no unpaid dues on March 1, the date of its report.

Associated Manufacturers Getting Results

The finance committee found no unpaid dues.

There are 156 member companies, with 256 executive and associate representatives.

Standardization of design and stabilizing statistical work accomplished.

Fifteen sections organized and others under consideration.

More than 100 meetings held during the year by sections or committees.

Uniform cost accounting idea making progress.

Standardization of sizes of literature being discussed.

An extended investigation of electric wiring systems under way.

One hundred per cent membership the aim.

A tariff committee will be appointed.

REPORT OF CHARLES E. DUSTIN, THE GENERAL SECRETARY

Charles E. Dustin, the general secretary, gave a brief outline of the volume of work which has passed through the office and said that he found it very difficult to show all that has been accomplished for the welfare of the industry or to give credit to the many zealous workers who have given time and unceasing efforts in a desire to better conditions.

At the organization meeting, said Mr. Dustin, ninety-three companies signified a desire to become members, and these were enrolled as charter members. Three of these failed to qualify and nine decided that their special line of manufacture did not conform strictly to the requirements of the constitution, consequently the original membership really consisted of eighty-three manufacturers. To-day there are 156 member companies, with 256 executive and associate representatives. Mr. Dustin added:

"There are now fifteen sections, five having been organized during the past year, covering fan motors, attachment plugs, lighting fixtures, line material and carbon, all of which have been formed by special request of the manufacturers interested. Other sections are under consideration, but the general policy has been to extend the activities of the sections already formed, giving to the members an opportunity to standardize their products, and to encourage co-operation among the different manufacturers in their special lines, rather than to increase the number of sections until they could be handled to the advantage of those interested.

"Many lines of activities have been undertaken by the sections during the year, and after acting upon the ordinary topics of standardization of design, as well as matters of interest with the Underwriters' Laboratories, many of the sections have now specifically taken up the compilation of statistics pertaining to product handled by the members, figures being first submitted to the general secretary and tabulated by his office and the net results given to each of the members, without disclosure of the name of the individual manufacturer.

"Much progress has been made by co-operation of the manufacturers in the matter of a uniform basis for figuring costs. For this purpose articles manufactured by different members have been specified and costs submitted through the office of the general secretary. It is interesting to note that these figures have shown a variation of from 25 per cent to 40 per cent, indicating an improper distribution of expense items, and proving conclusively the necessity of adopting a uniform basis of cost accounting.

"In each section a cost accounting committee has been appointed. These committees are working on systems applicable to the products of their own particular sections, but no reports have been made or adopted, as it was thought wise to withhold all reports of these committees, pending the report of the cost accounting committee of the Electrical Manufacturers' Council.

"In the fuse section a standard for cartridge inclosed fuses has been prepared, which has resulted in a standard being approved by the Underwriters and the recommendation made that it be adopted as standard in the National Electrical Code, as issued by the National Fire Protection Association. I might say that the preparation of the fuse manual has involved an expenditure in cash of $940, which was borne by ten members of the fuse section, to say nothing of the valuable time given by the members of the committee.

"In the molded or formed insulation section a committee was appointed to consider a standard method for testing molded insulation, and a bulletin has been issued known as Standards Committee Bulletin No. 1, the first of a series to cover all the important properties of molded insulation. A brief reference to this bulletin in one of the electrical papers has brought requests from the leading scientific societies of this country and

Europe for copies, and this will testify to the interest which is being taken in this work and its value to the insulation industry.

"A great diversity in the method of handling its product led one of the sections to consider a list of customs of the trade. Naturally this involved a long and varied discussion, but in the end a list of customs was approved and recommended for adoption, although not in any way obligatory upon the members, all tending to mitigate many of the evils peculiar to that particular branch of the industry."

Remarks of T. M. Debevoise, General Counsel

Mr. Debevoise said in his remarks to the members:

"The work has gone on well and the plan of organization is proving excellent. We have been able to effect some changes, making it more workable, but very careful check has been kept on everything and everything that has been done has in my opinion been legal and proper.

"A few things have had to be done over and a few questions reconsidered—in fact, there are legal questions coming up almost constantly, but nothing has gone through which we have regretted, and I think we can say at the end of the year that the association has found methods of co-operation which are perfectly safe and which I believe you will agree are of the greatest advantage to the members.

"It has been a very interesting organization period. Now that period is over. The organization of the future will be devoted to bringing new sections into line and increasing the membership of the sections that are already parts of the association, but the new sections will be organized on the lines of the old. It was impossible to tell you at the beginning just what would be done, but I hope as the association goes on we will find new fields of activities which will prove just as valuable as those discovered to date."

Delegation to Electrical Manufacturers' Council Reports

D. Hayes Murphy, American Conduit Manufacturing Company, chairman of the association's delegation to the Electrical Manufacturers' Council, reported in part:

"One of the subjects now under consideration, for example, is the question of standardization of sizes of literature for the electrical manufacturing industry. A committee has been appointed by the council with instructions to confer with like committees appointed by the Electrical Manufacturers' Club, Electric Power Club and the Associated Manufacturers of Electrical Supplies for the purpose of assembling all available data on the subject and making such recommendation as seems proper.

Progress in Cost Accounting

"Perhaps the most important subject which has been considered by the council is uniform cost accounting. Chairman S. L. Nicholson of the council invited C. E. Patterson, comptroller of the General Electric Company, to be present at the July 17 meeting for the purpose of giving the council the benefit of his advice on this question. Mr. Patterson outlined a plan for working out a uniform cost accounting system for the electrical manufacturing industry. The uniform cost accounting committee, with Mr. Patterson as chairman, was then appointed, with instructions to start work at the earliest possible moment."

The results accomplished are summed up briefly in a letter from Mr. Patterson to Edward N. Hurley, chairman of the Federal Trade Commission, dated Jan. 23, 1917. Mr. Patterson's letter, as submitted by Mr. Murphy in the report from the delegation to the Electrical Manufacturers' Council, follows in part:

"The committee has worked steadily throughout the year. Its members include representatives who are accounting experts of large and small companies. The committee was also selected with due recognition of the diversification of manufacturing products and conditions. As a result of its work we are able to submit to the Federal Trade Commission outlines which we believe have been so planned that they not only conform to the requirements of scientific accounting and an adequate cost system, but are sufficiently flexible so that they may be used to advantage by both large and small manufacturers.

"Through their work the committee has kept in touch with your chairman of the commission and has felt that its efforts were directed along lines which harmonize with the progressive policy adopted by the commission."

Chamber of Commerce Membership

Hjalmer Hertz, Diehl Manufacturing Company, was unable to be present to read his report as national councilor of the association to the United States Chamber of Commerce. Mr. Debevoise read two letters from Mr. Hertz, giving his views on the value of the work.

Committee on Electric Wiring Systems

LeRoy Clark, Safety Insulated Wire & Cable Company, made a report for the committee on electric wiring systems, of which he is chairman. This committee is the development of what was started as the committee of business and technical experts, which was appointed at a meeting of the manufacturers in December, 1914. That committee has been enlarged gradually. At the start its work primarily was the consideration of the subject of concentric wiring, but it soon developed that that was too narrow a subject, and in order to do better work it was enlarged to include all of the representative electrical bodies. The work became an investigation of wiring systems, with the possibility of developing some system of wiring which would be not only cheaper, but safer from the viewpoint of life and fire.

Mr. Clark added that the committee now has representatives from the following organizations, aside from the manufacturing representatives who have been on it from the start:

National Electric Light Association, Western Association of Electrical Inspectors, International Association of Municipal Electricians, American Institute of Electrical Engineers, Associated Factory Mutual Fire Insurance Companies, Underwriters' Laboratories, Inc., Bureau of Standards, Electrical Supply Jobbers' Association and National Electrical Contractors' Association.

In addition, said Mr. Clark, the committee has two technical experts, Gano Dunn, J. G. White Engineering Corporation, and D. C. Jackson, Massachusetts Institute of Technology. During the last year the work has been confined entirely to the work of a sub-committee investigating the subject of bare grounded return wiring systems. Wiring systems would be naturally divided into two classes, insulated systems and partially insulated systems. Concentric wiring was only one of the possibilities in a grounded return system, therefore the committee considered not only concentric wiring, but any form of bare grounded return wiring system.

C. E. Corrigan, National Metal Molding Company, chairman of the sub-committee on bare grounded return wiring systems of the committee on electric wiring systems, presented the sub-committee report.

The Sections

No formal reports were made by the sections generally. E. B. Hatch, Johns-Pratt Company, chairman of the molded or formed insulated section, spoke informally.

One Hundred Per Cent Sought in Membership

R. E. Callahen, New York Insulated Wire Company, spoke of the desirability of increasing the membership still further. The campaign for new members is now in charge of the various sections. It is the aim to have the full manufacturing output in each field in the respective sections.

For Protective Action on the Tariff

L. Livingston of Edward F. Caldwell & Company spoke of the importance of action by the association on the tariff question. He said that the present duty on fixtures is 20 per cent. Prior to the reduction of the tariff it was 45 per cent. It has been stated in authentic sources that certain foreign manufacturers were able to bring influence to bear to promote this reduction, which was of assistance to them.

When this reduction was under consideration, said Mr. Livingston, manufacturers did not take an interest in maintaining the duty at 45 per cent. He spoke of the efficiency of war-trained workmen in Europe and of the wastefulness and higher wage scales in this country, and urged that a committee be appointed to present statistics to the Tariff Commission in order that the tariff might be so equalized as to put the American manufacturer on the same basis as the European manufacturer.

It wasdecided to have a general committee.

Governors Re-elected

Five members of the board of governors whose terms expire were re-elected for three years, from April 1, 1917, as follows: A. W. Berresford, Cutler-Hammer Manufacturing Company; L. W. Downes, D & W Fuse Company; E. B. Hatch, Johns-Pratt Company; B. E. Salisbury, Pass & Seymour, Inc.; R. K. Sheppard, Simplex Wire & Cable Company. The board will elect officers later.

Patriotism at the Banquet

Decorations in the banquet room in the evening were in keeping with the patriotism which characterizes the times. Every one present had a tiny flag and the flags and national colors were draped over the speakers' table, while in the center electric lamps blazed the initials of the association. During the evening the guests drank a toast to the President of the United States and patriotic songs were sung. Mr. Debevoise was the toastmaster, and the speakers were Edward N. Hurley, retiring chairman of the Federal Trade Commission, and the Hon. Job. E. Hedges. Mr. Hurley discussed the question "Are We, as Business Men, Doing Our Duty?" Mr. Hedges made a stirring patriotic address.

Are We Doing Our Duty as Business Men?

Mr. Hurley traced the development of the cost accounting movement in the commission and then took up the subject of the duty of business men to safeguard their own interests. He said in part:

"Is it fair to the President of the United States, the Governor of our State and our Congressmen, that business men, who are directly concerned regarding legislation and laws that have been enacted, or are to be enacted in the public interest, continue to be indifferent towards these measures by not giving them any attention or support? How can business men intelligently criticize government unless they pay some attention to these important questions and are familiar with the facts?

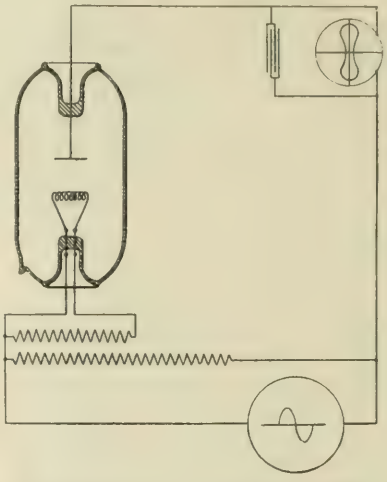
"We must not allow our prejudice, no matter what party is in power, to affect or bias our better judgment. We must be business men first and partisans second. If we do this, I know that we will be better business men and our country will profit by our counsel and advise.

"One of the real needs among American business men to-day is a broad view of business and a comprehensive grasp of industry as a whole. Too many American manufacturers and merchants center all their energy and attention upon their particular establishment and the work of making profits for it. Men at the head of factories need the point of view of what might be termed as the 'statesmanship of business.' They need to appreciate the fact that their plant is only a part of a great industry; that their individual welfare depends very largely upon the welfare and progress of the whole industry and of industry in general."

CREST VOLTAGE INDICATOR

Method Whereby Reading Is Maintained Long After Puncture Pressure Is Established

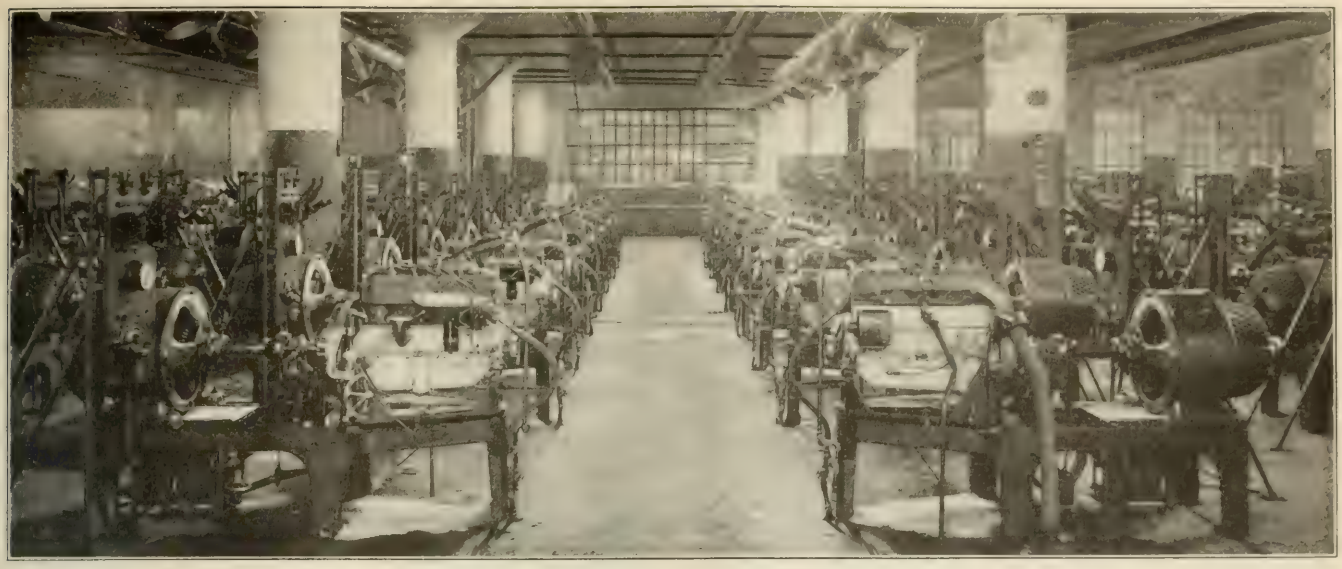
In testing insulating materials for dielectric strength or puncture value, where it is probable that the maximum value which causes the breakdown depends on the wave form it is often desirable to know the maximum or crest value of the alternating voltage wave. In patent No. 1,209,766 Dr. Clayton H. Sharp, director of the Electrical Testing Laboratories, New York, discloses a very effective method by which a crest-voltage indicator can be made to maintain its reading for a considerable period after the puncture pressure has been established.



ARRANGEMENT OF FLEMING VALVE, CONDENSER AND VOLTMETER FOR CREST VOLTAGE MEASUREMENTS

A Fleming valve of the general type used in wireless work is placed in series with an electrostatic voltmeter connected across an alternating-current line. If the current through the valve during the first quarter cycle has not been sufficient to raise the potential of the voltmeter to the full-peak voltage of the wave a certain amount of electricity will flow into the voltmeter during the fifth quarter cycle of the voltage wave and similarly a smaller amount may flow during the ninth, thirteenth, etc., quarter cycles until the potential indicated by the voltmeter has become the same as that of the peak of the voltage wave. Thereafter no current will exist except such as may be necessary to supply the leakage from the voltmeter and connected apparatus shown.

It has been found desirable to place a condenser having a considerably larger electrostatic capacity than that of the ordinary apparatus in parallel with the voltmeter in order to serve as a storage reservoir of charge flow. Both the condenser and voltmeter then become charged to the maximum voltage of the wave and the voltmeter will indicate this value in volts. If, when this condition has been obtained, the voltage on the line is for any reason reduced as, for example, by the puncture of insulating material under test, the voltmeter needle will retain its maximum position, dropping back toward zero slowly at a rate which depends upon the capacity and the leakage.



Engine Testing Made Cheaper and More Rapid by Electricity

How the Testing Department of a Toledo Automobile Plant Improved Its Facilities and Was Made Self-Supporting by the Adoption of Electrical Methods on a Large Scale

WHILE there is nothing particularly new about employing electric generators to load gasoline engines under test, the engine test room of the Toledo plant of the Willys-Overland Company is interesting because this method has been used so extensively. In addition the control arrangements are novel.

The test room, which is 120 ft. square, contains 100 engine testing stands arranged in ten rows of ten stands each. Each set includes a 10-hp. 500/1200-r.p.m., 230-volt, direct-current Westinghouse type S.-K. shunt-wound generator, semi-inclosed on the commutator end and a panelboard carrying control equipment and an ammeter. A single feeder connects each row of these sets to as many busbars at the main switchboard through a 400-amp. circuit breaker. The buses of this board are in turn fed from a 200-kw. motor-generator set or from a 300-kw. rotary converter housed in one of the company's substations. The line from the main buses to the motor-generator set passes through a 1200-amp. circuit-breaker set to trip at 1600 amp. The 300-hp. synchronous motor of the main motor-generator set receives its energy, when the set is supplying power to the test room, from the lines of the Toledo Railways & Light Company, and delivers power back to the central station system when the energy generated in the test room exceeds the local requirements. A commutator-type, 230-volt direct-current General Electric watt-hour placed on the main switchboard and connected in the main motor-generator circuit, records incoming and outgoing energy.

The direct-current motors were selected for this service because they afforded the wide speed range necessary in testing. Induction-type motors were tried in this service, but proved less satisfactory than the direct-current machines. Two hundred and thirty volts was chosen as the potential because a motor-generator set designed for this pressure was on hand and could be used advantageously in this work. The cycle of operations practically fixed the speed range of the motors between 500 and 1200 r.p.m. The semi-enclosed construction on the commutator end of the machines was considered desirable to eliminate troubles which might occur from falling material, overhead crane hooks and the like.

The cycle of testing operations is of interest since it shows what a large amount of work must be done on and by a gasoline engine in the electrical "limbering up" process employed in this plant. When the engines arrive at the test room they are completely assembled, even the automobile clutch being attached to the shaft. They are set on the concrete testing blocks by a traveling, motor-operated, Sprague hoist. After the testing motor is brought up to a speed of 500 r.p.m., (when the resistance has all been cut out of the armature circuit) the automobile clutch is closed thereby coupling the engine shaft to the revolving direct-current motor. The flywheel effect of the motor is sufficient to do what the factory men call "break the set in the bearings"; that is, overcome the high static friction which exists in a new engine despite the fact that the bearings are given a preliminary run before the engine is tested.

"Breaking the set in the bearings" overloads the direct-current motor about 300 per cent for a period of from one to three minutes, after which the load drops to normal. The motor is then allowed to drive the engine at 500 r.p.m. for about 30 minutes, when the load will have decreased to about 20 per cent full-rating of the direct-current motor. The speed is then increased to 700 or 800 r.p.m., and the set operated for one hour to one and one-half hours, depending on the condition of the engine. This process of driving the engine is called "running in," in factory parlance.

After a period of another one and one-half to two hours, artificial gas is admitted to the engine intake manifold through a mixing valve, the magneto switch is closed, and the engine is allowed to drive the direct-current machine, as a generator. An adjustment in the throttle valve is made at this time to regulate the load carried to about 25 amp. This current is maintained for one-half hour to one hour; then the speed

is increased to a value between 800 r.p.m. and 1200 r.p.m. to load the unit to 50 amp., the full-load rating of the direct-current generator. After a full-load run of one hour the engine is taken off the block.

To control the equipment in these operations and provide automatic protection against contingencies which might arise, the following methods and arrange-

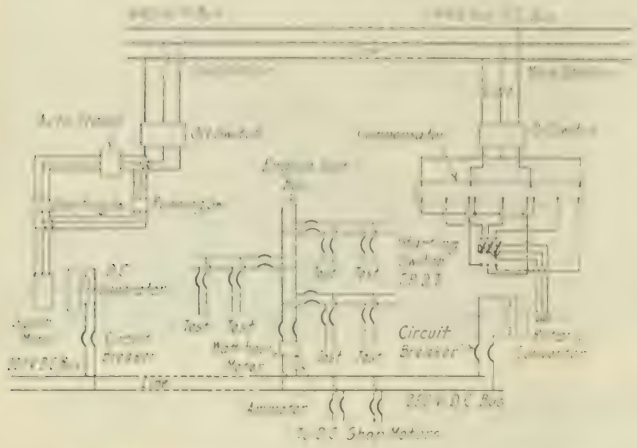


FIG. 1—CONNECTIONS OF ENGINE-TESTING CIRCUITS

ments have been employed. The direct-current motor of each set is brought up to a speed of 500 r.p.m. by cutting resistance out of the armature circuit, and its speed is increased beyond that point to 1200 r.p.m., by inserting the same resistance in the shunt-field circuit. Circuit protection at each set is afforded by a single-pole circuit breaker in each side of the line. One of the breakers is set to open on 400 per cent overload and is expected to open only on short-circuits. The other is set at 125 per cent overload. When the automobile clutch is closed to "break the set of the bearings" it is necessary to hold the low-set single-pole breaker closed, thus the operator is required to stay beside a unit until the "set has been broken" and the load has dropped to the rating of the motor.

Each of the single-pole breakers is equipped with a

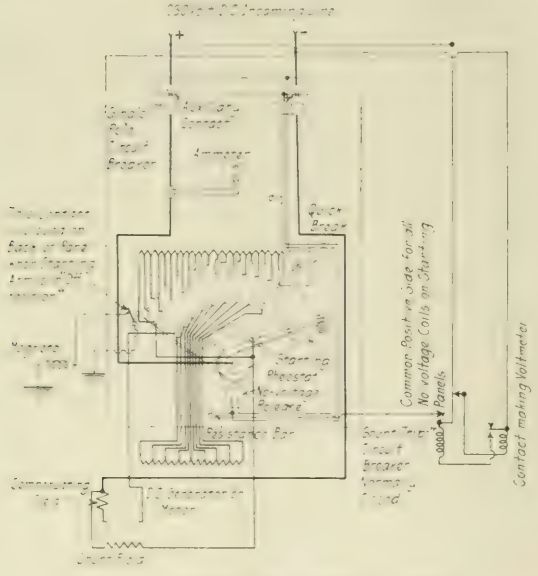


FIG. 2—WIRING OF CONTROL PANEL

special contact so that when a breaker opens, it also opens the no-voltage release circuit on the direct-current motor starter, allowing the handle thereof to swing to the "off" position. When the handle reaches this position it closes an auxiliary switch which short-circuits the engine-driven, high-tension magneto through a ground thus preventing ignition of the gases. Without this arrangement the set would continue to operate after being disconnected from its load, and might be damaged from over-voltage and high centrifugal strains set up by the ungoverned engine.

To avoid a somewhat similar case of trouble, which would occur if the large motor-generator set failed with a large number of the smaller units pumping into it, a contact-making voltmeter has been placed in the main motor-generator circuit. If a set starts to race the voltmeter closes a contact actuating a shunt-trip circuit breaker which, in turn opens the no-voltage release circuits on the entire 100 sets. This operation has the same result as in the former case, that is, it short-circuits the magneto and stops the engines. Three emergency push-buttons located in various parts of the test room are connected in multiple with the contact-making voltmeter circuit, so that the entire plant can be stopped if necessary.

Since the energy output of the test room exceeds the energy consumed, efficiency was not the controlling factor which prompted the selection of the testing equipment used. The chief requirements were increased production, a better product, and decreased maintenance

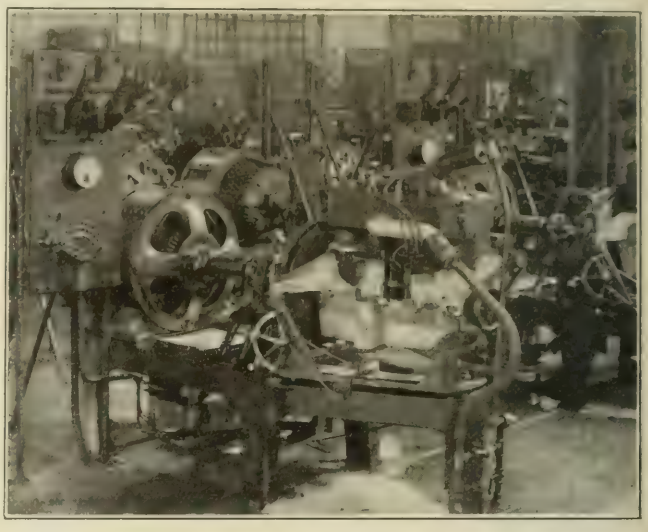


FIG. 3—ENGINE MOUNTED FOR TESTING

cost of test equipment. As for increased production, 100 per cent more engines were tested by the electrical method with less labor expense than by the old belt-and-jack test method. The absence of belts also improves the factory appearance, increases safety to employees and reduces noise. The electric testing equipment also facilitates mounting engines, it taking only two minutes for two men to set up a four-cylinder engine ready for test. The ammeter in the electrical circuit is an added convenience for the testers, since rapid fluctuation of the needle indicates that a cylinder is "missing fire." These conveniences with the quieter test room aid in "sounding out" motors, and thus insure higher quality in the product.

Although no accurate maintenance costs with the belted equipment are available, men who have been in test-room service for a long time declare that the two systems are not even comparable on this score. With the belted units there was nothing but trouble and expense. On the other hand during the two years that the electrical testing units have been operated there has been no trouble and practically no maintenance expense aside from lubrication.

Saving of energy, ordinarily wasted in brake tests, was of course one consideration in selecting the electrical equipment. With the test room running at full

capacity about 400 engines have been tested in a nine-hour day. During a period of this length from 200 kw.-hr. to 250 kw.-hr. will be pumped back either into the company's general direct-current network or into the lines of the central-station company. This energy is not produced inexpensively, however, since it originates from natural gas fuel burned in many comparatively small engines. The flow of energy at the end of a day is always from the test room—not toward it—notwithstanding the fact that all of the energy consumed by the crane hoists, exhaust fans, the mercury-vapor lamps and other auxiliaries is charged to the test room.

Seventy similar sets have been installed at the Elyria (Ohio) plant of the Willys-Overland Company for testing Knight engines according to W. A. Hill, electrical engineer for the company, since the Toledo installation has proved so satisfactory. One of the details in which the Elyria plant will be different, however, is the type of direct-current motor, since Knight engines require higher speeds in testing. At this plant a scheme will also be worked out for injecting steam into the exhaust header, so that fires which sometimes start therein can be quickly quenched.

The entire cost of the testing equipment and its installation at Toledo, exclusive of the large motor-generator set, which was on hand, was $40,000.

Electricity vs. Other Power for Coal Mines

Results Obtained in a Western Coal Mine by Changing from Steam to Steam-Electric Operation, with Data on Electric and Air Operation, and Cost of Using Locomotives in Place of Rope Haulage

BY CORNELIUS WEBER

HAVING been actively connected with the rehabilitation of a Western coal mine, especially from the motive-power standpoint, the writer will endeavor to point out how a change from steam to steam-electric operation affected the running expenses and output of the mine. In addition data will be presented to show how electric operation compares with air operation.

The mining company referred to was working two properties and opening a third. The first two were located 1 and 2 miles respectively from the power house and tipple, and in opposite directions from the latter. The power house, which was operated before steam-electric drive was adopted, included four air compressors and two hoisting engines directly connected to steam engines. The former furnished compressed air at 80 lb. pressure for operating the mining tools and equipment, and the hoisting engines were used to pull trains of coal cars from the mines to the tipple.

In addition to the apparatus in the main power house the following steam apparatus was used: One steam engine for operating the crusher plant and tipple, and one hoisting engine for pulling cars to the tipple (both engines operated by one engineer); one box-car loader engine, and two boiler and engine plants of 35 hp. each, one at each mine for operating ventilating fans. The latter plants each required three engineers on eight-hour shifts. Compressed air was delivered to the mines in opposite directions from the main plant through 8-in. mains. The air left the compressors at a temperature above boiling and cooled to the surrounding air temperature by the time it reached the mines. There the air was used for operating rock drills, coal-cutting machines or punchers and pneumatic pumps, the latter being ordinary steam pumps driven by air. An idea of operating conditions with steam drive can be obtained by an examination of the data in Table I. Interest, depreciation, etc., are not included in the expenses listed.

The condition under which electric service was adopted was that the local central station company should build and maintain an electrically driven air-compressor plant at its own expense and furnish electricity at 1 cent per kilowatt-hour. A 44,000-volt, 3600-kva. substation was built and motor-driven compressors were installed. Contrary to the original plans the old steam haulage system which pulled the coal trains with rope drives extending to the mines was retained, thus making it necessary to maintain a part of the original boiler plant. After the new power house was placed in service the operating expenses were as in Table II.

From the data given in Tables I and II it can be seen that a saving of $1,110.30 per month resulted by changing from steam to steam-electric drive, the items mostly responsible for the saving being the elimination of engineers and firemen and the reduction of coal consumed, which in round numbers cost the company $1 per ton on an average. In addition to this saving there was the elimination of interest, depreciation, insurance, etc., on a new plant which the mine operators would have had to build had they not accepted the proposition made by the electric service company. These items would have assumed considerable proportions.

TABLE I—MONTHLY OPERATING EXPENSES WITH STEAM EQUIPMENT

	Value of Coal Consumed	
	Working Days (26)	Idle Days (4)
Haulage system	$455.00	$46.00
Breaker plant engines	215.00	....
Steam heat and radiation	420.00	56.00
Electric light engine	237.00	36.00
Air compressor engines	1,475.00	85.00
Steam auxiliaries	14.00	1.00
Machine shop engine	7.00	....
Conveyor engine	27.00	....
Tipple engine and leakage	86.00	....
Ash-haulage engine	5.00	....
Total	$2,941.00	$224.00

	Labor Expense	
	Working Days (26)	Idle Days (4)
Firemen at $3.35 per day	$1,219.40	$80.40
Ash handlers at $2.90 per day	377.00	34.80
Water tenders at $3.35 per day	261.30	40.20
Boiler washer at $3.35 per day	87.10	....
Total	$1,944.80	$155.40

Supplies per month	$204.80	Ventilating Fans in Two Mines	
Engineers' wages per month	645.00	Value of coal for 26 working days	$175.00
Additional labor, machinists, carpenters, etc.	540.30	Engineers' wages per month	625.00
		Supplies per month	85.00
Total	$1,390.10	Total	$885.00
		Grand total	$7,540.30

Since the steam-driven haulage plant was a source of great waste and inconvenience, the writer made a thorough investigation and prepared an estimate of the cost of installing electric locomotives, which is given in Table III, and of the saving that could be effected thereby, Table IV. From the figures given in Table IV it may be seen that an electric haulage plant, such as proposed, would have paid for itself in two years and would have permitted future saving in the total cost

of operation greater than the compressor plant could alone bring about.

While the changes made in the mine motive-power equipment can hardly be classed as complete electrification, they proved to have many advantages. At the time that this electrification was in progress the mining company was opening a third property. Electric drive was employed exclusively there and electricity was applied directly at the tools. High-tension alternating current was stepped down to 2300 volts to operate an induction motor which in turn was directly connected to a 250-volt direct-current generator serving the mine locomotives. The 2300-volt energy was stepped down to 440 volts to operate the tools and machinery.

Owing to the presence of iron pyrites, chain coal-cutting machines were not used, but electrically driven coal-punching machines, electric rock drills, electric pump motors, ventilating fans and an electric locomotive haulage system were installed. By the direct application of electricity at the various driven tools, great

TABLE II—MONTHLY OPERATING EXPENSES WITH STEAM-ELECTRIC EQUIPMENT

	Value of Coal Consumed	
Steam Plant	Working Days (26)	Idle Days (4)
Haulage system	$155.00	$46.00
Breaker-plant hoisting engine	9.00	....
Steam heat and radiation	420.00	
Miscellaneous	40.00	95.00
Total	$924.00	$141.00

	Labor Expenses	
	Working Days (26)	Idle Days (4)
Firemen at $3.35 per day	$348.40	$40.20
Ash handler at $2.90 per day	75.40	....
Water tenders at $3.35 per day	174.20	13.40
Total	$739.00	$53.60

Supplies for the month	$145.00
Engineers' wages per month	312.00
Additional labor, machinists, carpenters, etc	550.00
Total	$1,007.00

	Cost of Electric Energy	
Electric Plant	Working Days (26)	Idle Days (1)
Breaker plant motor	$78.30	.....
Compressor motors (2)	2,680.00	$228.00
Machine shop motor	9.60	.....
Station lighting	9.00	1.50
Total	$2,776.90	$229.50

Supplies per month	$40.00
Engineers' wages per month	312.00
Additional labor, machinists, carpenters, etc	140.00
Ventilating fan motors	208.00
Total	$929.50
Grand total	$7,430.00

TABLE III—ESTIMATE OF THE COST OF INSTALLING AN ELECTRIC-HAULAGE SYSTEM

Based on installing a 500-volt direct-current haulage system 21,600 ft. long and designed to operate two 12-ton locomotives, one 15-ton unit and one 8-ton gathering locomotive.

Materials	
Overhead construction	$3,100.00
Switchboard	393.00
Switchboard accessories	82.00
Total	$3,575.00
Station Generating Equipment	
One 200-kw., direct-current, 500-volt (no load), 550-volt (full load), commutating-pole generator, direct-connected to 350-hp., 2200-volt, 60-cycle, three-phase alternating-current motor on common bedplate, and equipped with suitable starter	$3,600.00
Locomotives	
One 8-ton gathering locomotive	$2,220.00
One 15-ton locomotive	2,825.00
Two 12-ton locomotives at $2,480 each	4,960.00
Total	$10,005.00
Foundations for motor-generator set	$145.00
Freight	
Locomotives	$450.00
Motor-generator set	500.00
Switchboard	15.00
Line material and accessories	435.00
Total	$1,400.00
Labor	
Unloading motors and machinery and assembling machinery and switchboard	$200.00
Labor on line construction	700.00
Total	$900.00
Cost of strengthening present trestles to carry locomotives	$720.00
Grand total	$20,345.00

economy was obtained in power requirements and, for the greater part, labor items were eliminated. The electrically operated mine produced coal on a much smaller scale than the air-operated mines, owing to the fact that the latter were only being opened. However, even during the first stages of operation it was demonstrated that a high economy could be obtained with electric operation, as the comparisons in Table V show.

From these figures it may be observed that, with haulage included, the energy consumption is only a small part of that in the air-operated mines. It must also be borne in mind that in addition to the energy consumption charged to the air-operated mines there is the additional labor expense of operating the haulage system, which amounts to $10,556 per year or 2.9 cents per ton. It is apparent that the direct application of electric power at the machines and an electric haulage system greatly reduce the unit energy consumption, the total energy expense for the air-operated mines being $0.0817 per ton and for the electrically-operated mines $0.02385 per ton. The latter figure includes haulage, whereas the preceding figure does not. Furthermore, the unit energy expense of operating air mines should be increased by $0.029 per ton to cover additional labor, thus bringing the equivalent cost to $0.1407. In addition the electrically-operated mine requires no station operator, the motormen and blacksmith being selected to oil the machinery and operate the circuit breakers.

The installation of the electric machines, however, was not made without difficulty. In the first place the operators viewed the new machines with resentment. A man sent by the company which manufactured the machines was retained as a demonstrator. In one day he cut as much coal as an air-machine operator, the coal produced per machine being about 50 tons per day. All machine operators were paid on a square-foot basis, at the rate of $0.0205 per square foot for wide work and $0.0315 per square foot for narrow work. A certain minimum wage for these operators and helpers was established by the labor union. While hard-working air-machine operators could make a considerable amount in excess of this minimum wage, it was found that they could not cut as much coal when they shifted to the electrical machines as formerly, the result being that with a fair day's work they could not make much in excess of the established minimum. It was soon observed that these operators preferred to "take it very easy" and receive the minimum wage rather than exert themselves and make only a slight amount in excess of this minimum. As a result the coal production per man began to drop off, and it was found necessary to make a change in compensation rates for work done with the electric machines.

The reasons why the electric machines seemed to be more difficult to operate were their lighter weight and the fact that the pick moved through a fixed distance at every stroke. With air machines, on the other hand, the operators could feed their machines as fast as desired, the result being that the stroke would adjust itself. In the case of the electric machine, feeding too

rapidly caused the machine to kick back and endanger the operator. Furthermore, the lighter weight of the electric machine tended to aggravate this disadvantage. A careful study of the whole situation revealed the fact that a good electric-machine operator could not compete with a good air-machine operator. However, raising the rate per square foot for the electric-machine operator was a great inducement for the men to exert themselves, and the results were very gratifying, as the data given in Table V indicate.

It was found that the electric rock drill was not capable of drilling as many holes as the air machine, also that the air machine was far more convenient to move around and set up. Much time and thought were spent to improve the machines and various kinds were tried, but none could do what the air machines were capable of doing. However, as the total cost of production was so materially reduced, this disadvantage of the electric rock drill was offset. The chief disadvantages of the electric rock drills are their excessive weight, bulk and complexities. The writer has the opinion that a big future would be in store for a successful drill that would consist of a plunger oscillated back and forth by two solenoids. Such a machine would have nearly all the characteristics of an air machine. Efficiency would not be a deciding factor in selecting electric drills, as the air drills are very inefficient.

All of the preceding data show the comparative costs of energy under various conditions without regard to the final cost of producing coal. Although conditions vary in the different mines, none of the mines referred to required shafts, as they had entrances from ground level. Loading was paid for on a tonnage basis. The only items affected by electric drive were energy costs, machine operation, labor and haulage. The electrically operated mine produced only about 150 tons of coal per working day, while the air-operated mines, which were well developed, produced about ten times this amount. Consequently, the smaller mine had relatively high overhead charges and could hardly be expected to produce as cheaply under ordinary conditions as the larger mines. However, the labor and energy costs in the case of electrical operation on a small scale are actually lower than the same items in the case of air operation, as data in Table VI will show.

When the figures in Table VI were compiled the electrical mining machine operators were receiving a fixed wage per day on account of the fact that a rate adjustment was in progress. The result was that the machine operators did not work as ardently as usual, produced less coal, and naturally increased the cost per ton. The cost per ton ($0.321) is therefore higher than normal. If haulage expenses could have been included the difference would be far greater.

Since the mines referred to in this article were equipped a chain-type cutting machine capable of operating any fields in which iron pyrites are much in evidence has been developed, so the disadvantages cited above for electrical coal cutters will undoubtedly be overcome. With the remarkable results mentioned in this article and with purchased power at 1 cent per kilowatt-hour balanced against steam operation, it is quite possible that a modern electric generating plant which is located at a coal mine would prove to be a good dividend payer.

TABLE IV—ESTIMATE OF SAVING THAT COULD HAVE BEEN EFFECTED BY REPLACING ROPE-HAULAGE WITH AN ELECTRIC LOCOMOTIVE SYSTEM

Labor Items Eliminated

No. of Men	Classification	Rate Per Day	Total Per Day	Days Per Year	Total
2	Trip riders	$3.75	$7.50	240	$1,800.00
1	Rope cutter	3.15	3.15	240	756 00
2	Connection men	3.40	6.80	240	1,632.00
1	Rope splicer	3.75	3.75	365	1,368.75
2	Pulley repairers	3.75	7.50	240	1,800.00
5	Drivers	3.15	15.75	240	3,780.00
3	Firemen	3.35	10.05	365	3,668.25
2	Engineers	4.00	8.00	365	2,920.00
	Total per year				$17,725.00

Labor Items Introduced

No. of Men	Classification	Rate Per Day	Total Per Day	Days Per Year	Total
4	Motormen	$3.60	$14.40	365	$5,256.00
1	Helper	3.40	3.40	300	1,020.00
	Total per year				$6.276.00

Miscellaneous Items Eliminated		*Miscellaneous Items Introduced*	
2400 tons coal at $1 per ton	$2,400.00	Electrical energy	$2,400.00
Feed for five horses	550.00	Oil for locomotives	200.00
Oil for pulleys	400.00	Depreciation on locomotives	500.00
Depreciation on rope	1,200.00	Depreciation on motor-generator	200.00
Depreciation on pulleys	600.00	Brakeshoes	500.00
General repairs	200.00	Other repairs	300.00
Total	$5,350.00	Total	$4,100.00
Grand total of items eliminated	$23,075.00	Grand total of items introduced	$10,376.00

Annual saving = $23,075—$10,376 = $12,669.

TABLE V—COMPARISONS OF OPERATING CONDITIONS IN AIR-OPERATED AND ELECTRICALLY EQUIPPED MINES

Compressed Air Mines (Motor-Driven Compressors)	
Tons of coal produced per working day (average)	1,485
	Kw.-hr.
Compressors	228,000
Crusher plant	3,750
Fans	13,470
Slack coal conveyor	820
Lighting	1,650
Total	247,690
Tonnage produced per month (average)	30,300
Unit energy consumption (in kilowatt-hours per ton of coal produced) (average).	
Compressed air	7.52
Crushing	0.123
Ventilation	0.444
Miscellaneous	0.08
Total	8.168
Average coal consumption (in pounds per ton produced):	
Previous to electrification	114.4
After electrification	27.2
Ratio of power-plant labor expense after electrification to same expense before electrification	60.6
Electrically Operated Mine	
Tons of coal produced per day	4,444.3
Energy consumption in kilowatt-hours:	
Mining machines—drills, pumps and electric hoist combined	3,290
Ventilating fan	1,675
Haulage system	5,725
Total	10,680
Unit energy consumption (in kilowatt-hours per ton of coal produced:	
Mining machines, drills, pumps and hoist	0.718
Ventilation	0.377
Haulage	1.29
Total	2.385

TABLE VI—MACHINE LABOR AND ENERGY COSTS FOR ONE MONTH

Air-Operated Mines	
Wages of machine men, drillers and helpers	$4,872.00
Wages of power-plant operators and mechanics	500.00
Cost of electrical energy to operate air compressors and fans	1,632.00
Total	$7.004.00
Number of tons of coal produced	20,737
Cost of above items per ton	$0.338
Electrically Operated Mines	
Wages of machine men, drillers and helpers	$1,377.55
Cost of electrical energy, mining machines, pumps and drills	32.00
Ventilating fan	16.00
Total	$1,425.55
Number of tons of coal produced	4,444
Cost of above items per ton	$0.321
Balance in favor of electrically operated mine (per ton)	$0.017

STATION AND OPERATING PRACTICE

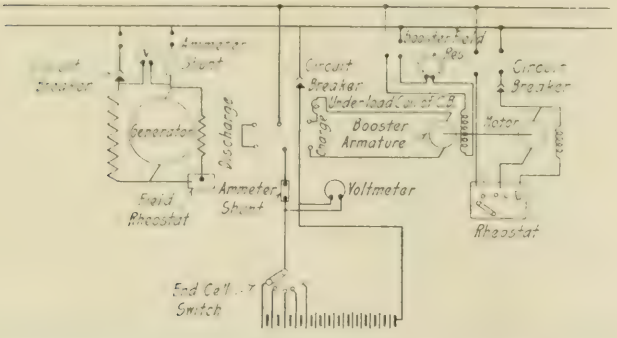
A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

REMEDYING BOOSTER TROUBLE

Straightening Mix-up in Connections and Changing Method of Excitation, Corrected Polarity and Voltage

BY H. L. HERVEY

While the wornout commutator of a booster armature, which had been in constant service for eighteen years, was being replaced, the old and brittle coil insulation was accidentally cracked by moving the coil leads. As soon as the machine was started a number of short-circuits developed, necessitating the rewinding of the armature. Since the pitch had not been counted before



CONNECTION OF BOOSTER WITH SUPPLY AND BATTERY CIRCUIT

the commutator was disconnected the first time, it was necessary to determine the coil throw. As there were ninety-one wave-wound coils the lead pitch had to be either 1 to 46 or 1 to 47, depending on whether a retrogressive or progressive connection was used. Both connections would work satisfactorily, but the polarity of the generated emf. would be different for the two connections. To experiment a retrogressive connection of 1 to 46 was used. In disconnecting the booster another obstacle was introduced by the engineer neglecting to mark any of the connections. When the machine was started with the new armature, the polarity built up in the wrong direction, showing that a progressive connection should have been used. After the engineer had made several changes in the external connections of the booster without getting the correct combination, the writer was called in to locate the trouble.

On starting the set the voltage rose in the right direction, so the generator was connected to the battery. Instead of obtaining a charging current of 40 amp., however, the highest that could be obtained with all the resistance cut out of the field rheostat was 25 amp. This condition indicated a reversed series field connection. After reversing the series field, the load was again connected, but the ammeter needle went off the scale, showing that the machine was too highly over-compounded. The series winding was then cut out, leaving a separately excited shunt-wound booster. It is not known whether the series coils were in use before the machine was taken down or not, but since they were cut out the generator end of the set has been running much cooler than formerly and very satisfactory voltage regulation is obtained.

THE EFFECT OF SOOT ON BOILER EFFICIENCY

Results of Tests Made on Oil-Burning Boilers Before and After the Installation of Soot Blowers

Tests have been made by the superintendent of power, Pacific Gas & Electric Company, on the efficiency of soot-blowing apparatus installed in the two 822-hp., oil-burning Stirling boilers at Station A. The equipment on each boiler consists of six revolving units, one at the top and one at the bottom of each pass. Each unit consists of a 2-in. pipe extending the entire width of the boiler, with special Venturi nozzles placed between the lines of tubes. The pipe is revolved by means of a chain wheel on the boiler side, thus blowing the steam between the tubes. When blowing tubes the path of the furnace gases is followed and the dampers opened wide to allow the soot to be carried out. As shown in the following test results, the temperature of the gases in the stack was decreased 69.25 deg. Fahr. (13.05 per cent) and the temperature of the superheated steam increased 3 deg. (0.6 per cent) by cleaning the tubes. Calling the efficiency of the boilers 70 per cent, this means a saving in fuel of 3.9 per cent due to dusting.

	Before Using Soot Blowers	After Operating Soot Blowers
Load meter	4.075	4.175
Per cent rating	101.88 per cent	104.38 per cent.
Steam pressure	199.5 lb.	200.75 lb.
Superheated steam	499.5 deg. Fahr.	502.5 deg. Fahr.
Stack temperature	553 deg. Fahr.	483.75 deg. Fahr.

The soot that accumulated on the tubes of the oil-burning boiler was a sticky, gummy substance which clung with great tenacity to the tubes. The soot blower used was made by the Diamond Power Specialty Company of Detroit.

USING TRANSFORMERS WITH DIFFERENT CHARACTERISTICS

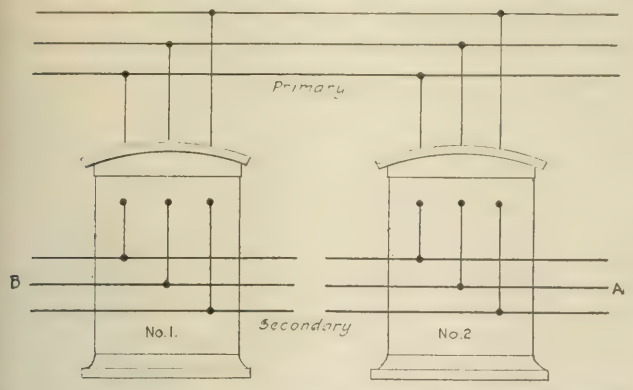
Proper Sharing of Load Insured by Separating Secondaries and Operating One Transformer with Reduced Ratio

BY E. C. PARHAM

The accompanying diagram shows the connections of two three-phase transformers tapped to the same high-tension primaries. By means of links located on the covers but not shown in the diagram, the secondaries can be connected for 115-volt or for 230-volt operation. One of the transformers shown, connected for 115 volts, was formerly used to supply the lighting service for a large mill yard. At that time it was connected to *A* and to *B* which represent service lines to opposite ends of the yard. Later it was necessary to install another transformer to take care of an increased load, one unit being connected to *A* and the other to *B*. Under this condition No. 1 carried more load than No. 2, although neither was fully loaded. Finally, however, No. 1 became so much overloaded that it was necessary to relieve it. Parallel operation was tried but the two units had such different characteristics that they failed to proportionately divide the total load. The condition

could have been improved by the installing of external reactances but the situation was further complicated by the excessive drop and the expense of installing more copper.

As relief was urgent, the operator replaced all of the 115-volt lamps of section *B* with 230-volt lamps and reconnected transformer No. 1 for 230-volt operation. The



TWO DISSIMILAR TRANSFORMERS USED FOR LIGHTING SERVICE

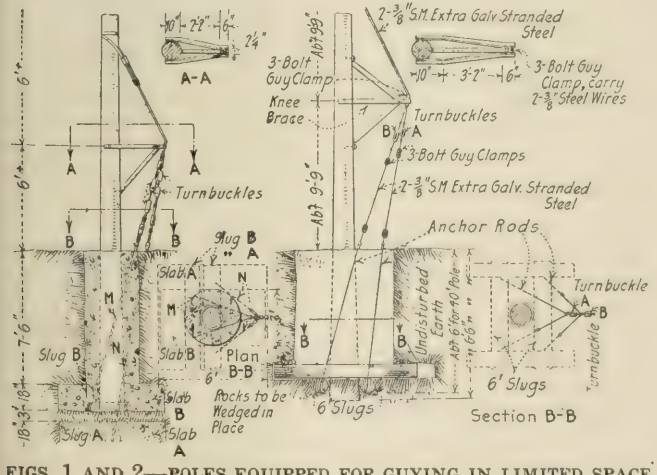
doubling of the voltage halved the current for the given load, halved the line drop for the given current, quartered the energy losses at all loads and solved the problem in a manner that was unobjectionable excepting that it was necessary to use lamps of two voltage ratings. As the 115-volt service was at one end of the yard, and the 230-volt service at the other end, there was little probability of applying low voltage lamps to the higher voltage lines.

GUYING POLES IN LIMITED SPACE

How Difficulties Were Overcome Where It Was Impossible to Secure Guying Rights on the Adjoining Land

BY H. B. SWEENEY

Where space for side guying poles in the usual manner is limited or not available, one of the large transmission companies of Pennsylvania employs the construction indicated in the accompanying drawings. A specific case which came to the writer's attention was



FIGS. 1 AND 2—POLES EQUIPPED FOR GUYING IN LIMITED SPACE

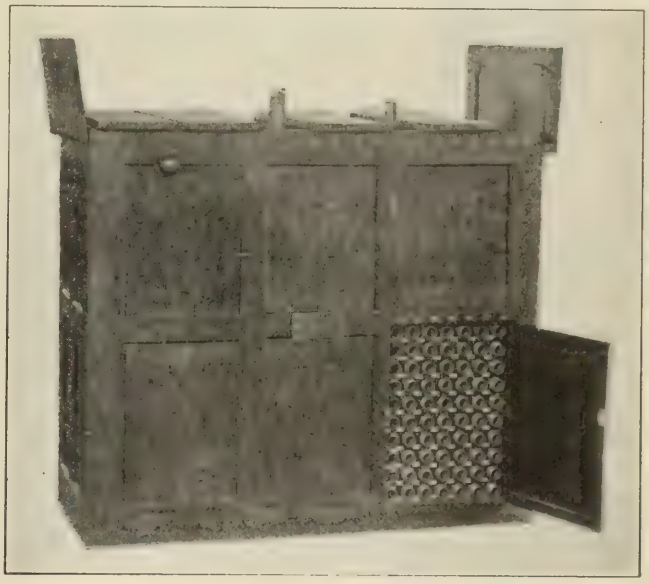
the guying of a pole at a sharp angle in the line where it was impossible to buy guy rights. A guy that might be called a combination knee-brace and truss guy was used. Fig. 1 shows a 45-ft. pole provided with such a guy. The knee is attached approximately midway between the ground and where the guy wires are fastened to the pole. With this construction two double guys are used. One set, *M*, is anchored to slug *B*, which is embedded in the same concrete slab as the pole, and is simply a brace to keep the pole from bending. The other double guy, *N*, serves the purpose of a side guy since it is anchored to the slug *A*, which is embedded in a slab *A* entirely independent of the pole.

Another case which came to the writer's attention was where the side guys on an angle pole had to be removed from the adjoining property. Since the line was an important high-tension circuit, service could not be interrupted, so the pole was temporarily guyed and trenches were dug to receive the slugs shown in the view *B-B* of Fig. 2. The slugs with their attached anchor rods were then securely buried. After guys had been hooked between the knee-brace and the anchor rods and drawn up taut by means of turnbuckles, as shown in the illustration, the temporary guys were removed.

FILING CABINET FOR BLUEPRINTS

Ready Reference Made Possible by Indexed Tubular Compartments in Which Prints Can Be Stored Compactly

Blue prints or maps may be easily filed in the 2-in. pasteboard tubes which are removable from the filing magazine shown in the accompanying illustration. These tubes slip into the fixed compartments which are



COMPACT, LARGE-CAPACITY MAGAZINE FOR PRINTS AND MAPS

arranged in twenty rows with ten in each row. Thirteen rows are 42 in. long and seven rows 18 in. long. In one of the lower corners are seven rows of horizontal tubes 24 in. long. Each fixed tube is numbered and the removable tubes are numbered to correspond. Numbers are also placed on the case opposite each row. With six maps in each tube, the magazine holds 1620 maps. The cost is said to be less than with drawer files, the space occupied a little over half as much, and the prints are not so liable to be torn.

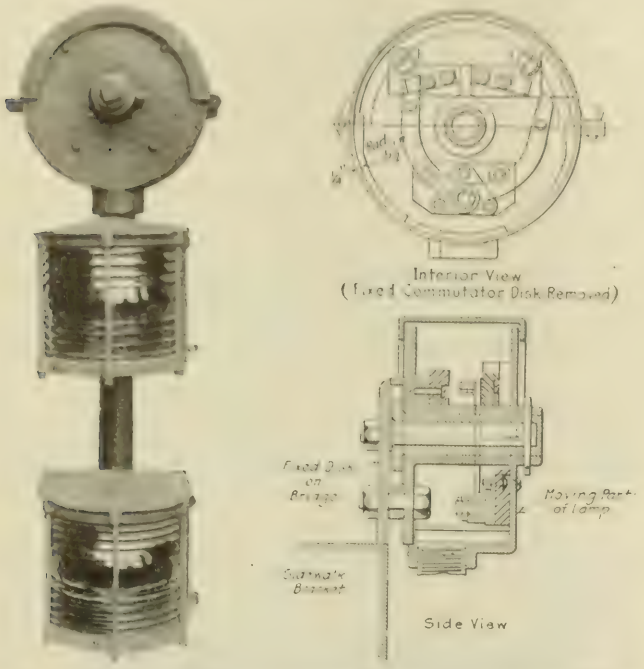
An indexed book is used in conjunction with the file to list the contents according to their numbers. This saves time ordinarily lost in reading titles. The maps are numbered on the back of all four corners, so that refiling is easy.

This magazine was made under the direction of and is patented by E. C. Deal, vice-president and general manager of the North Carolina Public Service Company, Greensboro, N. C.

LAMP FOR BRIDGE WARNING

Construction and Operation of Two-Color Channel-Light Lamp for Indicating Open or Closed Position of Drawbridge

After experimenting with mercury contacts and pendulum pipes swinging back of colored glass, F. H. Avery, engineer in charge of bridge repairs, Chicago, Ill., designed a drawbridge channel light like the one shown



LEFT—EXTERIOR VIEW OF CHANNEL LIGHT; RIGHT—INTERIOR VIEW—CHANNEL LIGHT DETAILS

herewith. It consists of two lamps hung on a pipe pivoted at its upper end to the end of the drawbridge. When the draw is raised the light is changed from red to green by a switch located at the pivoted end of the pipe. The switch contains no springs, being operated solely by gravity. As the span rises, the lamps remain vertical, pushing the jaw of the switch around by means of a cam passing through the bridge. The lamps can be rotated on the pipe in case a bridge crosses a channel at an angle. A line is attached to the bottom of the lamp and to the bridge hand rail, so that the lamp can be swung through 180 deg. Wherever possible the abutment lamps are hung on long pipes in the same manner.

The wearing surfaces are oiled from a pipe reaching from above the top of the casting covering the switch mechanism. The electric lamp bulbs are provided with spring sockets, as the filaments will not withstand the constant jar caused by traffic. Telltale lamps installed in a box in the bridgetender's house indicate when the lamps cease to burn.

Thawing Ducts with Hot Water

During the past winter ice formed in an unusual number of duct lines. To remove it several plans have been tried. Heated metal mandrils were used successfully, but slowly. Steam from a small boiler was also employed. The best method appeared to be to direct a stream of warm or hot water into the duct. This method was rapid and had the advantage of carrying away ice in chunks. The difficulty with the plan was one of supplying portable equipment that would deliver the water at temperatures and in quantities that could produce the desired result. One outfit fitted up for this purpose consisted of a small instantaneous gas heater set over a splicer's furnace. The furnace did not give sufficient heat. The gas heater was then suspended on a tripod over a large Wells light operated by kerosene. The flame from this apparatus gave plenty of heat, but was difficult to control. The arrival of warmer weather made further experiments with this apparatus impossible for this winter. It was thought, however, by the central station engineers in charge of the work that if some heat source of a size between that of the splicer's furnace and the Wells light were used the apparatus would be very successful.

INSPECTION SCHEDULE

Arrangements for Insuring Periodic Inspection of Station and Transmission Line Apparatus Used by Ohio Company

In the accompanying illustration is shown one side of an inspection report used by the Ohio Service Company of Coshocton, Ohio. This report covers all inspections that are regularly made, except those which must be reported on some special form. The other side has

SCHEDULE OF INSPECTIONS

January and July

First Week, Districts A & C.
Second Week, " B & D.

Switchboard Instruments (except watt-hour meters)
Low Tension Feeder Oil Switches and Relays
Insulation of Cables in Conduits.
Motor-Generator Sets and Control Devices.

Feb., Apr., June, Aug., Oct., Dec.

Second Week, Districts A & C.
Third Week, " B & D.

High Tension Oil Switches and Relays.
Switching Towers and High Tension Substations.

March and July

Third Week, All Districts.

Electrolytic Arresters and Grounds.
Low Tension Arresters:—Plants and Substations.
Transil Oil. H. T. Transformers, Oil Switches and Lightning Arresters.

March, June, Sept., Dec.

First Week, Districts A & C.
Fourth Week, " B & D.

Switchboard Watt-hour Meters.
Insulation of Generators, H. T. Transformers, Arc and Incandescent Street Lighting Transformers.

Jan., Feb., March, Apr., May, June, July, Aug., Sept., Oct., Nov., Dec.

First & Third Week, All Districts.

Transmission Lines, Poles, Anchors, Guys, Insulators, Conductors, Ground Wire, Trees, Land-Slides, River and Railroad Crossings.
Transmission Telephone Lines, Insulators, Transpositions, Trees and Undergrowth.

Jan., Feb., March, Apr., May, June, July, Aug., Sept., Oct., Nov., Dec.

Second Week, All Districts.

Transmission and Interurban Railway Telephones.

NOTICE: These reports are in triplicate and the first and second copies are to be held by inspector until report is complete. The third copy to be sent to the Manager immediately after inspection is made, and when the fault as found on inspection has been remedied, the first copy is to be sent to the Manager and second copy to Dist. Supt.

When no fault is found the first copy is to be sent to the Manager immediately, the second copy to the Dist. Supt., and the third copy destroyed.

FORM OF INSPECTION REPORT USED BY THE OHIO SERVICE COMPANY

space for the subject, location, date of inspection, results, and signature. Near the bottom is the heading "Following the above inspection, corrections have been made promptly to apparatus as follows," after which is left four lines for remarks, date and signature. It may be pointed out that lightning arresters are examined just before and during the lightning season.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

RURAL ELECTRIC SERVICE PROFITABLE IN WISCONSIN

Undesirable Ordinarily to Serve Small Individual Consumers from Transmission Lines with Voltages Over 6600

In the report of the committee on rural service before the recent convention of the Wisconsin Electrical Association, F. C. Babson, of Watertown, summarized the findings and opinions of the 1916 committee as follows:

First—The construction of purely rural service lines is not ordinarily warranted unless the saturation of service is such that a reasonable return on the added investment and sale of energy may be shown. Second—Rural service consumers on transmission lines of not over 6600 volts connecting towns or villages, are ordinarily profitable if a suitable minimum charge is made. Third—A suitable minimum charge to cover the higher cost of service for rural consumers should be made, variously estimated at from $2 to $3 per month. Fourth—A low second step in the energy rate should be provided so as to encourage a sufficient use of the service by the farmer to make it practical and attractive.

The total number of companies reporting rural consumers to the committee this year was twenty against eighteen for last year. Five companies which reported seventy rural consumers in 1915 did not report in 1916, but seven companies which did not report rural consumers last year reported 153 consumers this year.

An analysis of Table I, which covers reports from twenty companies, brings to light the following facts: First—In a moderate majority of cases the farmer pays for the extension of primary lines. Second—The cost of transformer installations is carried by the farmer in about one-half the cases reported and by the company in the other half. Third—In a large majority of cases the farmer pays for the extension of the secondary lines. Fourth—In a large majority of cases no refund on the cost of the extensions is made to the farmer where he has contributed to the expense of such extension. Fifth—In a large majority of cases single-phase motors are provided for on rural extensions, and provisions for motors over 5-hp. capacity, single-phase, are exceptional. Sixth—In a majority of cases lines have not been constructed exclusively for rural-service consumers, but have been extended from city lines into well-settled suburban or rural districts. A considerable portion of the rural consumers obtain service from low-voltage transmission lines, where the transmission voltage (up to and including 6600 volts) is stepped down direct to 110 or 220 volts. Seventh—In a majority of cases the rural service is reported to be profitable. It is interesting to note that with an average transformer capacity per consumer of 1.6 kw. and an average connected load per consumer of 2 kw., the income per consumer per annum is $39.

Table II recapitulates the findings in condensed form and compares the findings with those of 1915. The following inference may be reasonably deduced from the data shown: First—There is an apparent slight in-

TABLE I—STATISTICS OF RURAL LIGHT AND POWER SERVICE IN WISCONSIN FOR 1916

Name	Number Consumers	Maximum Dist. from Station, Miles	Farmer Pays for: Primary Line	Transformer	Secondary Line	Meter	Refund	Current: Single Phase	Three Phase	Direct	Maximum Size Single-Phase Motor	Lines for Rural Service Only	Profitable	Transformer Voltage	Lines Step Down Direct	Investment per Kw. Connected Load	Total: Kilowatts Connected Load	Kilowatt-Hours per Year	Transformer Capacity, Kilowatts	Income per Year	Per Consumer: Connected Load Kilowatts	Kilowatt-Hours per Year	Transformer Capacity, Kilowatts	Income per Year	Per Kilowatt—Transformer Cap.: Kilowatt-Hours per Year	Connected Load Kilowatts	Income per Year	Income per Kilowatt-Hour, Cents
Mineral Point	4	18	Y	Y	Y	N	N	Y	..	..	20	N	Y	13,200 33,000	N	..	2.4	2,066	4.0	$229	0.6	516	1 0	$57	516	0 6	$57	11*
Burlington	3	1¼	N	N	Y	N	N	Y	..	..	..	N	..	26,000	N	..	2.4	407	7.0	43	0.8	136	2.3	14	38	0 3	6	11
Edgarton	28	3	Y	Y	Y	N	N	Y	..	..	..	Y	Y	6,600	Y	..	44.0	11,000	45.0	900	1 5	400	1.6	32	244	1.0	20	8
Grand Rapids	3	2	Y	Y	Y	N	N	Y	..	..	3	N	Y	Under 6,600	Y	..	30 0	2,142	....	208	10.0	714	....	69	....	....	....	10
Green Lake	1	6	N	N	N	N	N	Y	..	..	5	N	N	6,600	Y	..	2.0	262	2.0	43	2.0	260	2.0	43	131	1.0	21	16
Ft. Atkinson	13	1½	Y	Y	Y	N	N	Y	Y	..	..	Y	Y	2,200	Y	*	18.3	7,547	17.5	601	1.4	580	1 3	46	431	1 0	34	8†
Durand	7	4	N	N	Y	N	N	Y	..	..	5	Y	N	6,600	Y	$60	5.0	2,084	14.0	156	0.7	298	2.0	24	148	0 3	12	8
Rice Lake	45	5	N	N	Y	N	N	Y	Y	..	15	Y	N	6,600	Y	..	....	3,871	60.0	608	..	86	1.3	13	60	..	10	16
Glenwood	5	½	N	N	Y	N	N	Y	..	..	..	Y	N	2,300	Y	..	....	....	7.0	204	..	....	1.4	41	....	..	19	
Janesville	6	15	?	N	?	N	N	Y	Y	..	7½	N	N	6,600	Y	..	6.7	1,637	6.0	160	1 1	273	1.0	27	273	1 0	27	10
Lake Mills	20	5	Y	Y	Y	N	..	..	Y	..	3	N	Y	6,600	Y	..	60.0	16,000	40.0	600	3.0	800	2.0	30	400	1 5	15	4
Oakfield	4	..	Y	Y	Y	N	Y	Y	Y	..	5	N	Y	6,600	Y	..	....	47,000	....	214	....	11,700	..	53	....	....	..	4‡
Sheboygan	163	7	Y	Y	N	N	Y	Y	..	Y	5	N	Y	13,200	N	..	....	322,022	....	11,152	....	68	..	68	....	....	..	3
Sturgeon Bay	21	2½	Y	Y	Y	Y	N	Y	..	..	3	N	Y	2,300	Y	..	....	....	32.0	450	..	....	1.5	21	....	....	14	
Lake Geneva	14	7	N?	N?	N	N	N	Y	Y	..	5	Y	Y	26,000	N	..	13 8	6,400	42.0	500	0.9	457	3.0	36	152	0 3	12	8
Hudson	4	..	Y	Y	Y	N	N	Y	Y	..	5	N	Y	13,000 13,000 6,000	Y	.	6.5	.....	6.5	200	1.6	....	1 6	50	....	1 0	21	
Grafton	14	3½	N	N	N	N	N	Y	..	..	10	N	Y	2,300	Y	.	20.0	....	40.0	....	1 4	....	2.8	....	....	0 5	....	
Baraboo	2	1½	..	..	..	..	Y	Y	..	..	..	N	..	....	..	‡	....	256	....	....	....	128	....	....	....	....	....	...†
Oshkosh	30	5	N	N	N	N	N	Y	..	..	7½	Y	Y	2,300	Y	‡	45.0	7,044	40 0	724	1.5	243	1 4	25	176	1.1	18	10
Beloit	32	2½	Y	N	Y	N	N	Y	..	..	20	N	Y	2,300	Y	.	75.0	17,775	....	1,617	2 3	555	....	50	....	....	....	9
Total reported	419	..	..	..	..												331.1	446,493	364.0	18,609	28.8	5,643§	26 2	$699	2,569	9 6	$286	136
Arithmetical average of those reporting	..	..	..	..	..																2 0	376	1 6	39	233	0.8	20	9

*Less than full year. †Suburban. ‡All power. §Oakfield out. ‖Probably suburban.

crease in the number of companies furnishing rural service and in the number of rural consumers being served. Second—The maximum distance of distribution has increased, indicating a decrease in saturation of service. Third—A large increase in total kilowatt-hour consumption and annual operating revenue. Fourth—A slight decrease in connected load and step-down trans-

TABLE II—COMPARATIVE STATISTICS OF LIGHT AND POWER RURAL SERVICE IN WISCONSIN IN 1915 AND 1916*

	1915	1916	Increase, per Cent	Decrease, per Cent
Total companies reporting		40 0		
Companies reporting consumers	18 0	20 0	11	
Number of consumers	366 0	419 0	14	
Average number consumers per company	20 0	21 0	5	
Maximum distance from station, miles	6 7	18		
Total connected load, kilowatts	471 0	331 0*		30
Kilowatt-hours sold per year	113,166 0	446,493 0	300	
Transformer capacity	429 0	376 0†		
Total income	$12,234 0	$18,609 0	51	
DATA PER CONSUMER—ARITHMETICAL AVERAGE				
Kilowatts connected load	2 3	2 0		13
Kilowatt-hours sold per year	375 0	376 0		
Transformer capacity	2 0	1 6		20
Income per year	$35 75	$39 00	9	
DATA PER KILOWATT OF TRANSFORMER CAPACITY—ARITHMETICAL AVERAGE				
Kilowatt-hours sold per year	299 0	233 0		22
Kilowatts connected load	1 0	0 8		20
Income per year	$32 6	$20 0		39
Receipts per kilowatt-hour	11 cents	9 cents		18

*Three companies with 165 consumers reporting in 1915 did not report in 1916. Total kilowatts connected load reported by these companies in 1915 317 kilowatts.
†Transformer capacity not reported by five companies.

former capacity per consumer, but a noticeable increase in the average revenue per consumer, which would indicate a greater use of the connected load and transformer capacity than in 1915. Fifth—There is an apparent reduction in the kilowatt-hours sold per kilowatt of transformer capacity, which would further indicate a tendency toward less saturation of business.

The feasibility and desirability of offering service or actually serving rural consumers along new or existing transmission lines of not over 6600 volts the committee believed to be a well-established fact.

It does not seem to be desirable ordinarily to serve small individual consumers from important transmission lines with voltages over 6600, unless the service can be delivered through the medium of local lower-voltage distribution lines.

NEWSPAPER PUBLICITY FOR THE CENTRAL STATION

Local Superintendents of Southern California Utility Receive Prizes for Greatest Number of Column Inches

At the recent annual convention of the Southern Sierras Power Company employees, held in Riverside, Cal., a surprise was announced in the shape of three $10 prizes which went to the local superintendents from towns where the greatest number of column inches had been published in the local newspapers relative to company activities. The towns which the company serves had been divided into three classes: those in which there existed one, two or three newspapers respectively, and the premium was given to the local superintendent who had secured the most publicity in each class.

The town in which headquarters was located was excluded from consideration, of course, but a complete file had been compiled of all press comment that had appeared in the other towns served. In one town in which three papers were published the total amount of space devoted to matters referring to the company during the year amounted to 555 column inches.

Local superintendents are instructed to give a reasonable amount of attention to seeing that the daily papers are provided with such items of interest relating to company business as would readily be classed as news, and to send to headquarters all such clippings.

CENTRAL STATION FINANCING OF MOTOR APPLICATIONS

A Number of Successful Plans Discussed at March Meeting of Ohio New-Business Co-operation Committee Held at Dayton

Through the institution of a trial sale plan, household electric appliances have become more popular and are winning the confidence of consumers of electricity. The success of this plan has led sales managers to ask themselves if a similar plan cannot be worked out to develop a large power load. The discussion of such plans as have been tried received considerable attention at the March meeting of the New-Business Co-operation Committee of the Ohio Electric Light Association when F. I. Woltz, power engineer Union Gas & Electric Company, Cincinnati, read a paper entitled "Financing Motor Installations."

In Cincinnati the forerunners of the trial motor plan were the trial campaigns for gas furnace equipments, gas arcs, and large nitrogen lamp units. The result of these campaigns in placing quickly a large number of appliances, revealed the possibilities of the trial plan.

The method worked out for motor installations, however, was different from the ones before mentioned in that it was not given great publicity and was used as a final argument after the salesman had first tried every possible means and argument to get the business. The customer having been led to the point where he wanted the service, and believed he would profit by it, but felt that the power salesman had perhaps underestimated the operating costs, or that a number of unforeseen conditions would likely arise, the power company assumes the responsibility of proof.

Following is a brief outline of the trial motor proposition which was offered by the Union Gas & Electric Company at Cincinnati.

A letter was written to the prospective customer stating that if he would sign the standard power contract, the company would agree to install all the necessary wiring, motors and starters, make the service connections, and supply the service for three months. During this time the customer would be under no obligations except to pay for energy used according to the specified schedule. If at the end of that time the customer was not satisfied with the service, the wiring and motors would be removed and the plant would be restored to its original condition, and he would be under no further obligations. If, however, the service was as represented and was satisfactory, the customer would pay the agreed amount for the wiring and motors, and service would be continued according to the contract.

Since the installation was to be made by the power company, the customer was requested to furnish the salesman with a list of motor manufacturers and wiring contractors from whom quotations were desired. The power company would then make propositions to these dealers, and those who were willing to co-operate would submit competitive bids direct to the customer. The wiring contractors submitted the same quotation to the power company and to the customer, and payment was made due in three months. The motor manufacturers were required to quote the power company a

resale or dealer's price, which usually was 85 or 90 per cent of the retail or customer's price. The company agreed to make settlement with the manufacturer at the end of the three-month period, and to pay interest from the date the motors were delivered.

The company had the option, however, of returning the motors at the end of the trial period, but was required to pay 10 per cent of the total agreed price. This amount was assumed to cover the expense of testing, cleaning and painting the motors returned.

The plan as above given was used in Cincinnati about two years ago, and Mr. Woltz said it resulted in remarkable success. It was offered only for a short time, because the rapid increase in the use of the central station service became so generally known that it was thought advisable to discontinue the trial proposition. During the three or four months that it was offered twelve large customers were signed and none lost.

"If the company's rates are right," said Mr. Woltz in conclusion, "and the salesman has properly estimated and presented the requirements of his customer, and has satisfied himself as to his customer's integrity, the success of the trial offer is assured. With the necessary modifications to meet local conditions this method of going after new power business will produce gratifying results."

Details of other plans were presented in the discussion by F. B. Steele of Dayton, who stated that a plan similar to that used in Cincinnati has been followed in Dayton. On that basis one installation has been made and a second one closed up a few days ago. Up to the present time the plan has worked perfectly as the only installation has been paid for by the customer. Mr. Steele continued with a description of plans for trial installations in other cities.

For a number of years the Brockton (Mass.) Edison Company has made use of a trial-motor offer which has proved itself a deciding factor in securing many important motor service contracts. The plan is applied only to prospective customers who are already using mechanical drive, for it is not considered necessary to offer a trial motor installation to a new factory. Motors are furnished, however, for new factories on a lease plan originated to care for customers who will use from 1 hp. to 25 hp., and who start business with little capital.

To protect the company against loss, a plate is attached to each motor thus leased, stating that the motor is the company's property. The customer is then required to sign a lease and make a cash payment of 10 per cent of the cost of the motor, after 5 per cent has been added to the list price to cover interest.

Leading up to a trial proposition, the practice is first to interest the man at the head of the company, who, if the plan appeals, is in a position to accept it without referring it to anyone else. With the consent of the owner or manager, an investigation is then made of the power requirements, including methods of manufacture, arrangement of machinery, handling of products, etc. Estimates of wiring cost are made by local contractors, the lowest bidder receiving the job. Failing to gain the prospective customer after a reasonable effort, the trial proposition is offered.

The central station agrees to install at its own expense all electrical equipment required and to allow it to be used for one year. The customer pays in equal monthly installments, as a rental, 15 per cent per annum on the total cost of the installation. The customer at the end of the year is the judge as to the value of the service, and if it is acceptable he agrees to purchase the equipment at cost less 60 per cent of the amount paid as rental.

Since 1906, out of trial propositions with a total connected load of 2500 hp., only one proposition, one of 115 hp., has been lost. The cost to the company for these installations was $42,400, or an average of $16.96 per horsepower, all of which was returned with 6 per cent interest, with the foregoing exception. The average gross yearly income from this 2500 hp. has been $65,200 or $26.08 per horsepower of motor rating.

In 1906 the connected motor load of the Brockton company was 892 hp. with a yearly gross income of $15,021, and it is now 7641 hp. with a yearly gross income of $156,071, about 37 per cent having been gained by the trial plan.

The Electric Light & Power Company of Abington & Rockland, another Stone & Webster property, has not yet lost a single installation of trial motors, and its connected power load has increased from 25 hp. in 1906 to 2810 hp. to-day, about 20 per cent of which was secured by the trial proposition.

ELECTRICAL MARKET IN MOVING PICTURE INDUSTRY

Value of Projection Machinery Placed at $11,000,000 —Daily Energy Requirements by Theaters 270,000 Kilowatt-Hours

An estimate of the present status of the moving-picture industry in the United States and Canada places the number of moving-picture houses at 20,000. On this basis, and assuming that these theaters use an average



IN SOUTHERN CALIFORNIA WHERE 80 PERCENT, OF THE PHOTO-PLAY OUTPUT OF THE WORLD ORIGINATES ELECTRIC LAMPS WORKING HAND IN HAND WITH THE SUN THROW PHOTO-QUALITY LIGHT FROM THE SIDES

of 30 amp. at 110 volts for projection, and that the average show lasts five hours per day, the requirements would be 270,000 kw.-hr. per day and 50,000 to 75,000 carbons per day.

The value of projection machinery involved, including transformers, motor-generator sets, mercury-arc rectifiers, etc., is placed at $11,000,000. The replacement of worn-out machines calls for ten to twenty new projectors per day. An army of 25,000 to 30,000 operators is required and they handle film valued at a total of $15,000,000. The daily income figured at an average of 8.5 cents per admission from 12,000,000 to 15,000,000 people amounts to $400,000,000 a year.

In southern California, which is one of the main centers of motion-picture production, forty-five producing companies operate studios. Of these twenty have indoor studios where pictures are filmed by electric light. One of the larger of these indoor studios is laid out for the use of 2000 kw. in lighting a structure 100 ft. by 150 ft. in plan.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

CURRENT DENSITY

How the Selection of the Current Density Affects the Design and Operation of the Whole Electrolytic Plant—Applications to Copper Refining

THE current density, or amperes per square foot or square meter of active cathode surface, is the factor in an electrolytic process, such as copper refining, upon which above all others the design and operation of the plant depend, as upon it hangs a string of minor factors which must be properly correlated in order to obtain the best return upon the investment. These factors may be classified under cost per pound of cathodes recovered, first cost of plant, and metallurgical purity of product. This subject is discussed in an interesting manner in an article by Lawrence Addicks in *Metallurgical & Chemical Engineering* of March 15.

Aside from commercial considerations there is a limit to the density which can be employed imposed by the temperature of the electrolyte. By far the larger part of the electrical energy called for is converted into heat in overcoming the ohmic resistance of the cells and the temperature of the electrolyte rises until the heat losses offset the C^2R gain.

The electrodes are spaced so closely in the tanks that the equivalent energy to be dissipated is quite large and further at about 150 deg. Fahr. a liquid will begin to steam sufficiently to make a tank room too foggy for comfort or for efficient inspection.

Mr. Addicks discusses at some length the question of electrolytic temperature. The final and really controlling reason for the use of warm electrolyte is the greatly improved metallurgical conditions resulting therefrom. Not only is the cathode smoother and denser, but the conditions at the dissolving surface of the anode are greatly benefited.

The increased temperature brings about a local circulation which assists in removing the dense solution of copper sulphate from the face of the anode and in preventing stratification in the tank. When current is passed through a cold cell without any circulation of the electrolyte, conditions soon become so unbalanced that the electrodes will gas, the voltage show violent fluctuations and the anode slimes be stirred up and carried in suspension, thereby fouling the cathode. When the electrolyte is systematically circulated these bad effects are counteracted, but the rate of circulation which can be employed is limited by the eventful stirring up of the slimes mechanically. There is in turn a current density for this limiting circulation which begins to bring about a return of the undesirable gassing, and for a cold liquor and an impure anode this density is so low as to require an abnormally large plant investment. When the electrolyte is heated this density limit is greatly raised and it was practice even in the very early days to heat the electrolyte somewhat—perhaps to 110 deg. Fahr.—and later this temperature has been gradually increased until 135 deg. Fahr. entering the tanks is not uncommon.

The temperature problem is summed up by Mr. Addicks in the following statements: (1) The temperature of the electrolyte should be carried well up toward the practical limit of 150 deg. Fahr. in order to be able to employ as high a current density as may be desirable from the point of view of cost of operation; (2) unless a very high density permitted by very unusual conditions is employed, heating in the solution well will be required to maintain this temperature; (3) with proper exhaust steam design this heating will be practically free of direct expense.

Power cost is the next subject taken up. Mr. Addicks gives a table which shows that the power cost per pound of copper rises nearly in proportion to the current density employed. On the other hand, the electrical heat dissipated in the tanks simultaneously increases, and this means that less heating steam will be required and this saving will give some credit to be applied against the power cost.

It is thus evident that the cost of producing a kilowatt-hour will have a great deal to do with the question; in fact, it is possible to plot the power cost at various plants against the current density used and obtain quite a smooth curve. Fig. 1 shows this general relation, but individual cases may show exceptions for special reasons. The abscissas give cost of power in cents per kilowatt-hour, and the ordinates give current density in amperes per square foot (1 amp. per square foot = 10.8 amp. per square meter).

The first cost of the refining plant depends in a double manner on the current density. The first cost of plant

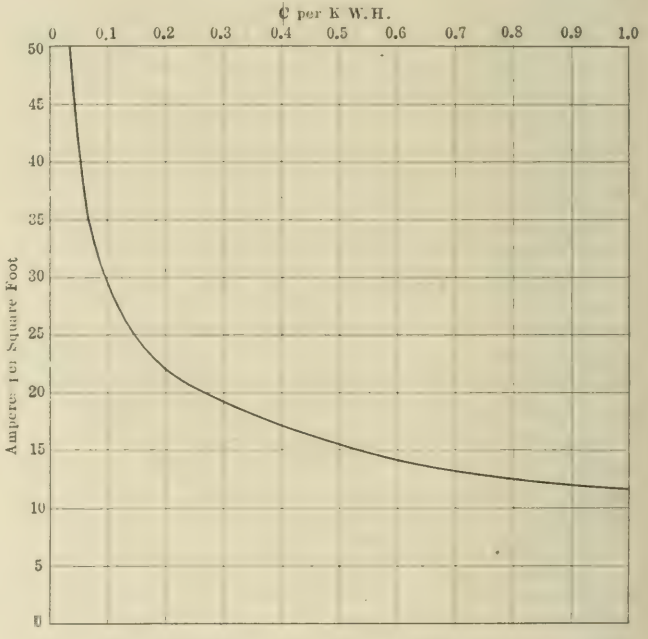


FIG. 1—CURRENT DENSITY VS. POWER COST IN PRACTICE

comprises an investment in tanks and an investment in power plant; the former varies with the output of cathodes per tank day and the latter with the kilowatt demand, both of which depend upon the current density. To show how this works out we extract a few figures from a table compiled by Mr. Addicks. Under certain plant conditions if the current density is 5, 15, 25, 30, or 40 amp. per square foot (54, 161, 269, 323 or 430 amp. per square meter), the total investment per pound

of copper per day will be $3.77, $1.71, $1.54, $1.57, $1.72, respectively.

The main labor items in operating a tank house are for inspection work to maintain current efficiency and for inserting and drawing the electrodes as the copper moves through the process. The higher the current density the more difficult is it to maintain the efficiency on account of the increased number of short-circuits caused by rough deposits on the cathodes.

In case of building a new refinery, it may be that there is a choice between five locations where the prob-

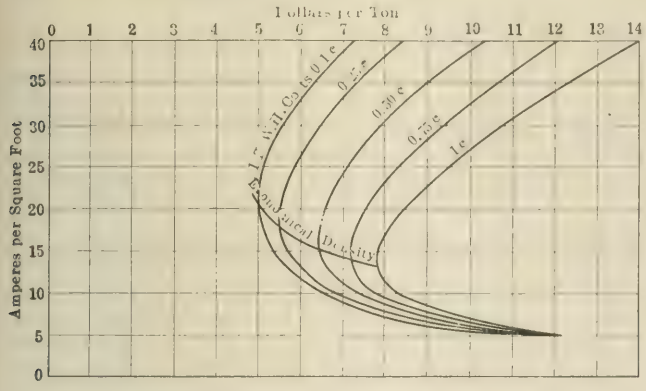


FIG. 2—CURRENT DENSITY VS. VARIATION IN TOTAL OPERATING COSTS

able power cost is estimated at 0.1 cent, 0.25 cent, 0.5 cent, 0.75 cent, and 1 cent per kilowatt-hour respectively, and other conditions are equal. In that case it will be necessary to calculate for each case the total cost of operation (including interest and depreciation) for varying current densities and plot the results, where a diagram like Fig. 2 will be obtained. If the minimum power costs from the different curves are taken from this diagram and plotted against current density, the same general relation is found which is shown in Fig. 1.

Generators, Motors and Transformers

Parallel Operation of Static Transformers.—J. LINDLEY THOMPSON.—The first part of an illustrated article in which the author deals first with the aspects of voltage ratio, impedance and polarity, as affecting the operation of single-phase transformers in parallel. Comparative tables are given showing the effect on loading of varying ratios of resistance and reactance, and also of unequal impedance. Formulas are given to determine the transformer current values and phase angles under these conditions. Polyphase transformers are then treated in a similar manner, but with the inclusion of a study of phase rotation. The "phasing out" of three-phase transformers is described, tables and diagrams being given which show possible voltage measurements obtainable. Results of paralleling dissimilar groups of transformers are described, and in conclusion the effects of position of junctions to busbars or main cables, temperature and power factor are discussed.—London *Electrician,* Feb. 9, 1917.

Polyphase Induction Motors with Unbalanced Secondaries.—A. A. GAZDA.—A paper read at the New York meeting of the American Institute of Electrical Engineers, in which continuous operation of the wound-rotor induction motor, when the external resistances in the secondary phase are not equal, is shown to be feasible. The effect upon power factor and heating is discussed. Curves showing the performance of polyphase motors with single-phase secondary are presented. The practical advantages of using unbalanced secondary connections are pointed out. The principal practical conclusions of the author are as follows: With the proper design of resistor steps, it is safe practise to operate polyphase induction motors at full-load torque, with unbalanced secondary resistance. Under these conditions, the power factor will be slightly reduced, but the increased copper loss will be amply compensated for by the better ventilation of the motor at the higher speeds. A limited range of motors which have a low percentage of magnetizing current, may be operated under full-load torque at half speed, with single-phase secondary, while practically any motor may be operated under these conditions when connected to a variable torque load, such as blowers, centrifugal pumps, etc. This method permits a great simplification of control apparatus. Control schemes, including single-pole resistance switches, may be used, which will result in fewer parts to maintain, less control wiring and smaller-size controller. The amount of resistance may be reduced, and floor space saved.—*Proceedings,* Amer. Inst. Elec. Engrs., February, 1917.

Calculating the Performance of Polyphase Induction Motors.—LUTHER H. JAMES.—An article illustrated by diagrams in which the author gives a new method for calculating the performance of a motor to within as close a degree of accuracy as may be obtained by the use of the triangle and compass, but without resorting to unnecessary refinements. The method is illustrated by numerical examples.—*Elec. Journal,* March, 1917.

Induction Motor Characteristics.—L. W. SMITH.—An article discussing and illustrating by diagrams the effect of variations of voltage or of variations of frequency on induction motor characteristics.—*Elec. Journal,* March, 1917.

Balancers for Three-Wire Continuous-Current Systems.—THOMAS CARTER.—In a continuation of his long illustrated mathematical article on balancers, the author discusses the effect of compounding on load in the armatures of rotary balancers, the types of field windings for rotary balancers, and the design of compound-wound fields for rotary balancers.—London *Electrician,* Feb. 16, 1917.

Electrochemistry and Batteries

Lead Storage Battery.—CH. FERY.—The author reviews the different theories of the lead accumulator and describes an investigation of his own from which he concludes that at the end of a charge the negative plate is spongy lead and the positive plants not PbO_2, but Pb_2O_5, and that during discharge the former is changed to lead sulphate and the latter not to lead sulphate, but to PbO_2 (with formation of water).—*Revue Gen. de l'Elec.,* Jan. 6, 1917.

Units, Measurements and Instruments

Direct-Current Meters.—ZIEGENBERG.—A discussion of various recent improvements in the design of direct-current meters. The comparative advantages of disk armatures and drum armatures as well as various constructive details are dealt with.—*Elek. Zeit.,* July 6, 1916; an illustrated French translation in abstract, *Rev. Gen. de l'Elec.,* Feb. 10, 1917.

Magnetic Braking Couples.—G. VALLAURI.—In a certain type of maximum-demand meter a magnetic brake formed of a nickel cylinder placed in a constant magnetic field is used. It is generally admitted that the couple required to start the meter is larger than the braking couple when the meter is in motion; so that the magnetic couple would be analogous to a friction couple. The author demonstrates theoretically that this assumption is not correct and that the magnetic couple must be the same both at starting and during rotation. As a matter of fact, the magnetic couple is due to the hysteresis, and its value is given by the

formula $HI \sin \varepsilon$, where H is the field intensity, I the intensity of magnetization, and ε the angle between these vectors, which angle cannot be larger than a certain value ε_0, specific to the magnetic substance employed. When a small mechanical couple is applied to the cylinder this turns by an angle Θ and the vector I by an angle ε, so that $HI \sin \varepsilon$ is equal to the mechanical couple. The angle Θ is always larger than ε. The static equilibrium is only possible if the mechanical couple is not larger than $HI \sin \varepsilon_0$; beyond this value the cylinder begins to turn. The small number of experiments available have shown that the value of $HI \sin \varepsilon_0$ is independent of the speed. The reason why the starting couple in the meter referred to is larger than the motion couple must be found, therefore, according to the author, principally in the mechanical friction between the axis and its supports, rendered still larger than usual by the practically unavoidable lateral magnetic attraction between the cylinder and the permanent magnet forming the field. Subsidiary reasons can be errors of centering of the cylinder, lack of homogeneity in its material, and its strong residual magnetization. In these cases the starting couple must be larger than the maximum value of the magnetic couple, while during the rotation, owing to the mechanical inertia of the rotating parts, the mechanical couple need be equal only to the mean value of the magnetic couple.—*Elettrotecnica*, Oct. 25, 1916; abstracted in *Science Abstracts*, Section B, Jan. 31, 1917.

Telegraphy, Telephony and Signals

Effect of Water Vapor in the Atmosphere on the Propagation of Electromagnetic Waves.—F. SCHWERS.—An abstract of a British Physical Society paper. The author discusses the probable influence of moisture in the atmosphere on the refraction of electromagnetic waves round the earth's surface. The conclusion of Kiebitz that the presence of moisture does not affect the dielectric constant by more than 10 per cent is shown to be erroneous, being based on the assumption that the Clausius-Mossoti formula holds when passing from the liquid to the gaseous state. Examples are quoted to show that this law fails in many cases, especially where the dielectric constant is high in the liquid state. In the absence of more accurate data for ordinary temperatures, the author prefers to assume a value for the dielectric constant of water vapor obtained by extrapolating the results obtained by Baedeker for higher temperatures. The extrapolated value is almost certainly too low. From this result, and the average conditions of the atmosphere over the ocean with regard to temperature gradient, etc., deduced from meteorological data, it is shown that the lowest layers of the atmosphere (1000 to 1500 m. approximately in depth) refract electromagnetic waves toward the earth, so that the greater part of the space waves will reach the receiver, contrary to the conclusion of Kiebitz.—London *Electrician*, Feb. 16, 1917.

Installations, Systems and Appliances

Frequency Changers.—R. TOWNSEND.—A paper read before the (British) Institution of Electrical Engineers in which the author first deals with induction frequency changers and then with synchronous frequency changers. From the point of view of cost, efficiency, overload capacity, reliability, maintenance and floor space, both types are practically on an equality (assuming the same synchronous speed with each type). The type to be adopted must, therefore, be determined by the other characteristics of the machines. The difficulty and troubles experienced in connection with the operation of synchronous frequency changers are not as real in practice as one would at first expect. If either the motors or the generators are fitted with rotatable stators, the synchronizing and load distribution is as simple, or even more simple, than with induction frequency changers. If the machines have non-rotatable stators, the difficulty of synchronizing depends to a great extent on the ratio of frequency conversion. In any case, the operation of "slipping poles" by reversing the motor excitation is easily carried out, and will quickly bring the generators into the correct phase relation for paralleling. Taking all the points into consideration, the advantages of the synchronous frequency changer are sufficient to justify its adoption in the majority of cases.—London *Elec. Rev.*, Feb. 23, 1917.

Automatic Methods of Accelerating Motors.—H. D. JAMES.—A continuation of the illustrated serial on industrial controllers. In starting a motor, resistance is inserted in the armature and is gradually short-circuited. For doing this automatically four methods are in use, namely the counter-emf. method, the series relay method, the series lock-out switch method, and the time-element method. These are discussed in succession. The counter-emf. method is used for small controllers, although it can be successfully employed for quite large units. The series relay method is the most expensive, but very satisfactory, and should be used for heavy service, where the load varies through wide limits. The series lock-out switch is satisfactory for starting service where the acceleration is always under load. The last resistance switch is often provided with a holding coil to keep it from drooping out on light loads. Sometimes the last switch is operated by the counter emf. of the motor and the preceding switches on the lockout principle. The time element device is the most satisfactory to use where the voltage varies over wide limits, particularly where rapid starting is not necessary.—*Elec. Journ.*, March, 1917.

Wires, Wiring and Conduits

Cable Junction Boxes.—S. G.—An article illustrated by a series of diagrams on the design and construction of cable junction boxes discussing sweating sockets, design of fittings, disconnecting links, spreaders and separators, wood brushes, compound pockets, lifting handles, coating of boxes, pavement frames and covers, lead sleeve joints, lid joints, and the filling compound.—London *Elec. Rev.*, Jan. 12 and 19, 1917.

U. S. Safety Rules.—An editorial on the Safety Rules on Electrical Work issued by the U. S. Bureau of Standards. Some doubt is expressed whether such voluminous regulations will secure the end for which they are issued, but it is emphasized that the code is the outcome of a great deal of work. "Although certain criticisms have been made, it must be acknowledged that the code is the considered opinion of a large number of experienced engineers in the United States." It is thought that in some respects the rules have gone rather too far in detail.—London *Electrician*, Feb. 9, 1917.

Generation, Transmission and Distribution

Flywheel Load Equalizers.—An illustrated article on the operation of flywheel load equalizers such as are used for electric winders and rolling mills and also for coal hoists and ore-handling plants. After an explanation of the principle of the flywheel load equalizer an algebraic and a graphical method of determining the weight of the flywheel are given and illustrated by examples. After some notes on windage losses of flywheels and mechanical details, three systems are described and discussed (the simple flywheel generator set, the motor-generator flywheel set, and the converter system) and the differences between the three systems are discussed.—London *Electrician*, Feb. 16, 1917.

Book Reviews

UNDERGROUND TRANSMISSION AND DISTRIBUTION FOR ELECTRIC LIGHT AND POWER. By E. B. Meyer. New York: McGraw-Hill Book Company, Inc. 312 pages. 156 illustrations. Price, $3.

For the specialist and for central station engineers who are responsible for the installation and maintenance of underground distribution systems, this book will be found of every-day interest and value. Through his extensive experience and practical knowledge of the various requirements of underground systems as an engineer of the Public Service Electric Company of New Jersey Mr. Meyer is especially well qualified to write on this subject. The information presented reflects a practical viewpoint so that besides being a treatise on underground work, it is in every way complete and suitable as a practical engineer's guide and reference on the latest and best practice as well as on systems and equipment. With the exception of the work by Gear and Williams on central station distribution systems, there is no book which compares with it for wealth of detail. These two works are in no way rivals, for the field covered by Mr. Meyer forms only a small part of the scope of Gear's and Williams' book. They should therefore be considered as companions and both have a place in the library of the central station engineer who has to do with any part of distribution work. The following chapter headings of the book under consideration indicate in a fair way the character of the material presented: Historical review; preliminary survey; conduit and manhole construction; methods of distribution; cables; installation of cables; testing of cables; distribution systems and auxiliary equipment; electrolysis; operation and maintenance.

HANDBOOK OF MACHINE SHOP ELECTRICITY. By C. E. Clewell. New York: McGraw-Hill Book Company, Inc. 462 pages. Illustrated. Price, $3.

The author of this book has compiled from many sources including the latest handbooks, a great deal of practical data and information on the selection, installation, and operation of the electrical equipment that is required in a machine shop. While at first thought it might seem that existing handbooks on electrical engineering would be preferable to a condensed volume dealing with a special field of electrical applications, an inspection of the volume under discussion shows there is considerable merit in the plan of the author. Just the information pertaining to machine shop practice is presented and the user is not required to select from a mass of general information that data and information which seems to him to fulfill his conditions. This work has all been done by the author and where it lacks in completeness it makes up in its definiteness and practical value. It is plainly a practical man's handbook written in a simple understandable way with little technical theory except where it was essential to explain the operation of electrical machines and devices. The book is divided into ten sections devoted to the following topics: 1—Abbreviations, terminology and units. 2—Circuits. 3—Costs. 4—Communication and distant control. 5—Current supply, generators, and transformers. 6—Electrochemical, soldering and welding applications. 7—Heating and magnetic apparatus. 8—Lamps and shop lighting. 9—Measuring instruments and measurements. 10—Motors and applications.

The section on costs is a valuable feature of the book, a feature which is too often overlooked in handbooks and published articles on the excuse that costs may be misleading or possess value for a limited time only. While the author takes this attitude through an introductory statement in which he says, "Costs in themselves based on averages must be interpretated with caution and it is suggested that the values given be employed only for preliminary estimates," he is rather liberal in his selection of prices and covers a range that enables the operator who uses, rather than buys materials, to get an idea of costs certainly much closer than from catalogs, with list prices, on which discounts of 50 to 60 are possible. Since the catalog is the most familiar and most common form of information on machines found in the hands of operators it is certain that carefully interpretated costs in a handbook can not work serious harm to the user or the manufacturer while on the other hand when checked up on final estimates by up-to-the-minute prices such data are most useful and helpful information. The costs in this handbook are of just this nature and the author is to be complimented on the prominence he has given this matter. This handbook merits the careful consideration of all practical workers, electricians, mill and shop master-mechanics, etc.

PRIMARY BATTERIES: THEIR THEORY, CONSTRUCTION AND USE. By W. R. Cooper. London: "The Electrician" Printing & Publishing Company. 458 pages. 215 illustrations. Price 12s. 6d.

This is a new and enlarged edition of a very practical textbook which first made its appearance in 1901, and which has received much new material since that date. The author has been fortunate in selecting a title sufficiently restrictive to enable him to discriminate against all secondary and storage cells, thus keeping the book on a consistent basis. On the other hand, by including selenium cells, which owe their emf. to incident radiation energy, the author comes up to the narrow edge of security in his definitions and discrimination. It is so seldom, however, that we find selenium cells suitably treated in electrical literature that we owe the author thanks for nearly having trespassed beyond his own delimitations.

The book is divided into thirteen chapters on the following subjects: Historical; The simple voltaic element; Local action; Theory of the voltaic cell; Non-chemical cells; Testing cells; One-fluid cells; Two-fluid cells; Dry cells, Standard cells; Selenium cells; Carbon-consuming cells.

The chapter on standard cells is particularly attractive. The treatment is clear and practical. The electrochemical theory is explained in simple terms with the aid of mathematical expressions.

Books Received

AWAKENING OF BUSINESS. By Edward N. Hurley. Published by Doubleday, Page & Company, Garden City, N. Y., for the Associated Advertising Clubs of the World. 240 pages. Price, $2.

MANUFACTURE OF ARTILLERY AMMUNITION. By Members of the Editorial Staff of the *American Machinist*. L. P. Alford, Editor-in-Chief. New York: McGraw-Hill Book Company, Inc. 766 pages. 669 illustrations. Price, $6.

INTERIOR WIRING AND SYSTEMS FOR ELECTRIC LIGHT AND POWER SERVICE. By Arthur L. Cook. New York: John Wiley & Sons, Inc. 416 pages. 248 illustrations. Price, $2.

ELECTRIC AND MAGNETIC MEASUREMENTS. By Charles Marquis Smith. New York: The Macmillan Company. 374 pages. 171 illustrations. Price, $2.40.

CALCULUS. By Herman W. March and Henry C. Wolff. New York: McGraw-Hill Book Company, Inc. 360 pages. 125 illustrations. Price, $2.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

SUPREME COURT DECISION AGAINST UTAH COMPANY

Highest Tribunal Holds That Congressional Right to Control Occupancy and Use of Public Lands Is Controlling Over State Enactments— Mr. Mitchell's View

The United States Supreme Court rendered on March 19 its opinion in the water-power case of the Utah Power & Light Company and others. Justice Van Devanter delivered the opinion, which is in part as follows:

"Not only does the Constitution commit to Congress the power 'to dispose of and make all needful rules and regulations respecting' the lands of the United States, but the settled course of legislation, congressional and state, and repeated decisions of this court have gone upon the theory that the power of Congress is exclusive and that only through its exercise in some form can rights in lands belonging to the United States be acquired.

"True, for many purposes a state has civil and criminal jurisdiction over lands within its limits belonging to the United States, but this jurisdiction does not extend to any matter that is not consistent with full power in the United States to protect its lands, to control their use and to prescribe in what manner others may acquire rights in them.

National Supremacy Sustained

"From the earliest times, Congress by its legislation, applicable alike in the states and territories, has regulated in many particulars the use by others of the lands of the United States, has prohibited and made punishable various acts calculated to be injurious to them or to prevent their use in the way intended, and has provided for and controlled the acquisition of rights of way over them for highways, railroads, canals, ditches, telegraph lines and the like. The states and the public have almost uniformly accepted this legislation as controlling, and in the instances where it has been questioned in this court its validity has been upheld and its supremacy over state enactments sustained.

"And so we are of opinion that the inclusion within a state of lands of the United States does not take from Congress the power to control their occupancy and use to protect them from trespass and injury and to prescribe the conditions upon which others may obtain rights in them, even though this may involve the exercise in some measure of what commonly is known as the police power.

Congress Intended Some Regulations

"By their answers the defendants assert that some of the administrative regulations promulgated under the act of Feb. 15, 1901, go beyond what is appropriate for the protection of the interest of the United States and are unconstitutional, unauthorized and unreasonable. That Congress intends there shall be some administrative regulations on the subject is plainly shown in the act, and that its discretion in the matter is not narrowly confined is shown by our decisions.

"If any of the regulations go beyond what Congress can authorize or beyond what it has authorized, those regulations are void and may be disregarded, but not so of such as are thought merely to be illiberal, inequitable or not conducive to the best results. In the nature of things it can hardly be that all are invalid, and this was conceded in argument."

Through a mistaken view the defendants "are occupying and using reserved lands of the United States without its permission and contrary to its laws. Not until they seek a license or permit under the act and conform or appropriately offer to conform to all lawful regulations thereunder will they be in a position to complain that some of the regulations are invalid. As we interpret the decrees below, they enjoin the defendants from occupying and using the lands of the United States until, and only until, they acquire rights to do so by complying with some applicable statute and the lawful regulations. Of course we do not imply that any of the regulations are invalid but leave that question open.

Compensation Measured by Reasonable Value

"As the defendants have been occupying and using reserved lands of the United States without its permission and contrary to its laws, we think it is entitled to have appropriate compensation therefor included in the decree. The compensation should be measured by the reasonable value of the occupancy and use, considering its extent and duration, and not by the scale of charges named in the regulations as prayed in the bill. However much this scale of charges may bind one whose occupancy and use are under a license or permit granted under the statute, it can not be taken as controlling what may be recovered from an occupant and user who has not accepted or assented to the regulations.

"It follows that the decrees are right and must be affirmed, save as they deny the government's right to compensation for the occupancy and use in the past, and in that respect they must be reversed."

Statement of Sidney Z. Mitchell

Sidney Z. Mitchell, president of the Electric Bond & Share Company, of which the Utah Securities Corporation, which controls the Utah Power & Light Company, is a subsidiary, said that the case was not important as affecting the particular matter in controversy between the Utah Power & Light Company and the government because the water power involved at Battle Creek, Utah, is less than 3 per cent of the total capacity of the Utah company. The question was not whether the company should continue to operate the site or move off, but whether the company had the right to use the site under the act of Congress passed in 1866, which the government claimed had by inference been repealed, or if the company should continue to operate the site under lease from the government, paying a nominal rental.

The particular issue, Mr. Mitchell said, was whether the act of 1866 had been repealed, thus making legal the policy adopted by the Agriculture and Interior departments in regard to leasing the public lands generally in Western states for water-power purposes. The actual money involved is trivial in amount, but the principle concerned is of tremendous importance to all states having public lands, the development of which has been greatly retarded by interpretation of federal laws.

SUPPORT THE FRANCHISE PLAN FOR DALLAS, TEX.

J. F. Strickland and C. W. Hobson Stand by the Offer Upon Which Voters Are to Act on April 3, Notwithstanding Impending War Conditions

J. F. Strickland and C. W. Hobson have issued a statement in reply to the announcement of Mayor Lindsley of Dallas, Tex., that he will not vote for the franchises which are to be submitted to citizens on April 3. Messrs. Strickland and Hobson say in part:

"As to valuation, we say that our agreement with the Mayor and entire Board of Commissioners was that if the valuation was approved by the postal card vote the question was then settled as between them and us.

"As to the rate of return, we say that our last concession of a 7 per cent base rate of return on the lighting properties, as well as on the railway properties, was made on the statement of the Mayor that he would support the franchises in that respect.

"As to the franchises being perpetual, we say that the point as presented by the Mayor is entirely new. He says it is a perpetuity because the valuation is too high and the terms of purchase burdensome. As to the valuation, we would have obtained our option at a lower price if we could. The valuation, in our opinion, is fair. The terms of purchase are also, in our opinion, fair.

"If our commitments to reorganize and refinance the lighting and traction properties of this city had been made only to the Mayor, we should feel, under existing circumstances, that our commitments with propriety might be withdrawn. The burden of financing these properties with impending war conditions is much greater than it was at the time the commitments were made. We feel, however, that our good faith is pledged to those members of the Board of Commissioners who have announced their intention of supporting the franchises on a referendum and to the people of Dallas to go forward with the enterprise of localizing the management of these properties, and we shall not withdraw unless the people of Dallas indicate their disapproval of the franchises."

HYDROELECTRIC PROGRESS AND PLANS IN CALIFORNIA

Pacific Gas & Electric Company Puts 10,000-Kw. Plant in Service and Great Western Power Company Completes Arrangements for a Larger Development

The new 10,000-hp. generating station of the Pacific Gas & Electric Company, known as the Wise plant, was put in service on March 4. This plant is a unit of the Drum system, which includes four successive sites developing all the available head along the same watercourse. Three of the plants in this chain have already been built. The farthermost is just within the 150-mile circle centering at San Francisco. A general description of the two latest additions to this series appeared in the ELECTRICAL WORLD for Jan. 15, 1916, page 171.

Simultaneously with the addition of this plant to the system comes word that the Great Western Power Company has been making surveys looking to the construction in the near future of a new plant on the North Fork of the Feather River about 3 miles from Oroville. This plant will be about 9 miles due south of the Big Bend; it will be designed for about the same minimum stream flow and will utilize it under a 300-ft. head. There will be a 12-mile canal from the tailrace of the Big Bend plant to the forebay of the new plant.

In addition to this site the company controls three others on the North Fork of the Feather River.

The reason assigned for selecting the site near Oroville for the increase of capacity now contemplated is that this plant will be within about ¼ mile of the 100,000-volt line which now delivers energy from the Big Bend plant. By the development of this site the additional power can be put into the transmission system with the least investment in copper, a most important consideration.

COLUMBUS CO-OPERATION A NOTABLE DEVELOPMENT

Dinner Given by Electrical Contractors and Dealers' Association to the Twenty-Six New-Business Representatives of the Central Station Company

Members of the new-business department of the Columbus (Ohio) Railway, Power & Light Company were entertained on the night of March 14 at a banquet and theater party given by the Columbus Electrical Contractors' & Dealers' Association. In addition to the twenty-six representatives of the company, eighty-five contractors and dealers were present.

SUCCESSFUL WIRING OF OLD HOUSES

This association was formed in March, 1916, for the purpose of co-operating to the fullest extent possible in the electrical industry in Columbus. Since that time the Columbus Railway, Power & Light Company alone has taken 829 contracts for wiring already-built houses. All of this work is turned over to the contractors under a plan whereby the company pays the contractors in full at the completion of the work and allows the new customer to pay the amount in ten monthly payments with his light bill.

The contractors have wired over 400 already-built houses. Much progress has also been made in other branches of the industry as indicated by the improvement made in show-window lighting, the thousands of electrical applances sold, the large number of electrical signs placed in operation and the wonderful increase in the use of electricity for power.

The meeting was unique in the fact that the contractors' association acted as host. A fine spirit of co-operation is in evidence between the association and the central station and both sides have pledged their loyal support to the advancement of the electrical industry in Columbus and vicinity.

LARGE GENERATING STATION DEVELOPMENT

Harold W. Clapp, general superintendent of the Columbus company, made a short talk at the banquet. He referred to the new power station now under construction, located 8 miles southeast of the city. The initial installation will consist of a 15,000-kw. turbine unit with all necessary auxiliaries. This turbine will be placed in operation in the fall of this year. The energy from this installation will be distributed over the system through necessary transmission and tie lines between stations. A 10,000-kw. turbine unit is now on order for delivery in April, 1918. This will be in service in the early summer of 1918. Another 15,000-kw. turbine will be installed in 1919, making the ultimate capacity of the station 40,000 kw. This is an indication of the development possible in the territory, and the contractors are working hand in hand with the company for proper development and for their mutual benefit.

O. L. Bowers is president of the Contractors' & Dealers' Association and Howard Thompson is secretary. C. A. Entrekin, contractor, made a successful toastmaster of the evening.

DELAY IN THE INDIANA ELECTRIC RANGE CAMPAIGN

Committee Has Not Yet Secured the Fund Which It Requires, but the Pledges Received Will Probably Be Held and Additions Made When Possible

The new-business committee of the Indiana Electric Light Association, which made an attempt to secure funds to promote a State wide electric range campaign, has not been able up to the present time to collect the $2,000 which it was estimated would be required. Twelve Indiana central stations have subscribed $872, and according to O. M. Booher of Kokomo, chairman of the new-business committee, it will probably be necessary to postpone the campaign. The pledges received will probably be held and additions made as soon as possible.

The obstacles which the committee has found are: First, high cost of range installations; second, lack of enthusiasm on the part of central stations in regard to electric range load being profitable; and third, the small number of electric range rates among the Indiana companies.

Furthermore, the committee believes that it is unfortunate that the price of ranges should have been advanced at this time and that range manufacturers have expressed themselves as unable to contribute to the campaign.

INTEREST GROWS IN THE "WIRE-YOUR-HOME" CONTEST

Salesmen of Members of the Society for Electrical Development Are Anxious to Try for a Share of the $1,250

Since the announcement regarding the "Wire-Your Home-Time" prize contest was placed in the hands of the central station solicitors and the salesmen of the contractors the Society for Electrical Development has



been kept busy with inquiries for contest blanks. The requests have come from all sections.

The cover of the comprehensive booklet issued by the society in connection with the "Wire-Your-Home" plan is reproduced herewith.

IMPORTANCE OF EFFICIENCY IN GENERATING STATIONS

Samuel Insull, in His Pittsfield Address, Says That Far Greater Improvements Are Necessary to Overcome Additional Costs

During his remarks at the dinner of the Pittsfield (Mass.) Section of the American Institute of Electrical Engineers on the evening of March 14, Samuel Insull, president of the Commonwealth Edison Company of Chicago, called attention to the growing importance of efficiency in the generating station. A brief telegraphic report, covering some of the points in the address of Mr. Insull, was published in last week's issue.

"The great increase in the cost of fuel, labor and every other element which makes up the station cost," Mr. Insull said, "has such a serious effect on the balance sheets that far greater improvements in stations must be made if these additional costs are to be overcome.

"Demands for greater improvements in turbines and boiler construction are bound to come, and these demands are going to be far beyond what they have ever been in the past. I don't know where these improvements are coming from, but it is a problem the engineers of to-day must solve. Within the next few years I expect to see improvements made that will bring about 25 to 30 per cent better results than are being obtained in stations to-day."

Mr. Insull spoke of the importance of prompt delivery of apparatus and of the extent to which the manufacturing end of the industry is dependent upon the consuming or operating end, which cannot turn its capital more often than once in five years. The prosperity and development of the producer depend upon the consumer.

Mr. Insull also expressed the opinion that companies should not consider reductions in rates while the trend of costs is upward, as at present.

MINNESOTA ASSOCIATION LOOKS AHEAD IN ELECTRIC RANGES

Tenth Annual Meeting, Held in St. Paul This Week, Indicates That Nearly All of the Companies Have Sold a Few of These Appliances

Construction, maintenance and inspection of distribution systems, service for towns of less than 1500 inhabitants, the effect of load factor on operating costs, how central stations are using technical schools, the principles of rate making and electric cooking were the topics discussed at the tenth annual meeting of the Minnesota Electrical Association at St. Paul, March 20 and 21.

The paper on distribution systems, which was written by S. B. Hood of the Minneapolis General Electric Company, presented a fund of useful and sound information gathered as the result of the author's experience in building and operating distribution systems of the prevailing types in many communities. It contained valuable ideas and opinions on the selection of line material.

Earl D. Jackson, consulting engineer, St. Paul, speaking on twenty-four hour service in towns of less than 1500 people, gave some estimated and actual cost data comparing the price of locally generated energy and energy purchased from transmission companies. The paper brought out the limits of rates which towns of various sizes can afford to pay for transmitted energy.

A paper on load factors and operating costs, by M. Barnert, Minneapolis, contained data and curves to show how under assumed conditions the cost of producing energy would fluctuate with varying load fac-

tors in a system of combined hydroelectric and steam plants.

STUDENT WORKERS FOUND SATISFACTORY

Prof. George D. Shepardson, University of Minnesota, discussed "How Central Stations Are Making Use of Technical Schools." He reviewed the co-operative work of engineering colleges and member companies of the National Electric Light Association. In 1916, he said, 94 per cent of the companies temporarily employing college undergraduates declared them to be more satisfactory employees than the average new men, 4 per cent believed them just as good as the average and 2 per cent were not so well satisfied with their work.

Prof. W. T. Ryan, Minneapolis, speaking on the principles of rate making, characterized the desirable schedule as the one that is fair to the consumer, profitable to the central station, easily understood by the layman, not offensive to the small lighting customers' sense of justice and tending to induce all customers to increase consumption with economy to themselves and profit to the company. He expressed opposition to the value of service theory and favors the cost of service theory in rate making.

NEW ELECTRICAL ENGINEERING BUILDING FAVORED FOR MINNESOTA

A resolution was passed and ordered sent to the Legislature placing the association on record as favoring a new $160,000 electrical engineering building for the University of Minnesota.

The presentation of the two commercial addresses. "Electric Cooking," by E. H. Adler of Minneapolis, and "Selling Service," by Harry W. Alexander, New York, was followed by discussion. In all but the largest Minnesota cities electric ranges are still being introduced on a limited scale. Nearly all of the companies have sold a few ranges, however, and the managers evidenced live interest in the electric cooking experiences of others, in the various opinions on range rates and the profits in the electric cooking business.

There was every indication that many range campaigns will be conducted in Minnesota this spring.

HEARING ON SAFETY RULES FOR WISCONSIN UTILITIES

Railroad Commission and Industrial Commission Learn that Electric Utilities Favor Trial Adoption of Condensed Draft of Code

At a joint hearing conducted at Milwaukee, Wis., on March 16, by Walter Alexander, chairman of the Railroad Commission of Wisconsin, and J. D. Beck, chairman of the Industrial Commission of Wisconsin, public utility operators were given an opportunity to present views on a draft of proposed electrical safety rules for Wisconsin.

This draft, which in its present form is a twenty-six-page pamphlet, is a condensed edition of such parts of the National Electrical Safety Code as are deemed to be applicable to Wisconsin conditions. It is understood that when the commission engineers are satisfied that the rules are workable for the utilities in the State, they will be made the subject of an order to be issued by the two commissions.

In the discussion the light and power and street railway operators favored the adoption of the proposed draft for a suitable trial period.

Requests by the chairman for specific objections on the supposition that the rules were to be made mandatory showed that the objections of the telephone interests were confined to the grades of construction, and factors of safety required for wood poles, both of which they regarded as insufficiently severe to protect their lines.

They propose that the grades of construction be changed so that, instead of having supply lines over 5000 volts where exposing signal lines in crossing conflicts and common use of poles, divided into grades A and B construction, there should be only one grade for such construction, and that the stronger Grade A.

The electricity supply and electric railway companies were represented by a committee from the Wisconsin Electrical Association, composed of S. B. Way, Milwaukee; Lee Lathrop and M. C. Ewing, Wausau. Among the others who were present and participated in the discussion were Dr. E. B. Rosa and W. J. Canada, Bureau of Standards, Washington, D. C., and H. P. Gear, Chicago, representing the National Electric Light Association. Dr. Rosa described fully tests made by the bureau on telephone protective devices and defended the 7500-volt potential limit fixed by the code. He said he considered it a fair limit for all concerned.

The commissions gave no assurance that the rules would be either mandatory or tentative, and it was suggested that they might be made partly mandatory and partly tentative. This construction was placed on the word "tentative," *i.e.*, certain rules classed as tentative would be actually in effect unless a utility objecting to them presented informally reasons why in specific cases they should not be put into effect. Under such conditions the commissions will pass on the informal objection, and either refuse or grant permission to do work contrary to the rules.

ELECTRICALLY-LIGHTED NAVAL WINDOW DISPLAY

Merchants Can Assist Recruiting Campaign of the Navy Department by Using Their Space for Patriotic Exhibits

The Navy Department is interested in securing enlistments. Many merchants would be willing to co-operate with it by making electrically-lighted window displays.



Department stores with toy departments can add to the display such articles as toy battleships, destroyers, submarines, etc. A silk flag can be made to wave by the use of a small electric fan.

ATLANTIC DIVISION JOBBERS FAVOR LOWER INITIATION FEE

Merchandising of Staple Products Receives Attention at the Meeting in New York—W. E. Robertson of Buffalo Is the New Chairman

The merchandising of staple products was the topic that received the greatest attention at the meeting of the Atlantic division of the Electrical Supply Jobbers' Association, Hotel Biltmore, New York, on March 15. The lines that received particular attention were dry batteries, heating devices, sockets and switches.

A resolution providing that the chairman of the division shall not be elected to succeed himself was passed. This limits the consecutive period of office to one year. A recommendation was passed that the initiation fee to the Electrical Supply Jobbers' Association be reduced. Final action on this recommendation will not be taken until the meeting of the entire association at Hot Springs, Va., on May 23-25. Another recommendation that activities of each division be directed by the members of the national executive committee from the respective divisions was also passed.

O. D. Street, Western Electric Company, New York, read a paper giving a comprehensive analysis of the small-quantity business of the electrical supply jobber.

The following officers were elected for the ensuing year: Chairman, W. E. Robertson, Buffalo; executive committee members from the East, M. Havens, Jr., F. R. Elliott, George Patteron, F. S. Price, H. S. Savage, W. I. Pickford and E. C. Graham.

CO-OPERATION OF JOBBER AND CENTRAL STATION

Committee of the Electrical Supply Jobbers' Association Asks Executive Committee of the National Electric Light Association to Promote Joint Action

A committee of the Electrical Supply Jobbers' Association attended the meeting of the executive committee of the National Electric Light Association at the New York headquarters on March 9 to discuss ways and means of closer co-operation.

E. W. Rockafellow, Western Electric Company, was the chairman of the committee of jobbers. He stated that the Jobbers' Association has about 150 members, doing a business of $80,000,000 to $90,000,000 a year.

At the request of Mr. Rockafellow, Thomas M. Debevoise, general counsel of the association, explained the objects and accomplishments of the organization. He said that the jobbers realize that they cannot stay in the field unless they can prove to manufacturers that they are the most economical means of getting goods from factory to consumer; that that is the basis on which they go to manufacturers and that is the basis on which they came to the N. E. L. A. requesting co-operation. They are ready to put their organization at the service of the central stations if the central stations will co-operate with them in a movement which ought to redound to the advantage of both.

President Wagner of the N. E. L. A. said that that association believed in co-operation, and that he was sure that it believed in co-operation with the jobbers. He asked if the jobbers had any suggestions to offer as to definite means of co-operation.

Mr. Rockafellow said that he had not anticipated that sufficient time would be given for discussion of the details involved, but that the members of the committee had come to introduce themselves and to impress upon the executive committee that they were an economical factor in the business. They thought that Mr. Wagner might appoint a committee to meet a committee of the jobbers.

It is expected that a committee will be named in the Commercial Section.

STANDARDIZATION MOVEMENT FOR APPLIANCE PLUGS

Manufacturers of Heating and Other Appliances Meet N. E. L. A. Wiring Committee—Committees on Round Prongs and Flat Prongs to Continue Discussion, and General Meeting Will Follow

A meeting of manufacturers of heating and other appliances was called for March 15 by the wiring committee of the Commercial Section of the National Electric Light Association, to consider the question of standardizing the plugs by which the various appliances are connected to the portable cord. At the meeting, which was held at the headquarters in New York, the following were present: R. S. Hale, S. E. Doane, C. A. Bates, Willis H. Booth, John A. Campbell, J. C. Dallam, A. H. Fleet, A. G. Kimball, J. H. Kleigl, Robert Kuhn, E. N. Lightfoot, J. P. Mallett, H. J. Mauger, T. A. McDowell, M. C. Morrow, H. J. Morey and by letter J. F. Killeen and H. T. Pelonze.

The meeting was opened by Mr. Hale, chairman of the wiring committee, who stated that the general purpose was to begin standardization by discussion, and that the N. E. L. A. would not itself take any action unless and until there should be substantial agreement among the manufacturers.

After a general discussion, during a portion of which Messrs. Hale, Doane and Mallett withdrew, it was decided to appoint two committees as follows:

Committee on round prongs: A. G. Kimball, Robert Kuhn, H. J. Mauger, E. N. Lightfoot and a representative of the Simplex company. Committee on flat prongs: W. H. Booth, F. Thornton and H. T. Pelonze.

Mr. Hale will be a member and secretary of both committees. Each of these committees will consider the subject and submit to another general meeting reports giving the arguments and experience as to why round or flat prongs will be the best design for a standard. They will also suggest the best dimensions and specifications in case either should be adopted. The reports will also include the question of guides on appliances.

The committee on round prongs will meet at 10 a. m. on May 26, at the N. E. L. A. rooms, New York, the committee on flat prongs at 1 p. m. on May 28, for lunch in Atlantic City, at a hotel to be decided later.

Each member of these committees is requested to send to Mr. Hale by May 10 if possible a statement of reasons for his preference for round or square prongs, and suggestions as to specifications and dimensions.

In addition, and since it is possible that the committees may not adequately represent the manufacturers of either or both types of prongs, any other manufacturer who desires is requested to send a similar statement, and also to notify Mr. Hale if he would like to be present at the meeting of either committee.

If any manufacturer wishes to present the claim of any other form of connection than the round or flat prong he is requested to send the same to Mr. Hale.

The two committees will prepare reports which will not be published, but will be sent to the manufacturer interested. Any manufacturer not represented at the meeting on March 15 is requested to notify Mr. Hale if he wishes to be advised of these reports.

A further general conference of manufacturers will be called during the summer, or early fall.

CONNECTION WITH NEW ENGLAND POWER COMPANY IS ECONOMIC

Noteworthy Support Given to Fall River Electric Light Company Project by Municipal Authorities, Commercial Organizations and Influential Citizens

The Massachusetts Commission on Waterways and Public Lands gave a hearing at Boston recently upon a petition of the Fall River Electric Light Company for authority to build a 66,000-volt aerial transmission line crossing of 1800-ft. span over the Taunton River to enable the company to enter into a contract with the New England Power Company for the supply of energy in connection with the existing turbine station of the former company in Fall River. The hearing was of much engineering interest on account of the discussion of the project before the commission by Philip Cabot of Boston, vice-president of the Fall River company, and it was also noteworthy on account of the support rendered to the company by the municipal authorities of Fall River, the local board of trade and merchants' organization, and many influential citizens.

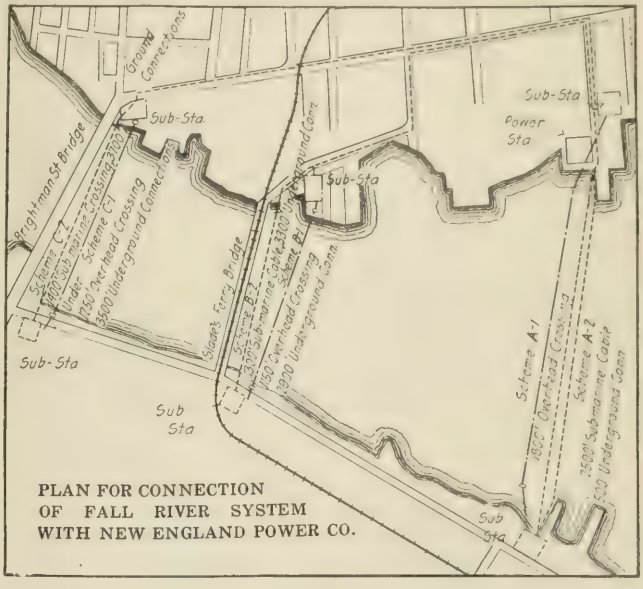
W. Rodman Peabody of Boston, counsel for the company, objected to a proposed delay in the proceedings. He said that as the price of steel for towers has increased by several thousand dollars while the petition has been pending, further delay was unfair.

MERCHANTS AND MILLS BENEFITED

Mayor James H. Kay of Fall River said that he firmly approved the aerial crossing, and that with the tie-in proposed with the large system of the New England Power Company merchants and mills in the city would be all the more willing to purchase central station energy. The Mayor said that he understood there would be a large increase in the taxable property of the company if the new construction went through. W. A. Beatty, vice-president of the Pilgrim Mills, said that this establishment was the first textile plant to be driven by central station energy in the city, and that it is the largest user of electricity on the company's lines. The speaker favored authorizing the overhead span. C. B. Chase, for the Stevens Manufacturing Company, which has recently installed auxiliary central station power service to assist in meeting the expansion of the mill business instead of extending its own power plant, said that the increased reliability of service would be valuable to the textile industry, which is closely dependent upon continuous operation.

Vice-President Cabot of the company said that it reached the limit of its capacity last December and has no spare equipment. Connection with the New England system is designed to bring an additional regular supply of primary power into the plant to enable it to most economically meet the demands of future business, especially in the textile field. Fall River, Mr. Cabot stated, is the least developed electric power market of any city of its size in the country, more steam power in proportion to its size being in use there than anywhere else. The margin of profit in supplying electricity to textile mills is very narrow, only 0.1 cent per kilowatt-hour, and this means that every possible economy in production and distribution must be sought. Any day the company is liable to be confronted with a demand for 5000 to 10,000 kw. in new mill business. It must be prepared to serve the public even on the foregoing small margin of profit or else give place to a more energetic organization. At a first cost of about $248,000 for the aerial crossing, necessary substation, conduit and related work 30,000 kw. can be added to the Fall River system, whereas additional local steam plant capacity to this extent would cost probably $2,000,000.

The proposed river crossing would have a span of 1800 ft., the minimum clearance of the ⅝-in. copper-clad steel cables to be used being 140 ft. above mean high water. Two 230-ft. steel towers would be erected on the Somerset and Fall River shores respectively and the crossing would be made by two three-phase circuits. Mr. Cabot said that the location settled upon is the result of analyzing six different schemes. The span proposed is the least expensive in first cost and in annual operating expense, including fixed charges. The preferred plan provides an aerial crossing higher than Brooklyn Bridge, with a clearance of at least 10 ft. above the topmast of any vessel of American registry at mean high water. All switching in the substation on



PLAN FOR CONNECTION OF FALL RIVER SYSTEM WITH NEW ENGLAND POWER CO.

the Fall River side will be controlled from the power plant switchboard. Transformers of 30,000 kw. combined rating will have windings connected for 66,000, 22,000 and 4200 volts. Energy may be distributed at 22,000 and 4200 volts, or the equipment in the power plant may be utilized in delivering 22,000-volt energy to the mills. Mr. Cabot said that the proposal to carry the 66,000-volt line across the river on the existing bridge structures was entirely unsafe, apart from its unsightly features.

The preferred scheme of a direct high-tension crossing by aerial cable, Mr. Cabot said, means from $22,000 to $59,000 less first cost in the crossing and connections than in the other schemes; from $71,000 to $56,000 less initial cost in substations, and from $93,000 to $115,000 less initial cost for the total installation. As the initial installation would be only one-half the ultimate, the total annual excess cost of the five alternative schemes over the preferred crossing would range from $17,600 to $18,600. Mr. Cabot said that if the commission denied the petition, the expenditure of about $100,000 more for any of the alternative schemes would make the project prohibitive to the company.

The estimated cost of the preferred crossing is as follows: Land in Somerset, $4,000; tower footings, $15,000; towers, $15,000; wires, $4,000; total overhead crossing, $38,000; underground connections with the existing plant, $5,900; land at the power station, $10,000; 66,000-volt transformers, $70,000; lightning arresters, $4,000; 66,000-voltmeters, $5,000; 66,000-volt switching apparatus, $16,000; 22,000-volt switching apparatus, $80,000; 4000-volt switching equipment, $15,000; substation piping, etc., $5,000; grand total estimated cost, $248,900. The total annual cost of the preferred scheme came to $41,470, of which $11,600 was in operating expenses and $29,870 in fixed charges.

SCRAP SALES HELP NORTHERN CALIFORNIA POWER COMPANY

Opportunity to Replace Aluminum Transmission Wire with Copper Line of Higher Voltage Promotes Economy and Prospects

Of $846,227 gross operating revenue of the Northern California Power Company, Consolidated, in 1916, $768,788 came from electricity, $35,505 from gas and $41,934 from water. Operating expenses, taxes and depreciation reserve were $375,789, leaving net earnings from operation of $470,438. Profits on merchandise sales were $11,221, making total net income of $481,659. Deducting interest of $352,920 and miscellaneous charges of $517, leaves $128,222 balance. An unusual item is "miscellaneous additions to surplus and profit on sales of junk," $57,039, comparing with $2,165 in the previous year. Valuation account and other extraordinary deductions from surplus took $54,551. Against the balance of $130,710 there were due sinking fund appropriations of $133,825, indicating a deficit of $3,115. The proportions of the different classes of electric business were:

		1916	1915
Light earnings:	Residence and commercial	$134,427	$133,249
	Municipal	22,273	19,726
Power earnings:	Commercial	67,512	61,274
	Municipal	6,623	6,279
	Irrigation	95,350	64,670
	Mining and dredging	205,373	183,213
	Other electric companies	213,481	212,667
	Other departments	23,749	23,555
		$768,788	$704,633

W. F. Detert, the president, estimates in the annual report to stockholders that in 1917 50,765 acres will be irrigated by pumped water, the pumps being electrically operated with power furnished by the company. Of plant additions and system changes the report says in part:

"Owing to increased demands, particularly in the more southerly portion of the territory, it has been necessary to adopt a definite plan having for its object the operation of all transmission lines at 60,000 volts, except in the mining section in Shasta County, where it is still feasible to operate at 20,000 volts over a portion of the system. The necessary steps involve construction of some new 60,000-volt lines, increase of copper wire capacity on others, a change in the equipment and arrangement of a number of substations and the dismantling of 20,000-volt lines which it is not desirable to retain for operation as low-voltage distribution circuits. It has been possible to take down practically all of the aluminum wire on lines between Red Bluff, Butte City and Chico and to replace same with copper wire of increased capacity where required. Up to the end of 1916, 150,000 lb. of aluminum wire had been taken down and sold at a net profit of $31,197 over its cost price. This has, of course, assisted very materially in defraying the cost of these changes. During 1916, $295,513 was invested in additional water rights and betterments and additions to the system in general. Purchase of water rights necessary for the operation of present plants and land which we were compelled to purchase with the water cost $77,220; additions and betterments to electric facilities, $208,000.

"Various lines or portions of lines were dismantled, the original cost of which amounted to $103,199, so that the net increase in investment values for the year was $192,314. From the lines dismantled material was recovered having a salvage value of $87,993. The cost of dismantling amounted to $2,942. A total of 36.7 miles of new primary distribution lines was constructed and 482 new services of a combined length of 68,114 ft. were installed.

"One new line is designed among other things to serve the Western States Gas & Electric Company, with which a contract has been made to furnish it with power which it may require for its Eureka district in excess of the output of its present generating facilities."

ELECTRIC COOKING DISCUSSED IN WISCONSIN

Experience of Milwaukee Company with the Electric Range—Safety Rules of the Railroad Commission—B. F. Lyons of Beloit Elected President

On the second day of the convention of the Wisconsin Electrical Association at Milwaukee, March 15, interest centered on a paper entitled "Electric Service for Domestic Cooking," by R. B. Snyder, sales manager of The Milwaukee Electric Railway & Light Company. Under Milwaukee conditions, Mr. Snyder showed, the characteristics of the cooking load make it a desirable one. He supplemented his arguments by data from actual range installations at Milwaukee. He said that the extra investment required to serve a range customer was only $35, or less than the investment originally required to serve the average residence customer, whose bills are about one-third those of a cooking customer. Mr. Snyder also spoke of the necessity that the sales department should have ready co-operation from the service and trouble departments to make ranges give satisfaction.

In the discussion Egbert Douglas of Milwaukee expressed the belief that characteristics of range loads taken from present installations should not be used as an absolute basis for predicting what will be the characteristics of the future cooking load, when there will be many more customers than to-day. He believed that electric cooking would fall largely on the evening lighting peak, and declared himself for cooking rates that took this encroachment on the peak into consideration.

This statement was answered by operators who have been offering cooking rates. C. L. Kuehlthan of West Bend, Wis., said that after offering trial range installations on a 3-cent rate for eighteen months he now had 4 per cent of his former lighting customers cooking electrically. In a city like West Bend with 3000 people the heavy cooking peak is at noon.

G. W. Van Derzee of Milwaukee pointed out that the experience of gas companies in Watertown and Kenosha, Wis., showed the cooking peak to be at noon. He said further that he expected the cooking business to have a diversity factor of ten.

Safety Code

Another topic of general interest was the new safety code which the Railroad Commission of Wisconsin has presented in tentative form for discussion by utility operators.

As explained by J. N. Cadby, electrical engineer for the commission, this code is a much condensed revision of those parts of the National Electrical Safety Code which are applicable to Wisconsin conditions. The National code contains 323 printed pages. The proposed Wisconsin code contains twenty-six similar pages. The National Electrical Safety Code could not be adopted as a whole in Wisconsin because parts of it conflict with the Wisconsin law and because it deals with industrial work over which the Industrial Commission and not the Railroad Commission has jurisdiction. The spirit and requirements of the proposed Wisconsin code are, however, substantially the same as those of the National Electrical Safety Code. A great deal of work was done to shorten it without eliminating rules necessary for

companies in the heavy loading district. It was the commission's plan to have its inspectors use the National Electrical Safety Code as a guide in administering the Wisconsin code.

A discussion of the Wisconsin code in detail was held at Milwaukee the day after the convention.

Other papers and addresses were as follows: "Plans for Wire-Your-Home Time, April 1 to May 15" by Harry W. Alexander, Society for Electrical Development, New York; "One-Man Car Operation," by Raymond P. Smith, Sheboygan, and "Transmission Problems," by G. W. McIvor, Jr., Eau Claire, which was read by A. E. Pierce of Eau Claire.

NEW OFFICERS

The election of officers resulted as follows: President, B. F. Lyons, Beloit; first vice-president, A. E. Pierce, Eau Claire; second vice-president, John St. John, Madison; third vice-president, F. C. Ludden, Mineral Point, and secretary-treasurer, George Allison, Milwaukee.

LARGE GROSS SALES OF THE WESTERN ELECTRIC COMPANY

Profits on Telephone Apparatus Not Proportional to Volume but Satisfactory on Cable and Merchandising of Quick Turnover—Manufacturing Conditions Difficult

Unsatisfactory manufacturing conditions affected the operations of the Western Electric Company during 1916. Gross sales, however, increased 67.6 per cent over 1915. H. B. Thayer, the president, indicates the extreme conditions of business in the different departments, the large increase in employees and the uncertainty of the situation in the foreign plants. Mr. Thayer says:

"The profits of the company are derived from the sale of telephone apparatus and cable of our own manufacture, and the sale of merchandise not made by us, and from our investments in foreign manufacturing companies in similar lines of work.

"While the output of telephone apparatus has been large in 1916, the deliveries were principally during the latter part of the year and on orders received considerably earlier in the year, as in this class of work some months elapse between the beginning of the process of manufacture and the final delivery of the finished apparatus. The costs of all the items going into the cost of manufacture have rapidly increased during the year, so that the profit on this department of the business has not been proportional to the volume.

"On sales of cable and merchandise not of our own manufacture, where the turnover is quick, the profits have been satisfactory.

"As to the foreign manufacturing companies in which we are interested, our information as to the most of them is meager, but we understand that they have, with the exception of the one at Antwerp, Belgium, been employed on fairly profitable work during the year. Whether a satisfactory profit will remain after the payment of war taxes in the several belligerent countries is not so certain. No dividends have been received by us, so that our foreign investments have made no contribution to our profits of the year, as shown in the statement.

"Manufacturing conditions in this country during the year have been extremely difficult. It has been almost impossible to provide a regular supply of material, not only on account of the general shortage, but also on account of the uncertainties of freight transportation. The demand for our products increased very rapidly during the year and the necessity of meeting this demand has taxed all available resources for machinery, tools and other expense items.

"Our shop force increased during the year from 10,838 to 18,928 employees. The total number of employees at Dec. 31, 1916, was 26,878. In recognition of the loyalty and efficiency with which the employees have met and are meeting the difficult conditions of the present time, your directors authorized the distribution of certain extra payments to them.

"The sales for 1916 were $106,987,000. For 1915 they were $63,852,000, and for 1914 they were $66,408,000. The orders on hand at Dec. 31, 1916, were $22,028,000 in value more than on Dec. 31, 1915. The average value of an order filled during 1916 was $75 as compared with $55 for 1915.

"The total disbursements from the employees' benefit fund for 1916 amounted to $185,344. These payments covered all classes of benefits and were made to 2789 beneficiaries."

The financial statements of the company and its constituent companies in the United States show that to the gross sales of $106,986,677 other income of $1,229,636 was added, making a total of $108,216,313. Cost of merchandise was $95,936,433, expenses were $7,014,254 and taxes were $587,050; there was appropriated for special payments to employees $973,866 and for reserve for contingencies $500,000. The balance available for interest and dividends was $3,204,710. Interest was $880,094, dividends were $2,100,000 and $224,616 was carried to the common stock.

The balance sheet for the same companies, as of Dec. 31, 1916, follows:

ASSETS		LIABILITIES	
Real estate and buildings	$11,633,290	Preferred stock, 150,000 shares	$15,000,000
Machinery and equipment	9,209,532	Common stock, 150,000 shares no par value	25,453,648
		Bonded debt	15,000,000
Total plant	$20,842,822		
Merchandise	33,001,524	Total capital liabilities	$55,453,648
Cash	5,328,180	Bills payable	5,500,000
Bills receivable	1,085,520	Accounts payable	12,334,003
Accounts receivable	18,109,258	Reserve for depreciation on plant	13,320,143
Total current assets	$57,524,482	Reserve for employees' benefit fund	1,000,000
Sundry investments	12,041,068	Reserve for contingencies	2,800,578
Grand total	$90,408,372	Grand total	$90,408,372

INTERIOR DEPARTMENT OFFICIAL FOR WATER POWER MATTERS

E. C. Bradley, of San Francisco, Formerly of the Pacific Telephone & Telegraph Company, Made Assistant to Secretary Lane

E. C. Bradley of San Francisco has been appointed assistant to the Secretary of the Interior, according to an announcement by Secretary Lane in Washington. Up to the time of his retirement from active business life two years ago Mr. Bradley was vice-president and general manager of the Pacific Telephone & Telegraph Company.

Mr. Bradley succeeds to the position formerly held by Adolph C. Miller, now a member of the Federal Reserve Board, which was also formerly held by Stephen T. Mather, who becomes director of the National Parks. Mr. Bradley was at one time superintendent of telegraphs of the Pennsylvania Railroad. He also has served as general manager and vice-president of the Postal Telegraph Cable Company.

It is expected in Washington that Mr. Bradley will become the public utility expert of the Department of the Interior, and that he will have much to do with the administration of water-power matters.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public-utility companies.

Delegation of Rate-Fixing Power to Municipality.—Since the right to regulate rates is an inherent element of sovereignty, such right can be delegated to a municipality only by clear and express terms, and all doubts must be resolved against the municipality, it was held by the Supreme Court of Oregon in the city of Woodburn vs. Public Service Commission of Oregon (161 P. 391). The right to regulate rates is a matter of general concern, and does not pertain solely to municipal affairs. Where a municipality under its home rule charter granted a telephone franchise limiting rates to be charged and later the public utility act was enacted, the Public Service Commission had authority thereunder to authorize the company to charge higher rates. When an owner devotes his property to a use in which the public has an interest, he must submit to be regulated and controlled by the public for the common good. The regulation of rates for the purpose of promoting the public health, comfort, safety and welfare is an exercise of the police power of the sovereign.

Public Within the Meaning of Employers' Liability Law.—An interesting decision was handed down in the case of Clayton vs. Enterprise Electric Company (16 P. 441) by the Supreme Court of Oregon, in which it was held that the employers' liability law, which provides for the safeguarding of transmission and distribution lines at all points where people are liable to come in contact with them, was intended to safeguard members of the public from coming in contact with wires carrying a dangerous current, and was not limited to the protection of the immediate employees of electric companies. The action was brought to recover for the death of the plaintiff's husband, caused by an electric shock which he received by attempting to turn off the power furnished by the defendant of a motor pump operated by a private individual by whom the deceased was employed. The court held that where an electric company furnished the energy for operating a pump owned by an individual and owned the wires leading to the switch which was installed by the company's predecessors, the company can exercise control over the switch even if it does not own it, and is liable under the employers' liability law if the switch is defective. And again, where an electric company undertakes to render service to a customer and runs its wires into a building and installs its apparatus therein, it must exercise a degree of care commensurate with the risk in protecting and insulating its wires and installing the apparatus.

Tree Cutting Liability.—Employees of both an electric light company and a telephone company entered plaintiff's premises and cut and disfigured her shade trees during the stringing of a new telephone line. Both companies and all who participated in the act as their agents were held by the St. Louis (Mo.) Court of Appeals (190 S. W. 612) jointly and severally liable for the damages. It was held to be no defense that a street commissioner of the city was present, giving orders and directions regarding such cutting, it not appearing that the commissioner had authority to direct such cutting nor that the branches were cut for any other purpose than to aid the telephone company.

Injury to Employee.—In an action by an employee injured in loading poles on a truck evidence was held to warrant a finding that the employer was guilty of negligence in furnishing a defective wooden horse to elevate one end of the pole, by the District Court of Appeals for the First District of California at a rehearing denied by the Supreme Court in the case of Hansen vs. Sierra & San Francisco Power Company (162 P. 924). An award of $11,310.05 to an employee thirty-two years of age, in strong condition mentally and physically with an earning capacity of $85 per month, for personal injuries which affected him both mentally and physically, cannot be held excessive.

Right of a Municipality to Purchase Under an Indeterminate Permit.—Under the public utilities statute of Wisconsin as to acquisition by a municipality of a public utility, providing that a public utility by acceptance of an indeterminate permit shall be deemed to have consented to a future purchase of its property by the municipality in which its property is, for the compensation and under the terms and conditions determined by the commission, and shall thereby be deemed to have waived the right of requiring the necessity of such taking to be established by the verdict of a jury, a proceeding under this statute by a municipality to acquire the property of a utility operating under an indeterminate permit, although termed a purchase, was in the nature of a condemnation proceeding, it was held by the Supreme Court of Wisconsin in Connell vs. Kaukauna Gas, Electric Light & Power Company (159 N. W. 927) since the acceptance by the utility of an indeterminate permit amounts only to a waiver by it of a verdict of necessity and a consent that its property may be acquired as provided by the act, but is not a contractual act. In a proceeding by a municipality to acquire a public utility under the statute, it was the municipality's duty to see that the amount of bonds outstanding under a trust deed on the property of which the city had notice was applied to the claims of the bondholders either by payment of the money into court for distribution or by securing consent of the bondholders to pay it to the trustee, or in the event that they would not consent to such payment, to wait until they asserted their rights in the fund.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Permissible Earnings on Stock.—In a decision affecting the St. Croix Gaslight Company the Maine Public Utilities Commission says that a fair rate "should be a rate which, when applied to the probable output of the company, will produce a revenue sufficient to yield such a dividend on an amount of capital exactly equal to the fair value of the property as will induce others to invest capital in similar enterprises with the expectation of getting their recompense from the normal earnings of the enterprise, not from the flotation of its securities."

Installation of Services and Meters in New York.—A general order establishing rules and regulations covering the installation of electrical services and meters, and the materials to be used therein, approved by the New York Public Service Commission, First District, is to take effect on April 1, 1917. No electrical corporation furnishing energy within the jurisdiction of the commission shall thereafter install or put in use on any service to a consumer's premises any appliance, device, switch, fitting or instrument transformer the type of which shall not have been approved by the commission. A service, for the purposes of the order, is defined as that part of the circuit, and all equipment pertaining thereto, between a main of the electrical corporation and the consumer's circuit. A service transformer secondary is considered a main. Following is the schedule of fees to be charged a manufacturer for each complete test: Conduit, metal molding, and fittings, each type, $2; armored, lead-covered, insulated cables or wires, $2; fuses, fuse blocks, insulators and ground clamps, $2.50; metal boxes and cabinets, each size, $2.50; knife switches, $4; circuit breakers, $5; potential transformers, 3200 volts or less, $6; 6600 volts, $8; current transformers, 250 amp. or less, $8; 300 to 450 amp., $12; 500 to 800 amp., $15; 1000 amp., $17. Protective devices, testing combinations, miscellaneous equipment, or service equipment with an ampere capacity in excess of 1000 amp., or a voltage rating in excess of 6600 volts, will be charged at the rate of $1 per hour per man for the time required to determine its serviceability, the minimum charge to be $3, and the maximum charge not to exceed $50. Whenever service equipment is submitted so that it is represented in more than three sizes or ranges, and it is found that tests of each range or size are not necessary to determine the serviceability of the type, the fee then charged will be as per schedule for each device tested, and for each device in addition to those tested only $1 per device will be charged.

Electricity at Mississippi Centennial Exposition.—Electricity and the electrical industries are to have a part in the Mississippi Centennial Exposition, opening at Gulfport on Dec. 10, 1917. Harry Chapin Plummer, industrial agent of the exposition, 505 Fifth Avenue, New York, has designed a "Plantation Electrical," to afford opportunity for the display and demonstration of electrical apparatus, as applied to the processing of standard products of the Gulf States, such as cotton, rice, sugar, tobacco, corn and lumber. Irrigation will be an important feature. A bungalow or dwelling will be included, to show the newest electrical devices for the home.

Test Run of Electric Vehicle in Pittsburgh.—A test run was made in Pittsburgh by the Keystone Laundry Company of a Ward special light truck. Representatives of the laundry company, the Lawrence Motor Company, the Ward Motor Vehicle Company and the Duquesne Light Company were on board. The truck was fully loaded from the plant of the laundry company and was operated until the battery was run down, covering the worst hills in the Pittsburgh district. The load was not lightened and the truck ran 63 miles on one full charge of the battery. It maintained its rated speed. The laundry company has ordered four additional trucks of this type, equipped with Edison batteries.

Sales of Stock to Byllesby Company Customers.—During February, 173 customers of the Northern States Power Company purchased $63,900 of the preferred stock, making a total of $1,398,900 now held by 2698 customer-shareholders, of which $187,000 is being purchased on the partial payment plan by 772 customers. The San Diego Consolidated Gas & Electric Company is offering $219,000 preferred stock to customers. A similar issue offered last year was absorbed in a short time. The present issue has been authorized by the Railroad Commission for purchase of new properties, improvements and extensions. Up to March 9, thirty-nine customers had purchased $48,000 at 105 and interest.

Fund for British Engineering Profession Relief.—Seventy-six prominent engineers have joined in an appeal to the members of the engineering profession in the United States asking for contributions to the Professional Classes War Relief Council, Inc., which was organized in Great Britain shortly after the beginning of the war. The families of many professional men in Great Britain are experiencing privation. Major Leonard Darwin, a son of the naturalist, is chairman of the council. Jerrard Grant Allen is now in America representing the council. J. Pierpont Morgan has loaned to the council his house in Prince's Gate for use as a maternity hospital. At present the council is disbursing about $5,000 a week and the administrative expense is less than 2 per cent. Contributions may be forwarded to Lewis B. Stillwell, treasurer, care the Farmers' Loan & Trust Company, 475 Fifth Avenue, New York.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Changes Asked in Wiring Requirements in Victoria, B. C.—The council of the British Columbia Association of Electrical Contractors and Dealers has appealed to the City Council of Victoria, B. C., to change some of its wiring requirements.

Water-Power Acquisition in New York.—Howard C. Mather, treasurer, and Stefaan Piek, chief engineer of the Salmon River Power Company, appeared before the New York Public Service Commission, Second District, on March 5, and explained the company's need for the acquisition of the small water power below its own large project at Pulaski. The company proposes to take over the whole Pulaski development with its stocks, bonds, rights and privileges as a measure of protection for its own works as well as on account of the possible valuable development in the new acquisition. No opposition to the plans has been expressed.

Tariff Commission Nominated.—President Wilson has sent to the Senate the nominations of the following for the recently created Tariff Commission: Prof. Frank William Taussig, Cambridge, Mass., Independent in politics, for a term of twelve years; Daniel Calhoun Roper, McCall, S. C., Democrat, for ten years; David J. Lewis, Cumberland, Md., Democrat, eight years; William Kent, Kentfield, Cal., Independent, six years; William S. Culbertson, Emporia, Kan., Republican, four years, and Edward P. Costigan, Denver, Col., Progressive Republican, two years. Professor Taussig, who will be chairman, has been with Harvard University. He has obtained a leave of absence until September, 1918. Mr. Roper was formerly first assistant postmaster general. Mr. Lewis is a former member of Congress from Maryland. Mr. Kent is also a former member of the House of Representatives. Mr. Culbertson is special counsel for the Federal Trade Commission. Mr. Costigan is a lawyer. The commission is to investigate the administrative, fiscal and industrial effects of the customs laws, relations between rates of duties on raw products, effects of ad valorem and specific tariff duties, questions relative to the arrangement of tariff schedules and classification of articles, the effect of tariffs on industries and labor, etc. The commission has power to investigate tariff relations between the United States and foreign countries, commercial treaties, economic alliances, export bounties, preferential transportation, dumping, and production costs. The commission is to gather and place this information at the disposal of Congress and the President.

Energy for Springfield, Mass., Railway.—Negotiations are under way for the sale of electrical energy by the Amherst Gas Company to the Springfield (Mass.) Street Railway.

Salt Lake County May Sell Lines.—Salt Lake County is considering the sale of its lighting system to the Utah Power & Light Company, the Murray Power Company or the Progress Realty Company.

Utility Tax Law in New Jersey.—The Oliphant bill, increasing assessments on electric, gas, water and other utilities in New Jersey has been signed by Governor Edge. It authorizes an added tax of 1 per cent on the present 2 per cent tax on gross receipts during the present year, increasing to 4 per cent in 1918, and to a maximum of 5 per cent in 1919. All companies with gross receipts of less than $50,000 a year are exempt. It is estimated that the increased revenue for the present year will aggregate about $1,000,000.

Plan to Merge Long Island Companies.—The New York Public Service Commission, Second District, heard on March 7 the application of the Long Island Lighting Company to purchase and merge all but one or two of the small lighting companies of Suffolk County. Martin S. Decker, representing the company, told the commission that not only could greater economies of operation be accomplished but that through the tying together of the many plants, service could be improved and perhaps extended to intervening communities which have not hitherto had gas or electric service.

Art in Signs at Portland, Ore.—Building Inspector Plummer of Portland, Ore, who completed recently a survey of illuminated signs in Portland, in accordance with instructions from the City Council, found 237 signs without the amount of illumination prescribed in the ordinance, and sixty-seven which he classes as unsightly. He recommends that the Council revoke permits for the maintenance of unsightly signs and for others which are maintained in violation of the law, and suggests that in future the art commission be empowered to pass on designs before permits are granted.

Milwaukee Men in Naval Reserve.—Employees of the Cutler-Hammer Manufacturing Company of Milwaukee are the first Wisconsinites to be enrolled in the industrial branch of the United States Naval Reserve. Medical examinations have been completed among the 436 employees of the corporation. During times of peace, according to Ensign John L. Riheldaffer of the United States Navy, who mustered in the employees, they will be under no obligation except to keep their names on file. They are free to resign or change their positions at any time, he said. In times of war, however, they cannot resign from the reserve or change their positions. At all times they will be exempt from military duty. Examinations are now being made at the plant of the Allis-Chalmers Manufacturing Company, employees of which will also be enrolled in the naval reserve.

Worcester Polytechnic Institute Branch, A.I.E.E.—Edward Dana, manager of surface transportation of the Boston Elevated Railway Company, addressed the Worcester Polytechnic Institute branch of the A.I.E.E. on March 16. His topic was "Traffic Problems on a Large Urban Railway."

Dallas Electric Club and Jovian League.—On March 5, the Dallas Electric Club and Jovian League met jointly to receive the reports of two important committees, that of the Jovian committee appointed last meeting and that from the committee preparing the Electric Club float to be entered in the spring style show parade.

Electrical Development and Jovian League of San Francisco.—At the March 7 meeting of this organization, P. L. Thompson of New York, advertising manager of the Western Electric Company, gave a talk on "Selling the Electrical Idea." With the aid of lantern slides Mr. Thompson outlined the policy of educating consumers to the use of electrical devices first, and of selling a particular make of equipment afterward.

Intensive Membership Campaign, N. E. L. A.—The membership committee of the National Electric Light Association wishes to call attention to the intensive membership campaign which will prevail during the week March 26 to 31. Several hundred central-station executives throughout the country have been asked to call upon neighboring nonmember companies and extend them an invitation to join. The committee hopes that this will serve as a reminder.

St. Louis Jovians Aid in Red-Cross Organization.—Following addresses which were delivered before the St. Louis Jovian League at the Mercantile Club on Feb. 27 by James J. O'Connor, chairman of the Chicago Red Cross committee, and George W. Simmons, chairman of the St. Louis branch of the organization, the support of the St. Louis Jovians was assured the local Red Cross organization. Herman Spoehrer, secretary and treasurer of the Union Electric Light & Power Company, was appointed chairman of the Jovian committee to supervise the Jovian activities in the movement. C. W. Shands presided as chairman of the meeting, which was attended by about 100 members of the order.

"Steam Turbines and Reduction Gears for Ship Propulsion."—A joint meeting of the Portland sections of A. I. E. E. and N. E. L. A. was held in the Assembly Hall, Multnomah Hotel, Portland, Ore., on March 6, under the auspices of the A. I. E. E. A paper was presented by W. J. Davis, Sr., Pacific Coast engineer of the General Electric Company, on "Steam Turbines and Reduction Gears for Ship Propulsion." The paper included a description of flexible helical gears, their application to cargo ships, destroyers, scout cruisers, etc., electric drive for battleships and cruisers, the electro-magnetic clutch and the latest design of Curtis turbine. The paper was illustrated by lantern slides and sketches.

Associations and Societies

A complete Directory of Electrical Associations is regularly printed in the first issue of each month on the next-to-last text page.

Electric Club-Jovian League of Chicago.—E. B. Rosa, chief physicist of the Bureau of Standards, Washington, D. C., addressed the Electric Club-Jovian League of Chicago on March 15.

Spring Meeting, A.S.M.E. — The spring meeting of the A.S.M.E. will be held at Cincinnati, Ohio, on May 21-24, opening on May 21, instead of May 22 as previously announced. A feature of this meeting will be a joint session with the National Tool Builders' Association. Other sessions include discussions of problems relating to the manufacture of munitions, gas power, and machine shop practice.

New York Companies' Section, N. E. L. A.—The March meeting of the New York Companies' Section, N. E. L. A. was held in the Irving Place Auditorium, Fifteenth Street and Irving Place, New York City, on Tuesday evening, March 20. About 300 attended, the speaker of the evening being William Leslie French. The Women's Auxiliary of the New York Edison Company gave a dance following the meeting.

American Electrochemical Society.—The proposed program of the thirty-first general meeting of the American Electrochemical Society, to be held in Detroit, May 2 to 5, is as follows: Wednesday—Visits to automobile plants; "Get-together" roadhouse dinner; Thursday—"Electric Steel—Its Manufacture, Uses, Advantages and Hart Treatment; Abrasives; Ferro-Alloys; general electrochemical papers; and smoker. Friday—"Melting of Non-Ferrous Metals; also Various Low Temperature Electro-Thermic Processes"; Visits to electric steel plants, power houses, etc., and address by Mr. Alex Dow. Saturday—"Electro-Deposition of Metals; Rust Prevention" and miscellaneous papers.

Chile as a Field for Manufacturers and Investors.—Jose A. Del Campo F., commercial delegate of the Chilean government, will speak at a meeting held under the auspices of the National Association of Manufacturers at the Waldorf-Astoria (Astor Gallery), New York City, on March 29. Mr. del Campo's address will be illustrated by lantern slides and motion pictures and will contain a great deal of information from official sources of the immense opportunities which Chile offers to American manufacturers and investors in the development of its varied natural resources. Manufacturers of machinery, engines and motors should be specially interested in this lecture, as the pictures have been selected with the view of illustrating Chile's present industrial development and immediate future needs in this direction. Oil, coal and water falls are available for development.

Electrical League of Cleveland.—Judge Carl D. Friebolin addressed the Electrical League of Cleveland March 22 on the subject of "How Our Laws Are Made."

Association of Iron & Steel Electrical Engineers.—The eleventh annual convention of the Association of Iron & Steel Electrical Engineers will be held in Philadelphia, Sept. 10 to 14, inclusive.

Chemist Talks to Electrical Men.—That the war has given the American chemical industry a big boost was a point brought out in an address by Robert A. Miller, Jr., on March 2, at the weekly luncheon meeting of the Philadelphia Jovian Electrical League at the Hotel Adelphia. The speaker is research chemist for H. K. Mulford & Company and a nephew of Thomas A. Edison.

St. Joseph Jovians Hear Henry L. Doherty.—Before an assemblage of Jovians gathered in his honor at St. Joseph, Mo., on March 6, Henry L. Doherty stated that greater progress could be made by the railroads and utilities if there were less governmental interference. "One of the foolish theories advanced in this new fad of conservation is that the cutting away of the forests has caused floods succeeded by drouths. There is no better reservoir for water than tilled soil. And yet the idea has gained until it has stopped altogether the development of water power and has forced this country to burn millions of dollars worth of coal every year to make power that could be generated by the water power of this country." The necessity of having to sign an agreement to remove dams in case they interfere with navigation and to submit to regulation by the war department was cited as a reason for halting one hydroelectric project.

Annual Convention of Tri-State Water & Light Association.—The annual convention of the Tri-State Water & Light Association of the Carolinas and Georgia will be held at Macon on April 17, 18 and 19, and the indications are that the 1917 gathering will surpass all previous meetings of the organization. The president of the association, E. M. Anderson of Abbeville, S. C., held a conference with the secretary-treasurer, W. F. Steglitz at Columbia, S. C., and prepared tentative plans for the approaching convention. An interesting and instructive program is assured and the first vice-president, J. E. Guilford of Macon, is arranging the entertainment features. Among the speakers expected to address the association are: Ray Werner, State chemist of Georgia; A. M. Schoen of the Southeastern Underwriters Association; Rawson Collier of the Georgia Railway & Power Company of Atlanta; Dr. F. L. Parker, State chemist of South Carolina; H. Y. Carson, New York; A. J. Sproles, Greenwood; R. T. White of Columbia, and others. The association is offering two prizes—one is to be given to the member securing the largest number of new members, the other goes to the firm or manufacturer making the most attractive exhibit.



F. M. BERNARDIN

Frank M. Bernardin, president of the B.-R. Electric Company of Kansas City, was unanimously elected chairman of the central division of the Electrical Supply Jobbers' Association at Chicago on March 13. Mr. Bernardin has been a figure in the electrical industry at Kansas City since the first trolley cars were operated there. He started work with the Metropolitan Street Railway Company of Kansas City when it was organized in 1886, and before 1897 rose to the position of assistant general manager. In 1897 he organized the B.-R. Electric Company, which concern he has continued to head since that date. He has always been an active committee worker in the Electrical Supply Jobbers' Association, and is at present a member of that organization's executive committee. He has also shown active interest in local civic affairs, and was the organizer and first president of the Kansas City Electric Club.

S. J. Dill, for several years vice-president of the United Gas & Electric Engineering Corporation, will assume until further notice the duties which were performed by George B. Tripp, who resigned as a vice-president of the corporation on March 1 to become president of the Central Construction Company of Harrisburg, Pa. Mr. Dill went to New Orleans early in 1915 to assume charge of the work of the corporation in the South, returning a year later to New York. For a number of years Mr. Dill was connected with the Elmira (N. Y.) Water, Light & Railroad Company, of which company he became manager in 1908 and two years later vice-president and general manager.

A. C. Jordan has been appointed commercial manager of the Cumberland County Power & Light Company, of Portland, Me., succeeding George T. Fisher, who resigned on March 15 to enter business in New York City. Mr. Jordan is a graduate of the Massachusetts Institute of Technology and his experience includes a term of service in the plant of the Westinghouse Electric & Manufacturing Company, at East Pittsburgh, Pa., and central station work at Elmira, N. Y. Since joining the Portland company two years ago he has been in charge of power sales.

Men of the Industry

Changes in Personnel and Position— Biographical Notes

George Gibbs, who has been prominently identified with most of the more important railroad electrifications in the East, was elected president of the American Institute of Consulting Engineers at the recent council meeting. Mr. Gibbs was born on April 19, 1861, and received his engineering education at Stevens Institute of Technology, graduating in 1882. From 1884 to 1897 he was in the employ of the Chicago, Milwaukee & St. Paul Railway Company, being mechanical engineer of the system during the last ten years of his service. During the next four years he was consulting engineer for the Baldwin Locomotive Works and the Westinghouse Electric & Manufacturing Company. From 1901 to 1905 he was consulting engineer for the Interborough Rapid Transit Company. In 1904 he was employed by the West Jersey & Seashore Railroad as chief engineer of electric traction, serving for two years. During this time he was appointed a member of the board of engineers for the New York terminal of the Pennsylvania Railroad, his connection with the Pennsylvania system dating back to 1903, when he became chief engineer of electric traction and station construction of the Pennsylvania Tunnel & Terminal Railroad Company, which position he held until 1912. He was also



GEORGE GIBBS

chief engineer of electric traction of the Long Island Railroad. Among the organizations for which Mr. Gibbs has acted in a consulting capacity are the Norfolk & Western Railway, Pennsylvania Railroad, New York Connecting Railroad, Public Service Commission for the First District of New York and Chicago Commission on Smoke Abatement and Electrification of Railway Terminals. Mr. Gibbs is a member of the firm of Gibbs & Hill, New York City.



B. F. LYONS

B. F. Lyons, the president-elect of the Wisconsin Electrical Association, was graduated from the University of Wisconsin in 1903. Upon leaving school he became assistant engineer for the Laclede Gas Light Company of St. Louis. After three years he went into the employ of the Merchants Power Company of Memphis, Tenn., where he remained until 1907. At that time he took up his present work as vice-president and general manager of the Beloit (Wis.) Water, Gas & Electric Company. He has always been an active worker in State association work and is at the present time the president of the Wisconsin Gas Association.

Paul Augustinus, vice-president of the Marquette Electrical Engineering Company, Chicago, has been appointed a national director of the American Association of Engineers to succeed W. F. Mauer, resigned.

Willis M. Deming of Schenectady, N. Y., has resigned his position with the General Electric Company and will spend some time on the Pacific Coast in rest and recreation, for which he has long felt the need. He expects eventually to engage in business in that part of the country. Mr. Deming has been in the service of the General Electric Company for the last twenty-eight years, having entered the employ of the Thomson-Houston Company at West Lynn in 1888. On the evenings of March 8 and 13 he was tendered farewell dinners by his associates of the General Electric Company and other friends in Schenectady.

Obituary

Louis B. Sharpe, for eighteen years a superintendent of the Queensborough Gas & Electric Company died quite suddenly a few days ago at his home in Far Rockaway, N. Y., from a cerebral hemorrhage, at the age of forty-nine. Mr. Sharpe was connected with the electrical industry for about thirty years, being first employed by the Citizens Lighting Company, which was later absorbed by the Queensborough company, with which he was employed as superintendent until 1909, when he retired to enter the real estate field.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

MARKET FOR ELECTRICAL GOODS STILL GROWING

Indications that Business for First Quarter of Current Year Will Be Greater than That for First Quarter of 1916

Electrical manufacturers continue to be swamped with business. At the present time there are evidences that the volume of unfilled orders exceeds that at the end of last year. December was one of the largest, if not the largest, month in the history of the industry up to that time, and then it was supposed that a good many orders were being placed prior to the new year so as to escape an expected advance in prices. January, however, it is understood, was even larger than December, and February, while not so large because of the smaller number of days, showed no diminution in weekly totals.

There seems to be good reasons to believe, therefore, that the first quarter of this year, which has one more week to run, will show a greater volume of business than the first quarter of 1916.

Electrical manufacturers have not the facilities to handle the great volume of business that is now being placed on the books in anything like normal times. At the rate orders are coming in it becomes evident that conditions must be getting worse instead of better. A number of new factories went up in 1916 and a number more are expected to be placed in operation during this year. The industry, therefore, will be in a position this year, unless the government intervenes, to turn out a greater volume of goods than was turned out in 1916, when the total was far in excess of $500,000,000. With prices generally higher for 1917 delivery than for 1916 delivery and with increased factory space it is not inconceivable that the value of the 1917 output will reach $750,000,000.

COPPER WIRE MARKET SHOWS CONTINUED LARGE DEMAND

Particular Activity Is Noticed in the Production of Both Code and Insulated Automobile Wire

Business has been large in the wire market and manufacturers are working at high speed. There has been a good demand for practically all kinds of wire and particularly code wire. This is house-wiring time and also marks the beginning of spring construction work. The manufacture of insulated wire for automobile purposes has reached a tremendous production and apparently is increasing all the time.

Local conditions as reported by correspondents of *The Wire Message*, published by the Habirshaw Electric Cable Company, Inc., and The Electric Cable Company follow:

San Francisco: General conditions good for 1917. Stock in bad shape owing to transportation difficulties. Lower prices and continued prosperity anticipated for this year. Business shows no falling off.

Los Angeles: Everything southern California has produced this year has been sold at record-breaking prices, and the yield has been large. Bank clearings show a heavy volume of business. More activity is manifest in real estate than for four years past. Banks are in condition to finance any legitimate enterprise.

Salt Lake City: Conditions are very good. Building is temporarily slack owing to weather conditions. Mines and smelters are working twenty-four hours.

Kansas City: The outlook for 1917 is good. There is considerable building activity regardless of prices, which are well maintained except by firms that cannot make good deliveries.

Atlanta: Expecting the biggest year in the history of Atlanta. Mills are running overtime; farmers have plenty of money. If we get enough cool weather to keep trees from budding too soon, the whole South will have a banner year.

DETAILED EXPORTS OF ELECTRICAL MANUFACTURES

Figures Are Arranged to Show Trade of the United States with Other Nations According to Customary Classification

There is presented on the next page a table showing in detail the exports of electrical goods of American manufacture to the different nations of the world under the customary government classification for the fiscal year ended June 30, 1916. The figures were compiled by the Bureau of Foreign and Domestic Commerce, and are shown here for the first time. The countries, it will be noticed, are grouped according to location.

LOW PRICE FOR COPPER TO THE ARMY AND NAVY

Agreement Reached by Producers to Take Care of the Government's Requirements at 16.67 Cents Per Pound

While it was generally understood that producers would take care of the copper needs of the Government at a price considerably below the present market, no concrete information came to light until this week, when it was announced that a price of 16.6739 cents a pound has been agreed upon by the producers as the price to the Government. This price, which is the average selling price for the past ten years, is about 20 cents under the present spot market price. During the coming year 20,000,000 lb. are to be furnished to the navy and around 25,500,000 lb. to the army at this price, representing a saving to the Government when compared with the spot market price of almost $10,000,000.

It is very doubtful if this cut to the Government will weaken the market, but it is more reasonable to expect that the market will be stronger than ever, and that higher prices will ultimately result. For a long time the market has been sluggish, although the high prices have been maintained. Prices early this week were practically the same as last week.

NEW YORK METAL MARKET PRICES

	Mar. 13 Selling Prices Bid	Mar. 13 Selling Prices Asked	Mar. 20 Selling Prices Bid	Mar. 20 Selling Prices Asked
Copper	£ s d		£ s d	
London, standard spot	136 0 0		136 0 0	
Prime Lake	35.00	to 36.00†	35.00	to 35.50†
Electrolytic	36.00	to 36.50†	35.50	to 36.00†
Casting	32.00	to 32.50†	31.25	to 31.75†
Copper wire base	42.50	to 43.50†	40.00	to 42.00†
Lead	9.00		9.00	
Nickel	50.00		50.00	
Sheet zinc, f.o.b. smelter	21.00		21.00	
Spelter, spot	10.82½	to 10.92½	10.55	to 10.80
Tin, straits	53.37½		55.50	
Aluminum, 98 to 99 per cent.	53.00	to 55.00†	54.00	to 56.00

OLD METALS

Heavy copper and wire	28.50	to 29.50†	28.50	to 29.50†
Brass, heavy	17.50	to 18.00†	17.50	to 18.00†
Brass, light	14.25	to 14.75†	14.25	to 14.50†
Lead, heavy	8.00	to 8.50†	7.75	to 8.00†
Zinc, scrap	7.75	to 8.00†	7.50	to 7.75†

†Nominal.

Exports of Electrical Merchandise Manufactured in the United States for the Fiscal Year Ended June 30, 1916, Arranged Under Customary Government Classification According to Nations of Import.

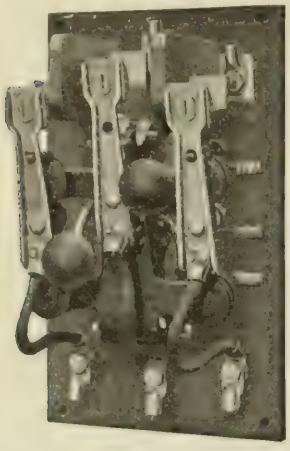
Country	Batteries	Dynamos or Generators	Fans	Insulated Wire and Cable	Interior Wiring Supplies, Including Fixtures	Arc Lamps	Carbon Filament Lamps	Metal Filament Lamps	Meters	Motors	Telegraph Instruments	Telephones	Transformers	All Others	Total
EUROPE:															
Austria-Hungary															
Azores and Madeira Is	$9	$305	$24		$25	$6		$377		$79				$156	$980
Belgium															
Denmark	5,452	188		$2,589	870			52	$5,205	4,881	$16,965	$1,722	$850	21,427	60,197
Finland	167	275		154									750	27,331	28,677
France	9,283	141,932	500	152,651	2,812		$3,034	40,429	9,123	333,628		34,971	50,597	592,106	1,371,065
Germany															
Gibraltar	48		25							35,380				37,445	72,898
Greece	486	52,722	1,805	465	1,594			1,124	138	527	444	193	113	81,840	144,457
Italy	12,924	66,586	16	47,256	28,067		5,020	12,320	30,990	146,709		137,176	84,443	920,351	1,481,853
Malta, Gozo, etc							17							67	65
Netherlands	8,652	12,387	80	95,037	1,157		201	1,419	667	17,754		6,818	9	53,588	197,769
Norway	14,875	547	726	318,380	226			4,742	545	21,299		1,133	10,597	687,190	1,060,261
Portugal	18	7,428		5,517	2,490	100	155	11,464	694	2,321		248	1,543	13,448	45,425
Roumania	42			15,073										1,344	16,459
Russia in Europe	9,987	76,638	217	13,915	13,112		17,695	114,899	40,184	614,404		299	77,915	452,301	1,431,566
Serbia, Montenegro, etc															
Spain	8,857	33,550	8	86,975	7,029	391	229	16,221	53,428	90,550	4,975	5,702	133,490	263,530	704,937
Sweden	537	1,168		1,276				269	1,868	711	210			31,449	37,488
Switzerland	53			2,571						400				12,345	15,369
Turkey in Europe															
United Kingdom:															
England	443,784	203,054	19,902	652,595	144,597		4,050	86,897	111,081	351,340	23,198	581,924	43,760	3,425,527	6,091,705
Scotland	14,082	936	187	11,020	282				256	28,907				63,620	119,293
Ireland					1,155				153	201				2,881	4,393
NORTH AMERICA:															
Bermuda	1,647	4	153	2,010	259			836	1,689	490		182	553	6,469	14,294
British Honduras	2,663	262	116	388	67		346	435	14	520		5		3,674	8,490
Canada	533,197	330,046	23,478	148,126	244,500	8,401	18,168	135,137	104,988	638,111	26,000	161,487	131,824	2,693,400	5,065,387
Central America:															
Costa Rica	2,177	3,289	117	7,746	2,225	152	5,389	5,399	201	5,300	1,978	1,968	6,254	26,082	68,271
Guatemala	894	7,859		3,988	401		1,290	1,276	210	2,397	237	475	4,177	11,619	34,810
Honduras	4,671	1,309	705	8,552	1,547	57	284	894	141	5,251	322	5,283	1,292	21,940	52,257
Nicaragua	2 948	511	137	310	314		285	1,666	60	1,106	1,982	625	5	15,405	26,444
Panama	27,437	17,335	3,696	235,926	14,332	802	1,799	4,956	13,645	102,397	3,597	10,957	50,007	211,867	462,824
Salvador	903	13,325	148	6,836	3,656		1,076	6,587	200	1,092		525	1,362	18,068	53,788
Mexico	27,642	8,776	6,573	58,398	8,148	230	13,729	86,136	14,364	48,877	41,174	20,347	17,400	313,969	665,767
Newfound. and Lab.	24,920			11,150	1,966		390	7,396	1,161	9,406	767	2,166	2,287	22,930	84,541
West Indies															
British:															
Barbadoes	738	57		218	262		93	221	28		882	156	40	1,419	4,101
Jamaica	4,951	418	261	1,419	2,959	49	99	904	1,204	3,088	2,651	733	359	7,589	26,684
Trin. and Tobago	1,876	641	401	1,392	362		198	1,481	680	1,059		898	637	8,047	17,611
Other British	1,627		232	600	407	88	27	702	351	415		575		2,598	7,629
Cuba	52,954	140,789	35,208	281,262	63,629	2,879	7,500	172,486	43,296	139,961	1,806	79,513	32,026	557,685	1,610,991
Danish	149		46	341	493		11	108	1,138	81		6		604	4,137
Dominican Repub.	2,781	3,100	250	6,552	3,894	282	146	3,050	516	1,057	12	2,145	68	14,383	38,246
Dutch	230		5	649	174		66	146	42	99		408	234	2,490	3,915
French	387	1,340	27	149	70			881		75		79		1,143	4,148
Haiti	327	62		1,674	561		10	459	712	225		1,656	445	4,305	10,430
SOUTH AMERICA:															
Argentina	51,489	10,475	62,816	140,146	18,051	584	11,276	82,101	75,110	54,163	2,455	5,658	13,185	412,450	921,908
Bolivia	306	904		4,928	347		314	1,550		2,106		164	35	10,152	20,802
Brazil	41,630	3,704	7,367	286,118	101,234	1,610	6,898	100,940	87,896	52,645	1,110	48,459	93,591	497,010	1,325,212
Chile	6,305	6,644	1,017	117,867	37,119	360	16,602	20,474	22,752	90,892	926	4,812	16,955	160,555	503,188
Colombia	7,268	40,751	1,344	22,509	7,416	164	2,178	16,524	1,905	26,302	1,160	11,039	11,703	62,154	212,417
Ecuador	3,565	747	979	2,912	2,702		1,604	4,842	1,109	3,704		11,022	761	21,336	53,783
Guiana (British, Dutch and French)	1,084	300	43	317	301	72	227	488	632	1,956	10	177	197	3,995	9,793
Peru	6,478	7,627	97	50,011	7,775	386	6,703	10,900	6,027	31,358	707	4,848	5,073	79,707	217,699
Uruguay	6,332	1,085	1,307	21,962	6,347	52	296	24,805	944	7,896	142	863	424	44,701	117,159
Venezuela	12,661	15,846	972	18,028	9,992	420	652	8,786	447	10,120	793	5,769	12,690	120,562	217,735
ASIA:															
China	14,065	46,989	17,506	20,215	6,756		4,680	67,285	5,053	43,480		15,685	7,317	159,002	408,033
China Leased Terr															
Japanese	75	1,624	50						482	48				7,074	9,354
Chosen	201	1,200		65				30	426	455		63		13,251	15,695
East Indies:															
British:															
British India	8,496	11,739	91,810	36,636	3,034	240	2,255	20,759	3,949	68,606		1,655	13,892	97,828	380,899
Straits Settlement	1,553	796	3,256		1,166		21	5,600		1,944				4,518	18,857
Other British	141	99	675	3,648				41				1,119	9,616	1,869	17,198
Dutch	4,898	5,294	698	79,873	369		2	380	2,461	9,126		3,135	256	61,059	117,551
Hong Kong	555	25,258	25,532		554		50	2,927	2,328	30,575			5,721	21,627	115,147
Japan	4,232	88,293	11,360	7,718	15,185	329		82	27,490	139,133	11	73,767	4,362	410,598	881,562
Russia in Asia	190	12,037		8,525	2,681		544	9,385	13,300	78,395		3,586		146,289	264,930
Siam	392	189	1,998	730	1,120		500	4,282		5,129		10	736	6,727	21,813
Turkey in Asia															
OCEANIA:															
British:															
Australia	86,345	24,336	21,366	66,360	28,992	78	6,297	91,708	61,965	685,596	1,254	61,979	70,192	549,882	1,756,355
New Zealand	31,835	1,251	973	2,028	1,469	356	118	5,630	3,821	54,340	5,761	1,209	10,161	132,716	251,658
Other British	532				21			942	71	167		25		1,777	4,135
French	3,260	379	39	548				135	66	70	89			3,989	8,575
German	316									514				349	1,179
Philippine Islands	8,964	32,252	6,631	45,332	7,133	581	664	20,938	6,984	50,787	6,910	12,689	2,953	177,109	379,930
AFRICA:															
British Africa:															
South	38,525	1,646	3,762	16,691	4,846		1,685	57,196	9,236	154,276		1,142	60,254	121,484	470,743
West	4				455					570				6,841	7,870
Egypt	268	358	40		3				2,701	2,124				1,280	6,774
East	58							150		66		94		855	1,223
Portuguese Africa	1,500	300	28	845				1,388	250	3,056		72		4,562	12,001
Total	$1,569,836	$1,468,961	$356,729	$3,157,239	$818,985	$18,693	$144,872	$1,282,039	$776,381	$4,218,974	$148,536	$1,329,346	$993,193	$13,972,944	$30,256,728

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Remote-Control Switches

Remote-control switches are being made in single, double and triple-pole types by the Cutler-Hammer Manufacturing Company of Milwaukee, a triple pole type being shown herewith. The design is such that energy is consumed only on opening and closing, a mechanical latch holding the contacts closed after the switch contacts are closed by magnetic force. The same type of contact fingers is used as on other control apparatus made by this company. The contacts are made of cold-rolled copper and are kept clean by a wiping motion produced during operation. Two solenoids are used, one for closing and the



TRIPLE POLE REMOTE-CONTROL SWITCH

other for opening the switch. They are energized by circuits connected to push-button control switches which may be placed where desired. The new switches are of 100 amp. capacity and are made for both alternating and direct-current circuits. They are particularly adapted to the control of lighting circuits from a distant point or central location.

Automatic Printing Press Controllers

The Industrial Controller Company of Milwaukee has recently developed a new line of automatic controllers, designed particularly for printing press service. The accompanying illustration shows one of the several automatic printing press controllers brought out. The controller has an automatic starting movement of the same construction used in the type E controller which is largely used for industrial purposes, and a hand-set speed regulator mounted on the same panel with the automatic movement.

Speed regulation is accomplished manually, speed below normal being obtained by inserting resistance in the armature circuit and speed above normal by inserting resistance in the shunt



FIG. 1—PUSH-BUTTON SWITCHES

field. The standard controllers are designed for 40 per cent speed reduction and 100 per cent speed increase. Full field strength during starting is secured by means of a vibrating field relay mounted on the panel. A dynamic brake is also provided for rapid stopping of the press. The controllers designed for wall mounting have the automatic starting mechanism at the top, and the speed regulating lever below, thus permitting the controller to be mounted fairly high, and allowing convenient access to the starting lever.

The speed regulating lever may be set to give any desired speed to the press. Push buttons mounted on, or near, the press are used to stop and start the motor, always bringing it up to the predetermined speed at which the regulating lever has been set. The time of acceleration is adjustable by means of

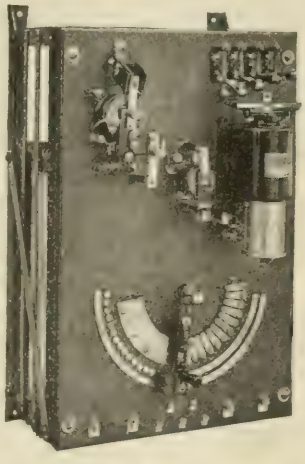
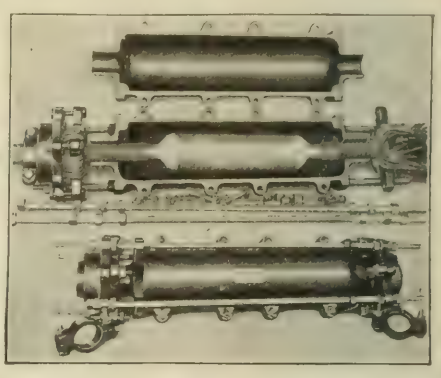


FIG. 2—AUTOMATIC CONTROLLER FOR PRINTING PRESSES

needle valves in the dash pot of the automatic movement. Any of the numerous types of standard I-C push buttons may be used with this controller. By these buttons the press may be started, stopped, "inched," run at extra low speed for make-ready, or reversed. Several stations are often furnished for each press, and buttons are also supplied with a lockout feature so that when the press is stopped at one station and locked out, it cannot be started from any other station until the lockout button is released.

Housing for Submarine Cables

An improved type of joint box or housing for use on submarine cables has recently been developed and perfected by the Standard Underground Cable Company. The box is designed



CONSTRUCTION OF HOUSING FOR USE ON SUBMARINE CABLES

so that all mechanical stresses resulting from the action of tides, currents, etc., that usually tend to damage cable joints are transmitted past the joint by long "take-up" rods running parallel to the joint box and are rigidly connected to the steel-wire armor on each side of the joint by heavy iron clamps. This construction is clearly shown in the accompanying illustration. As submarine cables, even under normal conditions, are subjected to severe mechanical stresses and have heretofore often failed first at the joints, this new device, which so far has proved very effective, offers a solution for a serious problem in submarine cable laying.

The boxes are being used on submarine cables supplied to the Atlantic City Electric Company for the U. S. Ship Canal at Atlantic City, and to the Wilmington & Philadelphia Traction Company and the Pennsgrove Light, Heat and Power Company for crossing the Delaware River at Wilmington, Del. It was also used in Canada on submarine cables of the Halifax Electric Tramway Company and the City of Ottawa Water Works Department.

Drive Head for Installing Ground Pipes

The Fargo Manufacturing Company of Poughkeepsie, N. Y., has developed a drive head made of cold-rolled steel



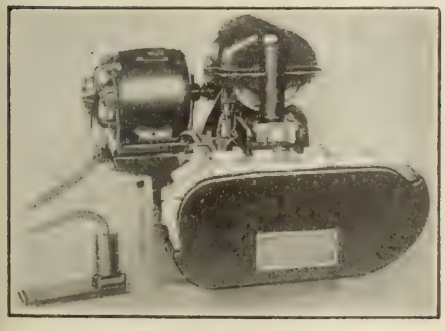
DRIVE HEAD THAT PROTECTS PIPE THREAD

which is used to protect the thread on pipe when it is being driven into the earth for making grounds and the like. When the ground pipe is driven the required depth the driver head can be removed and a ground cap screwed in place, thus making a ground connection that can be easily and cheaply installed, and tested as often as desired.

Motor-Driven Tag Marker

Shown herewith is a motor-driven tag marker, manufactured by the H. G. Davis Manufacturing Company, 4131 Frankford Avenue, Philadelphia, Pa., which has a capacity of printing 2400 tags in one hour. The mechanism of this tag marker, which is driven by a 1/20 hp. Westinghouse motor through a worm and gear, consists of a set of cams which move an endless chain of aluminum trays beneath a miniature-type chase. The tags are printed as they move along on these trays. The trays are hand fed. A tag is placed in each tray beneath a clip which holds the tag in place from the time it is fed into the machine until marked by a downward movement of the type chase. This arrangement insures uniform register of the marking. When the tag is printed it is automatically released from the clip and discharged from the tray at the end of the machine.

The machine will accommodate any size or shape of tag up to 1.75 in. wide, of any thickness from thin paper up to



MARKER THAT PRINTS 2400 TAGS IN AN HOUR

cards 3/32 in. thick. The type chase is adjustable so that it can be adapted to various sizes of type and can be used to mark as many as seven lines with fifteen small characters or nine large characters on a line. The type commonly used is of metal (full 12 point, 1/6 in. high). With the usual set-up of the chase, it is possible to print both the tag and the stub with the words, Lot, Size, Price and some other word if needed.

This tag marker is compact, portable, very quiet in operation, due to the worm drive, and weighs 45 lb. It is furnished complete with a type drawer conveniently arranged at the back of the machine, and is finished in black japanned enamel. All gears and mechanism are thoroughly protected. The motor leads are brought out through cord and plug for attachment to any lamp socket. In addition, a foot switch is provided by which the operation of the machine is controlled.

Safety Panel Cut-Out

A panel cut-out, which is said by its manufacturer, to combine the simplicity of the porcelain cut-out with the finished appearance of a busbar type of

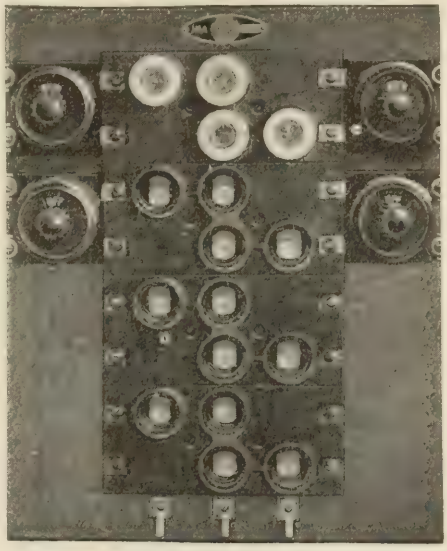


FIG. 1—PANEL CARRYING EIGHT CIRCUITS

panel has been developed by the Chicago Fuse Manufacturing Company.

The cut-out does away with the many exposed live parts and the possibility of poor contact between copper parts. The method of installing it is shown in the accompanying illustration, which represents a panel carrying eight circuits, four with switches and four without switches. On the panel are mounted three busbars over which are mounted the safety cut-outs, each being firmly attached to the panel by two screws. Three grooves in the base of the cut-out which measure ⅛ in. deep by 1 1/32 in. wide, are provided to admit the busbars between the panel and the cut-out. These grooves are separated by the required 0.75-in. space. When the fuse plugs are screwed into the cut-outs they make firm contact with the busbars. All connections between the shells and the terminals are embedded in the body of the cut-out and are completely concealed. The cut-out block itself is made from an approved composition with high mechanical and dielectric strength. It will withstand a temperature of 400 deg. Fahr, without injury, it is claimed.

The advantages of this safety panel cut-out, as set forth by its manufacturer, are that it is practically indestructible, that it has a dead-front feature,

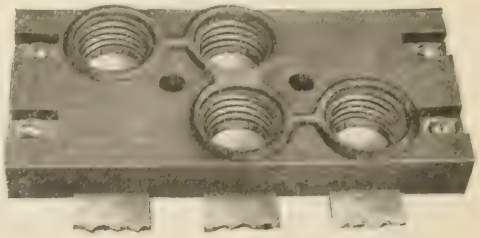
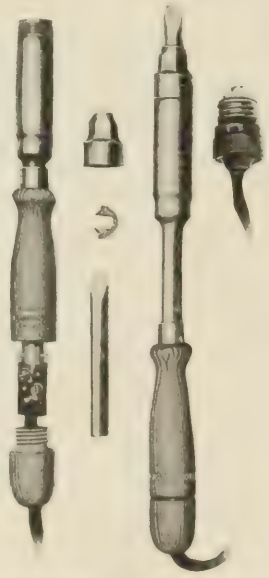


FIG. 2—SECTION OF SAFETY PANEL

that it has the approval of the Underwriters' Laboratories, that it has high dielectric strength and great heat resisting qualities, that it is simple and can be quickly built up for any number of circuits, that it has a neat and finished appearance, that it requires a minimum amount of cabinet space, that circuits can be easily added and that it is inexpensive.

Small Electric Soldering Iron

A small electric soldering iron designed with a tip which is easily removable, and which can be extended at various lengths both for special use or as the tip is melted down, has been developed by the Frank B. Cook Company, 326 West Madison Street, Chicago, Ill. The heating element is wound on a steel shell, well insulated with mica. One end of the tip is designed to be placed inside the steel shell. The heating element itself is easily removable for repair or renewal. The end of the handle can be unscrewed and the iron partly telescoped to permit the removal or renewal of the cord. This iron is



CONSTRUCTION OF SMALL ELECTRIC SOLDERING IRON

rated at 95 watts, its weight is 13 oz., the length 14 in., and the diameter of tip 0.5. The company also makes other irons, which weigh 10 oz., 15 oz. and 13 oz., and have tip diameters of 0.5 in., 0.75 in. and 1⅛ in., respectively.

Trade Notes

NEW MANUFACTURERS AGENCY AT CHICAGO — The interests of W. J. Doherty, at 618 West Jackson Boulevard, Chicago, has been incorporated and will be conducted under the new name of the Doherty Hafner Company, at the present address. Henry G. Hafner, who joins Mr. Doherty in the new corporation, has been connected with the Central Electric Company for the last ten years. The concerns which this agency will represent are: Stanley & Patterson, New York City; V. V. Fittings Company, Philadelphia; McGill Manufacturing Company, Valparaiso, Ind.; Eck Dynamo Motor Company, Belleville, N. J.; Thomas & Betts Company, New York City; Central Tube Company, Pittsburgh, Pa., and A. B. Wilson Company, Cleveland, Ohio.

ERNEST F. LEARNED has joined the staff of the Day-Baker Motor Truck Company and will devote himself to the sale of the Hunt industrial electric truck, with headquarters at 110 State Street, Boston, Mass. Mr. Learned was formerly employed by the Stone & Webster Engineering Corporation of Boston, and has had an extensive experience in the fields of hydroelectric power and transportation development.

P. & B. MANUFACTURING COMPANY, Milwaukee, Wis., has increased its capital stock from $25,000 to $50,000. It is now building a new plant, which will be completed by May 1.

SOUTHWEST GENERAL ELECTRIC COMPANY will move its Oklahoma City branch office from 402 Insurance Building to 301-302 Terminal Building.

POST & LESTER COMPANY, Hartford, Conn., in order to more readily supply the requirements of the automobile trade and extending service to automobile users throughout New England, has recently been appointed distributer of S K F ball bearings. With branch houses in Boston, Bridgeport, New Haven, New London, Providence, Springfield, Waterbury and Worcester, the Post & Lester Company will be able to supply S K F radial and thrust bearings from stock.

FOX METAL MANUFACTURING CORPORATION, 295 Fifth Avenue, New York, N. Y., which was recently organized, has the patent and manufacturing rights of the Jules folding and portable lamp. In addition the new company will manufacture other metal products, principally electrical. William H. Vidor is president of the new company and Baret Bernstein is secretary and treasurer.

E-H ELECTRIC COMPANY, 1405 Brush Street, San Francisco, Cal., is now doing business under the name of Electric Signal Company, 1307 Sutter Street, San Francisco.

STANDARD UNDERGROUND CABLE COMPANY OF CANADA, LTD., in preparation for the prosperous times which the company anticipates will prevail after the close of the war, is making an addition to its factory at Hamilton, Ont., which when completed and equipped with the necessary machinery will represent an investment of $50,000. The new structure, which consists of one story with basement, built of brick and concrete, and is 125 x 120 ft. in dimensions, giving a total increase in floor space of 30,000 sq. ft., will be devoted exclusively to the uses of the wire drawing department, and in addition to housing the former equipment will contain material additions of new machinery.

CROCKER-WHEELER COMPANY in its February statement shows an increase in surplus of about 7 per cent, bringing the total surplus to more than $850,000. The net earnings broke the record for February, a short month, being greater than in any February since the founding of the company twenty-eight years ago. It is further stated that the bookings continue good and represent straight electrical business, as the company has returned to the exclusive manufacture of electrical equipment. However, it was announced that the company stood ready to re-enter the munition business if called upon by the United States government, as it has, in addition to the equipment, the trained men necessary for the work. The common stock of the company continues on a permanent 8 per cent per annum basis, with the preferred yielding 7 per cent.

WILLIAM E. COPELAND, for the past several years in charge of the New Orleans office of the Westinghouse Lamp Company, has been transferred to the New York office and in the future will have charge of the company's sales in the uptown district of Manhattan.

COOPER HEWITT ELECTRIC COMPANY recently held a salesmen's meeting at the factory in Hoboken, N. J. Representatives were present from the Boston, Philadelphia, Pittsburgh, Cleveland, Detroit, St. Louis and Cincinnati offices.

RAMEY MANUFACTURING COMPANY, Chillicothe, Ohio, manufacturer of the Simplex vacuum cleaner, has recently moved its factory to 35 South Wall Street, Columbus, Ohio. The factory has a capacity of sixty machines per day.

GEORGE C. KNOTT has resigned as sales and advertising manager of the Wirt Company, Philadelphia, and formed a partnership with George L. Hatheway. The new company will be known as Hatheway & Knott, with offices at 120 Liberty Street, New York, and will engage in the distribution of products of various electrical manufacturers. Mr. Knott was for many years associated with the Benjamin Electric Manufacturing Company, and Mr. Hatheway was formerly with Pass & Seymour. For the entire United States, they will act as general sales agents for R. M. C. conduit fittings, etc., and Eade chain insulators; in New York and Eastern territory, the Wirt Dimalites, Killark Electric Manufacturing Company products and others. They will also maintain a Canadian connection, representing throughout the dominion the following concerns: Manhattan Electrical Supply Company, Steel City Electric Company, Killark Electric Manufacturing Company, Capital Porcelain Manufacturing Company, Eastern Flexible Conduit Company, National Electric Porcelain Company.

Trade Publications

TELEPHONE PROTECTIVE APPARATUS.—The Frank B. Cook Company, 326 West Madison Street, Chicago, Ill., has issued a catalog descriptive of its telephone protective apparatus and supplies. Several new central office protectors are listed, and a new lightning arrester. A discount sheet, which is now in effect, is found on the inside back cover.

ELECTRICIANS' BITS.—The W. A. Ives Manufacturing Company, Wallingford, Conn., has prepared a booklet descriptive of its "Mephisto" bits.

LUMINOUS COMPOUND. — "Marvelite" a new luminous compound made with radium is described in the bulletin recently issued by the Cold Lighht Manufacturing Company of Denver, Col.

LAMPS.—The Franklin Electric Company of Hartford, Conn., has prepared an illustrated folder descriptive of Franklin Mazda lamps.

CHAINS.—The Link-Belt Company of Chicago has prepared bulletin No. 282, descriptive of Link-Belt silent chain transmitting power in the dye-making industry.

POWER DUMP.—The Taylor power dump is carefully described and illustrated in a bulletin recently issued by the American Engineering Company of Philadelphia, Pa.

BALL BEARINGS.—The Gurney Ball Bearing Company of Jamestown, N. Y., is distributing a bulletin entitled "Bearing on Bearings."

BALL BEARINGS.—The Hess-Bright Manufacturing Company of Philadelphia, Pa., is distributing an illustrated bulletin descriptive of ball bearings in machine tools.

RAILWAY APPARATUS.—"Steam Road Electrifications" is the title of a well-illustrated and prepared bulletin that has been issued by the Ohio Brass Company of Mansfield, Ohio.

REFLECTORS.—The National X-Ray Reflector Company of 235 West Jackson Boulevard, Chicago, Ill., is distributing its February issue of *Eye Comfort*.

MOTOR GENERATORS.—Hobart Brothers Company, Troy, Ohio, has prepared an illustrated leaflet descriptive of its battery charging outfits.

OIL TANKS.—The Wayne Oil Tank & Pump Company of Fort Wayne, Ind., has prepared an illustrated leaflet descriptive of its oil tanks and pumps.

STORAGE BATTERIES.—The General Lead Batteries Company of Newark, N. J., is distributing bulletin No. 20, descriptive of its Titan grid batteries for electric vehicles.

MOTORS.—"A Modern Lumber Mill" is the title of bulletin No. 114 now being distributed by the Wagner Electric Manufacturing Company of St. Louis, Mo. This bulletin describes the electrical and mechanical equipment.

New Incorporations

THE LAUDERDALE LIGHT & POWER COMPANY of Ripley, Tenn., has been incorporated with a capital stock of $20,000 to build and operate a light and power plant. The incorporators are: W. W. Craig, E. C. Bullock, J. M. Carney and G. M. Pittle.

THE COAL DISTRICT POWER COMPANY of Fort Smith, Ark., has been chartered by L. A. Pettit, Jr., L. E. Turner, G. W. Skow, Hugh Means and Albert Emanuel. The company is capitalized at $120,000 and proposes to generate and distribute electricity for lamps, heaters and motors.

THE STANDARD LAMP & SHADE COMPANY of Brooklyn, N. Y., has been incorporated by S. A. Tesley, B. Popkin and L. Brook, 171 Hewes Street, Brooklyn, N. Y. The company is capitalized at $5,000 and proposes to manufacture gas and electric lamps, fixtures, shades, etc.

THE RIVERIA CONSTRUCTION CORPORATION of Brooklyn, N. Y., has been incorporated by R. C. Lipman, J. J. Alexander and W. F. Murphy, 292 St. John's Place, Brooklyn, N. Y. The incorporators are: R. C. Lipman, J. J. Alexander and W. F. Murphy, 292 St. John's Place, Brooklyn, N. Y.

THE MATEWAN (W. Va.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $25,000 by C. M. Gates, W. O. Hay and C. R. Gates of Sprigg; G. T. Blankenship and G. T. Blankenship, Jr., of Matewan, W. Va.

THE BELLEVILLE (W. Va.) ELECTRIC COMPANY has been incorporated by Harrison A. Smith, K. B. Smith and W. G. Kerchoffer, all of Madison.

THE CENTRAL OKLAHOMA LIGHT & POWER COMPANY of Oklahoma City, Okla., has been chartered with a capital stock of $25,000 by George M. Green, H. L. McCracken and L. Smilie.

THE SHINNSTON (W. Va.) POWER & LIGHT COMPANY has been incorporated by Aura R. Walls, John B. Wyatt, M. A. Wells and others. The company is capitalized at $15,000.

THE COLUMBIA POWER COMPANY of Lexington, N. C., has been incorporated with a capital stock of $100,000 by Dermot Shemwell, J. E. Foy and I. L. Sink, all of Lexington, N. C.

THE BATAVIA (Ohio) LIGHT & POWER COMPANY has been chartered with a capital stock of $10,000 by Allen B. Nichols, Eli H. Speidel, Percy F. Jamieson, M. J. Kain and H. F. Buerkle.

THE LIQUID RECORDING INSTRUMENT COMPANY of New York, N. Y., has been incorporated, with a capital stock of $5,000, to manufacture and deal in electrical and mechanical machinery, apparatus, devices, etc. The incorporators are: C. Hoffer, J. D. Clay and C. S. Harris, 101 West Twelfth Street, New York City.

THE AMERICAN AUSOPHONE COMPANY of New York, N. Y., has been granted a charter, with a capital stock of $1,000,000, to manufacture machines for receiving and transmitting telephonic and telegraphic messages. The incorporators are: Samuel B. Howard, Harry B. Davis and Arthur W. Britton of New York, N. Y.

THE CHEMICAL ENGINEERING & RESEARCH CORPORATION of New York, N. Y., has filed articles of incorporation for the purpose of giving expert service and advice on mechanical, engineering, chemical, electric or other problems. The incorporators are: B. L. Walter, A. J. Brett and George Rosendale.

THE BATTERY EQUIPMENT & STORAGE COMPANY of Houston, Tex., has been chartered with a capital stock of $10,000 by S. M. Griffin, H. M. Harbin and R. C. Patterson.

THE CONSOLIDATED RADIO LABORATORIES of New York, N. Y., has been incorporated by J. F. Grinan, A. J. Faraon and William Biel. The company is capitalized at $2,000 and proposes to make technical experiments in wireless.

FRED W. L. FULLERTON, INC., of New York, N. Y., has filed articles of incorporation, with a capital stock of $10,000, to do a general electrical and mechanical engineering business and also electrical work. The incorporators are: M. J. Doran, T. R. Blake, F. W. L. Fullerton of South Orange, N. J.

THE WILLIAM C. KRAUTH ELECTRIC COMPANY of Louisville, Ky., has been chartered, with a capital stock of $3,000, by William C. Krauth, Edwin W. and Herman F. Andres.

New England

CONTOOCOOK, N. H.—The plant of the Contoocook Electric Light Company is now being reconstructed. I. L. Meloon is president and manager.

PORTSMOUTH, N. H.—The Rockingham County Light & Power Company is installing two 600-hp. Babcock & Wilcox boilers, one 1000-kw. General Electric 60-cycle turbine and new switchboard. Orders have been placed for two 600-hp. Babcock & Wilcox boilers and one 2500-kw. General Electric 60-cycle turbine. F. A. Belden is manager.

BROOKLINE, MASS.—Plans are being considered by the New England Fireproof Construction Company for the installation of an electric plant. G. B. Washburn, 6 Beacon Street, Boston, is architect..

WORCESTER, MASS.—Extensions to the ornamental street-lighting system are under consideration by the City Council.

NEW HAVEN, CONN.—Contract has been awarded by the United Illuminating Company for the erection of a substation 26 ft. by 54 ft., to be erected at 201 George Street, New Haven.

Middle Atlantic

AKRON, N. Y.—The bill passed by the State Legislature legalizing the bond issue of $19,000 for a municipal electric-light plant and street-lighting system in Akron has been signed by Governor Whitman.

BUFFALO, N. Y.—Contract has been awarded by the Lehigh Valley Railroad Company, 143 Liberty Street, New York City, to the Westinghouse, Church, Kerr Company, 37 Wall Street, New York City, for the construction of an engine house at East Buffalo, a 15-stall addition to the engine house at Tifft Farm, together with new machine shops, power house, etc. The size of the present boiler plant will be trebled. Later on a mechanical coaling plant will be added. Wherever possible electrically operated machinery will be installed in the engine house.

ELMHURST, N. Y.—The New York Telephone Company is planning to erect a three-story telephone exchange on Broadway to cost about $75,000.

HEMPSTEAD, N. Y.—The installation of a municipal electric-light plant in connection with the waterworks plant is under consideration by the Village Board.

MONTICELLO, N. Y.—The Murray Electric Light & Power Company of Monticello has contracted with the Port Jervis (N. Y.) Light & Power Company for energy to operate its system. The local power house will be closed down.

NEW YORK, N. Y.—Bids will be received by the Departments of Docks and Ferries, Fire and Water Supply, Gas and Electricity, at the office of the Central Purchasing Committee, Room 1220, Municipal Building, New York City, until March 29 for furnishing electrical fittings and supplies. The time of the performance of the contract is on or before Dec. 31, 1917.

NEW YORK, N. Y.—The city of New York, Department of Correction, is planning to erect an industrial building at New Hampton, N. Y., to cost about $75,000; also a power house, laundry and stores, one story and basement, to cost about $161,585. Burdette G. Lewis, Municipal Building, is commissioner of corrections. C. B. Myers, 1 Union Square, is architect.

NEW YORK, N. Y.—Bids will be received by the Board of Trustees or the Curator of the College of the City of New York, Room 114, Main Building, 139th Street and Convent Avenue, New York City, until March 28 for furnishing labor and materials necessary and required for (estimate A) alterations and repairs, including the installation of electric-lighting and fire-alarm systems; (estimate B) the restoration of the exterior brick and stone work of the Twenty-third Street Building of the College of the City of New York, Lexington Avenue and Twenty-third Street. Bids will be received for the entire work; also separate bids for estimates A and B.

PULASKI, N. Y.—The Salmon River Power Company, which operates a hydro-electric power plant at Orwell, has applied to the Public Service Commission for permission to take over the plant and holdings of the Pulaski Electric Light Company.

ROOSEVELT, N. Y.—The establishment of a municipal electric-light plant in Roosevelt is under consideration.

WELLSVILLE, N. Y.—The Water and Light Department is replacing the gas street lamps with 7.5-amp. series electric lamps as rapidly as the electric distribution lines are extended. J. M. Sill is superintendent.

WHITNEY POINT, N. Y. — The Union Electric Company contemplates building a new concrete dam about July, 1917, and changing its system from 133 to 60 cycles. D. O'Connell is president and manager.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

CHESTER, PA.—Bids will be received by John H. Mirkil, superintendent of parks and public property, until April 16, for construction of a new city hall; separate bids to be submitted for electrical work, heating and plumbing.

GREENVILLE, PA.—The contract for electrical work for the new Penn High School has been awarded to the Queen City Garage & Electric Company of Titusville, at $5,600.

LANSFORD, PA.—The Lansford Electric Light Company has been granted the right to erect a high-tension transmission line through Lansford to connect with its new substation recently completed.

PHILADELPHIA, PA.—The C. H. Wheeler Manufacturing Company contemplates the construction of a boiler and engine house addition to its plant at Eighteenth Street and Lehigh Avenue.

PHILADELPHIA, PA.—The Bell Telephone Company is planning to build a new branch telephone station on West Chelton Avenue, Germantown, to cost about $400,000. Plant equipment and improvements to local system for connection with the new exchange are estimated at $180,000.

PHILADELPHIA, PA.—Bids will be received by the Bureau of Surveys, Department of Public Works, Room 412, City Hall, Philadelphia, until April 10 for construction of concrete grit chamber with inlet and outlet sewers and superstructure, including machinery and equipment, electric wiring and fixtures, heating and incinerator, ventilating and plumbing.

PITTSBURGH, PA.—The power plant of the Westinghouse Electric & Manufacturing Company at East Pittsburgh was recently destroyed by fire.

POTTSVILLE, PA.—The contract for street-lighting has been awarded to the Eastern Pennsylvania Light, Heat & Power Company, under which provision is made for the installation of an ornamental lighting system in the business district.

QUAKERTOWN, PA. — The city of Quakertown has purchased a site for a new power plant and proposes to install new equipment, including engines, generators, boilers, etc. G. E. Willard is superintendent.

SCRANTON, PA.—The Scranton & Binghamton Electric Railway Company is contemplating erecting a 66,000-volt electric transmission line from the present terminal in Tiany to Binghamton during the present year.

SHARON, PA.—The Shenango Valley Electric Light Company is planning to make additions to its substation on Silver Street, for which additional space has been acquired. The company, it is stated, will arrange to carry the high-tension lines when the new transmission line from Lowellville to Masury is erected.

SIEGFRIED (NORTHAMPTON P. O.), PA.—The Lawrence Portland Cement Company is equipping its plant at Siegfried for electrical operation at a cost of about $250,000. Energy will be obtained from the transmission system of the Lehigh Navigation Electric Company of Hauto.

TELFORD, PA.—The Excelsior Electric Light & Power Company of Sellersville has submitted a proposal to the Borough Council offering to replace the arc lamps now in use with tungsten lamps. Harold M. Hamel of Sellersville is general superintendent.

NEWARK, N. J.—The Central Dyestuff & Chemical Company is planning to erect a transformer house, 17 ft. by 25 ft., at its plant on Plum Point Lane.

NEWARK, N. J.—Plans have been prepared by the Board of Works for a garbage incinerator plant, to cost about $538,000. Investigations are now under way to build a municipal electric plant in conjunction with the proposed garbage plant, to cost approximately $350,000 additional. Morris R. Sherrerd is chief engineer.

NEWTON, N. J.—The property of the Newton Gas & Electric Company has been acquired by the National Utilities Company of Boston, Mass. The new company will make extensions and improvements to the local plant and system.

WASHINGTON, N. J.—The Council is considering a bid submitted by the Washington Electric Company for street lighting, which provides for the installation of new tungsten lamps equipped with reflector refractors, throughout the city. Lamps of 250 cp. will be installed in the business section and 100-cp. lamps on other thoroughfares.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, War Department, Washington, D. C., until April 2, under proposal 935, for furnishing camp telephones and service buzzers in lots of 500, 1000 and 2000. For further information address Major Charles S. Wallace.

WASHINGTON, D. C.—Bids will be received at the office of the Commissioners of District of Columbia, Washington, D. C., until April 3, for furnishing during the fiscal year beginning July 1, 1917, and ending June 30, 1918, for use of the various branches of the government of the District of Columbia electrical supplies, etc. Further information may be obtained from the purchasing officer, Room 320, District Building, Washington, D. C.

North Central

MANISTIQUE, MICH.—Work on excavation has begun for the proposed paper and pulp mill, to cost about $1,000,000, for the Manistique Light & Power Company. J. C. Jacobson, Security Building, Minneapolis, is mechanical and structural engineer.

ST. LOUIS, MICH.—A petition has been presented to the City Council asking that steps be taken to learn the feasibility of acquiring water rights on the river below St. Louis and the erection of a dam and power plant to supply additional power for the city.

WEST BRANCH, MICH.—The Northern Power Company will install two new high-speed Leffel water wheels of combined rating of 166 hp. during the coming summer. J. J. Thorne of Bay City is owner.

ATHENS, OHIO.—The removal of the hospital power plant to a new location in connection with the construction of a railroad spur to handle fuel is under consideration by the board of administration of the Athens State Hospital. The present plant is old and in need of repairs.

BATAVIA, OHIO.—The Village Council expects to purchase energy to operate the municipal electric-light plant by July 1, 1917, from the Batavia Light & Power Company, which was organized to purchase power from the Cincinnati, Georgetown & Portsmouth Railroad Company and sell it to the village. The proposed new equipment will include one 120-kva., three-phase, 60-cycle, 2200-volt generator directly connected to a 200-hp., three-phase, 25-cycle, 440-volt motor and four 40-kva., 16,500/440-volt transformers. N. B. Dennison is secretary.

BLUFFTON, OHIO.—At an election held March 6 bonds to the amount of $35,000 for improvements to the municipal electric-light plant were authorized.

CINCINNATI, OHIO.—The installation of ornamental lamps on McMillan Street and on Gilbert Avenue is under consideration. Service Director Hornberger has been requested to submit an estimate of cost to the City Council.

CINCINNATI, OHIO.—The board of education is asking for bids for the completion of the vacuum cleaning system to be installed in the Madisonville high and elementary schools and in the Cummins Public School. Plans and specifications are on file in the office of C. W. Handman, business manager of the board.

CLEVELAND, OHIO.—Plans have been filed by the Cleveland Electric Illuminating Company for the erection of a substation, 50 ft. by 69 ft., at 817 East 103d Street, to cost about $35,000.

DAYTON, OHIO.—Permit has been granted to the Dayton Power & Light Company for the erection of a large power house at Millers Ford, to cost about $510,000.

ELMWOOD PLACE, OHIO.—The Village Council has voted to contract with the Union Gas & Electric Company of Cincinnati to replace the 60 gas lamps now in use with electric lamps.

ELYRIA, OHIO.—Work will soon begin on the erection of an addition to the Memorial Hospital and the construction of power plant and laundry, to cost about $85,000. Contract for erection of building has been awarded to L. A. Burgett & Son of Lorain and for heating system to J. A. Lucas.

FAIRPORT, OHIO.—The Sunnyside Electric Company is planning to erect an electric transmission line from Fairport to Flushing, a distance of 9 miles.

FREMONT, OHIO.—Arrangements are being made by the Ohio State Power Company for the construction of an addition to its power plant at Bellville to provide space for the installation of additional transformers to increase the output of the station to supply electricity in Shelby, where the company has secured a franchise.

GREENWICH, OHIO.—The town of Greenwich is contemplating improvements to the water and lighting plant, to cost about $25,000. The work will include excavating reservoir, enlarging suction pipe, purchasing new pumps, lowering pumps 6 feet, building addition to power house, etc. H. H. Daines is clerk.

MARION, OHIO.—In connection with the reorganization of the Columbus, Delaware & Marion Railway Company and its allied properties, represented by Joseph B. Forakar of Cincinnati, it is stated that Frank G. Glosser of Marion, superintendent of the Marion lighting department, has submitted recommendations for a large power plant, to be erected as soon as the receivership is lifted and reorganization effected. Mr. Glosser, it is reported, suggests that the power station be located at Newman's, 8 miles south of Marion. The cost of the proposed plant is estimated at $90,000.

MASSILLON, OHIO.—Arrangements are being made by the Massillon Electric & Gas Company for the installation of a new street-lighting system. Work will begin about May 1.

NELSONVILLE, OHIO.—A large amount of electrical equipment, it is reported, will be required by C. C. Sharp, head of a company organized to develop 800 acres of coal land. Energy will be furnished by the Hocking Power Company of Nelsonville.

ST. MARY'S, OHIO.—Improvements are contemplated to the municipal electric-light and water plant, involving an expenditure of about $61,000. C. L. Selby is superintendent.

ST. MARY'S, OHIO.—The Western Ohio Railroad Company is installing a new 4000-kw. General Electric, 25-cycle, 2200-volt turbine in its local plant, which will be ready for service about July 1.

LEBANON, KY.—The Lebanon Light, Ice & Power Company, it is reported, contemplates the installation of a new generator.

EDWARDSPORT, IND.—Preparations, it is reported, are being made by the Indiana Power & Water Company of Bloomfield to erect a power plant, 120 ft. by 150 ft. in Edwardsport.

FORT WAYNE, IND.—Bids will be received by the Board of Public Works of the City of Fort Wayne, until March 27, for furnishing and installing one steam boiler having a rating from 725 to 750 hp., with automatic stoker engine for the municipal electric-light plant. Bids will also be received on the same date for furnishing and installing one 3000-kw. steam turbine generator and surface condenser with auxiliary equipment. H. W. Becker is clerk.

GARY, IND.—Plans have been completed for an electric substation, 40 ft. by 40 ft., for the Gary Heat, Light & Water Company, to cost about $12,000. A. F. Wicks is architect.

GRIFFIN, IND.—Bonds have been authorized for the construction of a municipal electric-light plant.

NAPANEE, IND.—Declining to accept the offer of the Hawks Electric Company of Goshen to purchase the municipal electric-light plant, the Town Board is considering a plan to sell the plant to a corporation in which the town will be the controlling stockholder. As the town's indebtedness has reached the legal limit the trustees have taken this way of securing funds to make necessary improvements.

STROH, IND.—Arrangements have been made for the installation of an electric-light plant in Stroh. The Stroh Cement Company is interested in the project.

CHICAGO, ILL.—Plans are being prepared by A. S. Alschuler, 20 East Jackson Boulevard, Chicago, architect, for the erection of a two and three-story power house and dry kiln on Ogden Avenue, between Keeler and Kedvale avenues, for the Turner Manufacturing Company, 1414 South Sangamon Street, to cost about $150,000.

ORION, ILL.—The local electric-light plant has been purchased by D. W. Bowen of Sherrard. Improvements will be made by the new owner, including the installation of a new engine and establishing a continuous service. It is proposed eventually to supply electricity to neighboring towns and surrounding territory.

OTTAWA, ILL.—Work has begun on the construction of a new power plant for the Northern Illinois Light & Traction Company. The equipment will include a 4000-kw. turbo-generator. An outdoor transformer station will also be erected in connection with this station.

PEORIA, ILL.—At an election to be held April 3 the proposal to issue $60,000 in bonds for the construction of an underground conduit system for electric wires will be submitted to the voters.

ELKHORN, WIS.—Contract has been placed by the Municipal Light and Water Commission for ornamental street-lighting system, consisting of 35 arc street lamps of 250 and 100 cp. and one 7.5 kva. automatic regulator. Fritz Olesson is superintendent.

ENDEAVOR, WIS.—Plans are being prepared by the Endeavor Light & Power Company for erecting an electric transmission line to Packwaukee, a distance of 5 miles, and also for making some changes in equipment of power house. William H. Burwell is manager.

KAUKAUNA, WIS.—The Municipal Electric and Water Department contemplates the construction of a hydroelectric plant to develop about 1000 hp. under a 26 ft. head, using vertical generators. Work on the proposed development may begin this summer. William B. Montgomery is manager.

MANITOWOC, WIS.—Plans are being prepared by the Woolmansee-Davidson Company, First National Bank Building, Chicago, Ill., for the erection of a hydroelectric power plant at Manitowoc for the Wisconsin Public Service Company, a subsidiary of the Wisconsin Securities Company of Milwaukee, to cost about $250,000.

MARSHFIELD, WIS.—Preliminary plans are being prepared for the construction of hospital building, power house and laundry, to cost about $100,000, for St. Joseph's Hospital. Emil Eschmann & Sons Company, University Building, Milwaukee, are architects.

NEILLSVILLE, WIS.—Bids will be asked by the Water and Light Commission of Neillsville, it is reported, for an electrically operated pumping unit of 5500 gal. per minute capacity. Mead & Seastone of Madison, Wis., are consulting engineers.

SHEBOYGAN, WIS.—Plans are being prepared by the Eastern Wisconsin Electric Company of Sheboygan for the installation of a 7500-hp. turbo-generator unit at its local plant, which with other improvements contemplated, will cost about $150,000.

PRINCETON, MINN.—The Elk River (Minn.) Power Company is reported to be negotiating for the purchase of the municipal electric-light plant at Princeton.

ST. CLOUD, MINN.—The St. Cloud Public Service Company is erecting a new 16,500-volt transmission line, which will supply electrical service to the towns of Clearwater, Clear Lake, Becker, Monticello and Big Lake. Another new line will be extended to Foley. Wheelock Whitney is treasurer.

ST. PAUL, MINN.—The Chicago, St. Paul, Minneapolis & Omaha Railroad Company is contemplating the construction of a power house and addition to its shops at West Seventh Street, St. Paul, to cost about $300,000. A. W. Trenholm of St. Paul is general manager.

BONAPARTE, IOWA.—The Iowa Electric Company of Cedar Rapids has applied for a franchise to supply electrical service in Bonaparte.

CEDAR RAPIDS, IOWA.—The Iowa Railway & Light Company is planning to erect a high-tension transmission line from its power plant at Nevada to the Dayton Lake Amusement Park, 11 miles long, to furnish electricity for lamps and motors to the parks and also to the farmers along the line. Plans are also being prepared to extend the line through Gilbert to Story City.

DANBURY, IOWA.—The Board of Railroad Commissioners has granted Mark Durst and Godfrey Durst, Jr., a 25-year franchise to erect and operate electric transmission lines for the distribution of electricity upon the roads and highways in Woodbury County.

IOWA FALLS, IOWA.—The Iowa Falls Electric Company has applied to the State Railroad Commission for a franchise to erect an electric transmission line in Worth County and also in Hancock and Cerro Gordo Counties.

SHENANDOAH, IOWA.—Improvements are contemplated to the light, heat and gas plant. Burns & McDonnell, Interstate Building, Kansas City, Mo., are engineers.

SPENCER, IOWA.—Plans have been approved by the City Council for improvements to the electric-light and power plant.

WEST LIBERTY, IOWA.—The City Council has voted to abandon the municipal electric-light and power plant and secure energy from the Iowa Light & Power Company of Cedar Rapids. The company will extend its electric transmission line from Iowa City to West Liberty. The Iowa company will also furnish electrical service in West Branch.

HANNIBAL, MO.—The plant and holdings of the North Missouri Light & Power Company in Hannibal have been purchased by the Illinois Traction Company. It is understood that the transmission lines of the company would be extended on toward Mexico, Mo., in the near future.

HUME, MO.—A. C. White, owner of the local electric-light plant, contemplates the installation of a 15 or 20 kw., three phase, 60-cycle, 2300 volt generator, driven by an oil engine. The equipment may be new or second hand.

KANSAS CITY, MO.—Plans have been outlined by the Kansas City Railways Company for improvements to its system. The chief changes are to be made in the distribution of power and will involve the abandonment of two substations this year, a third later, and the establishment of five others at various locations this year and two more later. A portable automatic substation has been ordered for delivery this summer. The only equipment to be purchased for the new substation is a 3000 kw. rotary converter; eventually three 1500-kw. rotary converters, one 2000-kw., three 1000-kw., one 800-kw., one 600-kw. and four 750-kw. converters will be installed in the new substation. Some of the equipment will come from the stations abandoned. Extensive improvements are to be made at the power plant and distributing system, involving an expenditure of about $370,000, of which $100,000 will be used for the power plant; $161,000 for substations; $30,000 for switch houses and $43,000 for overhead lines.

NEW LONDON, MO.—The property of the North Missouri Light & Power Company of New London has been purchased by the Illinois Traction Company of Peoria, Ill.

ST. JOSEPH, MO.—Plans are being considered by the St. Joseph Railway, Light, Heat & Power Company for the erection of a new power station, to be used in connection with the present power house at the foot of Felix Street. An expenditure of $50,000 for equipment to increase the boiler capacity of the present power plant has been authorized by the officials of the company.

MARVIN, S. D.—The City Council has decided to install an electric-lighting system.

FREMONT, NEB.—Plans are being prepared by the Fremont Gas, Electric Light & Power Company for extensions to its plant. New Equipment, including one 625-kva. Westinghouse turbine and one 450-hp. Stirling boiler will be installed. It is not yet decided whether an entirely new building will be erected or an addition built to the present plant. H. C. Fuers is manager.

FREMONT, NEB.—The new Gisen grain elevator of the Nye-Snyder Fowler Company of Fremont will be equipped for electrical operation. The company has contracted with the municipal plant for energy to operate the elevator. This will make it necessary to increase the output of the municipal electric plant. It is proposed to install new equipment, including turbines and transformers, increasing the generating capacity to 300 kw.

JOHNSTOWN, NEB.—A petition has been presented Council asking that an election be called to submit the proposal to issue $15,000 in bonds for the installation of an electric-light plant and water-works system.

LITCHFIELD, NEB.—Bonds to the amount of $7,000 have been voted for the installation of an electric-lighting system.

OMAHA, NEB.—Contract for the construction of power house and extension to Union Pacific Shops, to cost about $600,000, has been awarded to the Westinghouse Church Kerr Company, 37 Wall Street, New York, N. Y. Eight new boilers of 400 hp. each will be installed in the new station.

ALMA, KAN.—The Alma Light & Ice Company is contemplating the erection of an electric transmission line and discarding its electric generating plant. George D. Page is manager.

BISON, KAN.—The installation of an electric-light plant in Bison is under consideration. It is proposed to erect an electric transmission line to La Crosse to obtain electricity to operate the system.

CAPRON, KAN.—Application has been made to the town of Capron by Mr. Darling of Hardtner for a 20-year franchise to install an electric-lighting system here.

CIMARRON, KAN.—The City Council is considering the installation of a municipal electric-lighting system. Electricity will be obtained from either Dodge City or Garden City. The Midland Water, Light & Ice Company of Dodge City and the Garden City Telephone, Light & Manufacturing Company have both submitted proposals to furnish the service.

INDEPENDENCE, KAN.—At an elec-

tion to be held April 3 the proposal to issue $75,000 in bonds for the installation of a municipal electric-light plant will be submitted to the voters.

LA CYGNE, KAN.—The Pleasanton (Kan.) Electric Company has submitted a proposal to the City Council offering to erect a transmission line from Pleasanton to the city limits and to furnish electricity to the city of La Cygne at 4 cents per kw.-hour. If the city of La Cygne would build the line the company would furnish energy at 3 cents per kw.-hour. The company proposes to install a plant and supply energy to surrounding towns and villages.

Southern States

SPRING HOPE, N. C.—J. B. Privette and others, it is reported, contemplate developing the Webb Mills water power, several miles from Spring Hope, and constructing a hydroelectric plant.

CHARLESTON, S. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until April 9 for shipbuilding crane (electrically operated) under specification No. 2331, at the Navy Yard, Charleston, S. C.

CHARLESTON, S. C.—Bids will be received by Todd, Simons & Todd, architects, 63 Broad Street, Charleston, until March 29, for construction of a four-story hospital building in the city of Charleston. Bids will be received for building complete, except heating, plumbing and electric wiring, for which bids will be received separately. Plans and specifications may be obtained from the architects upon deposit of $25, of which $15 will be refunded.

SENECA, S. C.—The municipal electric-lighting system will connect up with the transmission system of the Southern Power Company of Charlotte about April 1. Charles Floyd is manager.

DAVISBORO, GA.—The City Council has engaged W. M. Crook, Grand Building, Macon, to prepare plans and estimates for the installation of a municipal electric-light plant.

THOMASVILLE, GA.—Improvements to the municipal electric-light plant are reported to be under consideration.

TAMPA, FLA.—The Tampa Electric Company is planning to double the output of the West Jackson Street power house. The work will include addition to building and installation of an additional 7200-kw. steam turbo-generator. The Stone & Webster Management Association, 147 Milk Street, Boston, Mass., has charge of the plant.

COLUMBIA, ALA.—J. Ed. Foy and Dermot Shemwell of Lexington, N. C., who have organized a company with a capital stock of $100,000 for further development of a water power on Musser Creek, near Columbia, which they have recently purchased. It is proposed to build a dam and reconstruct the plant. Contracts to supply electricity in Columbia, Ashford and Headland have been acquired. The main office of the company is at Lexington, N. C.

TYLERTOWN, MISS.—Within the next 18 months the Tylertown Electrical Company expects to build a new power station and install another generating unit for day service; also in the meantime to put the entire town on a meter service.

PINE BLUFF, ARK.—The Pine Bluff Company contemplates extending its high-extension transmission lines to Stuttgart, England and other towns and cities.

BATON ROUGE, LA.—The Yazoo & Mississippi Valley Railroad Company is contemplating equipping a mechanically operated coaling station, to cost about $20,000, at Baton Rouge.

GATE, OKLA.—Bonds to the amount of $7,000 have been voted for the installation of a municipal electric-light plant.

HEADRICK, OKLA.—The installation of an electric-lighting system in Headrick is under consideration.

McALESTER, OKLA.—The Pittsburgh County Railway Company, which operates the local street railway system is contemplating the installation of a 3500-kw. steam turbo-generator in its power station at Ninth Street and Johnson Avenue.

ABILENE, TEX.—The American Public Service Company of New York, N. Y., which operates electric plants and other public utilities in Abilene, Baird, Cisco, Jefferson, Longview and Marshall, Tex., and Hugo and Henryetta, Okla., has sold its properties to the Insull Syndicate of Chicago, Ill. The new owners, it is stated, will install new machinery and make important improvements to some of these plants.

BEAUMONT, TEX.—Preparations are being made for the installation of new equipment for the Beaumont Iron Works, to cost about $65,000. Electric generating machinery and an electric steel furnace will be included in the equipment.

HOUSTON, TEX.—The Intermountain Railway, Light & Power Company of Colorado Springs, Col., has been granted a permit to do business in the State of Texas. The headquarters of the company will be in Houston and it will operate in Navasota, Sour Lake and Silsbee.

Pacific States

CASHMERE, WASH.—An agreement has been reached between the Town Council and the Wenatchee (Wash.) Valley Gas & Electric Company, whereby the contract for furnishing electricity has been awarded to the company.

LA CROSSE, WASH.—Application has been made to the Council by Harry G. Wilson for a franchise to install and operate an electric-light and power plant in La Crosse.

SEDRO WOOLLEY, WASH.—The contract for street-lighting has been awarded to the Pacific Northwest Traction Company for a period of five years. Considerable extensions, it is understood, will be made to the local system and new lamps installed.

ARCADIA, CAL.—The Board of Trustees has decided to install an ornamental street-lighting system, to be maintained by underground wires, on First Street.

BEVERLY HILLS, CAL.—Bids will be received by Sidney C. Rowe, city clerk, Beverly Hills, until April 2 (extension of date from March 12), for installation of an ornamental lighting system, consisting of 361 marbelite or metal posts, etc.

CROCKETT, CAL.—The Great Western Power Company of San Francisco is planning to erect a large substation at Crockett. The proposed station, it is said, will be used as a central distribution plant and will cost about $250,000.

MARYSVILLE, CAL.—Plans have been completed by the Pacific Gas & Electric Company for the installation of a new street-lighting system, to cost about $2,500.

SAN FRANCISCO, CAL.—Application has been filed with the State Water Supply Commission by E. Fletcher, 920 Eighth Street, San Francisco, for 30 second feet of water from tributaries of Santa Ysabel River for power purposes. The plans provide for a hydroelectric development of about 3000 hp., and include the construction of a concrete dam, 110 ft. high and 800 ft. long and 5 miles of pipe line.

STOCKTON, CAL.—The Tidewater Southern Railway Company, it is reported, contemplates the construction of terminal facilities at Modesto and equipping its railway between Modesto and Turlock for electrical operation. Byron A. Bearce is president

LEHI, UTAH.—Application has been filed at the office of the state engineer by W. F. Gurney, J. W. Wing, Jr., and A. J. Evans of Lehi for 20 second ft. of water from the American Fork Creek and Deer Creek for power purposes. The construction of a power plant, consisting of a dam, headgates, pipe lines, one 18,000-ft. and another 6000 ft., and a 7542-ft. channel is contemplated by the petitioners. It is proposed to develop about 2000 hp., under a 1150-ft. head.

SALT LAKE CITY, UTAH.—The City Commission has granted the Utah Light & Power Company permission to establish and operate a steam heating plant in Salt Lake City.

ST. GEORGE, UTAH.—The Dixie Power Company, which took over the municipal electric plant in October, 1916, is installing a hydroelectric plant on the Santa Clara River. At present the company is not furnishing current anywhere except in St. George. The company expects to erect transmission lines to and install distributing systems in Santa Clara, Washington, Leeds, Hurricane, La Verkin and Toquerville, and furnish electricity by June 1. A. L. Woodhouse, care National Copper Bank, Salt Lake City, is president and manager.

MIAMI, ARIZ.—Preparations are under way for the installation of additional equipment at the power plant owned jointly by the International Smelting and Inspiration Companies, which will include an increase in blowing machinery which supplies the pressure air for converting operations; also extensions to the coarse ore bins.

GERALDINE, MONT.—A franchise has been granted to W. J. Bentson and J. Rose to install and operate an electric-light plant in Geraldine.

POLSON, MONT.—The Northern Idaho & Montana Power Company of Kalispell contemplates the erection of an electric transmission line from Big Fork to Polson, thence to Ravalli, via Ronan and Mission, and from Dayton to Polson

ST. IGNATIUS, MONT.—The Northern Idaho & Montana Power Company of Sandpoint, Idaho, contemplates extending its electric transmission line and telephone line from Olsen to St. Ignatius, work to begin as soon as the weather will permit.

ROCK SPRINGS, WYO.—Work has begun by the Union Pacific Coal Company on combining its power plants at Superior and Rock Springs, Wyo., into one plant, to be located at the latter place. The cost of the work is estimated at $126,000 and will include a new General Electric 2500-kw. transformer and the erection of 22 miles of 33,000-volt transmission line. The plant at Superior will be held as a reserve plant. Improvements will be made in the mines, involving a further expenditure of $40,000, and will include the installation of new synchronous induction motors, etc. S. Peticolas of Omaha, Neb., is consulting engineer.

LOVELOCKS, NEV.—Preliminary work has been begun by the Nevada Valleys Power Company for the construction of a hydroelectric power plant on the Truckee River, a short distance below Vista, to develop about 2500 hp.

LAS CRUCES, N. M.—The Las Cruces Electric Light & Ice Company is installing a four-valve engine and an 180-kva. alternator (directly connected), two 125-hp. Brownell boilers, complete with Cochrane heaters and pumps. The company expects to establish a 24-hour service within four months. D. W. Morgan is general manager.

SILVER CITY, N. M.—The City Council has granted the Empire Zinc Company a franchise to build an electric railway in Silver City.

Canada

WINNIPEG, MAN.—T. H. Johnson has recommended the award of the contract for electric conduit and wiring for the new Parliament Buildings to the Mundy, Rowland Company of Vancouver, B. C., at $101,036.

CORNWALL, ONT.—The erection of a substation by the Cedar Rapids Transmission Company in Cornwall is under consideration. The initial installation will provide for an output of 3000 hp.

HANGINGSTONE FALLS, ONT.—Work has been started on the construction of a power plant at Hangingstone Falls for the South Bay Mines Company, under the supervision of Lynn Adsit, mining engineer. The plans provide for an ultimate development of between 1500 and 2000 hp. The first unit with an output of from 300 to 400 hp., it is expected, will be ready for operation by next September. Sutcliffe & Neelands, Haileybury, Ont., are in charge of the work.

LONDON, ONT.—Plans are being considered by the Victoria Hospital Trustees for the purchase of an auxiliary electric-lighting system.

NORTH COBALT, ONT.—The local car barn of the Nipissing Central Railway Company was recently damaged by fire. The loss to electrical equipment is placed at $30,000; to cars, $60,000, and to building, $40,000.

EAST ANGUS, QUE.—The Brompton Pulp & Paper Company is contemplating another hydroelectric development, 3 miles below their pulp and paper plant at East Angus, on the St. Francis River. Plans are being prepared to develop an additional 6000 hp.

GREENFIELD PARK, QUEBEC.—The Town Council has engaged W. G. H. Cam, consulting engineer, 3 Beaver Hall Square, Montreal, to prepare plans and specifications for the installation of an electric-lighting system and also to supervise the work.

MONTREAL, QUE.—W. L. Miller & Company, 44 George Street, Montreal, it is reported, contemplate the purchase of engines, boilers, motors, and planing-mill machinery, machine-shop and railroad equipment.

HUMBOLDT, SASK.—Improvements are contemplated to the municipal electric light plant, including the installation of an additional boiler with surface condenser and circulating pumps. F. K. Martin is manager.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until March 29, for furnishing the following supplies; 70 ft. tool steel, 500 lb. special bronze, 2000 ft. brass tubing, one motor-driven automatic screw machine and 5000 ft. 2-conductor cable, etc. For further information address the above office.

14,270 Centrifugally Regulated Power-Transmission System William Morrison, Chicago, Ill. App. filed Sept. 9, 1916. Improvements.

14,271. Dynamo Electric Clutch; William Morrison, Chicago, Ill. App. filed Sept. 9, 1916. Speed regulation of an automobile is effected by varying the speed of the engine, the dynamo acting in the main simply as an electromagnetic clutch, and generating only enough current, under normal running conditions, to produce the requisite clutching effect.

1,218,621. Slip Coupling for Electric-Cable Conduits; Maurice Blumenthal, Brooklyn, N. Y. App. filed Feb. 1, 1915. Electric cable conduits may be quickly and easily connected.

1,218,630. System for Amplifying Electrical Energy; Ralph V. L. Hartley, New York, N. Y. App. filed July 8, 1914. Increase the amplification of a repeater system beyond its normal capacity therefor.

1,218,682. Police Signaling System; Louis W. Miller, Rochester, N. Y. App. filed Aug. 23, 1911. Police officers or roundsmen may be called or summoned from headquarters or a precinct station.

1,218,692. Clock; Charles Edouard O'Keenan, Paris, France. App. filed Oct. 20, 1913. Synchronous electrical clock.

1,218,747. Multispeed Induction Motor; Rae W. Davis, West Allis, Wis. App. filed Feb. 7, 1913. Capable of efficient operation at a plurality of speeds.

1,218,768. Thermostatic Regulator; William C. Heindl, Rochester, N. Y. App. filed March 29, 1915. In connection with heating systems, to regulate the temperature of a building.

1,218,772. Battery Depolarizer; Major E. Holmes, Lakewood, Ohio. App. filed Dec. 13, 1913. Preparation of battery depolarizers and more particularly to manganese compounds for such use in dry cells.

1,218,795. Indicating and Recording Apparatus; Benjamin Frederic Merritt, East Orange, N. J. App. filed June 21, 1915. Remote control type.

1,218,796. Signal Transmitter; Benjamin Frederic Merritt, East Orange, N. J. App. filed June 30, 1915. Automatic type.

1,218,799. Phonograph Recorder and Reproducer; Herman G. Pape, New York, N. Y. App. filed March 8, 1915. Practical means for making records on phonograph recording blanks as cylinders, disks, or the like, of mechanically or telephonically transmitted sounds such as musical productions, speeches, or other subject matter which it may be desired to record for phonographic reproductions.

1,218,802. Apparatus for Electroplating Pipes, Rods, Etc.; Nelson H. Raymond, Buffalo, N. Y. App. filed Sept. 15, 1915. Means for feeding the pipes automatically step by step.

1,218,804. Selective Signaling System; Frank N. Reeves, Newark, N. J. App. filed Feb. 27, 1915. Partly line selective signaling in telephone exchange systems.

1,218,805. Automatic Call-Distributing System; John G. Roberts, Dobbs Ferry, N. Y. App. filed March 7, 1914. Rapid recording at the central office of subscribers' line numbers.

1,218,806. Telephone Trunking System; John G. Roberts, Dobbs Ferry, N. Y. App. filed Dec. 8, 1914. Applicable especially to two-wire trunks between offices.

1,218,817. Apparatus for Producing Ozone; Melbourne Roy Tennant, Colorado Springs, Col. App. filed July 12, 1913. Means for producing electric arcs for emitting a constant glow of light.

1,218,847. Emergency Power Device; William Payson Firey, Roanoke, Vt. App. filed June 22, 1915. Improvements.

1,218,850. Treatment of Seeds; Henry Ernest Fry, Godmanstone, Dorchester, England. App. filed June 3, 1916. To render them more productive.

1,218,864. Signal; William Robert Honeyball, Pasadena, Cal. App. filed July 25, 1916. Adapted for use on self-propelled vehicles.

1,218,870. Duplexing Telegraphic Lines; Isidor Kitsee, Philadelphia, Pa. App. filed Dec. 30, 1916. Produce efficient means to duplex telegraph lines.

1,218,890. Electric Switch; Clarence D. Platt, Bridgeport, Conn. App. filed April 20, 1916. Reduce the shock of the switch movements.

1,218,892. Muffler for Telephones; Aleksander Pludowski, Waterbury, Conn. App. filed Aug. 3, 1916. Improvement.

Record of Electrical Patents

Notes on United States Patents issued on March 11, 1917

1,218,916. Method and Apparatus for Separating Magnetic Ores; Joseph Weatherby, New Cumberland, Pa. App. filed June 12, 1915. Improvements in the treatment of magnetic ores in a subdivided mixture consisting of particles having different degrees of magnetic permeability.

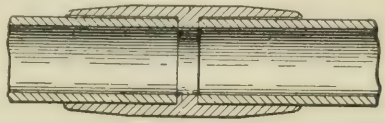
1,218,934. Sound Emitter; Sydney Evershed and Willie Dickson Kilroy, Chiswick, England. App. filed May 3, 1910. Electric vibratory motors and their application for signaling to a distance.

1,218,935. Low-Water Alarm; Charles R. Ford, Paducah, Ky. App. filed Aug. 26, 1915. For use upon steamboats and other water-navigating vessels.

1,218,952. Rectifier for Polyphase Alternating Currents; Ernst Oelschlager, Berlin-Charlottenburg, Germany. App. filed Nov. 20, 1913. Employing liquid mercury.

1,218,955. Service Demand or Operation Recorder; Emmet Grattan Ralston, Indianapolis, Ind. App. filed April 8, 1916. Provision of an instrument which may be used in connection with any source of electrical energy for the permanent recording of service, operation or periodic demand of any reciprocating or rotating mechanism.

1,218,960. Separating Device; Montgomery Sleeth, Bellevue, Pa. App. filed Nov. 3, 1915. Magnetic devices for separating extraneous metallic articles from cotton or the like.



1,218,621—Slip Coupling for Electric Cable Conduits

1,218,967. Separator for Storage Batteries and Process for Making the Same; Theodore A. Willard, Cleveland, Ohio. App. filed July 24, 1914. Separator having contained or embedded in the body thereof a layer or sheet of material which produces the pores and which is exposed at intervals on opposite sides of the body.

1,218,998. System for Packing and Shipping Telephone Apparatus; Alexander M. Haubrich, Chicago, Ill. App. filed May 23, 1913. Improvement.

1,219,001. Governor and Automatic Cut-Out for Electric Generators; Solomon F. Johnson and Levi P. Ayres, Indianapolis, Ind. App. filed Dec. 15, 1913. Apparatus adapted to establish a circuit between a battery and generator after the latter has developed the required voltage for charging the battery and disconnecting the generator from its driver when the generator has reached a predetermined speed so as to prevent the overcharging of the battery.

1,219,002. Electric Switch; Solomon F. Johnson and Levi P. Ayres, Indianapolis, Ind. App. filed July 27, 1914. Improvements.

1,219,003. Binding Post; William Kaisling, Chicago, Ill. App. filed Aug. 4, 1913. Spring binding post.

1,219,008. System for Supplying Electricity; William Oscar Kennington, Anderson, Ind. App. filed May 21, 1914. Employment of a relay having a magnet responsive to the output of the source.

1,219,063. Electrical Piano; Mario Arese, Turin, Italy. App. filed May 3, 1916. Modifying the intensity of the sound along the keyboard.

1,219,074. Galvanic Battery Cell of the Mercuric-Oxid Type; Johannes Nicolaus Bronsted, Copenhagen, Denmark. App. filed Aug. 4, 1915. Improvements.

1,219,098. Trolley Ear; William F. Hall, Newton, Mass. App. filed Oct. 15, 1915. Trolley wheel may freely pass over it without arcing.

1,219,109. Pocket Flashlight; Morduch L. Kaplan, Brooklyn, N. Y. App. filed Jan. 16, 1915. Vest pocket.

1,219,110. Method of and Means for Quadruplexing Cables; Isidor Kitsee, Philadelphia, Pa. App. filed Dec. 30, 1916. Improvements.

1,219,132. Meter-Testing Cut-Out; Thos. E. Murray, New York, N. Y. App. filed Dec. 5, 1912. Testing devices may be applied to meter case.

1,219,134. Switch; Thomas E. Murray, Jr., Brooklyn, N. Y. App. filed June 3, 1916. Fuse is carried on the switch lever and the co-operating contacts are simplified.

1,219,135. Method of Flanging the End of a Metal Tube; Thomas E. Murray, New York, N. Y. App. filed Nov. 29, 1916. Improvement.

1,219,136. Electrical Welding Apparatus; Thomas E. Murray, New York, N. Y. App. filed Nov. 29, 1916. From a welded joint between the butt end of a tube, or pipe, and a circular shoulder on the inner periphery of a sleeve receiving said tube.

1,219,137. Electrical Welding Apparatus; Thomas E. Murray, New York, N. Y. App. filed Nov. 29, 1916. Rotation of one of the two bodies to be welded causes a movement of the other of said bodies into pressing contact with said rotating body at the welding joint.

1,219,138. Electrically-Welded Tube and Flange; Thomas E. Murray, New York, N. Y. App. filed Nov. 29, 1916. Improvement.

1,219,139. Method of Electrically Welding the End of a Tube Within a Sleeve or Socket; Thomas E. Murray, New York, N. Y. App. filed Dec. 14, 1916. Improvement.

1,219,143. Supervisory System; James G. Nolen, New York, N. Y. App. filed July 23, 1909. Employed for indicating sudden and excessive rise in temperature.

1,219,171. Chandelier; Moritz D. Schwartz, New York, N. Y. App. filed Oct. 2, 1916. Indirect lighting systems.

1,219,189. Automatic Recording Fire Alarm; Henry Symes, Mornington, near Dunedin, New Zealand. App. filed Oct. 8, 1913. Improvements.

1,219,194. Electric Zinc-Distilling Furnace; John Thomson, New York, and Francis A. J. Fitz Gerald, Niagara Falls, N. Y. App. filed June 21, 1916. Minimize the cost of transforming metal into fume or gaseous vapor, to retain certain elements of the fume within the furnace and to then evacuate and conduct other portions of the fume.

1,219,215. System of Space Signaling; James C. Armor, Brooklyn, N. Y. App. filed July 26, 1912. Provide adequate electrical means whereby the normal inductance of the inductive means referred to may be maintained at approximately a predetermined value.

1,219,216. System of Space Signaling; James C. Armor, Ingram, Pa. App. filed Oct. 14, 1913. Transmitting station of a system of wireless telephony.

1,219,228. Electrical Grounding Clamp; James Elbert Birdsall, Philadelphia, Pa. App. filed Aug. 17, 1915. All tendency to loosening or shifting may be obviated.

1,219,230. Electric Route Indicating and Lighting System; Alfred Blackmore, Kensington, London, England. App. filed Oct. 7, 1916. Adapted to be controlled by means of switches.

1,219,245. Speedometer; Allen A. Canton, New York, N. Y. App. filed Aug. 8, 1916. Electrically operated.

1,219,250. Lock-Case Reversing Mechanism; Robert Cecchini, West Springfield, Mass. App. filed July 12, 1915. A combination lock for a safe.

1,219,264. Gage; Horace L. Dawson Evanston, Ill. App. filed Nov. 21, 1908. Level of a liquid in a tank.

1,219,265. Electric Fluid Heater; Harry W. Denhard, San Francisco, Cal. App. filed Dec. 20, 1915. Regulator which will render the heater adapted to heat liquids of different specific resistance to any desired temperature.

1,219,300. Spark Coil; John Alden Hall, East Orange, N. J. App. filed Aug. 25, 1915. Casing for an induction coil and condenser which are self-contained and substantially inclosed within said casing.

1,219,333. Water-Purifying Apparatus; John D. Kynaston, Washington, D. C. App. filed Nov. 15, 1916. To convert nitrogenous and other soluble impurities and animal and vegetable matters either in solution or suspension into insoluble precipitates to produce a coagulum for mechanical separation as by settlement.

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Borrowing Now

INTEREST on borrowed money is always a large item in the utility, which has to invest heavily in proportion to turnover. But it can be made still greater by borrowing in times of crisis just as it can be lightened by borrowing in periods of ease and confidence. When we make a great improvement we can afford to think in terms of hundreds of thousands or millions. When we sell the bonds to meet the cost we can afford to split eighths or sixteenths of 1 per cent with the banker. The operator who knows is the one who calculates the last dollar of cost. The unthinking man is the one who does not give much concern to price but passes the responsibility on to future years. Now is a time when the central station executive who plans ahead is considering capital requirements, present and probable, and economical means of providing for them. In seeking money he is competing with highly profitable industrial organizations, which promise a larger return than the public will let him give. He is hampered by reluctance of the public to let him have profits comparable with the huge profits of industrial properties. But he offers a stability in gross earning power which those properties lack and is forehanded in disposing of securities while the banking and public buying power is good.

Radio-Communication in War

THE present great war is an event of more importance than any in human history since the fall of the Roman Empire. All of Europe except a few of the smaller powers is fighting. All Asia is in the lists. Part of North America—that is, Canada—is already fighting officially, and the rest of North America—the United States and Mexico—are virtually in the war, although still unofficially. All Australia and Australasia are involved, and South America may soon follow, because the fence between the belligerents is too narrow and sharp to permit of comfortable sitting.

It has until recently been generally accepted that any alliance of nations which could maintain dominion on the seas could ultimately extend its dominion over the lands. It now looks as though the dominion of the air would ultimately transcend in importance the dominion of the sea. The dominion of the air is obtained by flying machines and by radio-communication. Those nations which collectively can maintain in alliance the greatest skill and ability in fleets of aeroplanes, and also the greatest skill and ability in radio-communication, may be expected jointly to retain command of the seas, and in combination therewith to maintain command of the land. This skill and ability is intellectual and moral. It calls for a high degree of inventiveness, engineering, discipline, hardihood, courage and initiative. No single country can expect to maintain such a hegemony, but a strong federation of progressive countries may hope to keep the peace of the world through the joint dominion of the air.

Expanding Manufacturing Plant

EXPANSION in manufacturing plant does not keep step with expansion in orders. One goes faster than the other, and sometimes it is plant which leads while in other periods it is the orders that outstrip the enlargement in physical capacity. In the electrical manufacturing industries the controlling judgment on the wisdom of extensive plant expansion is partially suspended because of the strangely conflicting influences and uncertainties of the day. It takes far-sighted courage to decide upon and prosecute a program of expansion in keeping with the indicated volume of orders this year. The price of not doing it, however, is lost orders and disappointed customers, provided, of course, the business tide remains at high level. The manufacturer turns to the other side of the picture and sees arrayed in argument against expansion such major points as high building cost, material scarcity, labor independence, and then the present waiting position of the country. Plant capacity is being used to-day to the full possible limit, shop rearrangement is promoting increase of output, but actual expansion is still far behind the gain in volume of business. The expansion of plant will follow and the long period of prosperity will make its financing easier.

The Lightning Peril

EVERY power transmission plant has a wholesome fear of Thor's hammer. It is the most uncontrollable factor in the situation. With growing experience valuable information regarding it has accumulated, and important remedial action has been taken, yet lack of complete knowledge of the practical phases of the situation has hampered the course of adequate defence. A brief paper by C. W. Piper in this issue constitutes a not unimportant addition to our knowledge of a difficult subject, in that it summarizes, over a territory including thirteen states, the nature of the damage which has recently been done. The statistics of the matter show that, as might have been anticipated from the general trend of experience, transformers and

meters are the most frequent seats of damage, covering on the whole approximately half of the entire damage due to lightning. Both transformers and meters are numerous and particularly susceptible to injury, and a more thorough statistical investigation would probably show like results all over the country.

An interesting addition to the data would have been an analysis of damage with respect to the voltage of the lines. It seems to be rather a usual experience that increase of voltage does not proportionately increase the risk from lightning, owing to the greater absolute margin of safety in the insulation; but exact data on this matter would be most illuminating. For instance, next to transformers and meters insulators come in for the largest amount of damage, and it certainly is of vital interest to know the relation of this particular difficulty to the voltage of the lines. Further, has there been any material damage in cases where suspension insulators were used, and what was the margin of safety between the working voltage and the breaking point in cases where damage has been done? The facts collected seem thoroughly to have proved that lightning does strike twice in the same place, and indeed it is not difficult to find certain points on particular systems where trouble from lightning is exceptionally frequent and which require, and should receive, particularly good protection. The present trend of practice is to install a moderate number of arresters, placing them as near as possible to the apparatus to be protected and paying special attention to branches of the main line and to large and consequently valuable transformers. Whether it is possible entirely to avert damage from direct lightning strokes may perhaps be regarded as dubious, since the efficient voltage may be enormously great with respect to the factors of safety even with the best apparatus. On the other hand, the data collected seem to show that most of the damage done is by induced strokes or their resulting surges, which are of relatively moderate voltage and hence much more easily dealt with.

In attempting anything like complete protection the cost of the arresting devices themselves rises to a very serious amount, and a balance has to be struck between the cost of arresters, the damage due to interruptions and the probable interruptions due to failure of insulation. It is a situation somewhat akin to that found in the installation of so-called automatic devices of many kinds. Used judiciously these are of vast value in the operation of an electric plant, but it is by no means impossible to reach a point where the automatic apparatus becomes itself a source of more practical difficulty than those things which it is installed to remedy. The final moral of this and other investigations into lightning is that in arranging protection hard common sense and experience, particularly the latter, count for a great deal, and that the fundamental rule in safeguarding a system is to pick out the danger points and to protect them, right there, by such means as seem adequately suited to the particular task. A bank of costly transformers justifies thorough, even if expensive, protection which would not be appropriate for apparatus of less cost and importance.

Electric Cotton Mill Equipment

IT is now a little more than twenty years since the first complete electric drive for a cotton mill went into service at Columbia, S. C. One or two attempts had been made previously by the mere substitution of motor for steam plant in the general drive of the mill, but the Columbia installation marked an epoch inasmuch as group drive by induction motors was there for the first time instituted. In another column Mr. David Elwell gives an important report on the electric equipment of a great cotton mill at Salem, Mass., in which it was practicable to plan the whole installation from the ground up so as best to meet the somewhat intricate requirements of that particular industry. The case is more than usually striking because the energy, instead of being generated locally, as at many electrically driven mills, is purchased from the Salem Electric Lighting Company and is delivered at the regular 2300 volts working pressure of the power house. The area covered amounts to nearly twenty-three acres of floor space, and the whole power load rises to between 4000 kw. and 4500 kw., distributed to nearly 300 motors. These motors are of the ordinary three-phase type, and with the exception of the equipment of the weave shed are all wound for 550 volts, which has been from the very beginning a popular voltage for mill distribution on account of relatively small requirements for distribution copper. In the weave shed 220-volt motors were used, for the reason that motors specialized for such service have been widely developed for this particular pressure. This voltage also facilitates the switching equipment by allowing the use of standard and comparatively inexpensive devices.

A particularly interesting feature of the transformer installation is that it constitutes an outdoor substation protected by a concrete and steel roof and partly housed in by a brick fire wall. The transformer units themselves are mounted on steel rollers bearing on rails so that they can be moved readily and the floor is drained to take care of the oil in case of accident. Alongside this main substation is a wire tower, from which radiate the 2300-volt feeders for the subsidiary transformer banks and the heavy 550-volt power circuits for the spinning mill. The weave-shed power at the lower voltage is derived from five banks, each of 600 kva., and these transformer groups are energized from two separate 2300-volt power feeders. The lighting circuits are worked single-phase from balanced connections to three-phase transformers, or sometimes from connection to a single phase.

The wiring is in general run in concealed conduits for the lighting, and open for the power. The details of the installation are fully discussed by the author. From a practical standpoint the most striking feature of the installation is the fact that the energy is purchased on the basis of demand charge plus a meter charge, and that there are special requirements connected with this contract by which the mill has to maintain an 80 per cent power factor, even if synchronous condensers should be required to keep it up. In point of fact the power factor is about 82 per cent, and a little higher

when lighting service is on. The final proof of excellence is in the results, and it should here especially be noted that the plant has emphatically made good by reaching an efficiency of production altogether extraordinary and very near to the maximum theoretically possible for the mill machinery employed. This performance is certainly in itself a complete justification for the often-made, and proved, claim that electric equipment leads to the best attainable results in efficiency of operation.

An Atomic Model

MATTER as known to our senses, on a small scale, comes in solid or in liquid particles—*i.e.*, in lumps. There is very strong theoretical evidence, however, that these perceptible lumps are aggregations of vast numbers of molecules, which, in a chemically pure substance, under uniform conditions, may be all alike. No one has ever seen a molecule, even in the microscope, but the shadows of large molecules are believed to be visible in the ultra-microscope. It is very hard to avoid belief in the existence of molecules. These latter are, in turn, believed to be formed of groups of atoms, the atom being the smallest portion of any single chemical substance which can exist independently. The word atom, in its Greek derivation, means that which cannot be cut or subdivided. Until recently it was supposed that the atom was the smallest possible subdivision of matter. Recently that supposition has been blown to atoms. Atoms are now believed to be aggregations of entities very much smaller, which are called electrons, because their electrical properties are so prominent. Two kinds of electrons are postulated; namely, positive and negative electrons. Of these, the behavior of negative electrons is the more easily recognized. All negative electrons are supposed to be exactly alike. Although negative electrons are so remotely beyond the resolving powers of the microscope, yet the electrical effects of single electrons are readily detectable in the physical laboratory. The atom then still retains its place as the smallest individual piece of a chemical substance; but the electron, of which all atoms are constructed, is now the smallest material entity of which we have any knowledge. It is also believed that all the forces which act upon electrons to bind them into an atom and to endow the properties of the atoms are purely electromagnetic forces; so that to understand an atom we must study electricity.

A very high degree of interest attaches to the investigation of the inward properties of atoms, not only from a purely scientific standpoint, but also from the standpoint of possible engineering applications. It seems evident that the store of electric energy in the structure of an atom is relatively very large, and is enormous with respect to the energy that atoms can liberate in forming chemical unions into molecules. For example, there is reason to believe that the energy inside atoms of carbon and atoms of oxygen is far greater than that which is released when these carbon atoms of coal burn with the oxygen atoms of the air. If, therefore, it were found possible to disrupt atoms under control, the energy released in the process might make modern fuels take a very subordinate place in the production and distribution of energy. However, the problem seems very difficult of solution. An atom has constitutional objections to being disrupted. Some heavy atoms, like those of uranium, thorium and radium, oblige us by undergoing occasional automatic disruption and with the concomitant liberation of relatively large stores of internal energy; but as yet we can neither hasten nor retard the process.

If we are to learn how to unlock the bonds that gird electrons into the structure of an atom, we must first deserve success by hard work in the study of atoms and their little ways. There is no royal road to knowledge, even into the heart of so minute a thing as an atom.

Various attempts have already been made to picture the structure of atoms and their component electrons. The best success so far has been obtained by representing the negative electrons as rotating in planetary rings about a positively charged center. On the extremely great astronomical scale we see that solar systems are built up as flats, or substantially in two dimensions, with planets revolving in nearly coincident planes about a central sun. In the opposite extremely small atomic scale it is supposed that atomic systems are also flats, with numerous electron planets revolving in planes about a center. It is doubted, however, whether the atomic center is more than a geometric center, and whether it is occupied by positive electrons. At all events, atomic models at present content themselves with the planet electrons and substitute for the central sun a central force which pulls the electrons inwards.

A recent and interesting atomic model, consisting of magnetized steel balls floating in rotating mercury, has been described by Prof. R. R. Ramsey in the *Philosophical Magazine* and is referred to in this week's Digest.

The Coming Issues

IN the issue for April 7 several articles which are of particular interest from the public policy point of view will be published. One will discuss the enlargement of the activities of holding companies in the public utility industries. This outcome is clearly forecast by recent developments. Other articles will take up recent decisions by courts and public service commissions which are worth attention as indicating tendencies in regulation. The regular monthly compilation of central station earnings and energy output will also appear in that issue, in addition to the statistics gathered every year by the ELECTRICAL WORLD, showing the output, peak load and time of peak on the largest generating systems in America for the year 1916. In the second issue of April subjects of interest to station and operating engineers will be discussed. The engineering number which will appear April 21 will contain an article on making direct-current network calculations and dealing with the effects of adding new conductors.

Electric Service in a Cotton Mill

Considerations Which Influenced Selection of Equipment, Layout of Apparatus and Methods of Installing It, with Features of Distribution Circuits and Central Station Contract

By David Elwell

Electrical Engineer Lockwood, Greene & Company, Boston, Mass

HAVING been forced by the burning of its cotton mills in 1914 to re-equip throughout, and wishing to use its entire plant and operating force for industrial purposes and not any for the generation of motive power, the Naumkeag Steam Cotton Company, Salem, Mass., adopted motor drive and central station energy exclusively for operating its machinery. Instead of having to fit motors to certain machine layouts and installations, as usually happens when rehabilitating a plant, with uneconomical results, conditions made it possible to study the requirements and select the most suitable types of motors and control apparatus as well as the most economical layout. Pending the rebuilding and equipping of the plant motor-driven looms were installed in the storehouse, which had escaped destruction by fire, and were operated by central station energy to maintain as large a portion of normal production as possible. Some of the considerations which influenced the selection of the permanent equipment will be outlined in the following article in conjunction with descriptions of the apparatus, layout and methods of installing it.



FIG. 1—WEAVE SHED OF NAUMKEAG STEAM COTTON COMPANY IN WHICH NEARLY 3000 SPECIAL LOOM MOTORS ARE INSTALLED

The new Naumkeag plant includes a storehouse, spinning mill, weave shed, and heating plant. In round figures, the plant has a total floor area of 1,000,000 sq. ft. Between the mill and storehouse basements, and also between the mill and the weave shed, are passageways which serve as thoroughfares and passages for pipes and electrical circuits.

Energy is furnished to the mill by the Salem Electric Lighting Company at 60 cycles and 2300 volts over four 500,000-circ. mil lead-covered, varnished-cambric, three-conductor cables laid in an underground duct line. At each end of each circuit is an oil circuit breaker, the switches at the station being equipped with inverse-time-element relays to prevent tripping from small peaks of short duration, and those at the mill with reverse energy relays to prevent energy feeding into a cable from both ends, in case of a fault in it.

Selection of Voltages for Distribution, Motors and Lighting

Since 2300 volts is the standard distributing voltage of the Salem Electric Lighting Company, energy is received and distributed to the transformer groups at that potential. A pressure of 550 volts was selected for the mill and storehouse motors since this pressure was not considered absolutely hazardous, and would not necessitate the use of lead-covered cable and iron conduit as higher voltages would, owing to insurance requirements. Moreover, many of the motors are of small sizes which are not commercially available in voltages above 550. For the weave-shed equipment 220 volts was selected, since electrical manufacturers have specialized on this voltage for the type of motors used there. Furthermore, better efficiencies can be secured and failures in insulation are less likely than at higher voltages. Another point in favor of this voltage is that standard condulet fittings arranged for 220-volt snap switches are available for individual motor control, which would necessitate more expensive inclosed knife, or oil, switches if a higher voltage were used. Single-phase, 110-volt circuits balanced on the legs of three-phase, 2300/110-volt transformers were selected for lighting service.

On the south side of the mill is a wire tower from which radiate 2300-volt power feeders energizing the various transformer banks and 550-volt circuits serving the spinning mill. Intermediate floors have been provided half-way between the main floors in the tower on which the 550-volt power distributing boards serving

each mill floor are located. In the basement of the tower is located the electric service company's equipment as well as the 2300-volt mill distributing board.

The incoming 2300-volt cables enter this basement from an adjacent manhole and terminate at a two-panel board bearing oil circuit breakers with reverse-energy relays, graphic power-factor meters and wattmeters and duplicate watt-hour meters. This equipment controls all energy delivered to the mill and affords the necessary data for computing power bills on the basis mentioned later in the contract. From this board conductors lead to the buses of the mill distributing board adjoining the electric service company's panels. This board consists of five single-circuit feeder panels—one for mill and storehouse power supply, two for weave-shed power supply, one for mill and storehouse lighting, and one for weave-shed lighting.

The mill and storehouse power feeder consists of two three-phase, 500,000-circ. mil lead-covered, varnished-cambric cables connected in parallel to a bank of power transformers in an outdoor station adjacent to the wire tower. All of the remaining feeders are three-conductor, varnished-cambric, lead-covered, steel-taped underground cables. These were used because the mill and weave shed have dirt-floor basements in which they could be laid without excessive expense. Aerial power lines might have been used to the weave shed, but were undesirable because of appearance. Lead-covered cables in rigid iron conduit would have been more expensive

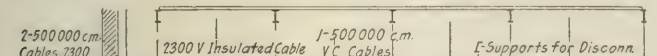


FIG. 2—METHOD OF CONNECTING MILL AND STOREHOUSE POWER TRANSFORMERS, ONE OF WHICH IS A SPARE UNIT

than steel-taped underground cables. Underground fiber conduit installed outside the buildings would also have been expensive and might possibly interfere with future building extensions. A duct system laid in the building basements would have been inherently expensive and the cost of waterproofing or draining the duct lines and manholes would have been prohibitive since the basement floors are at high-water level, the plant being situated on Salem Harbor. Moreover, diagonal runs afforded the shortest circuits in the weave shed to the transformer vaults and were practicable only with steel-taped cables since interference with the column footings, which are about 25 ft. apart, had to be avoided.

The storehouse power load consists of two 15-hp. motors operating electric elevators and two 5-hp. motors driving bale breakers. The use of 550 volts for the mill and storehouse motors permits economical transmission from one power transformer bank, since only one 2300-volt power feeder is required at this voltage.

The weave-shed power transformers are arranged in five banks of 600 kva. each. For reliability, and to minimize the reactive drop which would have resulted from the use of one feeder for a load of this size, the transformer banks are energized from two separate power feeders. An additional feeder serves the lighting transformers for the mill and storehouse, the latter having a single-phase transformer connected with one of the 2300-volt legs, which is carried in conduit to an outdoor-type transformer mounted on the canopy over the shipping platform. The fifth 2300-volt feeder serves four banks of lighting transformers in the weave shed.

A hand-operated 2300-volt distributing switchboard equipped with remote-control apparatus is installed. Front and back alleys are provided for inspection of switches and removal of tanks. Three-section panels carry the apparatus, which includes a polyphase indicating wattmeter, an inverse-definite-time-limit relay, an oil circuit breaker and a polyphhase watt-hour meter.



FIG. 3—BALE BREAKERS DIVIDED INTO GROUPS OF THREE MACHINES EACH TO PERMIT FLEXIBLE OPERATION

At all except one of the five power transformer locations in the weave shed is a bank of lighting transformers. In each of these vaults an oil circuit breaker is provided for each transformer bank, the two breakers being mounted on a single-section panel carried on pipe frame and having double-coil series trips with oil dash-pot attachments. Series trips were chosen for these breakers to secure a cheaper trip than is afforded by relays with current transformers and to permit a suitable time element before opening the circuit on overload.

The 550-volt distributing boards in the mill each consist of a disconnecting and metering panel and the required number of single-circuit feeder panels. A hook-operated knife disconnecting switch for separating the bus from the power supply and a watt-hour meter for measuring the total power to the floor constitute the first panel. Each feeder panel is equipped with a single-phase ammeter and a double series-trip oil circuit breaker having a dash-pot time-limit attachment. A voltmeter on the first-floor switchboard indicates the potential on the 550-volt system. The tripping attachment and time-element device used are simple and

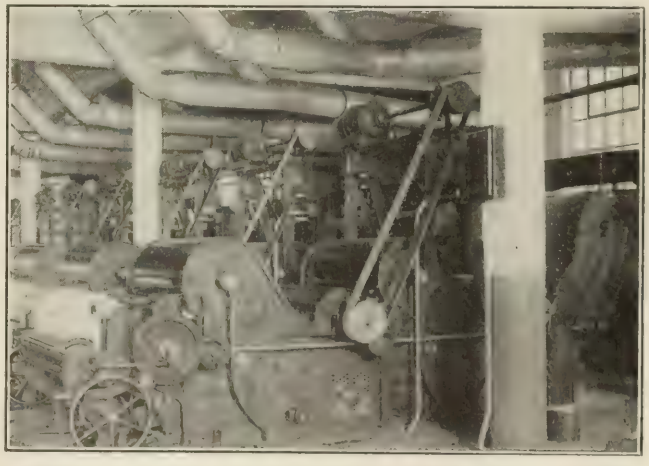


FIG. 4—PICKERS WITH INDIVIDUAL MOTORS MOUNTED ABOVE MACHINES

effective, and eliminate the expense of current transformers and separate relays. Single-phase ammeters, which are used instead of indicating wattmeters to eliminate current transformers, indicate the load on each feeder and permit proportioning the total power among the different lines. All of the switchboards are of natural oil-finished Monson slate, which is satisfactory electrically for all voltages used and is not stained by oil from the breakers. All switchboards were furnished and installed by the Condit Electrical Manufacturing Company. All oil circuit breakers have electrically welded boiler-iron tanks and the switch frames are provided with heavy lips, which engage the tops of the tanks and prevent their blowing off when the switches open under heavy overloads.

Transformer Equipment

The transformers for the mill and storehouse power supply are located outdoors beside the wire tower, and consist of four 1250-kva. self-cooled units, one of which is a spare. These transformers serve the bulk of the load in the plant, and as the entire power supply for the spinning mill is concentrated in this single bank, reliability is of prime importance. For this reason and to facilitate change-over when necessary, the fourth transformer was provided and the switching arrangement developed as shown in an accompanying diagram. The spare transformer is provided with a set of high and low-tension tie buses, permanently connected with double-throw switches, by means of which the spare transformer may be substituted for any of the regular units. The double-throw high-tension switch is provided so that the spare unit may be kept warm and in readiness for service. The value of this arrangement has already been demonstrated by the convenience afforded in taking the individual transformers out of service for drying and filtering the oil. With two transformers out of service, the larger part of the load can still be carried. Simultaneous failure of more than two transformers is very improbable.

The transformers are sheltered by a light concrete roof supported by a structural-steel framework which supports the high and low-tension wiring. On the front of the structure are wire gratings with openings which give access to the 600-volt switches. Since the rear of the house is toward the mill it is provided with a brick fire wall. Small iron doors permit access to the

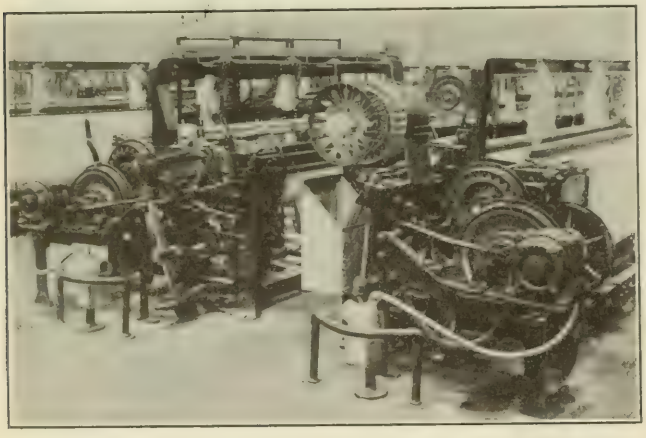


FIG. 5—METHOD OF APPLYING MOTOR DRIVE TO LOOMS

high-tension switches on this side. The transformers are mounted on steel rollers, rails being provided in the concrete floor to facilitate moving. The inclosure is pitched and drained to dispose of the oil in case of leakage.

The weave-shed power and lighting transformers are installed in vaults in the basement of the entrance towers. The mill lighting transformers are mounted in fireproof vaults in the basements. These vaults are ventilated and provided with raised door sills to prevent the escape of oil in accordance with insurance requirements. All of the lighting transformers for the plant, consisting of twenty-two units totaling 310 kva., were furnished by the General Electric Company, which also

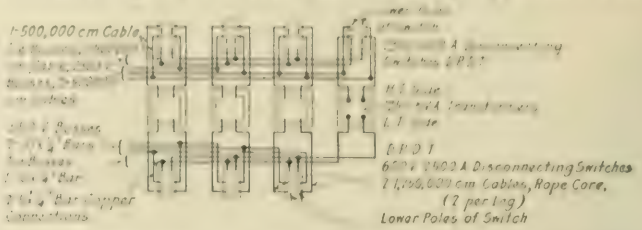


FIG. 6—SWITCHING ARRANGEMENTS USED IN CONNECTION WITH MILL AND STOREHOUSE TRANSFORMERS

furnished the weave-shed power transformers, consisting of five banks of three 200-kva. units.

Mill Power Wiring System

Two 10-in. by 0.25-in. buses per leg were used from the main transformers into the wire tower, rather than a larger number of smaller bars, to secure rigidity where they run across the tops of the transformers. To prevent the entrance of birds, and of cold air in the winter, and yet give proper ventilation and insulation, the arrangement shown herewith was used. After entering the wire tower the power buses rise to the top of the building, tapering in size toward the end and being supported by insulators 4 ft. apart. Distributing boards are tapped off at the successive floors.

A 4000-amp. transformer circuit breaker was required in the main secondary circuit, but its price and lack of space made it necessary to devise special arrangements. With the approval of the insurance company two buses per leg were extended to the top of the wire tower, the theory being held that any current which might cause dangerous heating in buses of this size would trip the primary transformer circuit breaker.

All arguments appear to be in favor of the busbar rather than cable construction for this main riser. If all of the 550-volt distributing boards had been located on the first floor near the power entrance, cable would have been used for the individual outgoing feeders, but the necessity of having the switch control near the point of utilization of power made this construction impracticable. A system of multiple cables for the main power riser would have necessitated fuses at each end of each line to meet insurance requirements. These would have been very undesirable. The ease of supporting the buses and connecting the distributing boards is another advantage in favor of the bus construction employed. The busbar riser is run in a rectangular transite-board duct, except where the taps to the distributing boards are taken off.

To assure continuity of service and ease of control, to group the manufacturing processes efficiently and to avoid unnecessary reactive drop from heavy currents, current loads in individual feeders were limited to 200 to 300 amp., resulting in nineteen feeder panels for the mill. The power feeder circuits are protected by slow-burning insulation and are uninclosed. They are carried on cable racks into the mill and are back-braced at the boards. To improve the appearance in the mill, minimize the chance of mechanical injury and make the power wiring as inconspicuous as possible, the conductors are run through the beams instead of along the bottom of beams as is usually done.

All connections from feeders to starters and to motors are inclosed in rigid iron conduit throughout the plant

for safety, appearance and mechanical protection. In most locations the starters are mounted in pairs and a single tap is taken from the feeder to serve the pair. Frequent blowing of fuses at this point is avoided by making the tap not less than 30 per cent of the size of the feeder and connecting the two solidly.

In the mill and storehouse are 277 motors, having a total rating of 4150 hp. These units and the transformers serving them were furnished by the Westinghouse Electric & Manufacturing Company. Division of the bale breakers into two groups of three each gives sufficient flexibility to meet requirements. There is considerable variation in demand upon the three classes of machines included under pickers, but the individual motor drive permits the use of the proper number of machines at any time to meet the demands of service. For the cards, slubbers and drawing frames, however, group drives are satisfactory. The power requirement per machine is small; thus the cost per horsepower with individual motors would be very high. These machines are generally in continuous service so that the saving made possible by shutting down an individual machine is small.

The roving machines occupy three rows lengthwise of the mill. Two rows are operated by four-frame-drive motors and the third row by two-frame drives. Four rows of spinning frames also extend lengthwise of the mill. These, too, are operated by four-frame-drive motors. The two and four-frame drives were adopted for this type of machinery because the number of machines required to produce a certain output varies, and because a saving can be made by shutting down groups of machines when they are not needed. The energy consumption of these machines, particularly for spinning, is considerable, and group drives from very large motors would require heavy millwright work. Moreover, the variations in load, due to machines being in and out of service at different times, would cause speed variations in large motors which do not occur with the method of drive used. Since the power required by warpers, spoolers and twisters is rather small per machine, and since all these machines are in rather constant service, group drive is successfully used with them. To harmonize with the class of construction used in the plant, and to provide rigid and permanent mounting for the motors, structural steel supports were provided for all motors.

Low-voltage release attachments are provided on all motor starters in the mill and storehouse. If this provision were not made, and service were interrupted and quickly restored again, the simultaneous starting currents would trip the breakers on the 550-volt distributing boards and probably on the 2300-volt distributing board too. Before starting again every motor switch would have to be opened by hand, thus entailing a delay in closing the main feeder switches. Such an event would also establish a new peak on the purchased power supply which would probably require an added service charge thereafter. With the low-voltage release attachments, after an interruption to service, the motors may be started up in the regular manner.

All of the motors in the mill are provided with terminal boxes into which the conduit from the starting switch runs, giving a complete pipe connection from main feeder to motor. In these terminal boxes split connectors are provided for the motor leads. With this arrangement a motor may be quickly removed by removing the conduit lock nut on the terminal box and opening the connectors.

The looms, about 3000 in number, are driven by ½-hp. or ¾-hp. individual motors, depending on the size of the loom. These motors were furnished, together with the other motors in the weave shed, by the General Electric Company. These motors, which are of the low-torque continuously-running type, are started light by snap switches and the loom is started and stopped as required by a clutch. An individual motor to start the loom directly would have required a high-torque characteristic, adding to the expense and necessitating a compromise in the other characteristics of the motor to secure it. As the loom is normally in operation, it would be unwise to impair permanently the motor's running characteristics to meet a starting condition that does not frequently exist and when it does is only momentary. The slashers and the cloth-room machinery, which are in the weave shed, are driven by motors from 10 hp. to 25 hp. in size. Elevator motors and a 100-hp. motor on the humidifier compressor add 215 hp. to the load in this building.

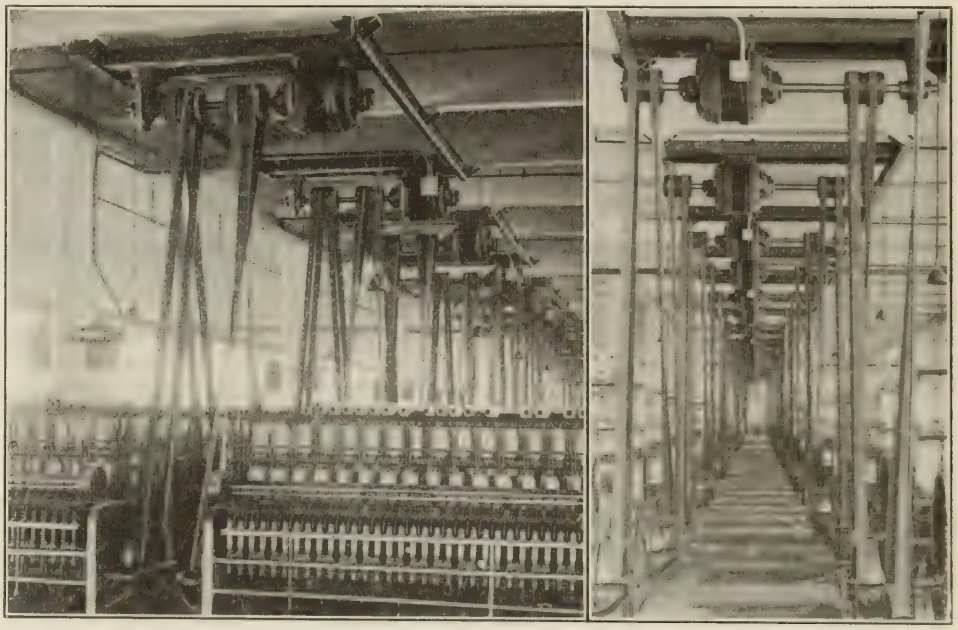


FIG. 7—TWO TYPES OF FOUR-FRAME DRIVE USED WITH SPINNING FRAMES

STOREHOUSE AND MILL LIGHTING

Since the storehouse is used chiefly for the storage of cotton bales, illumination of low intensity is satisfactory, and is obtained by 40-watt lamps installed 32 ft. apart. As the story heights are determined by the space necessary for storing cotton bales on end, there is very little clearance, so the lamps are mounted in box receptacles, without reflectors, directly on the slab. All of the wiring is run in conduit concealed in the slab. Energy is provided by a 10-kva. transformer connected on one leg of the 2300-volt mill lighting feeder, which is extended in lead-covered cable carried in conduit to the weave shed.

Concealed conduit risers from the banks of lighting transformers serve flush cabinets on the various floors of the main mill. The wiring from cabinets is in conduit throughout. For the sections occupied by rovers,

intermediates and spinning frames the outlets are so numerous and the spacing so special that concealed conduit is used up to certain points and exposed conduits beyond. Thus if the type of machinery is changed a different system of exposed conduits can be arranged from these definite feeding points. The mill is five bays wide, and longitudinal lines of conduit are installed in three of the bays with outlets 24 ft. apart in the sections mentioned. Cut-outs inclosed by pressed-steel boxes are provided at these points to serve the single-phase tap circuits.

On account of the size of the load and the transmission involved, three-phase, 110-volt feeders are used in general from the cabinets with single-phase tap circuits connected as required, with cut-outs on the ceiling, and lamps controlled in large groups from the cabinets. Reflectors are of the Ivanhoe steel type with green enamel outside, white inside, and clamp strap holders. Reinforced "slicked" drop cord is used with brass-shell keyless sockets having porcelain strain relief in cap.

Distributing panels inclosed by steel cabinets and bearing fused knife switches are mounted on the walls of the five transformer vaults in the weave-shed basement. On account of the relatively low voltage employed, and the load, the currents involved are considerable. The switches and busbars in the distributing cabinets are consequently liberally proportioned and the cabinets are provided with diamond mesh doors to give ample ventilation.

The wiring system, depending on the location, load and other circumstances, consists of four 400,000-circ. mil feeder circuits with six branches of No. 4 B. & S. conductors feeding about thirty looms. Three No. 12 B. & S. wires connected permanently to the branches rise through conduits to the fused starting switches above the slab. The main feeders run north and south four bays in from the outside walls of the building, one section of the weave shed being sixteen bays wide and the other eight.

The fuses required for motor protection are mounted in condulet supported on pipe framework which also carries a three-pole snap switch with cast-iron protective housing for the control of the motor. Except at main alleys, etc., the branch lines under the floor serve two rows of looms for which a fitting with two snap switches and two sets of fuses is used.

In the weave shed the rows of looms run north and south and the saw-tooth roofs east and west. As the roof and supporting beams are of concrete and the space from floor to roof is entirely clear (tie rods not being used between the saw-tooth beams) a system of illumination without suspension wires of any sort between beams was desired. There are four rows of looms, and therefore two weavers' alleys per bay. Very satisfactory illumination was secured by arranging 150-watt lamps with extensive-type reflectors in the center of these alleys 13 ft. above the floors. The units are suspended by drop cords from box rosettes, served by conduit concealed in the beams. Three phase, 110-volt feeders carried in conduit in the basement are run out from the various lighting transformer banks to the center of the weave shed, and tap circuits in concealed conduit taken up through the columns to serve the lamps overhead.

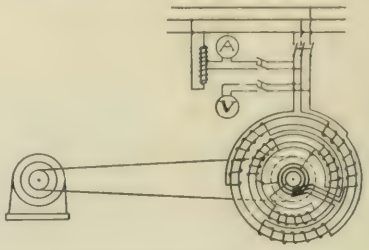
The basis on which electric service is furnished to this plant was given quite completely in the Sept. 30, 1916, issue of the ELECTRICAL WORLD. The mill is expected to maintain a power factor of 80 per cent and to install synchronous apparatus to secure this condition if the power factor falls below 75 per cent. The normal power load is from 4000 to 4500 kw., to which the lighting loads adds 275 to 300 kw. The power factor remains about 82 per cent, with a rise during lighting periods.

The system of electric drive used in this plant has resulted in an efficiency of production probably never before attained in a mechanically driven plant of its kind and has permitted an output very closely approximating the theoretical maximum for the machines employed. Lockwood, Greene & Company of Boston, Mass., handled the engineering for buildings and equipment, and supervised the construction of the plant.

METHOD OF SYNCHRONIZING

Proper Time to Parallel Alternators Indicated by Voltmeter or Ammeter Reading

A novel and effective method of synchronizing generators or motors in which both members of the machine are electrically connected to an alternating-current circuit is described in patent No. 1,204,169, issued to Carl A. Lohr of New York. The operation is as follows: The speed of the motor is raised to a value in the neighborhood of the synchronous speed. Then a fraction of the supply-voltage is impressed upon the motor windings with a voltmeter and an ammeter in circuit. The proper moment for synchronizing is indicated either by the ammeter showing a minimum current or by the voltmeter showing a maximum voltage.

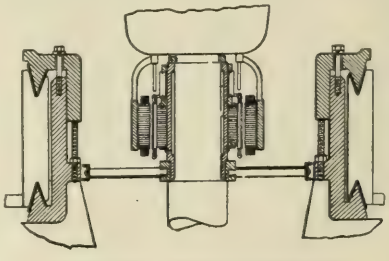


SYNCHRONIZING CIRCUITS

COOLING VARIABLE-SPEED MOTORS

Fan Operated by Auxiliary Motor Mounted Loosely on Machine Shaft

The irregular and changeable speeds at which variable-speed motors are operated are not conducive to normal self-cooling. In order to keep a motor cool under all conditions of operation, Henry V. Nye, Milwaukee, Wis., has devised a scheme which is the subject of patent No. 1,209,992. A rotary fan is mounted loosely on the motor shaft so that its speed of rotation will be independent of the shaft or rotor speed. Under ordinary high-speed operating conditions the rotor and fan rotate in common and ventilate the machine sufficiently. When the rotor speed drops the fan is rotated independently by an auxiliary motor attached to the fan but independent of the main motor speed. With this arrangement the main motor can be at a standstill and the fan rotated at any desired rate of speed.


AUXILIARY MOTOR MOUNTING

Human Factor in the Hotel Cooking Load

Stewards and Chefs Must Be Convinced of Advantages of Electricity, Generally by Trial Installations of Single Pieces of Electrical Equipment

BY FRANK B. RAE, JR.

PROBABLY no field for the industrial application of electric heat has been so misunderstood or had such tardy attention as the sale of electric cooking equipment and service to hotels, clubs and restaurants. This hotel load has suffered about equally, perhaps, from neglect and over-enthusiasm. Those who should have been interested in selling and installing this profitable class of apparatus either have done nothing or they have tried to do too much. And the result is that we have in this country hardly more than a bare hundred of hotel



ELECTRIC GRILL HELPS MAKE SAVORY MEALS AT THE BANKERS' CLUB, NEW YORK

cooking installations of any size, whereas there might be—should be—thousands.

It is difficult for any man unfamiliar with hotel cooking to realize the huge scale upon which the operations of a public victualer are performed. Therein lies the cause of our failure to grasp this opportunity. We cannot comprehend the problems nor appreciate the system involved in transforming five tons of cheese into welsh rabbits in thirty days.

SOME FAIR-SIZED LONG-HOUR LOADS

We cannot grasp the electrical requirements of cooking a 15-gal. kettle of soup. We almost refuse to believe that a single rather small and exclusive hotel runs its 4400-watt broiler continuously, seven days each week, from 6.30 in the morning until 1 o'clock the next morning—a daily energy consumption of more than 80 kw.-hr.

When such staggering facts are presented, one of two things happens: either we fall victim to the get-rich-quick idea and try to electrify immediately and completely every hotel and restaurant in sight, or else we throw up our hands in despair.

The first thing to realize, in attacking the problem of selling electric cooking apparatus to restaurants and hotels, is that it must be done piecemeal. No chef will permit his kitchen to be disrupted, his system to be demoralized. It has been truly said that the kitchen is the heart of the modern hotel, and that when it ceases to function the entire service collapses.

Understanding this basic fact, it must be plain that it is a serious mistake to try to change over the entire equipment at once. Such a change would be too revolutionary. It would inevitably result in confusion, disorganization and dissatisfaction. No matter how thoroughly a chef or steward might be "sold" on the electrical idea, it would be little less than suicidal for him to authorize a complete electrification at one time. Successful salesmen of hotel cooking equipment are content to make progress slowly. Some of the best installations in New York, for example, started with a single broiler—a few started with only a toaster. And most of them started with a free trial of from thirty days to six months.

At the outset it is necessary to get the chef's ideas about his particular and peculiar requirements. Most chefs are foreigners. They are temperamental as opera stars, finical as old maids. The chefs of big and famous hotels get salaries of more than $10,000 a year. Salesmen who approach men of such caliber with the thought that they are merely kitchen mechanics are doomed to disappointing experiences, for the chances are that the chef not only has the instincts of an artist, but the executive ability of a railroad superintendent, plus a very thorough, if unacademic, knowledge of chemistry, physics and mechanics. He is not a man to be *told* about electric cookery—he must be *consulted* as to whether, how and when electric service can be applied to his problems. Even the lesser chefs and cooks, the men who "brown the wheats" and manipulate the egg boiler, have a certain amount of the pride of craftsmanship in their work. Salesmen who aim to be successful in dealing with them must appreciate this viewpoint.

AMPLE WATTAGE NECESSARY FOR "SPEED"

Almost the first thing we learn when discussing electrification seriously with a busy restaurant chef is that he wants speed. Speed in cooking means plenty of heat, and high heat is to be secured only by ample consump-



EDISON WELFARE RESTAURANT RANGE, FEEDING 300 PERSONS WITH CONNECTED LOAD OF 28.7 KW.

tion of electricity. Because we are all accustomed to household toasters of 600 watts consumption at most, it is a bit staggering to have a chef demand results which can only be secured with a unit consuming six or seven times that amount. Yet 4000 watts is the size of a toaster installed in a rather small hotel in New England. A 2500-watt unit was first tried; then a 3500-

watt unit, finally the big toaster was put in in sheer desperation—and gave satisfaction.

In speaking of this incident, Ben Crosby, who probably has sold more hotel equipment than any other man in the country, said: "The average salesman is afraid of his proposition. He is afraid to advocate units big enough to do the work for fear he'll lose the business. He is afraid to estimate energy costs high enough for the same reason. He too frequently sells inadequate equipment and he invariably underestimates the cost of operation. The result is that the light equipment doesn't stand up under the terrific strain of hotel cooking, and the purchaser is disappointed because of the size of his energy bills."

Electric Broilers on Twenty Hours a Day

And right along this line let us mention the cost of operation. The electric kitchen of one New York hotel turns its broilers on in time for early breakfast service and does not turn them off again until the last midnight supper parties have gone. Careful manipulation would cut down the hours of burning fully one-half, but the chef does not want to cut the hours down; on the contrary, he removed the buttons from the snap switches so that the broilers could not be put out of commission except with a special tool. His reason is—speed. When he tosses a couple of *filets mignons* onto that grill he wants instant action. He does not want to wait three minutes for the broiler to come to heat. He cares nothing about the possible 75 cents a day which might be saved. He wants *speed*. Of what use to talk economy and kilowatt-hours to that man?

Economy of operation, as measured in kilowatt-hours, is comparatively unimportant. The real economy of electric cooking in hotels lies in the fact that there is no coal or charcoal to handle, no ash to remove, no fire to tend, no dirt, no smoke, no gas burners to repair or renew, no uncertainty as to the cooking results. As a matter of fact, the cost of maintenance on either coal or gas equipment in hotels is so much higher than the cost of maintenance of first-class and *ample* electric equipment that one needs never worry about the monthly bills for energy.

Note that we emphasize the word *ample*. Electric cooking equipment in hotels and restaurants must be big and sturdy, built for rough, grueling service. When an assistant chef picks up that 15-gal. kettle of soup and slams it down on a range, the range must not crumple. And be assured the equipment gets just that kind of treatment. The cooking utensils are big and heavy; the chefs bang, smash and slam them around without mercy.

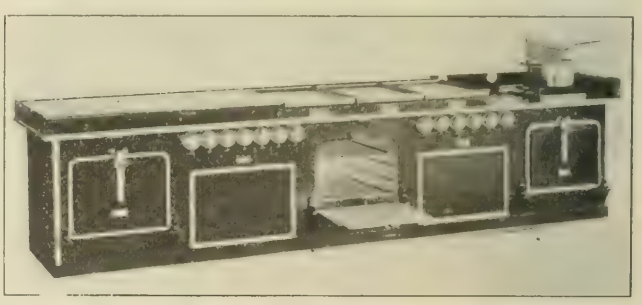
And the heat strains are equally severe. Restaurant apparatus requires fully double the amount of heat needed in a domestic appliance. The low and intermediate heats are seldom used. Everything is run at top speed. The heating units must be designed to stand any extreme of service. In this connection it is to be noted that the modern practice in electric and hotel equipment is to place these switches away from the heating units. No snap switch, no matter how good, will long stand up when located near a battery of hot plates or broiling grills. Knife switches, located upon a board away from the ranges, are now being recommended—and this plan was suggested by a chef.

Trial offers are necessary to convince hotel stewards and chefs of the advantages of electric kitchen equipment. Such trials, however, can be offered with confidence if the apparatus is right. One manufacturer of electric ranges for hotels claims never to have taken out a trial installation. In most cases a thirty-day trial will win the order, but in some cases the chef will insist upon a longer trial, so as to satisfy himself that the equipment will stand up in actual service.

The trial is best based upon a broiler. No central station or contractor should even try to get an order for an entire electric kitchen. It is a fatal mistake to start too big. In the first place the chef will not risk disorganizing his kitchen, and in the second place it takes a lot of salesmanship to secure the order for complete equipment from a man who has not had experience with electric apparatus; in the third place, it is prohibitive to put in a complete equipment on trial, and, finally, experience has proved that the best selling plan is to make the installation piecemeal.

An incident showing how hard it is to argue the average chef into believing in electric cooking occurred only a few days ago. A hotel manager was persuaded to put in a broiler on trial, but before he would even do this he insisted that a friend of his who is chef of a small hotel in the city where the apparatus is made should have a practical demonstration. This chef had been solicited without success, but agreed to watch the demonstration as a favor to his friend. On the appointed day he came to the factory with a couple of steaks, a chicken and some lamb chops.

He stated bluntly that he didn't believe in electricity, but that he had brought enough stuff along to give the apparatus a fair chance. He cooked just one steak. Pulling it out in eight minutes, he jabbed his thumb into the center of the rich, juicy, perfectly broiled meat, and his entire manner changed. "Why," he exclaimed, "this is wonderful—wonderful! What a fool



ONE OF THE ELECTRIC RANGES USED TO PREPARE MEALS FOR WELLESLEY COLLEGE GIRLS

I was not to come here before! I will tell our manager we must have one of these broilers in my kitchen. I will insist upon it. In the meantime you can ship this broiler to my friend in ———. I will write him—no, I will telegraph him—that this is the best broiler in the world."

An Exclusive Electric Kitchen

Another incident: One of the largest hotels in the world, now building, will have an exclusively electric kitchen, the cost of the equipment running into thousands of dollars. That sale was made upon the results of a trial installation of a broiler. The owner of the new hotel is at present operating a hostelry in New York, where he was persuaded to give electricity a trial. From a single broiler his electric equipment in the old hotel has grown piecemeal. When the plans for the new and larger hotel were drawn, he specified that everything should be electric.

That is the way to sell hotel and restaurant electric cooking equipment—piecemeal, and by demonstration and trial. The market is big. The margin of profit on the apparatus is ample. Every unit sold means an installation job for the electrical contractor. The kilowatt-hour consumption is large and the load factor desirable. And every installation is an advertisement both of electric service and electric cooking, which means that the business will grow and that it will favorably influence the sale of electric household ranges.

Insulation of High-Voltage Transformers—II

Second of Two Articles Taking Up the Fundamental Principles Underlying All Problems of Insulation and Giving Data Which Will Enable the Determination of Insulation Dimensions for Different Services

By Alfred Still

Professor of Electrical Design, Purdue University

SOME of the fundamental principles governing calculations for dielectric circuits were given in the first part of this article, which appeared in the Feb. 17 issue of the ELECTRICAL WORLD. The effect of employing together dielectrics with different inductive capacities was also discussed. Part II, which follows and concludes the article, deals with subjects connected with the more practical side of insulating high-tension apparatus.

Practical Rules Applicable to the Insulation of High-Voltage Windings

For working pressures up to 16,000 volts solid insulation, including cotton tape, micanite, pressboard, horn paper, or any insulation of good quality used to separate the windings from the core or framework, should have a total thickness of approximately the following values:

Voltage	Thickness of Insulation (mils)	Voltage	Thickness of Insulation (mils)
110	40	6,600	180
400	45	12,000	270
1,000	65	16,000	350
2,200	90		

In large high-voltage power transformers, cooled by air blast, the air spaces are relied upon for insulation. The clearances between coils and core or case are necessarily much larger than in oil-cooled transformers, and calculations similar to the example previously worked out should be made to determine whether or not the insulation is sufficient and suitably proportioned to prevent brush discharge. The calculations are made on the basis of several plate condensers in series; thus the flux density and dielectric stress in the various layers of insulation can be approximately predetermined. The difficulty of avoiding static discharges will generally stand in the way of designing economical air-cooled transformers for pressures much above 30,000 volts. A rough rule for air clearance is to allow a distance equal to $\frac{1}{4} + \frac{E}{4000}$ inches, where E stands for the virtual value of the alternating potential difference in volts between the two surfaces considered.

With oil-immersed transformers, the oil channels should be at least 0.25 in. wide in order that there may be free circulation of the oil. In high-voltage transformers having a considerable thickness of insulation between coils and core, it is advantageous to divide the oil spaces by partitions of pressboard or similar material. Assuming the total thickness of oil to be no greater than that of the solid insulation, a safe rule is to allow 1 mil for every 25 volts. For instance, a total thickness of insulation of 1 in. made up of 0.5 in. of solid insulation and two 0.25 in. oil ducts would be suitable for a working pressure not exceeding $25 \times 1000 = 25{,}000$ volts. Further particulars relating to oil insulation will be given later.

It is customary to limit the volts per coil to 5000, and the volts between layers of winding to 400. Special attention must be paid to the insulation under the finishing ends of the layers by providing extra insulation ranging from thin paper to Empire cloth or even thin fullerboard, the material depending upon voltage and also upon the amount of mechanical protection required to prevent cutting through the insulation where the wires cross. Sometimes the insulation is bent around the end wires of a layer to prevent breakdown over the ends of the coil. Where space permits, however, the layers of insulation may be carried beyond the ends of the winding so as to avoid surface leakage. This arrangement is more easily carried out in core-type transformers than in shell-type units. A practical rule for determining the surface distance (in inches) required to prevent leakage (given by Messrs. Fleming and Johnson in the book previously referred to) is to allow 0.5 in. + 0.5 × kilovolts, when the surfaces are in air. For surfaces under oil, the allowance may be 0.5 + (0.1 kilovolt). In any case it is important to see that the creepage surfaces are protected as far as possible from deposits of dirt. When the coils of shell-type transformer are "sandwiched," it is customary to use half the normal number of turns in the low-tension coils at each end of the stack. This has the advantage of keeping the high-tension coils well away from the iron stampings and clamping plates or frame.

Extra Insulation on End Turns

Concentration of potential between turns at the ends of the high-tension winding is liable to occur with any sudden change of voltage across the transformer terminals, such as when the supply is switched on, or when lightning causes potential disturbances on the transmission lines. It is therefore customary to pay special attention to the insulation of the end turns of the high-tension winding. Transformers for use on high-voltage circuits usually have about 75 ft. at each end of the high-tension winding insulated to withstand three to four times the voltage between lines that would puncture the insulation in the body of the winding.

It is very difficult to predetermine the extra pressure to which the end turns of a power transformer connected to an overhead transmission line may at times be subjected, but it is safe to say that the instantaneous potential difference between turns may occasionally be of the order of forty to fifty times the normal working pressure. In such cases the usual strengthening of the insulation on the end turns would not afford adequate protection, so a separate specially designed reactance coil connected to each end of the high-tension winding would seem to be the best means of guarding against the effects of surges or sudden changes of pressure occurring in the electric circuit outside the transformer. The theory of abnormal pressure rises in the end sections of transformer windings will not be discussed here.

Winding Space Factor

Knowing the thickness of the cotton covering on the wires, the insulation between layers of winding, between coil and coil and between coil and iron stampings, it becomes an easy matter to determine approximately the total cross-section of the winding-space to accommodate a given cross-section of copper. The ratio $\frac{\text{cross-section of copper}}{\text{cross-section of winding space}}$, which is known as the space factor, will naturally decrease with the higher voltages and smaller sizes of wire. This factor may be as high as 0.45 in large transformers for pressures not

exceeding 2200 volts; in 33,000-volt transformers for outputs of 200 kva. and upward it will have a value ranging between 0.35 and 0.2, while in oil-immersed power transformers for use on 100,000-volt circuits the factor may be as low as 0.13.

Oil Insulation

There is a considerable amount of published matter relating to the properties of insulating oils, and also to the various methods of testing, purifying, and drying oils for use in transformers. A concise statement of the points interesting to those installing or having charge of transformers will be found in W. T. Taylor's book on transformers.* What follows here is merely intended as a guide to the designer in providing the necessary clearances to avoid spark-over, including a reasonable factor of safety.

Mineral oil is generally employed for insulating purposes, its main function in transformers being to transfer the heat by convection from the hot surfaces to the outside walls of the containing case, or to the cooling coils when these are provided. The presence of an extremely small percentage of water reduces the insulating properties of oil considerably. It is therefore important to test transformer oil before using it, and if necessary extract the moisture by filtering through dry blotting paper, or by any other approved method. Dry oil will withstand pressures up to 50,000 volts (alternating) between brass disks 0.5 in. in diameter with a separation of 0.2 in. For use in high-voltage transformers, the oil should be required to withstand a test of 45,000 volts under the above conditions. The good insulating qualities of oil suggest that only small clearances would be required in transformers even for high voltages, but the form of the surfaces separated by the layer of oil will have a considerable effect upon the concentration of flux density, and therefore upon the voltage gradient. As an example, if 100,000 volts breaks down a 1-in. layer of a certain oil between two parallel disks 4 in. in diameter, the same pressure will spark across a distance of about 3.5 in. between a disk and a needle point.

Partitions of solid insulation such as pressboard or fullerboard are always advisable in the spaces occupied by the oil, since they will prevent the lining up of partly conducting impurities along the lines of force and thereby reduce the total clearance which would otherwise be necessary.

In a transformer oil of average quality the sparking distance between a needle point and a flat plate is approximately $(0.25 + 0.04 \times \text{kv.})$ inches. Since there may be sharp corners or irregularities corresponding to a needle point, which will produce concentration of dielectric flux, it therefore seems advisable to introduce a factor of safety for oil spaces between high tension and grounded metal—for instance, at the ends of high-tension coils and the containing case—by basing the oil space dimension on the formula,

$$\text{Thickness of oil (inches)} = 0.25 + 0.08 \text{ kv.} \quad (7)$$

With two or three partitions of solid insulating material dividing the oil space into sections, the total thickness need not exceed

$$0.25 + 0.05 \text{ kv.} \quad (8)$$

If the total thickness of solid insulation is about equal to that of the oil ducts (not an unusual arrangement between coils and core), the rule previously given for solid insulation may be slightly modified to include a minimum thickness of 0.25 in., and put in the form,

$$\left.\begin{array}{l}\text{Total thickness of oil ducts plus solid insulation of approximately equal thickness (inches)}\end{array}\right\} = 0.25 + 0.03 \text{ kv.} \quad (9)$$

A suitable allowance for surface leakage under oil, as already given, is,

$$0.5 + (0.1 \text{ kv.}) \text{ inches} \quad (10)$$

Terminals and Bushings

The exact pressure which will cause the breakdown of a transformer terminal bushing generally has to be determined by test, because the shape and proportions of the metal parts are rarely such that a concentration of flux density at corners or edges can be accurately predetermined. However, there are certain important points to bear in mind when designing the insulation of transformer terminals, and these will now be referred to briefly.

The high-tension leads of a transformer may break down (1) by puncture of the insulation, or (2) by spark-over from terminal to case. If the transformer lead could be considered as an insulated cable with a suitable dielectric separating it from an outer concentric metal tube of considerable length, the calculation of the puncture voltage (1) would be a simple matter. For instance, let r in Fig. 6 be the radius of the inner (cylindrical) conductor, and R the internal radius of the inclosing tube, the space between being filled with a dielectric of which the specific inductive capacity (k) is constant throughout the insulating material. The equipotential surfaces will be cylinders, and the flux density over the surface of any cylinder of radius x and of definite length, say 1 cm., will be $D = \frac{\psi}{2\pi x}$.

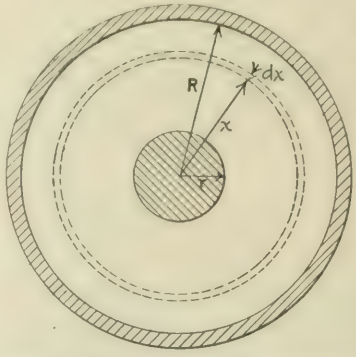


FIG. 6—CONDUCTOR SEPARATED FROM INCLOSING METALLIC SURFACE BY DIELECTRIC

By formula (6) the potential gradient is,

$$G = \frac{D}{Kk} = \frac{\psi}{2\pi x K k} \quad (11)$$

In order to express this relation in terms of the total voltage E, it is necessary to substitute for the symbol ψ its equivalent $E \times C$, and calculate the capacity C of the condenser formed by the rod and the concentric tube. Considering a number of concentric shells in series, the elastance may be written as follows:

$$\frac{1}{C} = \int_r^R \frac{dx}{2\pi x K k} = \frac{1}{2\pi K k} \log_e \frac{R}{r} \quad (12)$$

Substituting in (11), we have,

$$G = \frac{E}{x \log_e \frac{R}{r}} \text{ volts per centimeter} \quad (13)$$

the maximum value of which is at the surface of the inner conductor, where

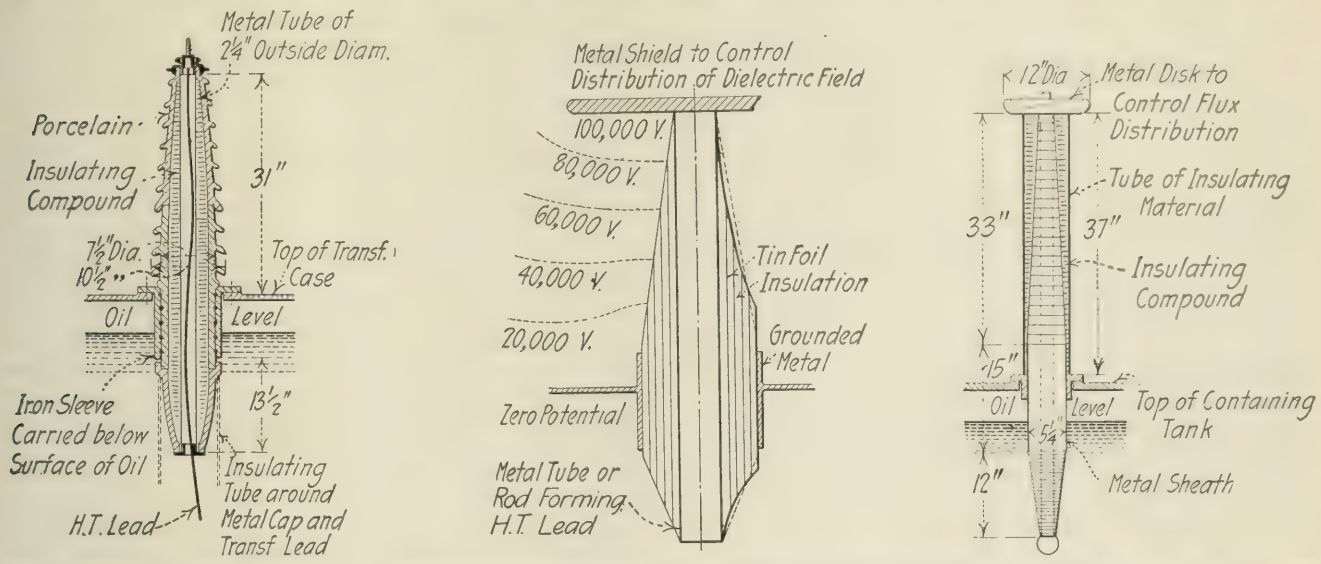
$$G_{max} = \frac{E}{r \log_e \frac{R}{r}} \quad (14)$$

This formula is of some value in determining the thickness of insulation necessary to avoid overstressing the dielectric; but it is not strictly applicable to transformer bushings in which the outer metal surface (the bushing in the lid of the containing tank) is short as

*"Transformer Practice," by W. T. Taylor: McGraw-Hill Book Company, Inc. For further information refer H. W. Tobey on the "Dielectric Strength of Oil"—*Trans.* A.I.E.E.; Vol. XXIX, page 1189 (1910). Also "Insulating Oils," Journ. Inst. E.E., Vol. 54, page 497 (1916).

compared with the diameter of the opening. The advantage of having a fairly large value for r is indicated by formula (14), and a good arrangement is to use a hollow tube for the high-tension terminal, with the lead from the windings passing up through it to a clamping terminal at the top.

Solid porcelain bushings with either smooth or corrugated surfaces may be used for any pressure up to 40,000 volts, but for higher pressures the oil-filled type or the "condenser" type terminal is preferable. In designing plain porcelain bushings it is important to see that the potential gradient in the air space between the metal rod and the insulator is not liable to cause brush discharge, as this would lead to chemical action, and a green deposit of copper nitrate upon the rod. The calculations would be made as explained for the parallel-plate condensers in which a sheet of glass was inserted (see "Capacities in Series"), except that the elastances of the condensers are now expressed by formula (12).



FIGS. 7, 8 AND 9—OIL-FILLED AND CONDENSER-TYPE BUSHINGS, WITH EQUIPOTENTIAL SURFACES OBTAINED WITH THE LATTER

OIL-FILLED BUSHINGS

The chief advantages of a hollow insulating shell filled with oil or insulating compound that can be poured in the liquid state are the absence of air spaces where corona may occur, and the possibility of obtaining a more uniform and reliable insulation than with solid insulators—such as porcelain, when the thickness is considerable. The metal ring by which such insulator (see Fig. 7) is secured to the transformer cover usually takes the form of a cylinder of sufficient length to end below the surface of the oil. The advantage of this arrangement is that the dielectric flux over the surface of the lower part of the insulator is through oil only, and not, as would otherwise be the case, through oil and air. With the two materials of different dielectric constants, the stress at the surface of the oil may exceed the dielectric strength of air, in which case there would be corona or brush discharge which might practically short-circuit the air path and increase the stress over that portion of the surface which is under the oil.

The bushing illustrated in Fig. 7 has been designed for a working pressure of 88,000 volts between high-tension terminal and case, the method of computation being, briefly, as follows: Applying the rule for surface leakage distances previously given, this dimension is found to be $0.5 + 88/2 = 44.5$ in. The insulator need not, however, measure 44.5 in. in height above the cover of the transformer case, because corrugations can be used to obtain the required length. A safe rule to follow in deciding upon a minimum height, *i.e.*, the direct distance in air between the terminal and the grounded metal, is to make this dimension at least as great as the distance between needle points that would just withstand the test voltage without sparking over. The test pressure is usually twice the working pressure plus 1000 volts, or 177 kv. (r.m.s. value) in this particular case. This value corresponds to a distance of about 48 cm., or (say) 19 in. In order that there may be an ample margin of safety, it will be advisable to make the total height of the insulator not less than 22 in., apart from the number or depth of the corrugations. The actual height in Fig. 7 is 31 in. because the corrugations on the outside of the porcelain shell are neither very numerous nor very deep. In this connection it may be stated that a short insulator with deep corrugations designed to provide ample surface distance is not usually so effective as a tall insulator with either a smooth surface or shallow corrugations. The reason is that much of the dielectric flux from the high-tension terminal to the external sleeve or supporting framework passes through the flanges, the specific inductive capacity of which is two to three times that of the air between them. The result is an increased stress in the air spaces, which is equivalent to a reduction in the effective height of the insulator.

In the design under consideration it is assumed that the hollow (porcelain) shell is filled with an insulating compound which is solid at normal temperatures, and that the joints therefore need not be so carefully made as when oil is used. The insulator consists of three parts only, which are jointed as indicated on the sketch. Oil-filled bushings for indoor use generally have a large number of parts, usually in the form of flanged rings with molded tongue-and-groove joints filled with a suitable cement. With this construction, however, there is always the danger that a vessel may not be quite oil-tight, therefore the solid compound has an advantage over the oil in this respect.*

The creepage distance over the surface of the insulator in oil may be very much less than in air. Applying the rule previously given, the minimum distance in this case would be $0.5 + (0.1 \times 88) = 9.3$ in. In the design illustrated by Fig. 7, however, this dimension has been increased about 50 per cent with a view to keeping the high-tension connections well away from the surface of the oil and grounded metal. To prevent the accumulation of conducting particles in the oil along the

*A description of the oil-filled type of transformer bushing, as made by the General Electric Company, will be found in the *General Electric Review* of June, 1913 (Vol. XVI, page 404).

lines of stress, and afford increased protection with only a small addition in cost, it is advisable to slip one or more insulating tubes over the lower part of the terminal, as indicated by the dotted lines in the sketch. Corrugations on the surface of the insulator in the oil are usually unnecessary, and sometimes objectionable because they collect dirt which may reduce the effective creepage distance.

Having decided upon the height and surface distances to avoid all danger of spark-over, the problem remaining to be dealt with is the provision of a proper thickness of insulation to prevent puncture. In order to avoid complication of the problem by considering the different dielectric constants (k) of the compound used for filling and of the external shell (assumed in this case to be porcelain), it may be assumed either that there is no difference in the dielectric constants of the two materials, or that the thickness of the inclosing shell of porcelain is negligibly small in relation to the total external diameter of the insulator. Either assumption, neglecting the error due to the limited length of the external metal sleeve,* permits the use of formula (14) giving the relation between the maximum potential gradient and the dimensions of the bushing without correction.

Suppose that the disruptive gradient of the insulating compound is 90 kv. per centimeter (maximum value) or 63.5 kv. per centimeter (r.m.s. value) of the alternating voltage. With a test pressure of 177 kv. and a margin of safety of 25 per cent the value of E in equation (14) will therefore be $E = 177 \times 1.25 \times \sqrt{2} = 313$ kv.

Since the disadvantage of a very small value of r is evident from an inspection of the formula, the outside diameter of the inner tube is made 2.25 in. Then, since

$$G = \frac{E}{r \log_e \frac{R}{r}}$$

$$\log_{10} \frac{R}{r} = \frac{313}{2.54 \times 1.125 \times 90 \times 2.303} = 1.216$$

whence $R = 3.79$, or (say) 3.75 in. An external diameter of 7.5 in. at the center of the insulator will therefore be sufficient to prevent the stress at any point exceeding the rupturing value even under the test pressure.

Condenser Type of Bushing

If the total thickness of the insulation between the high-tension rod and the (grounded) supporting sleeve is divided into a number of concentric layers by metallic cylinders, the concentration of dielectric flux at certain points (leading to high values of the voltage gradient) is avoided. The problem is therefore resolved into the simple case of a number of plate condensers in series, with a definite potential difference between the plates. Supposing the total radial depth of insulation is divided into a large number of concentric layers, (of the same thickness), separated by cylinders of tinfoil (of the same area), conditions would be equivalent to several condensers of equal capacity in series across the full potential difference. The dielectric flux density, and therefore the potential gradient, would be the same in all the condensers, so that the outer layers of insulation would be stressed to the same extent as the inner layers, and the total radial depth of insulation would be less than when the stress distribution follows the logarithmic law (formula 14) as in the case of the solid porcelain, or oil-filled, bushing.

The section on the right-hand side of Fig. 8 is a diagrammatic representation of a condenser bushing properly shaped to comply with the conditions of equal thicknesses of insulation and equal areas of the condenser plates. With a sufficient number of concentric layers, the ideal condition of equal potential difference between plate and plate throughout the entire thickness would be approximated; but the creepage distance over the insulation between the edges of the metal cylinders would be much smaller for the outer layers than for layers nearer to the central rod or tube. It is equally if not more important to prevent excessive stress over the surface than in the body of the insulator, so the practical condenser type of terminal is designed to compromise between the two conflicting requirements. By making the terminal conical in form, as indicated by the dotted lines on the right-hand side and the full lines on the left-hand side of the sketch (Fig. 8), neither of the ideal conditions is exactly fulfilled, but practical terminals so constructed are easily manufactured, and give satisfaction on circuits up to 150,000 volts.

If the ends of the metal cylinders coincide with equipotential surfaces having the same potential as that which they themselves attain by virtue of the respective capacities of the condensers in series, there will be no corona or brush discharge at the edges of these cylinders. This ideal condition is represented diagrammatically in Fig. 8, where a large metal disk is shown at the top of the terminal. The object of this metal shield is to distribute the field between the terminal and the transformer cover in such a manner as to satisfy the above-mentioned condition. In practice, the tendency for corona to form at the exposed ends of the tinfoil cylinders is counteracted by treating the finished terminal with several coats of varnish. In addition it is inclosed with an insulating cylinder filled with an insulating compound which can be poured in the liquid form and which solidifies at ordinary temperatures. This construction is shown in Fig. 9, which represents a practical terminal of the condenser type. Compared with Fig. 7, it is longer, but appreciably smaller in diameter where it passes through the transformer cover.

The dimensions of a condenser-type terminal such as illustrated in Fig. 9 may be determined approximately as follows: Assuming the working pressure as 88,000 volts, and the maximum permissible potential gradient in the dielectric (usually consisting of tightly wound layers of specially treated paper) as 90 kv.,* the maximum radial thickness of insulation required will be

$$\frac{\text{total volts}}{\text{voltage gradient}} = \frac{313}{90} = 3.48 \text{ cm. or (say) } 1.5 \text{ in.}$$

to include an ample allowance for the dividing layers of metal foil. If the inner tube is 2.25 in. in diameter, as in the previous example, the external diameter over the insulation at the center will be $2.25 + 3 = 5.25$ in. instead of the 7.5 in. required for the previous design.

It is customary to allow about 4000 volts per layer, and twenty-two layers of insulation alternating with twenty-two layers of tinfoil are used in this particular design. It is true that ideal conditions will not be actually fulfilled; the aggregate thickness of insulation might have to be slightly greater than 1.5 in., the inner tube might be made 1.75 in. or 2 in. instead of 2.25 in., and a practical terminal for 88,000-volt service could undoubtedly be constructed with a diameter over the insulation not exceeding 5.25 in.

The projection of the terminal above the grounded plate (the cover of the transformer case) need not be so great as would be indicated by the application of the practical rule previously given for surface leakage distance, namely, that this distance should be $(0.5 + \text{kv.}/2)$

*The maximum stress in the dielectric might be 5 to 10 per cent greater than calculated by using formulas relating to very long cylinders. The corners at the ends of the outer cylinder should be rounded off to avoid concentration of dielectric flux at these places.

*Same as in the example of the compound-filled insulator.

in., where kv. stands for the working pressure. The reason why a somewhat shorter distance is permissible is that the surface of the terminal proper has been covered by varnish and a solid compound, and so far as the inclosing cylinder is concerned, the stress along the surface of this cylinder will be fairly uniform, especially if a large flux-control shield is provided, as shown in Fig. 9. If the length of the external cylinder, in inches, is made equal to working kilovolts ÷ 2.3, it is probable that a voltage somewhat higher than the test pressure may cause a spark-over from metal to metal without damaging the insulation. In order to avoid the formation of corona at the lower terminal (below the surface of the oil) this end may conveniently be in the form of a sphere, the diameter of which would depend upon the voltage and the proximity of grounded metal.

Advantages of Rock Island for Government Nitrate Plant

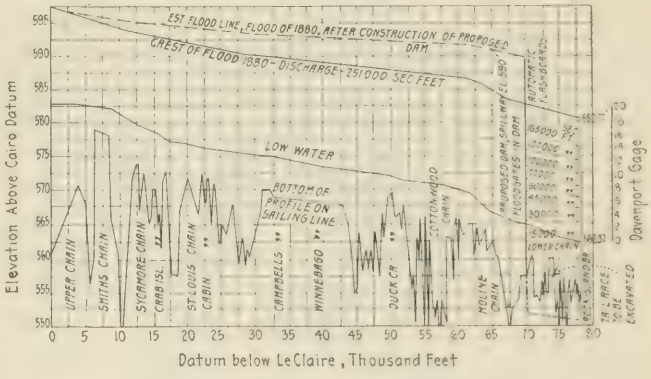
Available Water Power, Nearness of Fuel for Auxiliary Steam Plant, Central Location, Transportation Facilities, Abundance of Labor and Protected Position Form Reasons for Selecting This Site

BY H. S. PUTNAM,
Consulting Engineer, New York City.

REASONS why the proposed government nitrate plant should be established at Rock Island, Ill., are presented in this article. In addition, estimated data are given on the approximate cost of developing different-size hydroelectric installations at this point. Among the advantages of Rock Island as a government center for producing nitrates are the following: First, about 100,000 kw. to 125,000 kw. in water power is available from the Mississippi River at Rock Island. Second, the Illinois coal fields are near, so that ample fuel for operating a reserve steam plant can be obtained and transportation eliminated by establishing the steam plant at the mine. Third, the site is centrally located with regard to the neighboring industrial centers as well as the rest of the country. Fourth, excellent transportation facilities are afforded by rail and water in all directions. Fifth, added electrical generating facilities are required at the Rock Island Arsenal that would be unnecessary if a generating plant were built for nitrate production. Sixth, abundant labor is obtainable in the vicinity. Seventh, the site, being far inland, is practically safe from foreign attack. In addition the Rock Island Arsenal is one of the finest and largest arsenals belonging to the United States government.

The arsenal is built on an island in the Mississippi at the foot of the Rock Island Rapids. The water power at this point is now used by the United States government and is only partly developed. Under present conditions the most economical development which could be made—*i. e.*, one which would produce power at the lowest cost per kilowatt-hour and per horsepower-year—is approximately 100,000 kw. The cost of the hydraulic works in the river will not be excessive, and the amount of power developed can be increased from a beginning of 30,000 kw. to 100,000 kw. or more as the demand for such power increases.

The general plan proposed is to develop the large amount of water power now available in the Mississippi River at Rock Island and insure a continuous supply of power by the construction of an auxiliary steam plant at the mines in the coal fields of Illinois. In connection with the auxiliary steam-power plant it is proposed to construct a plant for the recovery of the fixed nitrogen and other by-products that exist in the coal and for the production of fuel gas to be used under the boilers in the auxiliary steam-power plant. Supplemented by the steam-power plant the hydroelectric plant will furnish an almost unlimited amount of power at low cost for the recovery of nitrogen from the atmosphere by any process which the government may select. It is proposed to construct a dam above the railroad bridge between Davenport and the island of Rock Island, with a crest elevation of 21.63 ft. above low water. This elevation can be increased to 27.63 ft. by the use of automatic steel flash-boards, which lower automatically to allow floods to pass. In addition to the automatic flash-boards, discharge gates can be placed in the dam to relieve flood conditions. Careful consideration should be given, however, to a plan proposed under which the dam would be constructed opposite Moline, Ill., and the channel behind the island of Rock Island used as a tailrace, since such an arrangement would



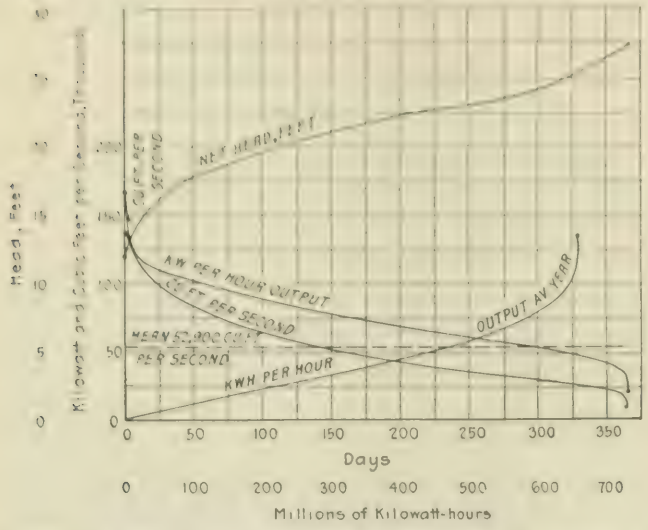
PROFILE OF MISSISSIPPI RIVER, LE CLAIRE TO DAVENPORT

reduce the property damage and the amount of protecting walls required. At the same time better relief would be afforded at flood times and the effective head would be increased.

Tabulated herewith is the estimated cost of constructing the proposed plant, the figures presented being based upon the high cost of materials and apparatus brought about by conditions produced by the war in Europe. It is assumed that money is worth 3 per cent to the United States government. Depreciation charges are based upon the economical life of the apparatus employed. The cost of coal has been taken as $1 per ton at the mine. This price can be realized or even reduced, it is believed, since low-grade and waste coal can be utilized. Data are also given on the cost of operating two hydroelectric developments of different size.

From the data showing the annual cost of operation for a 100,000-kw. hydroelectric installation it can be readily seen that using a by-product gas-producer plant

in connection with an auxiliary steam plant has marked advantages. In this case both the water-power plant and the steam plant are run continuously. The average load is thus increased from 100,000 kw. to 173,000 kw. Under these conditions the load will be 200,000 kw. for a period of about two months and will gradually fall off



AVERAGE YEARLY DURATION CURVE OF FLOW OF MISSISSIPPI RIVER AT DAVENPORT, IOWA

to approximately 130,000 kw. for a period of a few days. In a plant of this size, operated at its full capacity, developing an average of 173,000 kw. throughout the year, energy can be produced at an estimated cost of $2.90 per kilowatt-hour, or $2.16 per kilowatt-hour after due credit is made for the sale of by-products.

TABLE I—COST OF DEVELOPING AND OPERATING 100,000-KW. WATER-POWER PLANT

Hydroelectric plant, complete (100,000 kw.)	$9,726,760
Auxiliary steam plant in coal fields (100,000 kw.)	5,527,420
Transmission line, 60 miles with reserve line	908,470
Total	$16,162,650
Gas-producer plant (1,350,000 tons)	3,315,700
Total estimated cost*	$19,478,350

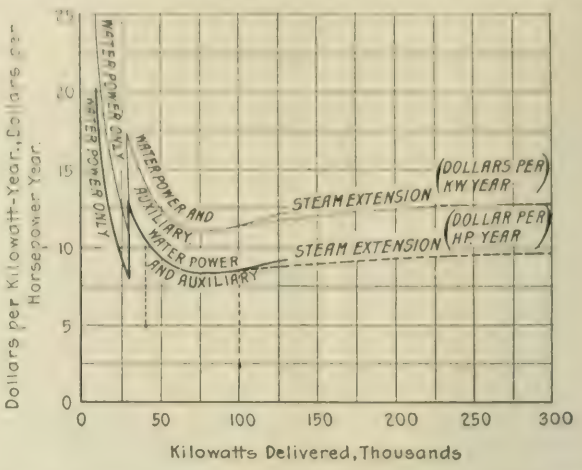
Annual Operating Costs

	Total Annual Costs, Including Interest, Depreciation, Maintenance, Operation, etc. Average Load (Kw.) 100,000 W. P. & S. Aux.	173,000 W. P. & S. Aux.	173,000 W. P., S. Aux. and Gas Producer
Hydroelectric plant	$448,470	$448,470	$448,470
Auxiliary steam plant, excluding coal	410,560	621,840	621,840
Transmission line (60 miles)	50,900	50,900	50,900
Gas-producer plant, excluding coal	.....	.....	1,246,190
Coal at $1 per ton	224,180	793,380	1,348,750
Total	$1,134,110	$1,914,590	$3,716,150
Credits:			
Ammonium sul. at $60 ton	.....	.....	$3,034,800
Tar at $4 per ton	.....	.....	180,000
			$3,214,800
Net cost of power	$1,134,110	$1,914,590	$501,350
Cost per kw.-year	$11.34	$11.07	$2.90
Cost per hp.-year	8.46	8.26	2.16

*The expenditure of $2,000,000 for river improvements, etc., now authorized, will be unnecessary and should be credited to the cost of this development.

An initial installation of 40,000-kw. in water-power equipment with an auxiliary steam plant of corresponding size and a gas producer plant can be constructed at an estimated cost of $11,663,090. The expenditure of $2,000,000 otherwise necessary for added facilities at the arsenal should be credited to this amount. In a plant of this size, operated at its full capacity, developing an average of 80,000 kw. throughout the year, energy can be produced at an estimated cost of $6.54 per kilowatt-hour, or $4.88 per horsepower-hour after due credit is made for the sale of by-products.

To meet existing conditions the following construction program is suggested: Construct the first portion of the auxiliary steam plant in the coal fields at once



COST PER HORSE-POWER-YEAR AT 100 PER CENT LOAD FACTOR AND RESULTANT NET COST TO NITRATE PLANT

and install therein generating equipment rated at 25,000 kw. to 50,000 kw. The initial plant should be designed for ultimate extension to two or three hundred thousand kilowatts or more. In selecting the size of units to be installed the ultimate development should be carefully considered. A high-tension transmission line should be constructed at once to connect the power plant with a substation to be constructed at the Rock Island Arsenal. This plant will take care of all the power developed at the present water power, amounting to 6000 kw. or 8000

TABLE II—COST OF DEVELOPING AND OPERATING 40,000-KW. WATER-POWER PLANT

Hydroelectric plant, complete (40,000 kw.)	$8,208,580
Auxiliary steam plant in coal fields (40,000 kw.)	2,737,000
Transmission line, 60 miles with reserve line	717,510
	$11,663,090
By-product gas-producer plant (551,400 tons)	1,560,380
Total estimated cost*	$13,223,470

	Total Annual Costs, Including Interest, Depreciation, Maintenance, Operation, etc. Average Load (Kw.) 40,000 W. P. & S. Aux.	80,000 W. P. & S. Aux.	80,000 W. P., S. Aux. and Gas Producer
Hydroelectric plant	$335,970	$335,970	$335,970
Auxiliary steam plant, excluding coal	185,860	297,840	297,840
Transmission line (60 miles)	32,660	32,660	32,660
Gas-producer plant, excluding coal	.....	.....	621,070
Coal at $1 per ton	13,680	324,350	551,400
Total	$568,170	$990,820	$1,838,940
Credits:			
Ammonium sul. at $60 per ton	.....	.....	$1,240,800
Tar at $4 per ton	.....	.....	74,840
			$1,315,640
Net cost of power	$568,170	$990,820	$523,300
Cost per kw.-year	$14.20	$12.39	$6.54
Cost per hp.-year	10.60	9.23	4.88

kw., will supply the additional power required at the arsenal at an early date, and will furnish such power as is needed in the construction of the hydroelectric plant. Such a steam plant can be constructed in one year under normal conditions. In case of emergency it could be constructed within six months.

ANALYSIS OF DAMAGE CAUSED BY LIGHTNING

Information Secured from Central Station Companies in Thirteen States and Suggestions Made Concerning Protection Against Lightning

BY C. W. PIPER
School of Electrical Engineering, Purdue University

Extensive investigations of the damage done to electrical equipment by lightning have been made at the School of Electrical Engineering, Purdue University, by F. Scott and R. F. Schuck. In securing information on this subject letters were sent to 300 electrical companies, asking five definite questions. The companies were distributed over thirteen north-central states—Indiana, Illinois, Iowa, Kansas, Kentucky, Michigan, Minnesota, Missouri, Nebraska, North and South Dakota, Ohio and Wisconsin. For this reason it is fair to assume that the data secured are representative of the damage to power companies in this section. Of the thirty-five or forty companies which replied, 90 per cent have had trouble due to lightning and 45 per cent had had their generative and distribution systems seriously damaged.

The accompanying table contains a list of different pieces of electrical apparatus and indicates the relative number of companies which reported trouble therewith due to lightning and the relative amount of damage to the apparatus, compared with the total damage from lightning.

As shown by the table, 75 per cent of the companies replying reported damage to transformers. The damage to this apparatus represented 36 per cent of the total damage by lightning. The high susceptibility to damage is due to the placing of transformers in exposed positions (as by connecting them directly to a line which subjects them to lightning and line surges).

Many meters are damaged because there is more of this type of apparatus than any other, and because they are always placed on incoming and outgoing lines where they are especially subjected to lightning surges. Insulators are damaged often because they are exposed and unprotected. Fifteen per cent of the companies reported damage to generators. This percentage is a fair indication of the damage to revolving machinery in general, since the generator is, probably, the most important and costly apparatus used, and no doubt all damage would be recorded.

The extent of arrester damage is comparatively large. This seems reasonable, as arresters are always placed so as to receive any abnormal surge before it reaches other apparatus. The damage reported on the remaining apparatus listed is comparatively small. This does not necessarily indicate that less of this apparatus has been damaged, but rather that no record was kept, as it did not directly interfere with service. Furthermore, the cost of fuses, lamps, poles, etc., is negligible, compared with costs of other equipment.

Some localities are more subject to disturbances than others, because the section may be at a higher altitude than the surrounding country, or because it is difficult to obtain good grounds for the arresters. One company stated that its trouble was confined almost wholly to a section that was formerly swampy ground, explaining that since the soil was made of decayed vegetable matter it was almost impossible to secure a good ground. Most trouble occurred either where too few arresters were used or where they were improperly placed.

Arresters were formerly installed in a haphazard way. This was not due to negligence, but rather to the lack of information on correct methods of installation. In many cases arresters were placed quite a distance from the apparatus they were intended to protect, so there was a chance of lightning striking between the two, thus preventing the arresters performing their function. In practically every case arresters were placed at the power house and substation, and in many cases at the ends of the lines and at regular intervals along the line.

From this survey, the following rules for the installation of lightning arresters were derived: Install arresters (1) on first pole outside of stations and substations where lines are overhead; (2) as near as possible to all risers; (3) where branch lines are tapped off; (4) at the crest of hills; (5) at every transformer rated at 10 kw. or greater; and (6) on the same pole with the transformer or apparatus they are to protect.

If an iron or copper wire that is grounded at frequent intervals is run a few feet above the transmission line enough protection to justify its expense will be secured. Consideration should also be given to the following: The best arrester made is absolutely worthless unless it has a good ground. For station grounds, heavy copper or iron plates should be embedded in carbon to such a depth that they will be in damp soil the entire year. For line grounds, iron pipe should be driven to such a depth that the lower end is always in damp ground, and the wire from the arrester should be soldered to the top. Wire should never run down inside the pipe, for under this condition the pipe acts as the short-circuited secondary of a transformer, and chokes back the flow of current to ground. Inclosing arresters in iron boxes tends to produce the same effect.

ANALYSIS OF DAMAGE TO APPARATUS FROM LIGHTNING

Apparatus	Per Cent of Companies Affected	Per Cent of Total Damage
Arc lamps	3	2
Arresters	12	5
Fuses	10	5
Fuse blocks	12	6
Generators	15	7
Incandescent lamps	3	2
Instruments (switchboard type)	5	4
Insulators	17	8
Lines	10	5
Meters	25	12
Oil switches	10	5
Poles	3	2
Power houses destroyed	3	2
Transformers	75	36

Ground wires for arresters should not be smaller than No. 6 B. & S. gage. All bends should be avoided. If a turn is necessary, sharp angles should be avoided. In addition all joints should be carefully soldered. The air gaps should be kept free from dirt and foreign matter.

Protection from a direct stroke of lightning is very difficult. The cost of protective apparatus which can be relied upon in case of direct stroke is so great as to make its use prohibitive. A greater number of arresters could be used in many cases to advantage, but economy must be considered in the installation of protective devices. One engineer says: "It is not a good policy to burden a system with devices to stop all trouble. It is cheaper to have the line burn down occasionally than have it completely protected." Considering the disadvantages of interruption to service, however, and the fact that arresters cost relatively little compared with other electrical apparatus, it is better to have too many arresters than too few. Damage can also be minimized by not placing transformers in elevated positions. The location of arresters is an important consideration. Placing them as near as possible to the apparatus to be protected seems to be the present tendency. Companies that are following this rule are apparently suffering the least damage.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

DECREASING FUEL USED PER KILOWATT-HOUR

Contest Conducted by a Texas Company in Which Station Attendants Are Encouraged to Improve Plant Economy

To secure the highest plant economy possible the Houston (Tex.) Light & Power Company offers a prize of $50 to the station crew making the best operating

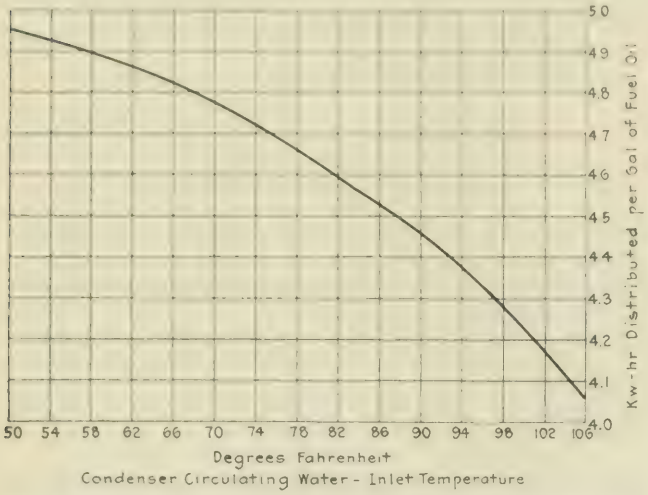


FIG. 1—RELATION BETWEEN CONDENSER COOLING WATER TEMPERATURE AND ENERGY DISTRIBUTED PER UNIT OF FUEL

record for three consecutive months. The points made by each crew are based upon the number of kilowatt-hours which can be generated per gallon of fuel with good operation. Since this ratio is different for differ-

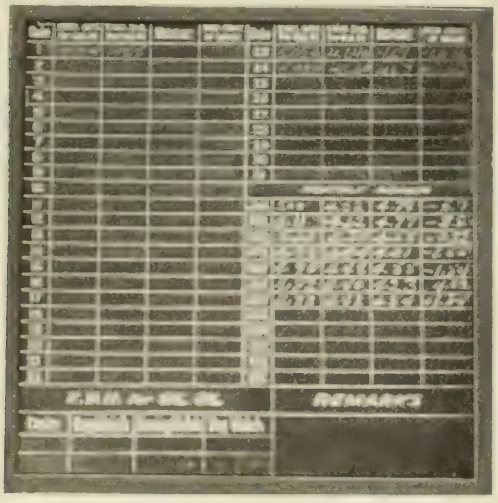


FIG. 2—METHOD OF DISPLAYING BOGIE AND PERFORMANCE OF CREWS COMPETING IN CONTEST

ent times of the year, due to the change in condenser water inlet temperature, a curve was drawn to show the ratio or bogie that would serve as a fair basis for judging the results of the different crews.

The bulletin board shown in the accompanying illustration is placed just outside Chief Engineer W. A. McDonald's office and serves to keep each crew familiar with the others' results. The bogie mentioned is shown on the board as indicated in the next to the last column of the accompanying table, together with the points or

TABLE I.—RESULTS OBTAINED DURING TEN MONTHS

Month	Kw.-Hr. Generated per Gal. Oil	Kw.-Hr. Dis. per Gal. Oil	Bogie	Per Cent of Bogie
January	5.00	4.52	4.79	−5.70
February	5.11	4.62	4.77	−3.20
March	5.00	4.54	4.55	−0.22
April	4.89	4.44	4.51	−1.55
May	4.90	4.48	4.55	1.54
June	4.92	4.40	4.23	4.02
July	4.88	4.42	4.34	1.84
August	4.80	4.37	4.38	0.00
September	4.83	4.40	4.32	1.85
October	4.97	4.56	4.45	2.41

percentages secured by the crews. The prize of $50 is awarded as follows: Engineer, $15; fireman, $15; switchboard attendant, $10, and oiler, $10.

As the men change shifts every month the advantages of variations in load and operating conditions are evenly balanced between them. Great interest is shown in the contest by the men, and the company is profiting as the fuel per kilowatt-hour is at present 10 per cent less than it was in March, 1916, when the bulletin board was first put up.

TABLE II.—CONSECUTIVE DAYS' RESULTS COMPARED IN KW.-HR. PER GALLON OF OIL

Date	Day Watch	Evening Watch	Day Watch
November 23	5.233	5.013	4.687
November 24	5.168	5.000	4.894

The monthly results from January to October, 1916, inclusive, which are shown on the bulletin board but do not appear in the illustration on account of the use of red chalk in some of the columns, are shown in Table I. In Table II is shown the method of comparing consecutive days' results.

Flash Lamp Used for Phasing Cables

Under ordinary circumstances cable men of the Commonwealth Edison Company, Chicago, use 110-volt lamps and energy from the company's mains to flash a code of signals in phasing out cables. Sometimes, however, it is necessary to connect up an isolated piece of cable at the ends of which no energy source is available. In such instances use is made of ordinary flashlight equipment for locating the phases.

The man who is at what is called the sending end of the cable, and who knows which conductor should be the A phase, which the B phase and which the C phase, connects a pocket flash lamp between phase A and the cable sheath. The other tester, who is equipped with a miniature lamp in a small socket, attaches one lead from

the socket to the cable sheath, and by touching the cable conductors one at a time with the other lead can locate phase A, since his lamp and the one at the sending end both light. When phase A has been located simple code signals are flashed and then the other phases are located in a similar manner.

It is important that both miniature lamps used in this testing be of the same rating, because if they are not one lamp will glow but the other filament will remain dark.

Trolley Retriever for Test Leads

Where testing of motors for grounds, etc., is done with current taken from a switchboard, the leads for carrying the current are generally made several feet long to reach heavy machines which cannot be easily moved. For keeping such leads out of the way, the Knoxville (Tenn.) Railway & Light Company uses an old trolley retriever. Flexible leads are used, current being supplied to them through two slip rings attached to the retriever. The leads reach 10 ft. when unwound. When not in use the retriever promptly coils them on its drum.

REDUCING WASTE OF SUPPLIES

Cost of Frequently Used Materials Impressed Upon Employees by Posters

On page 273 of the Feb. 10 issue of the ELECTRICAL WORLD was described a method employed by the Consumers' Power Company, Jackson, Mich., to impress employees with the value of supplies, in that way preventing waste. The table which was presented, showing costs of materials, has been revised to agree with the present prices and is shown herewith. This table with a foreword is posted in all the company's plants and on all trucks. The foreword points out that every piece of material should earn its cost, just as should every hour of labor. Employees are expected to properly conserve and care for the small materials in the same way they would protect the more valuable property of the company.

COSTS OF MATERIALS LISTED IN POSTER

Anchors and rods	$ 1.00 each
Batteries (dry cells)	.35 each
Bolts, machine, ⅜ x 4½	10.00 per M.
Brooms	.50 each
Brushes 2½ x 1¼ x ¾	.43¾ each
Brushes, 2¼ x 1¼ x ½	.34 each
Brushes, metite	1.69 each
Crossarms, 8-ft.	.60 each
Crossarms, 5-ft.	.40 each
Electrolyte KD	1.00 per gal.
Fire extinguisher (container)	6.50 each
Fire extinguisher (Pyrene)	4.00 per gal.
Gasoline	.20 per gal.
Grease (transmission)	.05 per lb.
Hose, garden, ¾-inch	.18 per ft.
Insulating compound (G. E. 184)	.75 per gal.
Insulators (17,000-volt)	.25 each
Insulators (40,000-volt)	1.00 each
Insulators (70,000-volt)	2.10 each
Insulators, suspension type	1.26 each
Lamps, 25 watt Mazda	.27 each
Lamps, 40 watt Mazda	.27 each
Lamps, 60 watt Mazda	.36 each
Lamps, 100 watt Mazda	.65 each
Motor bearings, 5 hp.	2.08 per set
Motor bearings, 15 hp.	4.50 per set
Oil—engine	.22 per gal.
Oil—cylinder	.48 per gal.
Oil—transil	.20 per gal.
Paint (floor enamel)	2.35 per gal.
Packing	1.25 per lb.
Rectifier tubes	25.00 each
Relay contacts (Tirrill reg)	2.75 per set
Rings—A. C. collec. 900 r.p.m.	75.00 per set
Rings—A. C. collec. 1200 r.p.m.	55.00 per set
Screws, ½ x 5-in. lag	.0157 each
Solder—wire	.30 per lb.
Solder—bar	.30 per lb.
Soldering paste	.12 box
Switch-bars—K-12 oil	4.50 each
Switch fingers—K-12 oil	.50 each
Tape (friction), 2 rolls to lb.	.25 lb.
Waste (white)	.11 lb.
Waste (wiping rags)	.08 lb.
Wire, No. 10 B. & S. r. c.	.05 per ft.
Wire, No. 12 B. & S. r. c.	.04 per ft.
Wire, No. 14 B. & S. r. c.	.03 per ft.
Wire, band, .072 steel	1.50 per lb.
Wire, 5-16 in. stranded (5000)	65.82 per reel
Scrap copper	.30 lb.

DETERMINING SIZE OF MOTOR FOR PUMPING

Graphical Method of Calculating Required Rating of Motor That Takes Pump Efficiency Into Consideration

BY W. F. SCHAPHORST

In the accompanying illustration is shown a chart for determining the power or size of electric motors desirable to install for pumping purposes. The result applies to average conditions, and includes the pump efficiency,

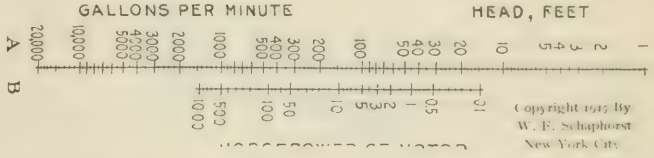


CHART FOR DETERMINING HP. OF MOTOR FOR PUMPING WATER

friction of water in piping, etc. For example, what size of motor will it take to pump 2000 gal. of water per minute against a head of 10 ft.? Find the point midway between 10 and 2000 in column A. Opposite that point will be found the answer—9 hp.

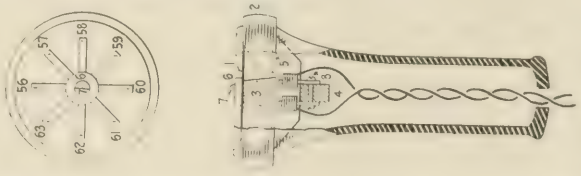
To find the mid-point, there are many quick and simple ways, such as dividers, a ruler, etc. The chart may also be used backwards to find the number of gallons per minute that a given motor will pump, or it will give the head against which a given motor will pump a given quantity of water.

A HOMEMADE TYPE OF FREQUENCY INDICATOR

Reconstructed Telephone Receiver with Eight Vibrators in Place of Diaphragm Labeled with Natural Frequency

In the absence of a more expensive instrument, a frequency indicator which gives good results has been constructed by the writer from a telephone receiver as follows:

Eight strips of 0.006 in. spring steel 5/64 in. wide by 2 in. long marked (1) in the top view of the receiver shown in the accompanying illustration were clamped radially between two burrs (6) on the cork (3) by means of a wood screw (7). The contacting metal surfaces were tinned and sweated together. The whole



FREQUENCY INDICATOR MADE FROM TELEPHONE RECEIVER

was then mounted on the diaphragm of a telephone receiver (5) by means of beeswax. The magnet had been previously removed from the receiver, and the brass screw (8) replaced by one of steel.

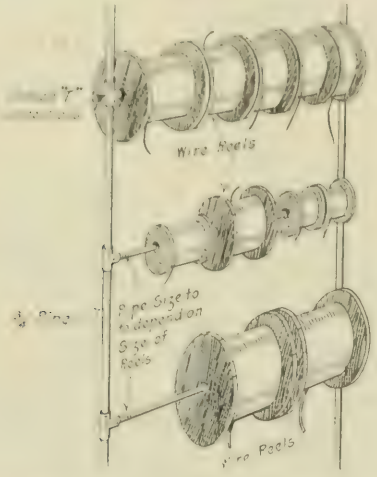
For use with 110 volts it was found necessary to use a 400-ohm resistance in series. In calibrating this device a motor-generator of adjustable frequency was used in

connection with a standard instrument. After setting the machine at 56 cycles, one of the springs was carefully clipped off at the end, piece by piece, until it set up a strong vibration. The machine was then raised to 57, and the operation repeated with the next spring, and so on up to 63 cycles. Each spring thereafter vibrated only in response to the frequency to which it was adjusted.

CONVENIENT RACK FOR WIRE

Axis for Supporting Wire Reels of Various Sizes Mounted in Slotted T Fittings

Various sizes of wire on small reels are conveniently stored on a rack of 0.75-in. pipe, built 7 ft. high by 3 ft. wide and supported 9 in. from the wall, at the South Deerfield (Mass.) office of the Greenfield Electric Light



HOME-MADE WIRE RACK THAT HOLDS VARIOUS-SIZE REELS

& Power Company. Slotted "T" fittings are attached to the vertical standards at various heights to enable horizontal pipes to be laid in place and removed with the utmost facility. The horizontal pipes are used to support the reels, the smaller ones being carried on ⅜-in. pipe. Any reel can be rolled on its support easily. The frame holds fifteen various-sized reels without crowding.

COST OF CONDUIT INSTALLED

Data Presented to the Massachusetts Commission by the Boston Company in the Recent Street-Lighting Case

Among recent data presented in the Boston Edison street-lighting case by the company for consideration of the Massachusetts Gas and Electric Light Commission are the costs of various sizes and types of transmission conduit laid in the city of Boston. Particulars of general engineering interest drawn from these data are presented in the accompanying table. The prices include engineering incidentals and contractor's profit.

In the compilation given herewith the significant data are the types of construction and the unit costs, which are given in the first and last columns. In presenting the data to the commission the unit costs given, which are the result of the company's extended experience, were applied to the quantities in the second and third columns, and later the prorated cost of conduit for street-lighting service only was deduced. The quantities are printed in connection with the unit costs in the third column to show the relative importance of the various types of duct construction for underground transmission work in Boston proper.

COST OF INSTALLING DIFFERENT KINDS OF DUCT

Under the heading "Material," F. stands for fiber, V. C. for vitrified clay, C. L. I. P. for cement-lined iron pipe, and I. for iron.

	Ducts per Conduit	Diameter of Ducts (In.)	Material	Conduit Feet	Duct Feet	Average Cost per Duct Ft. (Cents)
Under dirt sidewalk	6	3½	F.	9312.0	55,872.0	45
Under dirt	8	3½	F.	4502.1	36,016.8	30
	10	3½	F.	16.3	163.0	30
	12	3½	F.	402.2	4,826.4	30
	16	3¾	V. C.	58.5	936.0	25
Under granite blocks with cement grout and concrete base	8	3	C.-L. I. P.	1705.8	13,646.4	60
	12	3	C.-L. I. P.	25.0	300.0	45
	20	3	C.-L. I. P.	245.0	4,900.0	35
	30	3¾	V. C.	584.0	17,520.0	30
Under wooden blocks with concrete base	4	3	C.-L. I. P.	1319.6	5,278.4	80
	6	3¾	V. C.	141.7	850.2	75
	8	3½	F.	7702.3	61,618.4	60
	12	3½	F.	953.5	11,342.0	45
	14	3¾	V. C.	929.1	13,004.6	40
	24	3⅜	V. C.	802.9	19,269.6	30
Under bitulithic cement	4	3	C.-L. I. P.	1365.3	5,461.2	80
	6	3¾	V. C.	1467.3	8,803.8	75
	8	3¾	V. C.	90.6	724.8	60
	9	3⅜	V. C.	3899.0	35,091.0	45
	10	3	C.-L. I. P.	400.1	4,001.0	45
	12	3½	F.	171.8	2,061.6	45
	12	3¾	V. C.	153.1	1,837.2	45
	15	3¾	V. C.	280.7	4,210.5	40
	18	3⅜	V. C.	77.3	1,391.4	35
Under macadam	2	3¾	V. C.	319.9	639.8	60
	4	3½	F.	394.5	1,578.0	50
	4	3	C.-L. I. P.	829.1	3,316.4	50
	4	3⅜	V. C.	160.0	640.0	50
	6	3½	F.	8812.2	52,909.2	45
	8	3¾	V. C.	3579.1	30,632.8	30
	8	3½	F.	9634.0	77,072.0	30
	10	3½	F.	3306.6	33,066.0	30
	12	3½	F.	8171.9	98,062.2	30
	12	3	C.-L. I. P.	846.8	10,161.6	30
	12	3¾	V. C.	56.7	680.4	30
	14	3½	F.	2096.9	29,356.6	25
	14	3⅜	F.	182.1	2,549.4	25
	16	3½	F.	727.4	11,638.4	25
	20	3¾	V. C.	9.1	182.0	25
	24	3½	F.	239.8	5,755.2	25
	30	3½	V. C.	196.4	5,892.0	25
	67	3⅜	V. C.	6.0	402.0	25
Under asphalt	6	3⅜	V. C.	28.0	168.0	75
	6	3½	F.	330.2	1,981.2	75
	7	3½	F.	87.5	612.5	60
	8	3½	F.	230.5	1,844.0	60
	10	3½	F.	1534.2	15,342.0	45
	12	3¾	V. C.	591.7	7,100.4	45
	15	3¾	V. C.	11.2	168.0	40
	18	3½	F.	14.4	259.2	35
	30	3¾	V. C.	126.0	3,780.0	30
	32	3⅜	V. C.	16.0	512.0	30
Under granite blocks	3	3	C.-L. I. P.	68.4	205.2	50
	4	3½	F.	10.3	41.2	50
	4	3⅜	V. C.	1509.7	6,038.8	50
	6	3	C.-L. I. P.	715.3	4,291.8	45
	6	3½	F.	270.3	1,621.8	45
	8	3⅜	V. C.	7212.2	57,697.6	30
	8	3	C.-L. I. P.	7059.4	56,475.2	30
	9	3⅜	V. C.	2417.2	21,754.8	30
	10	3	C.-L. I. P.	71.5	715.0	30
	10	3½	F.	1396.4	13,964.0	30
	12	3⅜	V. C.	2189.5	26,274.0	30
	12	3	C.-L. I. P.	7882.7	94,592.4	30
	12	3¾	V. C.	889.3	10,671.6	30
	12	3½	F.	4904.8	58,857.6	30
	14	3⅜	V. C.	20.3	284.2	25
	15	3⅜	V. C.	6753.7	101,305.5	25
	15	3½	F	154.1	2,311.5	25
	18	3⅜	V. C.	193.5	3,483.0	25
	18	3½	F.	344.5	6,201.0	25
	24	3	C.-L. I. P.	249.3	5,983.2	25
	24	3½	F.	223.5	5,364.0	25
	30	3⅜	V. C.	586.4	17,592.0	25
Under granite blocks with pitch-joints and concrete base	4	3	C.-L. I. P.	4960.3	19,841.2	80
	6	3	I.	19.6	117.6	75
	6	3⅜	V. C.	216.6	1,299.6	75
	8	3	I.	147.6	1,180.8	65
	8	3⅜	V. C.	1092.8	8,742.4	65
	8	3	C.-L. I. P.	9673.9	77,391.2	65
	10	3½	F.	8089.8	80,898.0	45
	11	3	C.-L. I. P.	120.7	1,327.7	45
	12	3½	F.	346.6	4,159.2	45
	12	3⅜	V. C.	5165.8	61,989.6	45
	18	3	C.-L. I. P.	208.1	3,745.8	35
	24	3	C.-L. I. P.	205.0	4,920.0	30
	30	3	C.-L. I. P.	101.4	3,042.0	30
	30	3⅜	V. C.	237.0	7,110.0	30

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

DINNER FOR TWENTY TAKES ONLY 6 KW.-HR.

Roast of Beef Shrank but 5.8 Per Cent in Weight While Cooking with Electricity, Which Required Almost Three Hours

Further figures showing the economy of operation of an electric range are given by T. H. Kettle of the Minneapolis General Electric Company. An electrically cooked dinner was given to the sales department on the occasion

THE MINNEAPOLIS GENERAL ELECTRIC CO. SALES DEPARTMENT'S ELECTRICAL DINNER

HELD TUESDAY, MARCH 20, 1917.

MENU.

Tomato Soup

Olives — Radishes — Celery

Rolls

Roast Beef

Baked Potatoes — Stewed Apples — Scalloped Corn

Combination Salad

Cake

Prune Whip

Coffee

ENERGY TO COOK THIS MEAL WAS 0.3 KW.-HR. PER FERSON

of one of the monthly meetings to discuss the lesson of the commercial engineering course of the N. E. L. A. The meal was cooked by the members of the company's electric cooking bureau, and accurate records were kept of costs, weights, shrinkage, etc. The results were:

1. Number of people served	20
2. Total cost of supplies	$8.54
3. Total kilowatt-hours used	6
4. Kilowatt-hours per person served	0.3
5. Total cost of energy at 2½ cents	$0.15
6. Weight of roast before cooking	9 lb. 10 oz.
7. Weight of roast after cooking	9 lb. 2 oz.
8. Per cent shrinkage	5.8 per cent
9. Total cost of meal	$8.69
10. Total cost per person per meal	$0.434

All of the cake and rolls were made during the afternoon and baked on the electric range just before the dinner was served, and in addition to this the two demonstrators and the range salesman waited upon customers all afternoon. For this reason no portion of their time was charged to the actual preparation of the meal.

The roast beef was placed in the oven at 3.10 and was taken out at 6 o'clock, and it was found to be perfectly cooked. The electric range used in preparing this dinner was not put into operation before 2.30 in the afternoon.

WHAT IT COSTS TO SERVE SMALL COMMUNITIES

Data Compiled by Wisconsin Company Show Whether or Not Service Can Profitably Be Extended

More and more central station service is being extended into small outlying communities, and rural districts are more and more demanding service. Uppermost in the minds of the station manager is the question "Will it pay?" Data on actual installations of this character undoubtedly furnish the most satisfactory method for arriving at an answer.

At the recent convention of the Wisconsin Electrical Association G. W. McIvor, Jr., presented a paper on this topic which contained considerable data on a number of installations in small Wisconsin towns.

As regards their disposition the earnings from the sales of electricity in towns served by transmission lines can be divided into three parts, Mr. McIvor pointed out, namely, interest on the investment, depreciation of property and operating expenses. The relative cost of the first two items is easily determinable. An allowance of 6 per cent per annum for each, or 12 per cent of the original investment, must be taken out of earnings to pay these costs. The third item, however, is not a fixed quantity and does not bear a definite relation to the original investment. It varies widely, depending on local conditions. Overhead is generally the determining factor. In a small town operated from a district office operating expense may be as low as 8 per cent to 15 per cent of the earnings; but in a town where it is necessary to maintain an office and a manager the operating expense will rise from 15 per cent to 25 per cent. Putting one manager in charge of several small towns will, of course, decrease the proportion of operating expense to be deducted from the earnings of each town, but even so it is not conservative to use a percentage under 20 in estimating the operating expense

SUMMARY OF OPERATING RESULTS AND COSTS FOR TEN SMALL WISCONSIN TOWNS FOR 1916.

	Population	Connected Load	Kilowatt-Hours Per Annum	Kilowatt-Hours Per Capita	Operating Exp.	Earnings	Operating Ratio %	Sub-station Capacity	Substation Total Cost	Substation Cost Per Kw.	Distribution System Total Cost	Distribution System Cost Per Capita
A	417	28	12,226	30	$230	$1,549	14.8	..	....	....	$3,144	$7.55
B	425	20	7,864	20	145	940	15.5	..	....	....	3,944	9.28
C	678	58	45,502	68	423	3,674	11.5	100	$3,898	$38.98	4,781	7.05
D	1,474	..	112,800	77	378	2,528	15.0	100	3,573	35.73	....	....
E	523	43	19,090	36	259	2,331	11.2	100	2,533	25.33	4,542	8.52
F	700	127	64,641	92	2,194	4,788	45.8	100	779	7.79	....	....
G	1,000	136	93,821	93	1,784	6,928	65.8	..	742	....	....	....
H	250	16	3,546	12	9	462	1.95	50	2,431	48.65	5,707	22.00
I	527	56	32,958	63	529	3,170	16.7	100	1,784	17.50	4,373	8.30
J	765	140	72,768	95	328	1,481	22.2	100	750	7.85	4,373	8.30
Average	675	70	47,521	58	$627	$2,785	22.0	100	$2,061	$24.23	$4,415	$10.60

Analyses of the costs of actual installations of several small towns, A, B, C, D, E, F, G, H, I, J, on the transmission lines of a Wisconsin company are given in the accompanying table. These towns are served from lines operating at potentials of from 6600 to 66,000 volts, 60 cycles, single-phase and three-phase. The average cost per kilowatt for substations in these communities was as follows: On 33,000-volt lines, $33.35; on 13,200 volt lines, $17.50, and on 6600 volt lines, $16. The cost per mile of transmission line to the communities, in one case using a 33,000-volt, three-phase, No. 6 copper line, was $1,334; in another case, using a 13,200-volt, single-phase, No. 6 copper line, it was $1,082, and in another case, using a 6600-volt, single-phase, No. 6 copper line, it was $1,020. All lines carried a ground wire.

As shown in the table, the population of the towns ranges from 250 to 1474 and the average is 675; the connected load varies from 16 kw. to 140 kw. and the average is 70 kw.; the annual sale of energy in 1916 varied from 3546 kw.-hr. to 112,800 kw.-hr. and the average was 47,521 kw.-hr.; the energy sold per capita ranged from 12 kw.-hr. to 95 kw.-hr. and the average was 58 kw.-hr.; the annual operating expenses varied from $9 to $2,194 and the average was $627; the earnings ranged from $462 to $6,928 and the average was $2,728; the percentage of earnings required for operation varied from 1.95 per cent to 65.8 per cent and the average was 22 per cent; the substations cost from $7.79 to $48.65 per kilowatt and the average cost was $24.23; the costs of the distribution system ran from $7.05 per capita to $22.80 per capita and the average was $10.60.

With these data compiled from its existing lines the company is at all times able to decide quickly whether or not it can profitably extend its service. A study of the data has revealed that it is not profitable to give service to a local distributing system owned municipally or otherwise; it is believed that the profit in the business is not sufficient to support a middleman. The averages shown in the table are materially affected by two cases where energy is sold to a local distributing company. As a general rule the company believes, however, that small communities within reasonable transmission distance can be served at rates which compare favorably with those in larger towns, except at times when labor and material prices are abnormal.

A RATE THAT ENCOURAGES SOCKET APPLIANCE LOAD

Experience of Southern Sierras Power Company with Rate Designed for Electric Cooking but Available for All Customers

Practically every central station which has devoted attention to putting electric ranges on its system has first established a rate specially designed for electric cooking. Socket appliances also use this rate and as a result their sale has increased because they can be operated more cheaply than on the lighting schedule.

This condition has been capitalized by the Southern Sierras Power Company by putting into effect a rate designed specially for electric cooking but available for all consumers whether users of electric ranges or not. This rate carries a minimum of $1.50 per month, which covers the installation of the separate meter, subject to which 4 cents per kilowatt-hour is charged for the first 50 kw.-hr., 3.5 cents per kilowatt-hour for the next 50 kw.-hr., and 3 cents for all in excess of 100 kw-hr. per month. Under these terms, if a consumer could ordinarily use more than 50 kw.-hr. per month in socket appliances, it would be worth his while to apply for the cooking rate.

With this rate in effect the company has been able to encourage the more generous use of socket appliances and has provided its appliance salesmen with the best possible inducement to offer the prospective purchaser.

CENTRAL STATION SERVICE AND HEATING PROBLEMS

Several New England Operators Emphasize Difficulties Met With in Plants Where Heating and Electric Demands Are Non-Coincident

The treatment of the steam-heating problem was discussed at some length at the recent "question box" convention of the New England Section of the N. E. L. A. at Boston, Mass. The various speakers emphasized the difficulties of installing central station service in plants where the heating and electric service demands are non-coincident. It was pointed out by G. F. Parsons of C. D. Parker & Company, Boston, that night service in isolated plants may be very expensive under some conditions. He advocated a careful investigation of load and heating demands with respect to the time of their occurrence. A point that helps the central station is that in isolated plants the heating pipes must be large in order to keep the exhaust pressure low. With central station operation the raising of steam pressure on cold days is feasible without other drawbacks.

Instances were cited by A. C. Jordan, Portland, Me., where the engineering conditions of the isolated plant were unfavorable to its retention. In one factory the cost of heating was excessive on account of the location of the radiating surface on the ceiling, and the results were unsatisfactory in cold weather. In another shop a steam hammer was a difficult feature from the standpoint of central station service. This was changed to air service, with motor drive of the compressor. Five other hammers similarly driven are now in service in Portland. The importance of equipping radiator returns with traps and of reducing the coal consumption on Sundays and holidays was pointed out. In one plant where 8000 lb. of coal were used for Sunday heating central station service has been installed, and by modernizing the piping system, stopping leaks and reducing the pressure from 80 lb. to 20 lb. the plant is heated by 3000 lb. of coal per day in the coldest weather. Scientific plant management on the low-pressure "steam end" of installations taken over by central stations helps the latter to maintain and increase savings due to the use of their service.

Mr. Jordan spoke of the good results of purchasing $800 worth of steam-flow meters for the use of the power sales department of the Cumberland County Power & Light Company. By adding two extra movements and two extra nozzles at a cost of about $54, the department is able to measure from 6000 lb. to 54,000 lb. of steam per hour, thus covering a wide range of commercial conditions. In the course of the discussion it was brought out that in the last two years at Portland the cost of power sales work was about 18 per cent of the estimated revenue. The average revenue figured per horsepower of connected load per year in power installations is $12.

The cost of the first group of power reports made by a central station to prospective customers is not important, D. S. Boyden, Boston Edison company, stated, because new business of this kind can be obtained afterward in large measure by less elaborate methods based on estimated costs and showing the prospective user what has been accomplished in typical installations.

The wastefulness of flat-rate service in central station heating was emphasized by V. M. Tallman, Worcester (Mass.) Electric Light Company. This year 48 per cent of the Worcester company's heating service is metered, compared with 20 per cent a year ago. It is important to know the total condensation of return lines and of the general system. Automatic air valves on radiators are desirable. Customers can be educated to economical service with meters installed, whereas the opposite is true with flat rates. This year the company's heating revenue is 43 per cent more than last, on account of the use of meters and better control of the heating demands of customers. The rates are the same as last year. The Worcester company's meter rate is $1.50 per 1000 lb. of steam condensed. Closing, the speaker said that the ordinary building as laid out by the average steamfitter has probably twice the radiating surface needed.

In one plant where central station service appears favorable to the most economical operation, according to H. D. Stokes, Worcester, the coal cost was cut down 60 per cent by stopping the practice of feeding cold water to the boilers and other wasteful measures. The steam pressure in the piping of the plant was cut from 80 lb. to 25 lb. by eliminating a steam-driven fire pump, which increased the insurance rate only $100. With an electrically driven fire pump good protection could be secured with a saving in expense.

COST OF ELECTRIC HEATING IN SHOE FACTORY

Average Energy Consumption per 100 Pairs of Shoes for Heating Service Over Eight-Month Period Was 16.55 Kw.-hr.

Extended data as to the cost of electric heating in a Brockton, Mass., shoe factory were presented at the recent "question box" convention of the New England Section of the N. E. L. A. by D. M. DeBard of the Edison Electric Illuminating Company of Brockton. In this establishment thirteen machines are provided with electric heat, and in the eight months ended Feb. 28, 1917, the total energy consumption for this service was 19,600 kw.-hr., the number of pairs of shoes manufactured being 118,359. The average energy required per 100 pairs of shoes was about 16.55 kw-hr. The energy consumption of the several machines for heating service was as follows in the months of maximum and minimum shoe production:

	August, 1916 16,998 Kw.-Hr.		November, 1916 12,490 Kw.-Hr.	
Number Pairs Manufactured	Total	Per 100 Pairs	Total	Per 100 Pairs
Two Goodyear stitchers	369	2.2	348	2.8
Two Goodyear welters	232	1.4	192	1.5
Two pulling-over machines	616	3.6	83	0.7
Four box toe machines	724	4.3	700	5.6
One bottom drier	741	4.4	638	5.1
One bottom filler	211	1.2	178	1.4
One Gem insole machine	72	0.4	43	0.4
	2965	17.5	2182	17.5

It will be noticed that while the energy per 100 pairs of shoes is apparently a constant, except for the pulling-over machines, the energy consumed is much less for quantity production. For manufacturing or other reasons the energy consumption of the pulling-over machines was much greater in August than in the following November.

FORMS DESIGNED FOR CUSTOMER'S CONVENIENCE

Boston Edison Company Introduces Two New Forms for Use in Connection with Telephone Communication

In talking with an electric light company office over the telephone customers frequently are subjected to long delays, transfers and other inconveniences because of the departmental system of the office. Efforts are constantly being made by progressive companies to find methods to expedite telephone service in a way helpful to the customer.

Two forms designed for just such a purpose have

FORM TO BE USED FOR TELEPHONE APPLICATIONS

District
Service Wanted
Date
No.
St. Ave.
Town
Name
The name must be furnished as customer will sign App.
Suite or Room
Phone No

Discontinuance to be made at old address Yes No When?
Approximate Load lamps H. P. Miscell.
New or Old Wiring

CREDIT INFORMATION
Customer at / Former Customer at St. Ave.
Other Address
Reference
Remarks

Taken by
Date

The E. E. I. Co. of B. Form 1358 5M 12-16

THE CUSTOMER BY MEANS OF THIS FORM MAY OBTAIN SERVICE AT NEW HOME WITHOUT A WHOLE LOT OF RED TAPE

recently been introduced by the Edison Electric Illuminating Company of Boston and, it is claimed, are proving very serviceable. The upper form of the two here reproduced is to be used for receiving telephone applications for service. It can be used by any one liable to receive rush orders by telephone for the purpose of starting a "dummy" application where service is already installed on the premises and permits are not required.

It will be noticed that the form is for the information of the credit department as well as the application desk. Forms are sent directly from the person taking the call

The E. E. I. Co. of B. Form 1355 12-16

TO- ACCOUNTING INSTALLATIONS | APPLIANCE LAMPS | BILLING | CONSTRUCTION MAINTENANCE | ELECTRICAL ENG. SALES | INFORMATION SPECIAL SERVICE

FROM ..... DEPT.

ADDRESS

NAME

DATE PHONE NO.

NOTES

REPORT BACK TO ORIGINATOR CUSTOMER

Employees in Operating Bureau receiving telephone calls must use this form and avoid transferring calls to other departments.

THIS FORM ENABLES THE CUSTOMER TO TELL HIS STORY TO WHOMEVER ANSWERS PHONE

to the application desk, where a "dummy application" is filled out and sent along in regular course.

The other form, also reproduced, saves the customer's time by making it possible for him to tell his story to the first person using the telephone, instead of waiting to be transferred to some other desk or department, and perhaps "cut off" in the meantime.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

ELECTRIC AUTOMOBILES

The Field of the Electric Vehicle in Competition with the Gasoline Car and the Horse Carriage in Great Britain

AN elaborate paper on "Self-Propelled Electrovehicles and Their Applications," by L. Brockman, is published in the *Transactions* of the Institution of Engineers and Shipbuilders in Scotland, Vol. LX, Part III, January, 1917.

The author emphasizes two reasons why the electromobile should now be strongly pushed. The first reason is the crisis in the gasoline supply (petrol is the British expression for gasoline): "After petrol—what will follow? The very success of the petrol motor has brought with it a severe shrinkage in the supply of its life-blood. In future the air service will claim priority in its demand for motor spirit over all users, and no one can possibly foresee the extent of such a demand. This crisis throws back the internal-combustion motor on new and untried fuels and chemical mixtures, the only sure knowledge about which is that they are inflammable. The engines will have to be redesigned to suit these new fuels. . . . There is a hugh capital investment in electric central station plants in Great Britain, but in America it is larger still, built up laboriously in the course of the last thirty years. Yet the capitalization of the motor car industry there has within one decade exceeded twice the sum invested in central stations. Think of the respective rate of progress, the potentialities of both endeavors, and to what excellent purpose they may be combined."

The second reason is the necessity to find some means of quickening traffic in congested British city streets. The electromobile is thought to solve the problem. "For short-distance work within restricted boundaries, entailing frequent stopping and restarting, petrol machines have proved to be neither suitable nor economical —hence horse haulage has been affected to a very small extent only by their introduction. It is an unpalatable fact that in these days of scientific enlightenment 80 per cent of the freight movement in main thoroughfares [in Great Britain] still depends on horses, which effectually puts the brake on all efforts at speeding up locomotion. . . . The great preponderance of horse-drawn lorries, etc., with rare exceptions, progresses at the rate of from 2 to 3 miles per hour—if it can make any headway at all."

Of all power vehicles, electrically driven vans and lorries have proved themselves best suited in every respect to supersede horse traction in city and suburban service for these fundamental reasons: The cost of energy is low and no power is consumed while at rest. The speed is double or treble that of horses with equal loads. They are self-starting and easily controlled by cheap labor. They have a short wheelbase, taking up a minimum space on streets and in garages. They have a reliability to 95 per cent of the working hours, due to simple mechanism, consequently the upkeep charges are low. They are clean, sanitary and free from fire risks. Smooth and rapid circulation of traffic in streets, regardless of weather conditions and steep gradients, can, therefore, be insured by their employment. Further, the inclusive expenses entailed by operating within a radius of from 8 to 10 miles from any center—or from 40 to 60 miles' run per day—compare most favorably with all other means of animal and motor traction.

The coefficient of reliability—*i.e.*, the ratio of working days in commission to total number of working days during any given period—is stated to show the fine average of 95 per cent. The relative values for other haulage systems are: Petrol lorries, 90 per cent; steam lorries, 85 per cent, and horses, according to severity of service, from 65 to 85 per cent. (In the discussion which followed the paper, J. Hully Craig thought these figures were too unfavorable to the electromobile. From records in a certain district he figured that the electric delivery wagon had shown a reliability coefficient of 99.65 per cent, while that of the steam lorry was much below 85 per cent.)

The author's conclusions as to the field of the different types of automobiles are summed up as follows: "Electric vehicles come out easily first when operating within a radius up to 10 miles from a given center. For conveying tonnage beyond that distance at high speed petrol motors are best adapted—principally in competition with railways. Time saved, handling of consignments reduced, empties returned, and many other advantages, are all factors which must be taken into account in comparing motor expenses with freight charges and setting the limit where costs outweigh benefits. Where tonnage and long distance are essentials, but more latitude can be given as regards speed of delivery, traction by steam motors, with or without trailers, makes a strong bid for consideration in England. These had not been employed long enough in the United States when the study of transport economics was undertaken by the institute to be included in its report. Horse haulage may still be able to hold its own at present, if costs alone are reckoned, and if used within a radius of 2 miles in dense territory requiring calls at every few blocks, though in any modern scheme of transport, and especially for the most congested central areas of cities, it has no rightful place whatever. But daily expenses even in this very service can be cut down by working motors on a properly organized plan. One outstanding advantage of electric vehicles is that all debit items can be determined beforehand to a small fraction of a penny. There need be no surprise costs of any kind."

The author then takes up automobile design and says: "It is only bare justice to acknowledge that the high state of development reached in the art of constructing chassis and equipments is due mainly, if not entirely, to a group of American engineers, far-seeing, resourceful men, who never faltered in their allegiance to the electric vehicle, convinced of the important part it must play in future road transportation."

Speed, distance limit, weight, price, electric troubles and recharging facilities are next considered. Several types of electromobiles of British make are briefly described, with notes on automobile batteries and motors and controllers, and very extensive data are given on the operating costs of electric automobiles under British conditions.

While the major part of the paper deals with industrial or utility automobiles and their numerous special applications, electric passenger or pleasure automobiles are also considered and the importance of practically effortless manipulation, due to the ideal simplicity of control, is emphasized.

The author concludes that the useful sphere of the electric automobile extends much beyond the bounds commonly credited and is steadily being widened. Yet the measure of power carried on board and the time and facilities necessary for replenishing it must always be borne strictly in mind, and this the car makers do to excellent purpose.

"Too much stress cannot be laid on sound garaging practice, methodical supervision and the keeping of records where users have to house and care for vehicles in their own establishments. With the return to peace conditions far-reaching facilities in that respect are sure to be developed. As the use of electromobiles becomes general, an independent organization will be called into life to occupy a place between the two groups of interested parties, namely, between manufacturers and electricity supply undertakings on the one side and electric vehicle owners on the other. Such organization will aim at providing 'service garages' in suitable localities throughout the country, where electric cars and trucks may be cleaned, charged, stored and delivered to residence or business premises. Along with this class of service another function will be to maintain vehicles permanently in full operating condition, *i.e.*, to effect needful repairs and renewals of every description, recharge or exchange batteries (to admit of day and night duty of the trucks) for an inclusive fixed fee per mile run. On that principle users need only find remunerative work for the vehicles, being fully assured as to costs for upkeep and running."

Emphasis is finally laid on the possibility of improving the load factor of the average central station by filling up the valleys in the supply curve by creating a large electromobile industry.

Generators, Motors and Transformers

Balancers for Three-Wire Systems.—THOMAS CARTER.—In his long illustrated serial on balancers for three-wire continuous-current systems the author discusses static balancers. A static balancer consists essentially of a choking coil of two or more phases connected to two or more equidistant points on an armature winding by means of slip-rings. The author gives diagrams of a three-wire systems with a static balancer, of the method by which a transformer for a rotary converter may be used as a static balancer, and of a three-wire dynamo with a four-phase static balancer. He then discusses the method of neutralizing continuous-current magnetization in static balancers. In the two-phase arrangement it is possible to utilize the opposing directions of the two halves of the current in the balancer to cause their undirectional magnetic effects, superposed on the alternating-current magnetization, to neutralize each other by a suitable disposition of the coils or portions of them relatively to each other. This is also possible in the four-phase case, but in the three-phase case the three unidirectional magnetizations cannot neutralize each other if three simple coils are used on a three-legged core of the ordinary sort. Two modifications of the simple arrangement have been suggested to overcome this. One is to wind each limb with a second winding having a number of turns equal to only one-third of those of the choking-coil winding, and to connect these three additional windings in series to the middle wire at one end and to the star point at the other end, so that they carry C_3 amp., while the choking-coil windings carry one-third C_3 amp only. If the additional windings are so connected that their ampere-turns oppose those set up by the direct current in the choking-coil windings, then, as the two sets of ampere-turns are exactly equal, the net unidirectional magnetization is zero. The second suggestion is to have the three phases in halves, coupled up as in Fig. 1, which shows that the continuous-current magnetization would

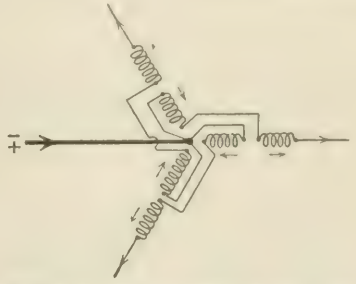


FIG. 1—ARRANGEMENT FOR NEUTRALIZING CONTINUOUS-CURRENT MAGNETIZATION IN THREE-PHASE STATIC BALANCER

thereby be neutralized in each limb. Owing to the extra weight of copper involved by the first suggestion, and the loss of output, in the ratio $\sqrt{3/2}$, in the second case, due to the halves of phases connected in series with each other not being in phase with each other, and so giving a total voltage per phase less, in the ratio $\sqrt{3}/2$, than twice the voltage of each portion, the three-phase balancer proves relatively expensive, and it is preferable, therefore, to use four phases instead of three. Generally speaking, small dynamos are fitted with two-phase balancers with two slip-rings, and the number of phases increases to four, and eventually to six, as the size of the generator increases. Beyond six the balancing does not greatly improve, and it is not economical to spend more money on extra rings and subdivision of windings on the balancer, as the advantage is so small. The author next discusses the voltage variation on unbalanced loads with static balancers and, finally, gives a note on the tapping of armature windings for connections to static balancers.—London *Electrician*, March 2, 1917.

Lamps and Lighting

Principles of Good Lighting.—P. G. NUTTING.—A Franklin Institute paper on the fundamental principles of good lighting. The author discusses at considerable length vision with steady, nearly uniform, field brightness, and vision in contrasting fields, with applications to practical lighting. He concludes that the best seeing requires an abundance of nearly unidirectional light. The light from the sky through high, well-spaced windows is very nearly ideal. Indirect lighting from numerous sources is very bad. Semi-indirect lighting with units closely assembled and at one side is probably the best form of artificial lighting. No part of any lighting unit within the range of vision should exceed 250 millilamberts in brightness, nor should contrasts ordinarily visible exceed 100:1.—*Journal Franklin Inst.*, March, 1917.

The Quality of Light from an Illuminant as Indicated by Its "Color Temperature."—E. P. HYDE AND W. E. FORSYTHE.—An account of an investigation carried out at the Nela Research Laboratory. The importance of quality in the light from various illuminants has been recognized for some time, and various methods have been worked out to designate this important characteristic. The spectrophotometer may be used to determine the relative distribution of intensity in the various wave lengths of the visible spectrum, and the colorimeters of Ives and of Nutting indicate component ele-

ments which may be used to specify the color of a light source. But it is difficult from such data to visualize the resultant color. It has been found by experiments that the light from most, but not all, ordinary illuminants can be matched in color by the light from a black body operating at some particular temperature, which is called the "color" temperature of the source in question. In the case of candles, oil lamps, ordinary gas flames and incandescent electric lamps it is found that, when operating at a color match, the distribution of energy in the visible spectrum of the black body and the source is quite closely the same, although this would not necessarily follow. Data have been obtained on the color temperatures of various illuminants, and it is suggested that these be made the basis of a color scale for sources whose light is sufficiently near that of a black body in color to permit of comparison. For sources, such for example as the Welsbach mantle, whose light cannot be matched in color with that from a black body at any temperature, the method outlined above is not entirely satisfactory, but the authors have in mind a possible modification of this method which may extend its applicability to almost all practical sources. Experiment has shown that it is possible to specify the quality of light from the Welsbach mantle, whose color is somewhat greenish, by stating the temperature of a black body whose light when mixed with that transmitted by a blue-green filter and coming from a black body at a definite temperature matches that from the mantle. Further investigation is planned to determine the feasibility of some such method for those sources whose colors do not lie on the scale of color of a black body at various temperatures. Data for some of the most common illuminants are given in the table. (Degrees Kelvin are degrees in the absolute scale = 273 + deg. C.)

COLOR TEMPERATURE OF VARIOUS ILLUMINANTS

Source	Color Temperature, °K.
Gas flame, fish-tail burner	1870
Hefner	1875
Pentane (10 cp. standard)	1914
Candle:	
Paraffin	1920
Sperm	1925
Kerosene lamp:	
Round wick	1915
Flat wick	2045
Acetylene (as a whole)	2368
One spot	2448
2.3 w.p.h.c. Nernst glower	2388
4.0 w.p.h.c. carbon	2070
3.1 w.p.h.c. treated carbon	2153
2.5 w.p.h.c. gem	2183
2.0 w.p.h.c. osmium	2176
2.0 w.p.h.c. tantalum	2249
1.25 w.p.h.c. tungsten	2385
0.9 w.p.h.c. tungsten	2543
0.5 w.p.h.c. gas-filled tungsten	2900

From these data and those on the black-body brightness temperatures, the brightness of the various illuminants may be computed.—*Journal Franklin Inst.*, March, 1917.

Electrophysics and Magnetism

Phase Rotation.—C. J. FECHHEIMER.—After some general notes on phase rotation the author discusses three-phase machines and shows that the sequence of maximum value of emf. in a three-phase, three-wire system can be reversed if any two of the three wires from the supply be interchanged without in any way altering the generators; and the direction of rotation of a synchronous or induction motor may be reversed by reversing its phase rotation; that is, by interchange of any two leads. He then takes up six-phase machines and finally gives a simple general rule for effecting a reversal of phase rotation for any polyphase system. If the n phases of any system be represented as in diagram A, Fig. 2, choose any diameter, such as e-k, and imagine the plane of the paper rotated through 180 deg. about this diameter. This results in the diagram B in which for the same sequence the direction of rotation is opposite to that in A. Thus in diagram C (an odd and prime number of phases has been purposely chosen to illustrate the application of the general rule) five phases are shown for counter-clockwise rotation for sequence of a, b, c, d, e. This may be reversed by rotating through 180 deg. say about the diameter through a, in which case b and c will interchange respectively with e and d, thus obtaining diagram D of opposite phase rotation. Or it may be rotated about a diameter, MN, at right angles to the diameter through a and result in diagram E of opposite phase rotation to C. In general, the preferable method is to choose the diameter about which the phase diagram is to be rotated so that it will coincide with the vector of one phase to neutral (or two phases, with an even number of phases).—*Elec. Journal*, March, 1917.

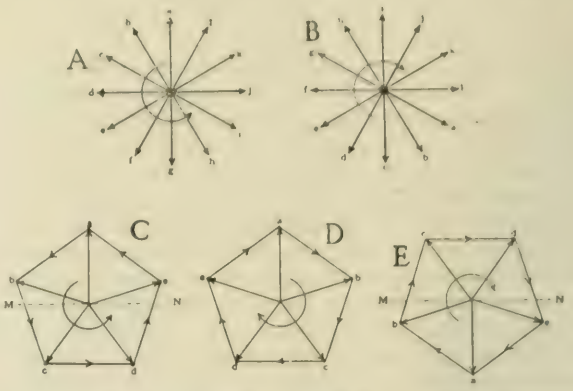


FIG. 2—POLYPHASE CIRCUITS CONNECTED TO GIVE DIFFERENT PHASE ROTATIONS

Atomic Model.—R. R. RAMSEY.—Modern theories of the structure of an atom assume one or more electrons in motion about a central body or positive nucleus. A mechanical model of this structure employs magnetized needles floating by means of corks in water. The present author uses instead small bicycle balls floating on mercury and rotating. A wooden tray is used with an electrode at the center and four electrodes, one at each corner, which are connected in multiple. By sending the current in at the middle electrode and out at the corners one has an approximately radial current flowing at right angles to the magnetic field of the magnet, which plays the part of the positive nucleus in the experiment. This causes the mercury to rotate and carry the balls with it. The movement of a number of balls is rather complicated. The mercury at the edges of the box is stationary while the central portion is rotating. The angular velocity increases as we go from the edge to the center. The balls floating on the surface tend to take up the same angular velocity as the mercury upon which they float. "There is a tendency for the balls to take up a motion which may approximate to planetary motion. Thus we may assume that they obey Kepler's law." The arrangement is believed to illustrate various phenomena like the production of X-rays and gamma-rays and the disintegration of an atom of radium.—*Philos. Mag.*, February, 1917.

Units, Measurements and Instruments

Lead Oxide Resistance Thermometer.—S. LEROY BROWN.—The author has formerly pointed out the possibilities of utilizing the high temperature coefficient of resistance of metallic oxides for the construction of resistance thermometers. The author experimented with an oxide resistance thermometer made by thrusting two wires into a globule of molten lead oxide

and allowing it to cool so that only a thin layer of the solid oxide separates the wires. Some difficulty may be experienced by the oxide cracking on account of unequal expansion of the oxide and connecting wires. Lead oxide is easily melted in a gas flame, and when fused with iron wires makes a reliable connection which is permanent when subjected to temperatures ranging

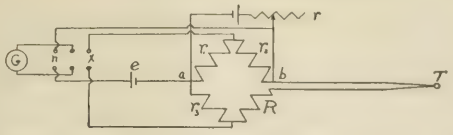


FIG. 3—CONNECTIONS FOR CONTROLLING EXCITING CURRENT

from —10 deg. C. to 120 deg. C. The resistance of such a thermometer may range from a few hundred ohms to several thousand ohms at room temperatures. The iron wires are soldered to larger copper wires near the oxide so that the variation of resistance of the leads due to variable immersion is negligible and compensating leads are not necessary. The electrical resistance of the oxides decreases as the current through them is increased, and therefore the oxide resistance thermometer must be excited with a constant current, or so nearly constant that the variation in the current does not cause an appreciable change in the electrical resistance. The plan of accurately controlling the strength of the exciting current is shown by reference to Fig. 3. The electromotive force across *ab* is maintained equal to the electromotive force of the standard cell *e* by adjusting the variable resistance *r*, and this equality is determined by throwing the galvanometer connections to *n* and balancing the electromotive force across *ab* against the electromotive force of the standard cell. The resistance from *a* to *b* is maintained constant; any increase or decrease of the resistance of thermometer *T*

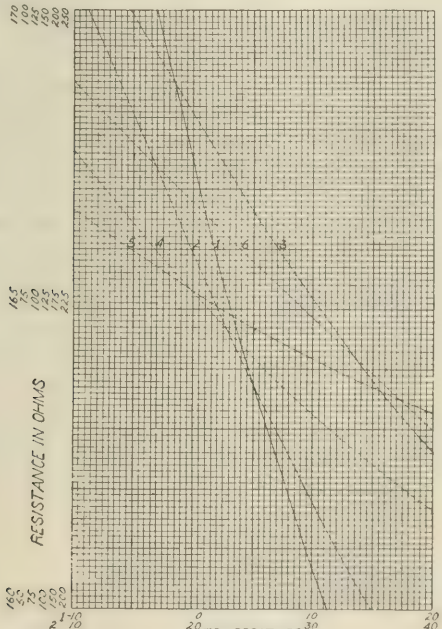


FIG. 4—VARIATIONS IN RESISTANCE OF LEAD OXIDE WITH DIFFERENT TEMPERATURE RANGES

is compensated for by a decrease or increase at *R*. The bridge arms, r_1, r_2 and r_3 were so chosen that 1 milliampere of current flowed through the thermometer *T* while the electromotive force across the bridge was maintained equal to the electromotive force of a standard Weston cell. The results are shown graphically by the several curves in Fig. 4, each curve extending over a temperature range of about 30 deg. C., excepting No. 6, for which the temperature range is only from 25 deg. to 28 deg. C. The steepness of these curves indicates the sensitiveness of the oxide resistance to temperature variations. A resistance thermometer of this kind does not require compensating leads, has low heat capacity, and since the junctions are close together unequal heating cannot produce thermal electromotive forces. Temperature measurements can be reproduced with the oxide resistance thermometer to within a few thousandths of a degree between 0 deg. C. and 100 deg. C. The principal disadvantage as compared to the platinum resistance thermometer is that there is no simple relation between resistance and temperature.—*Phys. Review*, March, 1917.

Book Review

ELECTRIC CENTRAL STATION DISTRIBUTION SYSTEMS. Their Design and Construction. By Harry Barnes Gear and Paul Francis Williams. New York: D. Van Nostrand Company. 458 pages. 187 illustrations. Price, $3.50.

When the first edition of this book was published in 1910 it stood apart as a distinct practical survey and treatise of the different phases of American practice in the distribution of electrical energy generated by a central station. The developments in underground installations and city distribution have been considerable, however, during the past seven years, and this the authors have recognized in their second edition by completely revising much of the material in the first edition dealing with transmission systems and substations, overhead and underground construction. Mr. Gear's noted investigations of diversity factor and demands of customers for the system of the Commonwealth Edison Company of Chicago are reflected in the chapter devoted to distribution economics, which takes up about twice as much space as in previous edition, and covers with practical illustrations a variety of conditions in central station work including cost of service and rate considerations. This section of fifty-nine pages is well worth the price of the book, and those who have found the first edition of service will want to supplement it by the new information now available not only on this subject but on the other developments of the art as it now exists. The subjects covered in the new edition of this book are: Systems of distribution; transmission systems; substations; voltage regulation; line transformers; secondary distribution; special schemes of transformation; protective apparatus; overhead construction; underground construction; cable work; distribution economics; properties of conductors; alternating-current circuits.

Books Received

THEORY AND CALCULATION OF ELECTRIC CURRENTS. By Charles P. Steinmetz. New York: McGraw-Hill Book Company, Inc. 362 pages. 133 illustrations. Price, $3.

HIGH-FREQUENCY APPARATUS. Its Construction and Practical Application. By Thomas Stanley Curtis. New York: Everyday Mechanics Company, Inc., 245 pages. Illustrated. Price, $2.

THE NATURE OF MATTER AND ELECTRICITY. An Outline of Modern Views. By Daniel F. Comstock and Leonard T. Troland. New York: D. Van Nostrand Company. 204 pages. Illustrated. Price, $2.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

ELECTRICALLY PROPELLED BATTLE CRUISERS CERTAIN

Time Will Be Required for Details—Opinion of Admiral Griffin—Contracts for Electrical Equipment of Battleships Awarded

The Navy Department has decided to build five battle cruisers with electrical propulsion machinery. Two of these are to be built by the Newport News Shipbuilding & Drydock Company, one by the New York Shipbuilding Company, one by the Fore River Shipbuilding Company, and another by the government at the Philadelphia Navy Yard.

Costs and Equipment

The vessels will cost about $76,000,000 for hulls and machinery. There has been fixed a limit of cost of $19,000,000 each for hulls and machinery, although there will be another expense of about $5,337,810 for arms and armament on each ship.

The ships will have displacement of 34,800 tons; they will be 850 ft. in length and 91 ft. beam. They will be of 180,000 hp. and have a speed of 35 knots per hour.

These will be the first battle cruisers built by the United States, although ships of this powerful type and high speed have been in use by England and Germany for some time. These vessels will be the first equipped with electrical propulsion, although the collier Jupiter, electrically driven, was built by the United States some time ago and has proven a great success from a naval viewpoint. The details of the electrical machinery have not yet been worked out. Several months' time will be needed for this work. In general, however, it is known and decided that the generators will be driven by steam turbines, with current on four shafts, each shaft with 45,000 hp.

Opinion of Admiral Griffin

Rear Admiral Robert S. Griffin, U. S. N., engineer in chief, bureau of steam engineering of the Navy Department, will have general charge of the construction of the vessels. Admiral Griffin expressed to a correspondent of the Electrical World in Washington the opinion that the electrical engineers of the country, as a body, are generally in favor of the electrical propulsion of naval vessels.

"You can't find two real electrical engineers in the country," Admiral Griffin said, "who are opposed to electrical propulsion."

Admiral Griffin said he had gathered the general impression from his knowledge of the subject that those who are opposed to electrical propulsion for naval vessels are those who have an interest in other methods of propulsion.

Electrical Equipment on Battleships

Of the four new battleships which are to be equipped with electric drive, the contracts for the construction of two each were awarded to the New York Shipbuilding Company and the Newport News Shipbuilding & Drydock Company. The contracts for the electrical equipment were awarded to the General Electric Company and the Westinghouse Electric & Manufacturing Company, two to each company.

COMPLETING THE DETAILS FOR N. E. L. A. CONVENTION EXHIBITS

Lamp Committee and Electric Vehicle Section Expected to Set High Standards in Attractive and Educational Displays

The exhibition committee of the National Electric Light Association has about completed the details in connection with the exhibits for the fortieth annual convention to be held during the week ending May 28 at Atlantic City, N. J. Plans for the decorations, if present ideas are carried out, will be unique.

The membership committee is securing many new manufacturers as members, who are not only joining the association, but also taking advantage of the opportunity to make an exhibit at Atlantic City. Class "D" members are urged by the exhibition committee to send in their applications at once.

The exhibits will be completed on Saturday night, May 26, and the exhibition will open on the ensuing Monday morning at 9 o'clock with special ceremonies

ILLUMINATING ENGINEERING SOCIETY CONVENTION

Annual Meeting Will Be Held in Newark, N. J., During the Third or Fourth Week of September

The annual convention of the Illuminating Engineering Society will be held in Newark, N. J., during the third or fourth week of September. P. S. Young, vice-president and treasurer of the Public Service Corporation, will be chairman of the committee on the 1917 convention. The committee on time and place, composed of the vice-presidents of the five sections, in conference with Mr. Young, will decide upon a definite date.

Preston S. Millar, chairman of the committee on papers, has reported to the council of the society that three papers have been scheduled definitely and several are under negotiation. Ten brief papers to form a symposium on color are listed.

A committee on diffusing media has been authorized, with I. G. Priest, associate physicist of the Bureau of Standards, as chairman.

JOVIAN PROBLEMS TO BE STUDIED BY A COMMISSION

Ways and Means of Improving Relations with Local Electrical Leagues to Be Considered in Cleveland on April 3

A commission appointed to devise ways and means to improve existing relations between the Jovian Order and local electrical leagues will meet at the club rooms of the Cleveland Electric League, Cleveland, on April 3. The commission was appointed by Reigning Jupiter Henry L. Doherty in accordance with a resolution passed at the last Jovian annual convention. Mercury Ell C. Bennett is chairman of the commission.

INJUNCTION HALTS NATIONAL ELECTRICAL CODE MEETING

Restrained from Considering the Subject of Fuses by the Supreme Court, Electrical Committee Adjourns Biennial Meeting

The 250 or more electrical inspectors, city electricians, underwriters, manufacturers, engineers, etc., from various sections of the country who had assembled in the large auditorium of the New York Board of Fire Underwriters on Wednesday to attend the biennial meeting of the electrical committee of the National Fire Protection Association were greatly surprised when one minute after the session was called to order by Chairman G. E. Cabot it was summarily adjourned. The object of the meeting was to consider changes and additions to the National Electrical Code, and the only inkling that most of those assembled had of any trouble was given in the form of a resolution read immediately after the meeting opened. The resolution was as follows:

> Whereas the maker of a certain electrical service device has brought suit in the New York Supreme Court against all the members of this committee and has obtained a restraining order which not only enjoins the committee as a body from taking any action disapproving of this device, but prevents us as individuals from saying or doing anything which any person might interpret as being unfavorable to the device; and
>
> Whereas we have engaged counsel to protect our interests in the litigation and have been advised by the counsel that the character of the restraining order is such as to render inadvisable any general discussion at this time of any subject that may come before the committee,
>
> Be it therefore resolved, that the committee now adjourn subject to the call of the chairman.

Inquiry developed that earlier in the week the various members of the electrical committee were served with an injunction order issued by Judge Delehanty of the Supreme Court of the State of New York to the Economy Fuse & Manufacturing Company, argument on which was heard by the court on Thursday, the defendants being represented by ex-District Attorney Jerome of New York City and the plaintiffs by Platt & Field.

The complainants in the case brought suit against every member of the electrical committee, which, as is well known, includes many representatives of professional and trade associations who are not interested in the insurance business at all.

The Basis of Complaint

The plaintiff, which manufactures a certain type of refillable fuse, in asking for the injunction claimed that many profitable contracts have been made, that it has large unfilled orders on hand, is making many other profitable contracts with users for its fuses, and will renew and continue in the future to renew contracts if not threatened by the acts of the defendants. Its fuses, it maintains, have been tested by the Underwriters' Laboratories, Inc., and certified by it at various times as complying with the requirements of the code.

The immediate and direct cause of the action was the resolution adopted by the switch and cut-out committee to be presented at the March 28, 1917, meeting, which was as follows:

"Sec. d. The switch and cut-out committee has continued its investigation and study of the subject of refillable fuses, and desires to report the following opinion: 'The evidence presented to or obtained by the committee does not warrant it in recommending any change in Rule 68 d.'"

The injunction served restrained the defendants, both individually and as switch and cut-out committee and as electrical committee, their agents, servants, employees, attorneys and agencies through which they act, from taking any vote, passing any resolution, doing any act or having any communication, either oral or written, the purpose or the effect of which will be or that will cause or tend to cause:

(1) The customers of the Economy Fuse & Manufacturing Company to break contracts to purchase fuses from said company.

(2) The customers of the Economy Fuse & Manufacturing Company to refuse to renew contracts to purchase fuses from said company.

(3) Persons, firms or corporations desirous of becoming customers of the Economy Fuse & Manufacturing Company from making contracts for the purchase of Economy fuses.

(4) Any persons, firms or corporations using fuses or about to use fuses to infer that said defendants either individually or as members of either of said committees have condemned the Economy fuse as a fire hazard, a dangerous device or one which it is not proper to use.

(5) Any persons, firms or corporations using fuses or about to use fuses to believe that the Economy fuse is a dangerous and hazardous device.

(6) The withdrawal or annulment of permission or permissions heretofore granted for the sale and purchase, installment and use of the Economy fuse.

(7) Refusals to grant further permissions in the future to purchase and sell, install and use Economy fuses.

(8) Or to call, or that will call or tend to call, attention to the fact that the fuse manufactured by the Economy Fuse & Manufacturing Company is not recognized by the defendants' National Electrical Code; and

(9) Or that will be to declare or lead others to believe that the Economy fuse is not a proper device to be recognized by said defendants' National Electrical Code, or the purpose or effect of which will be to discriminate against the Economy fuses in favor of the fuses of competitors of the Economy Fuse & Manufacturing Company.

Statement by Underwriters

Speaking to a representative of the Electrical World, an official of the National Fire Protection Association said that ample notice of the next meeting of the committee would be given to the technical and business press as well as to the various inspection departments. He regretted the postponement of the meeting and the expense to which many were put in coming to New York needlessly, but said that the action was advised by counsel for the protection of the committee.

It was pointed out that many inspection departments having jurisdiction have permitted the installation of certain types of refillable fuses so as to obtain the necessary field experience on their behavior in practice. Moreover, the Bureau of Standards has made a thorough study of the fuse in question at the request of both the manufacturer and the underwriters and has published its findings in an elaborate report. The Bureau of Standards recommended "that Economy fuses be not approved at present for general use on the same basis as fuses now listed as standard by the Underwriters' Laboratories, Inc., but that a continuation and extension of their use be permitted by municipal and underwriters' inspection departments under conditions where their performance can be observed by each inspection department until sufficient experience regarding their performance under service conditions can be obtained to justify an unqualified approval or refusal to approve."

ELECTRICAL COUNCIL FOR THE UNDERWRITERS' LABORATORIES

New Organization Formed to Supervise Work of the Electrical Department, Which Grows in Volume and Importance

An electrical council has been organized by the Underwriters' Laboratories to supervise the work of its electrical department. Such supervision has been done heretofore by the fire council of the Laboratories, but the volume and importance of the work have grown so much that a special council is necessary.

F. E. Cabot Honored

In connection with the initial meeting of the electrical council, held at the Machinery Club, New York, on the evening of March 28, the retirement of F. E. Cabot of Boston as a member of the fire council after twenty-five years' service was announced. Mr. Cabot continues as chairman of the electrical committee of the National Fire Protection Association and secretary of the Boston Board of Fire Underwriters. In honor of his long and valuable service his associates presented him with a gold watch.

The members of the new electrical council are:

Active Members of the Electrical Council

L. A. Barley, electrical inspector, Rocky Mountain Fire Underwriters' Association, Denver, Col.
R. C. Bird, inspector, Fire Underwriters' Electrical Bureau, New York, N. Y.
W. S. Boyd, electrical inspector, The Union, Chicago, Ill.
G. E. Bruen, superintendent electrical department, Suburban Fire Insurance Exchange, New York, N. Y.
W. J. Canada, Bureau of Standards, Washington, D. C.
B. W. Clark, electrical inspector, Public Lighting Commission, Deroit, Mich.
H. H. Clark, electrical engineer, experiment station, Bureau of Mines, Pittsburgh, Pa.
James Cole, commissioner of wires, Boston, Mass.
W. Devereux, chief electrical department, Philadelphia Fire Underwriters' Association, Philadelphia, Pa.
J. C. Forsyth, electrical inspector, New York Board of Fire Underwriters, New York, N. Y.
B. H. Glover, associate engineer, Underwriters' Laboratories, Chicago, Ill.
C. H. Hill, chief electrical inspector, Underwriters' Association of the Middle Department, Philadelphia, Pa.
M. F. Jones, chief electrical inspector, New England Bureau of United Inspection, Boston, Mass.
C. E. Lum, National Board of Fire Underwriters, New York, N. Y.
W. D. Matthews, superintendent of inspections, Chicago Board of Underwriters, Chicago, Ill.
A. H. Miner, Jr., United Bureau of New England, Boston, Mass.
C. W. Mitchell, inspecting engineer, Board of Fire Underwriters of the Pacific, San Francisco, Cal.
I. Osgood, chief engineer, Boston Board of Fire Underwriters, Boston, Mass.
A. M. Paddon, engineer, Underwriters' Association of New York State, Syracuse, N. Y.
Dana Pierce, vice-president, Underwriters' Laboratories, New York, N. Y.
A. M. Schoen, chief engineer, Southeastern Underwriters' Association, Atlanta, Ga.
E. H. Sigison, manager, Buffalo Association of Fire Underwriters, Buffalo, N. Y.
H. F. Strickland, chief electrical inspector, electrical inspection department, Hydro-Electric Power Commission of Ontario, Toronto, Ont.
R. P. Strong, chief electrical inspector, Louisiana Fire Prevention Bureau, New Orleans, La.
Ralph Sweetland, engineer-in-charge, New England Insurance Exchange, Boston, Mass
Victor H. Tousley, chief electrical inspector, municipal department, Chicago, Ill.
A. G. Wilbor, Factory Insurance Association, Hartford, Conn.
H. S. Wynkoop, electrical engineer, Bureau of Electrical Inspection, New York, N. Y.

Corresponding Members

H. M. Beecher, chief inspector, Department of Electricity, Los Angeles, Cal.
F. A. Cambridge, city electrician, Winnipeg, Man.
M. E. Cheney, electrical engineer, Washington Surveying and Rating Bureau, Seattle, Wash.
R. L. Daniel, engineer, General Inspection Company, Minneapolis, Minn.
F. O. Evertz, electrical inspector, Ohio Inspection Bureau, Columbus, Ohio.
J. H. Fenton, electrical inspector, St. Louis Fire Prevention Bureau, St. Louis, Mo.
Oscar M. Frykman, chief electrical inspector, Building Department, Minneapolis, Minn.
Warren Hadley, electrical engineer of District of Columbia, Washington, D. C.
C. H. Hodgson, chief electrical inspector, Allegheny County Board of Fire Underwriters, Pittsburgh, Pa.
W. B. Hubbell, chief electrical inspector, Cincinnati Fire Prevention Bureau, Cincinnati, Ohio.
Howard A. Jocelyn, city electrician, Seattle, Wash.
I. H. Moore, chief inspector, city electrical department, Indiana Inspection Bureau, Indianapolis, Ind.
J. R. Morrissey, superintendent electrical department, Wisconsin Inspection Bureau, Milwaukee, Wis.
William Lincoln Smith, Secretary National Association of Electrical Inspectors, Concord, Mass.
H. B. Sutton, chief electrical inspector, State Insurance Commission, Austin, Tex.
C. M. Tait, chief electrical inspector, Canadian Fire Underwriters' Association, Montreal, Canada
E. W. Trafford, city electrician, Richmond, Va
F. D. Varnum, city electrical inspector, St. Paul, Minn.
H. G. Veit, chief electrical inspector, Cleveland Inspection Bureau, Cleveland, Ohio.
F. D. Weber, electrical inspector, Underwriters' Equitable Rating Bureau, Portland, Ore.

PROGRAM FOR ANNUAL MEETING PACIFIC COAST SECTION, N. E. L. A.

Commercial, Engineering and Public Policy Sessions with Wide Range of Subjects and Addresses by Prominent Men

Program details have been announced for the first annual convention of the Pacific Coast Section of the National Electric Light Association, which is to be held at Riverside, Cal., April 19, 20 and 21. The convention committee is under the chairmanship of A. B. West, Southern Sierras Power Company, Riverside.

On Thursday, the first day, after the registration and reception of members, there will be an open meeting at which welcome will be extended by Riverside civic officials. Reply will be made by John A. Britton, Pacific Gas & Electric Company. The secretary and treasurer and the membership committee will report.

On Thursday afternoon will be the opening of the commercial committee session. Subjects discussed will be: Rates, merchandising of lamp socket devices, electric cooking and water heating, and highway lighting. At 8 p. m. on the same day there will be an illustrated address on the Southern Sierras Power Company's system by C. O. Poole, the chief engineer.

Engineering Session Friday

On Friday morning the commercial committee session will be continued. The subjects will be: Industrial electric heating and commercial organization. The report of the accounting committee will be read.

On Friday afternoon the engineering committee session will be held, and at its close the nominations and election of Pacific Coast Section officers will take place. Subjects for discussion at the engineering committee session are: Standardization of distribution transformers; report of conferences with engineers of California Railroad Commission on general safety order affecting line construction; suspension insulators; standardization of pin and clevis hardware for suspension insulators; inductive interference; fuse protection of transformers and branch lines in rural distributing systems; joint pole construction; operation of steam turbine standby stations; high-head waterwheels.

At 8 p. m. the report of the public policy committee will be read and thereafter short addresses will be presented by Max Thelen, president of the California Railroad Commission; John S. Mitchell, Los Angeles Chamber of Commerce; O. B. Coldwell, representing the Northwest Electric Light & Power Association, and H. M. Byllesby of Chicago. The program will be concluded with an illustrated lecture by W. D'Arcy Ryan.

Inspection Trip for Saturday

Saturday will be devoted to an automobile trip to the crest of the San Bernardino Mountains. Luncheon will be served at Pine Crest by the Southern Sierras Power Company. In returning the party will stop at the San Bernardino steam generating station and the substation at Colton. The convention will close on Saturday night with a ball at the Glenwood Inn.

STATE HYDROELECTRIC OWNERSHIP KILLED IN MAINE

Comprehensive Report by an Electrical World Representative on the Disposal of Plan to Emulate the Ontario Commission

By recent votes in the House and Senate sustaining an adverse report of the Judiciary Committee on the Dutton bill, the Maine Legislature has effectually disposed of any early prospects of a State hydroelectric system development along the lines of the Ontario Hydro-Electric Commission's work in Canada. At the present session hydroelectric matters have occupied a prominent place on the calendar. Questions of State policy under discussion included the Dutton bill, providing for the establishment of a water-power commission similar to that in Ontario; the Baxter bill, providing for the transfer of water-power investigations from the Public Utilities Commission to an independent board, and a bill introduced on March 27 to repeal the existing statute prohibiting the transmission of hydroelectric power from Maine to another state.

The Judiciary Committee has decided that the Baxter bill ought not to be passed and will shortly render this report. It is expected that the interstate transmission bill will be vigorously contested.

To a representative of the ELECTRICAL WORLD Governor Milliken said on Monday of this week that the present policy of the State is opposed to the sale beyond its borders of energy generated in Maine, the encouragement of local industrial upbuilding being the foundation of this policy. Maine has the highest per capita water-power development and the third largest total development in the Union.

The Governor declared to the ELECTRICAL WORLD representative that the State should proceed as rapidly as possible to acquire full knowledge of its water-power resources, and that while later developments might modify the present ban upon interstate transmission from Maine, no company can transmit power at present outside the State if the prohibition of the general law is contained in its charter. The proposed repeal of the interstate ban already has a substantial backing in the Legislature.

MAINE UNWILLING TO ATTEMPT GOVERNMENT OWNERSHIP

The Dutton bill on behalf of public ownership was a storm center of discussion in the committee hearings. Among its supporters was Gifford Pinchot, who was unable to visit Augusta, however, to give his views.

The principal witness on behalf of the bill was P. B. Yates, manager of electric service at St. Catharines, Ont., associated with the engineering department of the Ontario Hydro-Electric Commission. Mr. Yates described the work in Ontario at great length, stating that the commission now supplies 140 municipalities and distributes 200,000 hp. of energy generated at Niagara and in other plants. It has been found practicable to distribute power to farm customers even if three per mile of line can be secured. Iron wire is generally used on such jump-offs, however.

A 5-hp. motor, Mr. Yates said, if mounted on skids, suffices for the greater part of the farm work. The witness claimed that a diversity factor of five exists among the farming installations and that 100 hp. supplied to a township will meet the needs of 500 farms. The witness cited many of the low rates in vogue on the system, and contended that the work is handled efficiently by the commission. Work has been started on the construction of a 200,000-hp. plant at Queenstown Heights to operate under 305-ft. head. An ultimate development of 1,000,000 hp. is planned.

C. B. Carter, for the Central Maine Power Company, Cumberland County Power & Light Company and other utilities, brought out the point that there never has been an audit of the books of the Ontario commission by an outside auditor. At the end of 1915 the province of Ontario had given the commission $924,000, which was not figured in its costs up to 1916, and in 1916 the province advanced $127,000 to cover the activities of the board.

E. F. Merrill, also counsel for the central station interests, declared that the Dutton bill is unconstitutional. The Supreme Court of Maine in Brown vs. Gerald (100 Maine) has held that the creation and distribution of power for manufacturing purposes is clearly a private enterprise, no matter how great its general utility. This decision held that to enable the right of eminent domain to be exercised in such behalf would be taking the property of one private person for the use of another private individual, "which is not legislation, but robbery."

ARBITRARY POLITICAL POWER OF ONTARIO COMMISSION

Mr. Merrill said that the Ontario commission obtained power at Niagara for $9 per horsepower-year practically under threat of eminent domain. "When legal action was threatened against the commission, this great political machine forced through the Canadian Parliament a statute which provides that all suits in which the authority of the commission shall be called in question should be forever stayed. Under our constitution things are not done that way," said Mr. Merrill.

"They passed another statute that no action at law should be brought against the commission without the consent of the Attorney-General," he continued. "I have been unable to find a single case where the Attorney-General has granted his consent to bring such an action. It has been further provided that when the commission is acting within any powers granted to it by Parliament, its action shall not be reviewable by any court."

Mr. Merrill pointed out that the Maine constitution limits the State to taking on any indebtedness above $300,000; that the Ontario commission has already expended $40,000,000 on its transmission system and its service, and that the bill was one of the most dangerous pieces of legislation ever proposed in Maine.

Reginald P. Bolton, consulting engineer, New York, outlined the work of the Ferris committee in New York State, which investigated the Ontario system and reported against a similar scheme of state ownership of water powers in New York.

Mr. Bolton referred to the loss of $128,000 shown in the Cleveland (Ohio) municipal lighting plant by an expert accountant's report in 1915, and intimated that low rates are a snare and a delusion under such conditions. Mr. Bolton said that it is impossible to obtain as high efficiency of labor under public ownership as under private operation, and contended that the Ontario commission's rates were too low in relation to costs.

ENERGY SOLD BELOW ENGINEERS' ESTIMATES

P. W. Sothman, consulting engineer, New York, chief engineer of the Ontario commission from 1906 to 1912, said that he resigned from the board's employ because he could not agree with its financial methods.

"Being chief engineer," he said, "my duty was to make out estimates and figures down to the final point on which the cost of power was to be fixed. I don't believe in a single instance our figures were adopted and presented to the municipalities or to the party or parties asking for the cost of power."

The witness said that in 90 to 95 per cent of the cases energy was sold at far below the engineers' estimates.

He stated that in Europe most of the plants originally publicly owned are going over to the privately owned companies and that plants making a fair success under public ownership make a great success after about two years of private ownership and operation. In closing, Mr. Sothman declared that the published reports of the Ontario commission do not reveal the true cost of electricity.

Walter S. Wyman, general manager of the Central Maine Power Company, pointed out that the cost of rendering its service is far less in proportion to the volume of business concerned than is the case in Ontario. In 1915 the commission expended $2,800,000 to take power from Niagara and deliver it to the consumer. The Central Maine company, under private management and deducting taxes (no taxes are paid by the Ontario municipalities), handled about one-eighth of the business of the Ontario system at a cost of about $210,000. It is hoped to be able to pay a common-stock dividend before long.

Nearly all the stockholders live in the company's territory, there being 1100 in Maine. The greater part of the stockholders are customers. Almost every Maine savings bank has invested in the securities of the Central Maine Company.

Equitable Rates in Maine

Mr. Wyman referred to the power of the Ontario commission to drop substantial loads to keep down the peak and to the increased rates in vogue as the distance from Niagara Falls increases. In spite of the sparsely settled territory, the Maine company's rates are the same on country roads as in town. There are 1180 farm customers and the lines run in some cases from five to twelve miles into the country to serve them.

The company is obliged to maintain a steam turbine reserve station at Farmingdale capable of handling 75 per cent of the system peak load. Sixteen plants supply the system and there are no large stations, as at Niagara. Energy is sold to the Lewiston, Augusta & Waterville Street Railway at 8 mills per kilowatt-hour. The system represents an investment of about $10,000,000.

Mr. Wyman said that with very large steam turbines a total generating cost of about 4.25 mills may be anticipated. He said that the mean low run of the Kennebec River is under 1000 hp. at 12-ft. head, dropping for two or three days to 500 hp.

Municipal ownership, Mr. Wyman declared, is absolutely inefficient, and one of its serious defects is the opportunity it affords to try freakish experiments whose real cost may not be known for months. In conclusion, he referred briefly to the economic benefits of a high-tension electrical trunk line from upper Maine into eastern Massachusetts which might serve as a kind of interstate busbar of electrical supply, absorbing surplus energy at one point for use elsewhere under proper control.

The Baxter bill, designed as stated above to transfer the investigation of water-power resources from the Public Utilities Commission to an unpaid board, to be known as the Maine Water Power Commission, was introduced by Representative Baxter of Portland.

The author of the bill informed a representative of this journal that the sole object of the measure was to facilitate the development of the State's hydroelectric resources through comprehensive investigation. Proponents of the bill contended that members of the Public Utilities Commission should be relieved of the burdens of water-power investigation.

The opposition, which included representatives of the electric service companies, held that the commission is entirely capable of handling the work; that if additional engineering assistance is required the work can be done at less cost than by a new and separate official organization; and it objected on the additional ground that it might prove to be a step toward public ownership.

The commission is entirely willing to continue the work and to broaden the inquiry.

HEAVY WINDSTORM TESTS CINCINNATI PREPAREDNESS

Long-Standing Preparations for Emergency Prove Their Value When Cyclonic Wind Strikes a Section of the City

A heavy windstorm in Cincinnati during the evening of March 23 gave the Union Gas & Electric Company an opportunity to test its preparations for such a dangerous emergency. Long before this cyclone struck the city, long before the last previous severe windstorm about two years ago in fact, the company had made definite plans to hasten the work of reconstruction. Francis R. Healy, superintendent of distribution, in describing the result of the storm says:

"Always prepared for catastrophes of this or any other sort, our company has an organized emergency



HEAVY WINDSTORM TESTS CINCINNATI PREPAREDNESS FOR EMERGENCY

crew, men who are reached by the simple SOS call. The time of evening—7.45 officially—would ordinarily make the chance of need of such a crew a very slight one; nevertheless, within half an hour we had 100 men on the ground.

"Company automobiles hurried them to the scene, and by noon of the next day, despite night and drenching rain, they had the main arteries working again. But that did not repair the damage.

"All in all, this wind, which, as you read of it, took perhaps two blocks on Grace Avenue, Hyde Park, and possibly the territory for one city block on either side at most, cost us between $4.000 and $5,000."

COMBINING UTILITIES WITH THE OIL BUSINESS

Cities Service Company Enlarges Its Scope and Adds Materially to the Sources of Gross Earnings —Power Business Growing Rapidly

The growing importance of the oil and refinery business in the operations of the Cities Service Company is shown by the 1916 statement. Of the total gross earnings of the holding company, $5,573,116 were from utilities and $4,537,227 from oil and refineries. The combined statement of earnings of all subsidiary companies shows that the gross of those properties was $48,052,573.

In addition to the great change in the operations and business resulting from further development of the oil business a conspicuous feature of the year was the high rate of growth of electric central station companies.

ORDERS FOR TURBINES OF 200,000 HP.

"In spite of the large additions to plant equipment reported last year," says President Henry L. Doherty, "we have been compelled to place orders for additional turbine capacity for the electric properties aggregating 200,000 hp. This includes 67,000 hp. for Toledo, 22,000 for Warren (Ohio), 16,500 each for Denver and Empire District (Mo.), 11,000 for Elyria (Ohio), and smaller units for almost every other electric property.

"The progress of your Ohio properties is especially noteworthy. Last year we reported that the Massillon company had doubled its capacity in 1914 and again in 1915. We now have equipment ordered which will more than double the present capacity.

"The Trumbull company at Warren has been similarly called upon to increase its turbine capacity from 10,500 hp. to 33,000 hp., and the Lorain County company at Elyria from 9500 hp. to 20,000 hp.

"Work on a new power station for Toledo has been started. The first installation will be 54,000 hp. The output is now practically three times as great as when your company became interested four years ago.

"The growth of the Southwestern companies has been practically as rapid, and the commercial development of the Empire District, St. Joseph (Mo.), Hutchinson (Kan.) and Salina (Kan.) properties is gratifying.

"Conditions have improved materially in most of the Southern properties, and we have ordered adequate equipment to handle the additional business offered at Durham (N. C.), Bristol (Va.) and Athens (Ga.)."

HIGHER COSTS WILL AFFECT NET EARNINGS

Mr. Doherty regards the outlook for increased gross earnings of the various utility properties as the brightest in the history of the company. "But the net earnings," he adds, "will be affected by the increased costs of fuel, materials and labor. Taxes, already a large factor in operating costs, are rapidly increasing because of new federal and state legislation. Economies effected through increased volume of business and higher efficiencies obtainable from the new equipment now being installed will be a material factor in alleviating these conditions."

The judgment of the directors is that "the company is fully equipped for whatever eventualities may develop during the year, and a continuance of increasing earnings seems to be assured."

To cover briefly the extensive operations of the company in oil: At the end of 1916 28,000 bbl. of oil daily were being marketed and stored. The refineries have facilities for handling 30,000 bbl. of crude oil daily. Their equipment includes 1157 tank cars, with 385 additional on order, several ocean steamers and storage capacity of 1,800,000 bbl. The Empire Pipeline Company has 180 miles of pipelines, with 176 additional under construction, and has storage tanks of 1,400,000 bbl. capacity with accessory gathering lines and pump stations. Operations in the Eldorado and Augusta (Kan.) fields have fully proved 24,000 acres.

Earnings compare as follows:

	1916	1915
Gross earnings	$10,110,343	$4,479,800
Expenses	239,390	172,856
Net earnings	$9,870,953	$4,306,944
Interest on notes and debentures	258,960	490,000
Net to stock	$9,611,993	$3,816,944
Dividends preferred stock	2,409,691	1,570,005
Net to common stock and reserves	$7,202,302	$2,246,939

SAFEGUARDING THE COAL SUPPLY OF BROOKLYN COMPANY

Plans to Secure Adequate Reserve, Take Advantage of Low Summer Prices, Avoid Shipping Delays and Eliminate Possible Embargo

Plans of the Edison Electric Illuminating Company of Brooklyn and the Kings County Electric Light & Power Company for safeguarding the coal supply are set forth in the combined annual report of these properties to shareholders. The report, signed by N. F. Brady, president, and W. F. Wells, vice-president and general manager, and also secretary to the board of directors, says on this point:

"To insure an adequate coal supply, take advantage of low prices during the summer, avoid shipping delays often encountered in obtaining coal during the winter and eliminate possible embargo on coal consignments by the railroad companies, some 37 acres of waterfront property were purchased near Rossville, Staten Island, which will be utilized for the storage of a reserve supply of coal. The company has under way the construction of a concrete bulkhead wall along this entire waterfront, and is installing a large-capacity overhead traveling crane which will be utilized in handling coal when received from the mines and in reloading into boats for shipment to the generating stations."

Earnings of the combined companies for the calendar year 1916 follow:

	1916	1915
Total revenues	$8,237,686	$7,038,180
Expenses, including taxes and reserve for replacements	5,046,928	4,606,896
Gross income	$3,190,758	$2,431,284
Reserved for contingencies	569,175	.....
	$2,621,583	$2,431,284
Bond interest and other income deductions	$761,628	$863,784
Dividends, profit sharing, etc	1,293,579	1,150,216
Surplus for the year	$566,376	$417,284

"The foregoing results," says the report, "have been made possible through strict adherence to the established policy of economical operation of all departments, coupled with energetic efforts toward increasing the number of consumers. Many residential and small commercial users have been connected to the system, including over 1000 unwired houses equipped under the company's partial payment plan. Very satisfactory results have been attained in securing big power business, the contracts signed aggregating upwards of 50,000 hp., including eighteen installations of over 300 hp. each. Sixty-one private plants have been discontinued in favor of the company's service, including one of 4000 hp. It is also gratifying to note that a three-year contract for 4600 hp. has been taken covering the construction of the Fourteenth Street tunnels under the East River, and that material additions have been made to the connected load of existing customers."

ARBITRATION OF BOSTON STREET-LIGHTING COSTS

Allocation of Investment in This Class of Service Discussed by City's Witness Under Cross-Examination

Cross examination of Prof. Harry E. Clifford of Harvard University and the Massachusetts Institute of Technology, expert for the city of Boston in the Boston Edison Company street-lighting rate arbitration, was begun recently before the Massachusetts Gas and Electric Light Commission.

Professor Clifford maintained that an allowance of one-tenth of 1 per cent, or $816, for general office, land and buildings cost is a fairer proportion chargeable to street lighting in Boston proper than the company's allowance of $42,075, or 5.367 per cent. The latter was determined by the ratio of the street lighting to the total energy demand at the L Street generating station. The witness attacked this allocation on the ground that a much smaller percentage should be charged to office expenses in handling the street-lighting business. He maintained that the substation cost should be allocated to street lighting on the basis of space required by equipment.

Does Not Approve Municipal Ownership

The witness said, in response to an inquiry by Frederick Manley Ives, counsel for the Edison Company, that he doubted whether the city at the present time could establish a plant which would supply street-lighting service more cheaply than the company should do it; that he did not approve of municipal ownership, and that the following advantages should result from the connection of the Boston street-lighting load with a large system: Reduced investment for a given volume of service, lower generating costs due to the use of much more economical station apparatus for the 65,000-kw. (1914) demand, and greater reliability of service.

Professor Clifford held that these benefits to the city street-lighting service are offset in a measure by the long-hour advantage to the company of the load thus imposed in its effect upon the load factor. For this reason he questioned the wisdom of charging the street-lighting service with particular sums derived from the investment in the remainder of the system. The witness would not concede that the street lighting should bear any of the expense of getting other business which benefits it.

Mr. Ives pointed out that if the city supplied its own street-lighting service substantial office facilities and a good-sized staff would be required. Professor Clifford conceded this, but maintained that very few draftsmen would be needed on account of the repetitive character of street-lighting engineering work.

Professor Clifford allocated 1 per cent of the general service buildings property to street lighting on account of the relative amount of storage space required by poles, globes, lamps and cables. This amounted to $12,089, whereas the company maintained that $78,000 of the general service buildings cost should be charged to street lighting. The witness refused to charge any proportion of the welfare buildings cost into the street-lighting investment.

Allocation of Transmission Lines

Of the cost of transmission lines connected with Boston substations from which street-lighting service is distributed, the company allocated 4.155 per cent to street lighting. This was the ratio of the series arc and incandescent load on the transmission lines to the total capacity of the latter, as determined by L. L. Elden, electrical superintendent of the company. The total rated capacity of the ten lines thus concerned was 40,000 kw., according to the company.

Professor Clifford contended that for peak rating this capacity could be figured at 60,000 kw., on the basis of raising the voltage on cables now operated at 6900 volts to 13,800 volts and increasing the capacity of the upper voltage lines 20 per cent. The witness contended that all the spare carrying capacity of these cables should be charged against the commercial lighting business, since it is only on the peak that the cables are run at or near their rating, and because the growth of the commercial business is far more rapid than that of the street-lighting load. As the load increases new substations and cables are installed, so that in a specific case the actual load on an individual cable may for a time decrease. Rearrangements of street-lighting circuits may also reduce certain substation loads.

Professor Clifford stated that in his opinion the allocation of substation investment to street lighting based on the capacity of installed apparatus was not fair on account of the advantage possessed by the street-lighting apparatus in greater capacity per unit of occupied floor space as compared with the other equipment in the substation taken in relation to the total area. The space potentially available for commercial apparatus development is greater in square feet per kilowatt, the witness held, but he admitted that the actual capacity of commercial apparatus per square foot of substation floor area is greater than that of the street-lighting equipment. In other words, the intrinsic production capacity of the latter is less in terms of floor area occupied.

In one representative substation the street-lighting apparatus occupies 3.28 sq. ft. per kilowatt of capacity, compared with 0.92 sq. ft. for the commercial apparatus, exclusive of halls and stairways in the former allocation. The witness refused to charge the street-lighting system with any of the space available for equipment expansion in the substations.

PLANS FOR NEW GENERATING STATIONS IN WISCONSIN

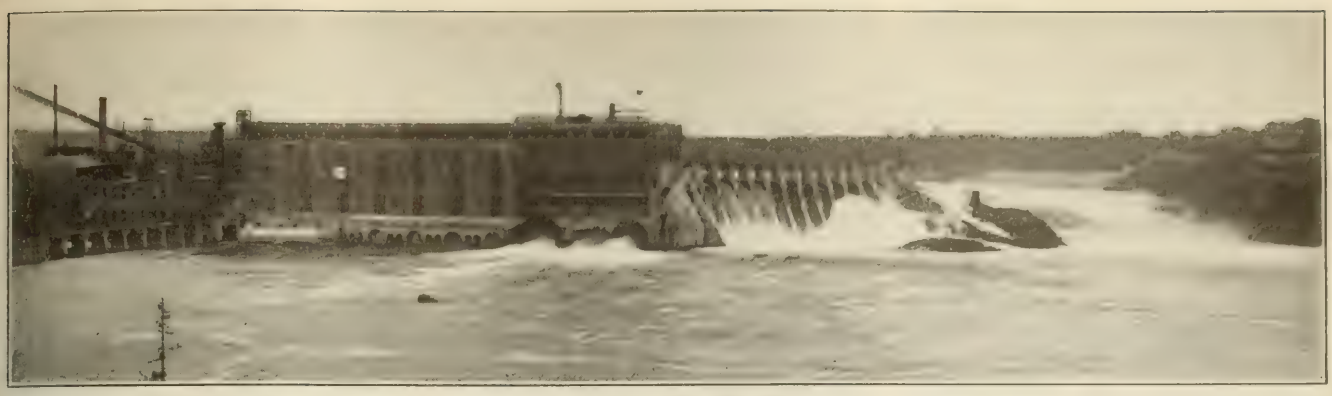
Milwaukee Electric Railway & Light Company Will Build Station with Initial Rating of 65,000 Kw.—Eastern Wisconsin Company Improvement

The Milwaukee Electric Railway & Light Company will begin the construction during the coming summer of a new generating plant on the shore of Lake Michigan, just south of St. Francis, a Milwaukee suburb. The first installation will contain 65,000 kw., a generating capacity somewhat larger than that of the river-front generating station on Commerce Street, Milwaukee. The new station will contain ultimately 200,000 kw.

The power plant will be connected with the Chicago & Northwestern Railway by a spur track. The right-of-way for the track has been purchased. Work on the railroad construction will begin at once.

Three existing stations of the company in Milwaukee will be continued, as will the purchase of 12,000 kw. of water power now being transmitted from plants on the Wisconsin River.

The erection of a new power house of 5000 kw. or 6000 kw. rating at Sheboygan, Wis., is part of the plan of the Eastern Wisconsin Electric Company, according to Raymond H. Smith, general manager. This plant will be connected with the Fond du Lac and Oshkosh properties of the company by the proposed new transmission line. Plans for construction will be perfected as soon as a survey now under way is completed. An issue of $998,000 bonds, to defray the cost, has been sold.



THE NEW LAURENTIDE POWER COMPANY PLANT IS NOW IN FULL OPERATION

SHAWINIGAN POWER BUSINESS DEVELOPS RAPIDLY

Production Now Combined with New Laurentide Plant and Subsidiary Industries Will Accelerate Future Upbuilding

Rapid development of power business is shown in the annual report of the Shawinigan Water & Power Company for the calendar year 1916. The Laurentide Power Company has completed construction work and its plant at Grand'Mère has been put into full operation. The Shawinigan company is operating the power station with economy to both companies. It began to take power from the Laurentide company in 1916 and, with the growth of the business, is using more than was provided in the original contract.

Industries and business growth are mentioned in the report by J. E. Aldred, the president, in part as follows:

"The Canada Carbide Company, Ltd., which manufactures calcium carbide by an electric reduction process, has enjoyed a very satisfactory sale for its product during the year. The company's agents report an active demand for the product in all of the countries where the company is represented. As the result of recent extensions made to the plant, it is anticipated that the output for 1917 will largely exceed that of any period in the company's history.

"The Canadian Electrode Company, Ltd., which was organized to meet the demand for electrodes used in the various electrical industries at Shawinigan Falls, has now completed its plant and is in a position to supply its product. As a large tonnage of these electrodes is consumed annually by electric reduction companies in Shawinigan Falls, the demand for this company's production is assured.

"Early in 1916 a contract was made by the Canadian Electro Products Company, a subsidiary of your company, with the Imperial Munitions Board, for the delivery of certain chemical products required for war purposes. An extensive plant has been constructed at Shawinigan Falls, and this plant is now completed and in operation. This company will be a large addition to the industries at Shawinigan Falls, and it is anticipated that its activities in the production of chemicals will continue after the war demand ceases.

"The total amount of power used at Shawinigan Falls is nearly 100,000 hp. This amount will be increased with the operation of the new industries, and the city may well claim to be one of the great power-using centers in the world.

"The figures of production from your power station and from that of the Laurentide Power Company show a substantial increase over the previous year. The total amount of kilowatt-hours produced during the year from both of these stations was 478,540,000. This amount represents an increase of 19 per cent over the previous year's production of the Shawinigan system.

"Your company, like other large corporations in Canada, has during the progress of the war contributed liberally to the Canadian patriotic fund and other worthy relief funds. The company has also maintained wages to employees who are on active service.

"The new business for 1916 was more than that written in any previous year, and should increase the demand for power on your generating station by 25,000 hp.

"Notwithstanding the fact that almost all commodities, by reason of war conditions, are being marketed at abnormal prices, it has not been the policy of your company to raise its rates, but rather to turn its power resources to the development of industries based upon the natural resources of the country and of such a character as will furnish permanent business and employment after the present conditions have passed."

Gross earnings of the Shawinigan Water & Power Company in 1916 amounted to $2,325,872, an increase of $405,729 over 1915. Expenses were $427,928, leaving a balance of $1,897,944. Net earnings showed a return of 9½ per cent on the average capital employed during the year. Dividends of 7 per cent were paid.

EARNINGS OF THE ELECTRIC STORAGE BATTERY COMPANY

Operations for 1916, After Payment of Manufacturing Costs and All Other Expenses and Dividends, Leave Good Surplus

The Electric Storage Battery Company of Philadelphia, reporting for the year ended Dec. 31, 1916, shows that $2,069,978 was the amount of gross sales less cost of manufacture and purchases and all expenses incident thereto. Operating expenses, including salaries, commissions, engineering, selling and traveling expenses and rent of branch offices, were $751,182. "Net earnings from sales" were $1,318,796. Other income of $263,257 gave total net earnings of $1,582,053. Dividends were paid of $649,964, leaving a balance of $932,089. The balance sheet surplus as of Dec. 31, 1916, was $2,318,686.

Plant investment was carried in the balance sheet at $2,676,688, and "patents, trademarks and agreements" at $11,000,000. Stocks and bonds in other corporations were listed at $1,658,954. Current assets stood at $5,316,272 and current liabilities at $838,352. In addition to the surplus shown, reserves of $1,231,789 are indicated, divided as follows: For depreciation of capital assets, $828,251; for depreciation of current assets, $187,171; for unfinished contracts and contingencies, $216,367. The annual report is signed by Herbert Lloyd, the president.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public-utility companies.

Right of Municipality to Issue Utility Bonds Without Submission to Popular Vote.—There being no restriction in its charter, the town of Belhaven, N. C., was held by the Supreme Court of the State (91 S. E. 369) to have power to issue bonds for the establishment of a system of electric lights, waterworks and sewage without submitting the matter to vote of electors.

Regulation of Right to Use Street.—Public service corporations derive their right to use the streets directly from the state, the right of a municipality to control such use being as agent of the state, it was held by the Supreme Court of New York (162 N. Y. S. 770). A corporation can acquire no right to use the streets of a municipality unless it has obtained a charter from the state authorizing such use. It is not within the power of state officials as such to confer any state franchise, but only the legislature in accordance with the constitutional limitations may confer such franchise.

Burden of Proof.—In an action against an electric power company for the death of a horse driven into a pool of water at the foot of a pole supporting electric wires, the burden was on the plaintiff to establish the fact that the electrical current which caused the death of the horse escaped from the defendant's equipment, according to the Supreme Court of Wisconsin in Bergeler vs. Waukesha Gas & Electric Company (160 N. W., 1076). Until it was established that the current escaped from the defendant's equipment to the pool, there was no burden on the defendant to establish that the current which killed the horse came from some other point.

Contributory Negligence Where Company Rules Are Disregarded.—A telephone company can escape liability as a matter of law for its negligent failure to make the place of work safe for its linemen if it promulgates a rule requiring constant and extraordinary care in all circumstances, and particularly the use of rubber gloves at all times when making repairs to telephone circuits, and if this rule is disregarded by the employee, only in case the inference of negligence from the disregard of such rule is so plain that all fair-minded men would be compelled to that conclusion, it was held by the Court of Appeals of New York (114 N. E. 1043). Where the company had established such rule, but there was evidence that it was never enforced, and that it was not intended to apply to the work a lineman was doing when killed, in performing which it would have been difficult, if not impossible, for him to work with gloves on, it was a question for the jury whether or not he was contributorily negligent in disregarding the rule so as to relieve the employer from its negligent failure to make the place of work safe. Where there was evidence that a telephone company was not enforcing its rules for the protection of employees in places made dangerous by the employer's negligence, it was not necessary to show knowledge of the disregard of the rule by an injured employee to charge the employer with liability. The law that disobedience to the employer's rule in situations inherently dangerous is contributory negligence does not apply where the situation was made dangerous by the employer's negligence.

Weight of Expert Testimony.—In the case of Bergen vs. Tulare County Power Company (161 P. 269) the Supreme Court of California held that in an action for death by electrocution testimony of experts as to insufficient grounding, where primary and secondary wires were in direct metallic contact with each other and grounded through the same wire, supported plaintiff's theory that death occurred from faulty and negligent installation and operation by defendant of the system in use at the deceased's pumping station. Where deceased was 50 years old, and evidence showed that he earned $50 a month about half his working time, the other half being spent in conducting his ranch, and he left a widow and minor children, a verdict of $12,500 was not excessive. In such an action where the plaintiff had established the death, while deceased was exercising ordinary care, from an excessive current furnished by the defendant, it then devolved upon the defendant to show that the excessive current was not due to its negligence.

Condemnation of State Land.—A law prohibiting the sale of state lands lying within a national forest reservation does not affect the power of a corporation entitled to exercise eminent domain to condemn such lands in accordance with a further law declaring all lands of the state subject to condemnation, saving such lands alone as are not appropriated to some public use, and providing that surveyed and unsurveyed sixteenth and thirty-sixth sections owned by the state or the United States included within a national reserve shall not be condemned as against the United States or the state where the state's title to land so included has not been thereby divested, it was held by the District Court of Appeals of California, and a rehearing was denied by the Supreme Court in the Pacific Power Company vs. State (162 P. 643). In a proceeding by a power company to condemn land excluded by the latter law there was a judgment for the petitioner filed and recorded May 29, 1915, sustaining its right to sue the state, though the final order of condemnation as provided by law had not been entered. The court held, on appeal from the preliminary order or judgment of condemnation, that as the judgment was permitted by the statute in force when it was rendered it would be affirmed.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Uniform Meter Deposits in Pennsylvania.—A meeting of representatives of electric, gas, water and other public utilities was called by the Public Service Commission at Harrisburg on March 23 to arrange equitable plans for the establishment of uniform regulations covering deposits required from consumers and the interest rates paid on such deposits.

Utilization of Energy Within Control of Company.—In a decision rendered recently affecting the Pennsylvania Utilities Company and the Lehigh Navigation Electric Company, the Pennsylvania Public Service Commission says: "It is universally recognized that while electricity may be measured before it is converted into light, heat or power and after the measurement may be conveyed by the wires of the consumer, nevertheless the ultimate utilization of the energy is within the control of the public service company and is a determination of its duty to serve."

Public Utilities Commission for Utah.—The Utah Legislature has enacted a public utilities law and it has been approved by Governor Bamberger. A public utilities commission is to have jurisdiction over the steam and electric railways, all common carriers, express companies, lighting, power and gas companies, heating companies, telephone and telegraph companies, water corporations including irrigation companies, and warehousemen. A strong attempt was made by some members of the Legislature to have included under the jurisdiction of the commission coal companies, sugar companies, lumber companies and other lines of trade which may be found by the commission to have a virtual monopoly of the business in the State, but this provision was finally defeated.

Rate of Returns and Cost of Inventory.—The Illinois Public Utilities Commission, in allowing an increase in water rates in Pekin, decides two interesting questions affecting income and cost of inventory. The fair, reasonable and adequate rate of return upon the valuation was fixed at 7 per cent per annum, "which affords, in addition to the interest rate, a compensation for the inherent risks of the venture and a recognition of efficiency in operating and management." The cost of preparing the inventory of the property is regarded as "an unusual and extraordinary expense sustained by the utility, and the commission accordingly provides for the reimbursement of the company for the moneys thus expended by a reasonable allowance by way of operating expenses for its amortization over a term of five years."

Engineering College in Manchuria.—The *Manchuria Daily News* has published a supplement describing the Engineering College at Port Arthur, which is one of the two colleges maintained in South Manchuria by the Japanese. There are six laboratories, of which one is electrical and is equipped with many kinds of apparatus and appliances.

Kansas Bill Vetoed.—Governor Capper of Kansas has vetoed the bill under which rates might be announced by utilities and go into effect in thirty days automatically unless the Public Service Commission, with which they were to be filed, entered a denial. Under the present arrangement, the rates must be approved formally by the commission before they go into effect.

Honor for Milwaukee Employees Returning from Mexico.—Seventy employees of the Milwaukee Electric Railway & Light Company who, as members of the Wisconsin National Guard, returned recently from duty on the Mexican border were entertained as guests at a banquet on March 24 by the Electric Company Employees' Mutual Benefit Association. Colonel J. A. Watrous, a retired army officer, and Vice-President and General Manager S. B. Way made addresses.

Civil Service Examination for Navy Department Vacancies.—Examinations are to be held for not less than six or more than nine vacancies as assistant civil engineer. Appointees are commissioned with the rank of lieutenant (junior grade) with pay and allowance of approximately $2,500 a year. The examination will comprise a preliminary one by mail and a final one in Washington. No candidate over twenty-six years of age on Jan. 1, 1917, will be eligible. The candidate must be a citizen, have a degree from a college or university of recognized standing showing satisfactory completion of an engineering course, and have had not less than eighteen months' practical professional experience since graduation. Further information will be furnished by the Chief of Bureau of Yards and Docks, Navy Department, Washington, D. C.

Power Survey in Reading, Pa.—The power sales department of the Metropolitan Electric Company of Reading, Pa., completed recently an industrial survey of the city, which has a population of 125,000. This reveals that there is 24,000 hp. still available to be electrified, and that it would mean an annual income of approximately $500,000 apportioned among 120 different industries. These figures do not take into consideration the growth of each industry in purchasing power, such extensions having been tremendous during the past five years. Nor do they include the contemplated extensions of present customers or the increased income in prospect from several smaller central stations in growing suburbs that buy power from the Metropolitan Electric Company to resell. Another industrial survey of the territories supplied by these smaller central stations is to be made in the near future.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Pennsylvania Bill to Prohibit Discontinuance of Electric Service.—The Pennsylvania Legislature is considering the passage of a bill prohibiting discontinuance of electric, gas, water or other utility service by the utility company while a dispute is in process of adjustment between consumer and company.

Bond Issue for New Jersey Utility Companies Operating Outside the State.—A bill has been introduced in the New Jersey Senate to permit public utility companies operating in the State to issue bonds and stocks for expenditures on property outside of the State without requesting permission from the Board of Public Utility Commissioners.

Medal to Dr. Alexander Graham Bell.—Before an audience which filled Carnegie Hall, New York, Dr. Alexander Graham Bell, inventor of the telephone, received on March 21 the Civic Forum "medal of honor for distinguished public service." This medal was presented in 1915 to Thomas A. Edison and in 1914 to Major General George W. Goethals.

Opportunity for Military Training in New York City.—President Sidney E. Mezes of the College of the City of New York writes to the ELECTRICAL WORLD that young men who desire to get training that will fit them to command troops can do so at that institution. Five hundred young men are now taking a military course during the daytime, consisting of five hours a week of practical training, chiefly drill, and three hours a week of theoretical instruction. Thirty young men in the evening session wish this course to be repeated after business hours, and this will be done if the course obtains an additional enrollment of about sixty. Any young man who resides in New York City and has been graduated from college, or even completed the sophomore year in college, will be admitted to the course and will be under no expense. The college is daily expecting the approval of this work by the War Department and the recognition of the City College battalion as a senior unit of the Reserve Officers' Training Corps, which will involve the detail of an officer by the War Department who will go to the college as professor of military science and tactics and have charge of the course. Those who complete the course satisfactorily, which they probably can do by next September if they elect to take suitable summer camp work, will be eligible for commissions in the Reserve Officers' Corps. Those who are interested can obtain full particulars by writing to Prof. Paul Saurel at the City College.

Power and Navigation at Niagara.—Brigadier General William M. Black, chief of engineers, has recommended that the Secretary of War be authorized to investigate the economic possibility of combining the development of power at Niagara with facilities for navigation. A memorandum submitted by him to the Senate Committee on Foreign Relations, indorsed by Secretary Baker, suggests a ship canal.

Purdue University to Have Engineering Experiment Station.—Trustees of Purdue University have authorized the organization of an engineering experiment station. Although this development may not include a separate engineering experiment station building at present, it means the organization of industrial and scientific research in the existing laboratories, and the publication of bulletins setting forth the results of such work. It is probable that the plans will include the employment of technical graduates as research fellows to carry out the details of investigations, while the managing board or executive committee will direct such work in the four engineering schools.

Honor Awards for Safety Work.—President Arthur Williams of the American Museum of Safety, New York, has made public the contents of the report of the jury of award covering the award of four of the five gold medals which are given annually for noteworthy achievement in safety. The jury has not yet completed its deliberations relative to the award of the E. H. Harriman memorial medals. The awards for 1916 are: The Anthony N. Brady memorial medal, awarded to that American electric railway which for the year has done the most to conserve safety and health of the public and its own employees, is awarded to the Connecticut Company. The silver replica is awarded to S. W. Baldwin, in recognition of his campaign. The bronze replica is awarded to W. J. Flickinger, secretary to the president. Honorable mention goes to the Pacific Electric Railway of Los Angeles, Cal., and the Interstate Public Service Company of Indianapolis, Ind. The *Scientific American* medal, awarded for the most efficient safety device invented within a certain number of years and exhibited at the museum, is awarded to the Pullman Company for originating the "Dean" end frame for passenger cars. The Louis Livingston Seaman medal, awarded for progress and achievement in the promotion of hygiene and the mitigation of occupational diseases, is awarded to the Julius King Optical Company, New York, as a recognition of its scientific investigation of the effect of colored lenses worn by workmen whose eyes are exposed to the blinding glare of metal melting and refining operations, oxyacetylene welding and electric arc welding. The Travelers' Insurance Company's medal for the American employer who has attained great success in protecting the lives and limbs of workers is awarded to the Commonwealth Steel Company, St. Louis, Mo., for its safety system, protective devices, sanitary methods and fellowship work among employees.

Rejuvenation of the Stark County Electrical League.—On March 23 a rejuvenation of the Stark County Electrical League was held in the Courtland Hotel, Canton, Ohio.

Chicago Section, Illuminating Engineering Society.—James R. Cravath, electrical and illuminating engineer, addressed the Chicago Section of the Illuminating Engineering Society on March 16. The subject was "The Headlight Glare Problem."

Spring Meeting of Electric Power Club.—The board of governors of the Electric Power Club has selected the Homestead Hotel, Hot Springs, Va., as the meeting place for the spring convention, June 11, 12, 13 and 14. C. H. Roth, 1410 West Adams Street, Chicago, is secretary.

Portland (Me.) Electrical Contractors Hold Banquet.—The retiring manager of the commercial department of the Cumberland County Power & Light Company, G. T. Fisher, and his successor, A. C. Jordan, were the guests of the Electrical Contractors' Association of Portland, Me., at its second annual banquet, held March 13.

Milwaukee Electrical League.—In an address at a luncheon of the Milwaukee Electrical League, in the Hotel Gilpatrick, Milwaukee, former Governor F. E. McGovern advocated the establishing of a market commission to look after the relations between consumers and producers, as the Wisconsin Industrial Commission looks after relations between employers and employees.

Joint Meeting of Engineering Societies of Portland, Ore.—At a joint meeting of the Portland (Ore.) sections of the A. I. E. E. and N. E. L. A. with the Oregon Society of Engineers, E. A. Beals, district forecaster, U. S. Weather Bureau, Portland, Ore., spoke on "Weather Forecasting." The meeting was in charge of the Oregon Society of Engineers, H. L. Vorse chairman.

Dielectric Losses in Insulating Materials.—C. E. Skinner, engineer of the research division of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., addressed a joint meeting of the Franklin Institute and the Philadelphia Section of the American Institute of Electrical Engineers on March 8 on the subject "Dielectric Losses in Insulating Materials."

Flood Lighting and Street Lighting.—Flood lighting and street lighting will be discussed at the April meeting of the New York Section of the Illuminating Engineering Society scheduled for the evening of April 12 at the Engineering Societies Building, 29 West Thirty-ninth Street, New York City. Two papers will be presented. R. B. Thompson of the Central Hudson Gas & Electric Company, Newburgh, N. Y., will describe installations of urban and suburban street lighting suitable for small cities. C. A. V. Halvorson of the Lynn (Mass.) works of the General Electric Company will talk on lighting projectors, their development and uses. The dinner preceding the meeting will be held at the Forty-second Street Grill, corner of Madison Avenue.

Associations and Societies

A complete Directory of Electrical Associations is regularly printed in the first issue of each month on the next to last text page.

Pittsburgh Section, Illuminating Engineering Society.—Prof. A. J. Rowland of Drexel Institute addressed the Pittsburgh Section of the Illuminating Engineering Society on March 30. The subject of his talk was "Elementary Lighting."

New York Electrical Society.—On March 28 Rear Admiral Robert E. Peary addressed the New York Electrical Society on "Air Power for the United States," Rear Admiral Bradley A. Fiske spoke on "The Mind of the Navy," and Major-General Leonard Wood spoke on "The Army of the United States."

Cleveland Section, A. I. E. E.—Two very instructive meetings of the Cleveland Section of the American Institute of Electrical Engineers were held during February and March. On Feb. 26 H. L. Wallau, electrical engineer of the Cleveland Electric Illuminating Company, contributed a very interesting paper on "The Central Station's Share in Industrial Development." On March 19 R. H. Rogers of the General Electric Company gave an illustrated lecture on "Electric Freight Handling in Terminals."

Electrical Men Hear Army Needs.—Major George R. Spalding addressed the Jovian League of Louisville, Ky., on March 12 at the Hotel Henry Watterson, and told the members of the work they could do in an electrical way in the general scheme of preparedness, at the same time promoting their own interests and the interests of the country in times of peace. He told of the work electrical engineers are doing in the European armies, and said that this work is identical with that done in times of peace, except that it is done under greater pressure because of the necessity for haste.

St. Louis Jovian League Meeting Under Auspices of Wagner Electric Company.—The March 20 luncheon meeting of the St. Louis Jovian League of Electrical Interests was held under the auspices of the Wagner Electric & Manufacturing Company at the Mercantile Club. Walter Robbins, vice-president of the Wagner Electric, presided. V. A. Finn, consulting engineer of the company, who has spent twenty-nine seasons climbing and exploring the Alps, delivered an illustrated lecture entitled "Experiences in Climbing Above the Skyline." At a meeting of the executive committee on the evening of March 20 a recommendation to apply for a Jovian charter was approved. Accordingly a committee was appointed to draft a new charter. After it is completed the proposal will be submitted to the members for approval.

Beaver County Light Company Section of the N. E. L. A.—H. H. Swaney was the principal speaker at a banquet held under the auspices of the Beaver County Light Company Section of the N. E. L. A. on March 7.

Schenectady Meeting of the A. I. E. E.—The three hundred and thirty-first meeting of the American Institute of Electrical Engineers will be held in Schenectady, N. Y., April 13. The Institute headquarters during the meeting will be in the Edison Club, 60 Washington Avenue. The meeting will be under the auspices of the standards committee. A paper on "Temperature Corrections" will be presented by V. M. Montsinger of the General Electric Company. Four other papers bearing on allied subjects will be presented for discussion. They are as follows: "Temperature Distribution in Electrical Machinery," by B. G. Lamme; "Rational Temperature Guarantees for Large Alternating-Current Generators," by F. D. Newbury; "Internal Temperatures of Alternating-Current Generators," by Ralph Kelly, and "Electrical Machinery Tests and Specifications Based on Modern Standards," by H. M. Hobart.

Public Relations Discussed at Banquet Concluding O. E. L. A. Meeting.—More than 400 persons were present at a banquet which closed the convention of the committee on new-business co-operation of the Ohio Electric Light Association. Charles S. Hall, president of the Dayton Jovian League, presided as chairman, and D. L. Gaskill, president of the Greenville Electric Light & Power Company, acted as toastmaster. After-dinner speeches were made by H. M. Waite, city manager of Dayton; W. W. Freeman, president of the Union Gas & Electric Company, Cincinnati; C. F. Kettering, vice-president of the Domestic Engineering Company, and F. R. Coates, president of the Toledo Railway & Light Company. W. W. Freeman, speaking on "The Relation of the Public Utilities to the Public," said the relation should be for the benefit of mutual interests. For example, the Dayton Power & Light Company is not primarily to make dollars for the stockholders, but rather to give the people the service they require. It is to the interest of the public that a public utility be prosperous, for if it be otherwise, it cannot give the character of service a community requires. At the same time, he maintained, public utility companies should have an incentive to render the most efficient and valuable public service. C. F. Kettering, speaking on "Future Applications of Electricity," said among other things that future applications will depend upon what the public demand. The importance of courtesy in telephone communication was emphasized by F. R. Coates, who spoke on "The Public Be Pleased." Conditions are changing and the public has begun to view public utilities in a different light. The change was attributed to the manner in which public utilities are treating the public. The speaker quoted ten commandments by which, he maintained, every public utility should be governed.

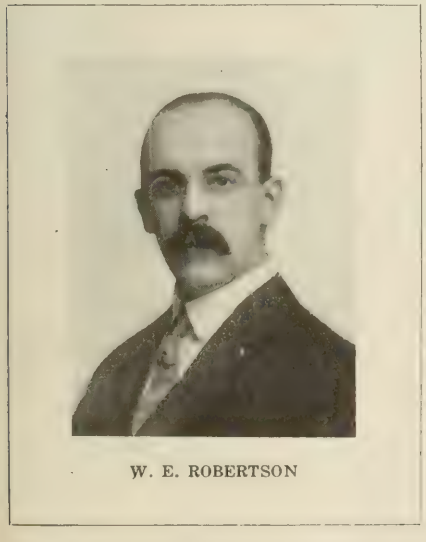
Men of the Industry

Changes in Personnel and Position—Biographical Notes

George T. Fisher has resigned from his position as commercial manager of the Cumberland County Power & Light Company, Portland, Me., to enter business in New York City.

C. W. Forbrich, Western manager of the *Electrical Review and Western Electrician* since 1908, has resigned his position to enter the advertising field on his own account, a plan which he has been maturing for some time. Mr. Forbrich, in point of service, is probably the oldest electrical newspaper advertising man, having been in the business since March, 1888. He began as office boy with the *Western Electrician,* and was secretary and treasurer of that publication for a number of years prior to its consolidation with the *Electrical Review* in 1908. Together with J. H. Burton, he has formed the Forbrich-Burton Advertising Service, Inc., Monadnock Block, Chicago, the object of which will be to give selling co-operation, to place trade paper and magazine advertising, and to prepare advertising literature.

W. E. Robertson of Buffalo, N. Y., has been elected chairman of the Atlantic Division of the Electric Supply Jobbers' Association. Mr. Robertson was born in South Carolina in 1874. He entered the electrical business in 1898 with his brother, James D. Robertson, and in the following year became a partner in the firm of Robertson Electric Construction Company. While engaged in business he found time to study law, being graduated from the Buffalo Law School in 1900 with the degree of Bachelor of Laws. He remained, however, in the electrical industry, and is now president of the Republic Electric Company, general manager of the Robertson-Cataract Electric Company, and vice-president and general manager of the Robertson Electric Construction Company. He has always been active in electrical association work, and was the sixth Jupiter of the Jovian Order. In addition, he is vice-president of the



W. E. ROBERTSON

Society for Electrical Development, of which he was one of the founders. Mr. Robertson has also taken a prominent part in the civic affairs of the city of Buffalo, having served for a time as the president of the Buffalo Chamber of Commerce.

F. H. Mugg, industrial engineer with the Enid (Okla.) Electric & Gas Company, has been promoted to a similar position with the San Diego (Cal.) Consolidated Gas & Electric Company.

H. L. Draper, for some time assistant commercial manager of the Birmingham (Ala.) Railway, Light & Power Company, has been appointed commercial manager to succeed H. M. Kohn, who resigned to enter business for himself.

A. V. S. Lindsley, formerly with the Syracuse Lighting Company, is now connected with the Northern Indiana Gas & Electric Company at the main office, Hammond, Ind. Both companies are operated by the United Gas Improvement Company of Philadelphia.

E. R. Treverton, for the past three years a member of the editorial staff of the *Lighting Journal,* recently amalgamated with the ELECTRICAL WORLD and ELECTRICAL MERCHANDISING, has become connected with Holophone Glass Company, Inc., New York City. Mr. Treverton was graduated from Lehigh University in 1907. After getting a fundamental training in central station work with the cadet school in the Doherty organization of Denver, he joined the engineering department of the Westinghouse Electric & Manufacturing Company at East Pittsburgh, designing and engineering for its various shops the first really scientific industrial lighting in this country. From 1910 for three years he was with the illuminating engineering department of the Westinghouse Lamp Company, later becoming chief engineer of that department.

E. Burt Fenton, for the last two years publicity manager of W. S. Barstow & Company, Inc., has severed his connection with that organization. Mr. Fenton became connected with the Barstow interests through the Sandusky (O.) Gas & Electric Company, for which he conducted the publicity work of two municipal ownership campaigns, and prepared a series of good-will advertising articles which attracted wide attention. He is the author of "Snuggling Up to John Smith," dealing with public relations in general, and "The Missing Link," dealing with the question of municipal ownership, both of which were read before the annual conventions of the Ohio Electric Light Association, one in 1916 and the other in 1915. They attracted considerable favorable attention from public utility operators throughout the country. Mr. Fenton was formerly connected with newspapers in Pittsburgh, Pa., Columbus, Toledo and Zanesville, Ohio, and was for some years editor of the Sandusky Star-Journal.

W. S. Mendenhall, commercial manager of the Grays Harbor Railway & Light Company, Aberdeen, Wash., has resigned his position to go into partnership with the Welch-Richards Printing & Bookbinding Company of Aberdeen. Mr. Mendenhall has been connected with the Grays Harbor Company for seven and one-half years, having begun as stock clerk and worked his way up to be commercial manager.

Sydney O. Swenson has resigned as a member of the engineering offices of Putnam A. Bates, consulting engineer, New York. Mr. Swenson was assistant electrical engineer of the Detroit River tunnel electrification from 1907 to 1911 and from 1911 to 1916 was electrical engineer of the Kansas City Terminal Railway Company, in charge of all electrical work in connection with the terminal improvements made at Kansas City. Before that he was engaged for two and one-half years on the New York terminal electrification of the New York Central & Hudson River Railroad Company. From 1899, when he was graduated as electrical engineer from the University of Illinois, to 1905 he was a member of the engineering department of the Commonwealth Edison Company, Chicago.

Fred A. Otto, who has resigned his position as superintendent of the electrical department of the St. Paul (Minn.) Gas Light Company and general superintendent of the St. Croix Power Company to become general manager of the Minnesota Gas & Electric Company at Albert Lea, Minn., is president-elect of the Minnesota Electrical Association. Mr. Otto was graduated from the University of Minnesota with the class of 1904, and subsequent to that time took up apprenticeship work with the Westinghouse Electric & Manufacturing Company at East Pittsburgh, Pa. Later he returned to St. Paul, where he has been for thirteen years continuously employed by



FRED A. OTTO

the St. Paul Gas Light Company. For the last four years he has been secretary of the Minnesota Electrical Association. He is a member of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers and the N. E. L. A.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

EFFECT OF WAR ON MARKET FOR ELECTRICAL GOODS

Small Possibility of Any Decrease in Manufacturing Activity Provided Sufficient Labor Can Be Procured

A wide divergence of opinion exists concerning the probable effect of war on the electrical manufacturing industry of the United States. The opinions, however, are frankly admitted to be but guesses, and are based on belief and supposition rather than fact. One thing, however, seems certain, and that one thing is that the factories will show no signs of decreased activity for some time, provided always, of course, that a sufficient amount of labor can be had. Factories are now working at capacity, and sufficient unfilled orders are on the books to provide capacity activity for practically the remainder of the year without receiving another order. However, the government, in the event of war, will be in the market for quantities of electrical supplies, and will add to the already congested condition of the factories. Government orders, of course, will be given preference, and will be rushed through the shops with all possible speed. Other consumers can expect, therefore, longer deliveries in proportion to the amount of factory space that will be taken for government manufactures. There are, however, many new factories, shops, and additions to present production facilities under construction, the work on which will probably be rushed to a more speedy completion should the congestion assume very large proportions.

A feeling exists that the country has practically reached its electrically equipped peak, and that any great war activity on the part of the United States would not necessarily mean any great added demand for motors and appurtenances. There is a feeling that munition factories, being about through with European contracts, will not need additional equipment to take on work for the home government, that other factories which have been fed by the munition factories are in the same position, and that the motors and generators now in the process of manufacture, together with those in the hands of second-hand dealers, will be sufficient to handle the load placed on them. There is no doubt that factories are equipped sufficiently to handle the demands of the government, but it must not be lost sight of that this demand, if it comes, will be superimposed upon a demand already in excess of manufacturing capacity. Consequently there seems some ground for the belief that an added amount of factory space will be built, and that this will require equipment. Because the government will have first call on production equipment is no reason to believe that other customers will have to wait indefinitely.

Wire and cable manufacturers have sufficient orders on hand to keep them going for some time, but there is a feeling that in the event of war the government contracts might be offset by a decrease in new construction and wiring. There is excellent ground for belief that this might be the result as regards dwelling, church, hotel, theater, office building and such construction, but utility, municipal, mine and industrial construction is much less apt to be put off—in the case of the utilities because of necessity owing to increasing load, in that of the municipalities because they are less affected by such conditions, and in that of the other kinds of construction for reasons given above.

In addition to the manufacture of electrical goods it must be remembered that electrical manufacturers are equipped to handle munitions contracts. Most of the large manufacturers have been engaged in turning out great quantities of shells and guns for Great Britain, France and Russia. It is, therefore, practically certain that electrical manufacturers will be called upon to furnish the government with shells as soon as plans are definitely made. In fact, it is even now reported that certain large contracts for shells have already been let to be fabricated in some of the more important electrical factories.

There is considerable apprehension regarding labor in the event of active war. The labor market, while easier than it was some months ago, still shows a deficit in the number of men available as compared with those needed. Planting time is coming on and will take men from the cities. Thus, before recruiting begins, industry finds itself short of help, with an added demand staring it in the face, for the more the men that go into the army the greater will be the government's needs. Of course, war will cause some readjustments. Many who are now employed will find that in the event of war their jobs will cease. But in the great factories and mills are men trained to their jobs, and if these industries are to turn out a maximum of product some provision will undoubtedly have to be made whereby labor in sufficient quantity and of satisfactory quality shall be furnished. The government, it is known, has made some arrangements in this direction. Should a large army leave the country there is no doubt that women will enter industries in greater numbers.

During the past two weeks there has been a perceptible let-up in trade. Contracts are being deferred, although not in large quantities. For the most part, however, the events preliminary to a declaration of war have had but little effect on the market. It is even probable that some of the noticed slowing up was due to other than war causes, possibly to seasonal conditions.

SHIPBUILDING USES QUANTITIES OF ELECTRICAL GOODS

Government Program for Construction of Warships Will Call for a Large Volume of Motors, Generators, Batteries, Etc.

At no other time in the history of the United States has there been so much activity in shipbuilding as there is at the present time. All along the Atlantic Coast shipyards are busy and have more work than can be handled. In the Northwest the building of ships for Pacific service has been so great as to change the entire complexion of the general business situation of that section. Prior to this activity in the shipyards the Northwest was suffering a general business and financial depression. Owing to the tremendous increase, however, in shipbuilding, the lumber, metal and labor markets have strengthened, and now the Northwest is comparatively prosperous.

The effect of this activity has been of no little consequence to the electrical trade. It has meant the purchase of large quantities of electrical supplies of practically every kind. Wire, cable, fittings, lamps, sockets, wireless apparatus, motors, batteries, generators and other electrical equipment are finding their way into the new vessels in quantities.

Of greatest importance probably in the matter of money spent are the new war vessels now being built or contracted for by the government. The use of motors for hoisting, refrigeration and in some cases for propulsion; the use of electricity for cooking; the use of storage batteries particularly for submarines, of which large quantities are being and will be built—these, together with all the necessary apparatus and appliances to go with them, constitute one of the large single sources for the sale of electrical supplies.

The naval program of the government, which calls for the building of many more ships in a short time, will un-

doubtedly mean an additional demand upon electrical manufacturers in this country for equipment. Manufacturers are now working at capacity, but the government contracts will of course have to take precedence over private contracts no matter for how long a time they may have been on the books of the producers.

EXPORTS OF ELECTRICAL GOODS ARE FALLING OFF

German Submarine Activity Holds Up Sailing of a Large Number of Ships, Causing Freight Embargoes

While no figures are yet available, it is generally understood that the exports of electrical goods since the first of February when the new U-boat order went into effect have been considerably less than during the previous months. Large quantities of material in this country await shipment abroad, but through fear of submarines vessels have been held up and a much smaller volume of goods has left the ports of the United States. The European trade, of course, is the only one affected by the submarine activity. Since the war began, however, Europe—particularly England—has been one of the large markets for American electrical goods.

The congestion of goods for export of every description at Atlantic ports has grown to such proportions that the railroads have had to place embargoes on goods coming through from the West for export. This has caused large quantities of goods to be held up at the shops although ready for shipment.

Delays are now so frequent and of such long duration that some American manufacturers have found it necessary to make a change in their method of billing foreign customers. Where formerly customers were billed f.a.s. New York, cash on receipt of shipping papers, they are now billed f.o.b. factory, cash on receipt of bill of lading. In this way the manufacturer places on the customer the burden of financing the goods after they are manufactured.

THE INTERNATIONAL COMMERCIAL OUTLOOK

Statistics Show Little Likelihood of Industrial War After Peace Has Been Declared—Loss of Ships of Little Consequence

To the electrical manufacturer in the United States the commercial outlook for international trade following the war has a double significance—first, in the market for electrical goods abroad, and second, in the market in this country for electrical goods brought about by foreign trade. American exports have been larger since the war than they ever were before the war, but it is equally true that no small part of the exports from the United States was purchased for either direct or indirect war purposes. To neutral countries, however, there is unmistakable evidence that the trade with the United States has grown considerably. Furthermore, it is undoubtedly true that the exports of goods having no connection with the war to Europe have also increased. The question has naturally arisen, therefore, as to whether American manufacturers will maintain the position in the foreign market now held and also in what condition the foreign market will be, first, to buy and, second, to produce goods.

That Europe will need goods there is no doubt. Goods will be needed not only for the rehabilitation of devastated areas but also for the regular commercial peaceful pursuits. There seems little reason to believe that nations now at war with each other will prolong the struggle after peace has been declared into an industrial war. Statistics show that after all great struggles trade between the warring nations was greater than before the struggle. Furthermore, there is no good reason to believe that European buyers are going to buy anywhere but in the most favorable markets. Price, quality, delivery, etc., are the factors which will influence trade after the war just as they did before the war. It is evident, therefore, that there is little occasion for American manufacturers to believe that after the war German markets will be closed to English and French goods and that English, French and Russian markets will be closed to German and Austrian goods.

Furthermore, statistics show that so far as labor is concerned Europe is in a better position to-day, and will be after the war, to make progress industrially than before the war. The net increase in male population of the countries now at war is greater than the number of males killed or maimed to an extent to be unfit for industrialism. This is in addition to the number of women who will undoubtedly seek to retain employment in industrial establishments after the war and in addition to the great developments in manufacture which have been brought about in Europe since the war began.

There is little likelihood that the destruction of vessels will in any way curtail foreign trade after the war is over, for according to the latest estimate only about 10 per cent of the world's tonnage has been destroyed so far, while the production of new ships in the meantime has been fully half as much as the tonnage of those destroyed, so that the net loss it may be assumed is not more than 5 per cent. With this loss distributed all over the world, it is not likely to prove of much account in post-war trade.

THE COPPER MARKET MUCH EASIER IN TONE

Weather Conditions Accountable for Much Freer Offering at Slightly Lower Prices Than Last Week

During the last week the tone of the copper market has become much easier, and offerings are being made much more freely. The warm spring weather has probably been the influencing factor. Many large buyers are now willing to release a part of their stocks with the feeling that deliveries are getting better, and that better weather will bring better transportation facilities and better mining conditions. The stocks now being offered are those that were kept for emergency or reserve purposes.

Prices are down a cent or so, but should any active buying develop they will probably take a sharp rise. The sale by producers of 45,000,000 lb. of copper to the government at around 16 2/3 cents is not expected to have much, if any, effect on the market because of the small amount in proportion to the total tonnage produced. There is, however, a distinct feeling that copper producers will exert whatever influence they have to prevent any great rise in the price of copper, because of the scandal that would undoubtedly arise.

Prices quoted on Tuesday of this week for electrolytic were as follows: March, 34.75 cents; April, 34.5 cents; second quarter, 34 cents; third quarter, 30.5 cents; and fourth quarter, 29.5 cents.

NEW YORK METAL MARKET PRICES

	March 20 — Selling Prices Bid	Asked	March 27 — Selling Prices Bid	Asked
Copper	£ s d		£ s d	
London, standard spot	136 0 0		136 0 0	
Prime Lake	35.00 to 35.50†		35.00 to 35.50†	
Electrolytic	35.50 to 36.00†		34.50 to 35.00†	
Casting	31.25 to 31.75†		31.25 to 31.50†	
Copper wire base	40.00 to 42.00†		39.00 to 41.00†	
Lead	9 00		9.00	
Nickel	50.00		50.00	
Sheet zinc, f.o.b. smelter	21.00		21.00	
Spelter, spot	10.55 to 10.80		10.80 to 10.92½	
Tin, straits	55.50		56.00	
Aluminum, 98 to 99 per cent	54.00 to 56.00		55.00 to 57.00	

OLD METALS

Heavy copper and wire	28.50 to 29.50†	29.00 to 30.00
Brass, heavy	17.50 to 18.00†	17.00 to 17.50
Brass, light	14.25 to 14.50†	13.00 to 13.50
Lead, heavy	7.75 to 8.00†	7.25 to 7.50
Zinc, scrap	7.50 to 7.75†	7.50 to 7.75

†Nominal.

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Electric Hand Lantern

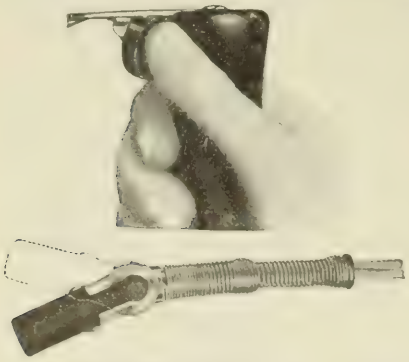
An alkaline storage battery is employed to operate the electric hand lantern shown in the accompanying illustration. The bulb support is designed so that if the lens is broken the lamp bulb will be knocked off its supports and the circuit broken before the filament can be exposed, thus preventing an explosion in case the lamp is being used where inflammable gases exist. The glass which is used is very thick and is annealed so that it cannot be easily broken. Enough electrolyte can be prepared from 1 lb. of the battery compound to operate one lantern constantly for four months. Soft rubber cover gaskets are used, which, while permitting the gases to escape, prevent the leakage of solution, should the lantern be overturned. The lamp is made by the Portable Electric Safety Light Company, 10 Johnson Street, Newark, N. J.



PORTABLE ELECTRIC SAFETY LANTERN

Plug for Electric Iron

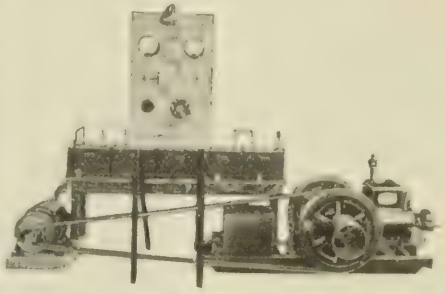
A hinged cord-protector switch plug which, the manufacturer claims, prevents cord breakage has been developed by the Hotpoint Electric Heating Company of Ontario, Cal. The cord passes through a double spiral spring, the end of which is securely fastened to a slide hinge joint provided on the upper part of a metal plug cap. The spiral spring supports the cord and prevents sharp bends or kinks which usually occur in the cord near the plug. A composition plug bar is provided as an anchor for the cord. Slotted contact springs are used to give four-point contact. Another improvement which this company announces is the thumb rest. Placing the thumb on this rest at intervals during ironing relieves the wrist and makes ironing easier, it is claimed.



CORD-PROTECTOR SWITCH PLUG AND THUMB-REST FOR IRONS

Electric Lighting Plant

The Main Electric Manufacturing Company of Pittsburgh, Pa., has brought out a new 25-lamp electric lighting outfit which includes a gasoline-engine operated flywheel-type generator rated at 40 volts and 15 amp., a thick-plate battery rated at 40 amp.-hr. and a switchboard equipped with a voltmeter, ammeter, automatic cut-out, field-regulating rheostat, pilot lamp, etc. Both magneto and battery ignition are furnished for the engine. Extra heavy flywheels with crown faces are employed to permit using belt drive. One feature, to which attention is called by the manufacturer, is the use of an inclosed intake valve which permits this type of engine to pass fire underwriters' inspection.



24-LAMP ELECTRIC LIGHTING OUTFIT

Interchangeable Mogul Sockets

The Arrow Electric Company has developed a complete line of porcelain mogul sockets, made up of interchangeable units, including five bodies and nine caps. All screw hole spacings are the same (1 5/16 in.), and all attaching screws are the same length and size (11/16 by 10/32 in.). The attaching screws have pointed ends, which facilitate assembling. The fourteen interchangeable parts make possible forty-five different combinations, which cover all the present types assembled and a number of additional types. With these arrangements it is possible to meet practically any requirement made in actual practice, and the number of pieces required in stock has been reduced from three to one and the investment from seven to one. The parts are packed with five bodies and ten caps to the carton. Standard packages contain fifty units in all cases.



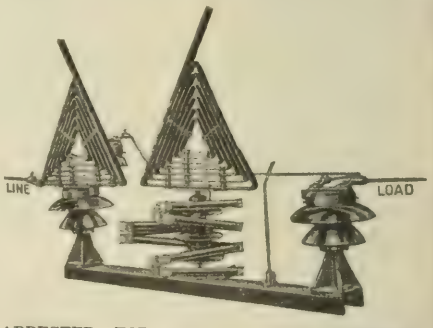
FIVE MOGUL SOCKET BODIES INTERCHANGEABLE WITH NINE CAPS

Low-Voltage Gas-Filled Lamps

The Lux Manufacturing Company of Hoboken, N. J., has recently developed 27 to 32-volt gas-filled lamps, which it is manufacturing in 25, 50, 75, 100, 150 and 200-watt sizes. The maker states that tests show these lamps are very sturdy and have high efficiency. It is said that a number of railroads are considering equipping coaches with this type of lamp.

Lightning Arresters for Transmission Lines

Two lightning arresters of the Burke series horn-gap type using a triangle choke coil have been placed on the market by the Railway & Industrial Engineering Company of Pittsburgh, Pa. The arrester shown in the accompanying illustration is intended for use on transmission systems where large-magnitude surges occur. A reactance coil connected in series with a Koppat resistance is provided in the ground circuit. An auxiliary gap shunts both



ARRESTER FOR USE ON TRANSMISSION SYSTEMS WHERE HIGH-CAPACITY SURGES ARE EXPERIENCED

the reactance coil and the resistance, thus giving a straight path to ground for surges that cannot be discharged quickly enough through the reactance coil and resistance. The reactance coil aids in limiting the rush of power to ground or between phases in case two or more arresters discharge at the same time, and also relieves the resistance of the heavy duty by smoothing out the surge before it reaches the resistance. It is claimed by the manufacturers that abnormal surges can be instantly and effectively relieved from the line without causing any noticeable disturbance of the transmission system.

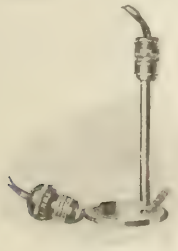
The other arrester which was recently developed contains a resistance that is shunted by an auxiliary horn gap connected direct to ground. When a discharge occurs across the auxiliary gap, the arc breaks almost instantly, thus inserting the resistance in the ground circuit in series with the power arc which is broken by the main horn gap.

Outlet-Box Receptacle

Harvey Hubbell, Inc., of Bridgeport, Conn., has redesigned its No. 6103 outlet-box receptacle, incorporating a subbase which is intended to protect the wires from contact with the box or fitting. Since the wire passages are free from sharp edges or corners, wear on the wire covering and the possibility of accidental short-circuits through the contact of exposed wire with the fitting are minimized. The receptacle is designed for cover mounting, the cover being securely attached between the upper and center porcelain by a single center screw. A leather gasket is furnished between the two pieces of porcelain to allow for variations in separation and assure the rigidity of the cover. The slots are of the standard 1-T type with which all Hubbell 10-amp. caps and lamp receptacles are interchangeable.

Immersion Heater

The heating unit of the immersion heater shown in the accompanying illustration is permanently embedded in cement under heavy pressure, the use of mica being entirely avoided. The heater is neat in appearance, has a round 3-in. base and weighs 11 oz. with plug and



DISK-BASE IMMERSION HEATER

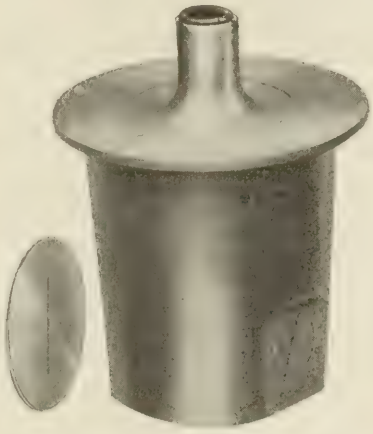
cord. The handle is always cool, it is claimed. Each heater is equipped with a 6-ft. detachable cord and two-piece connection plug. The Sterling Corporation of Cleveland, Ohio, is the manufacturer of this heater.

Washing and Wringing Machines

The Brokaw-Eden Manufacturing Company of Alton, Ill., has developed an electric washing and wringing machine which has the following features: The machine has an automatic stop button, which when pressed stops the cylinder in the correct position for opening. A slight pull on the button starts the cylinder. Every moving part of the machine is covered, thereby preventing accidents and making it impossible for clothing to catch on any moving parts. When the cylinder doors are open they engage with the sides of the tub in such a manner as to prevent the clothes from dropping down under the cylinder. Another feature of construction is a window with a cross bar to indicate the proper water level. The machine also has a wringer control lever, sanitary all-zinc cylinder that reverses automatically, and a quick-acting drain cock. A 1/6 hp. Robbins & Meyers motor with automatic release is used.

Non-Adjustable Floor Box

Shown herewith is a non-adjustable floor box which the manufacturer claims can be installed, inspected and repaired with very little labor expense.

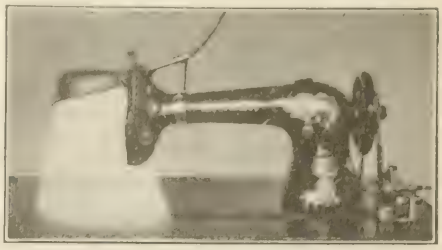


NON-ADJUSTABLE FLOOR BOX WITH RECEPTACLE AND PLUG

The box is made by W. R. Ostrander & Company of New York City. With this box it is possible to make a neat job, since it is only necessary to slit the seam of the carpet or rug to receive nozzle of the box. When the box is to be set in the floor, a hole can be counterbored therein with an ordinary expansion bit to accommodate the floor plate and another smaller hole bored through the flooring to receive the body of the box. By inserting the box with the floor plate removed screws can be driven horizontally through the iron body of the box into the surrounding boards. Thus any strains on the box will be carried by the body and not by the floor plate. The box is 2⅞ in. in diameter, has four outlets, and is drilled and tapped for ½-in. conduit. There are two outlets at the side and two at the bottom.

Sewing-Machine Lamp

Adjustable lighting fixtures that permit applying light directly on work which is being done on sewing machines have been brought out by the Keith Manufacturing Company of Clinton,

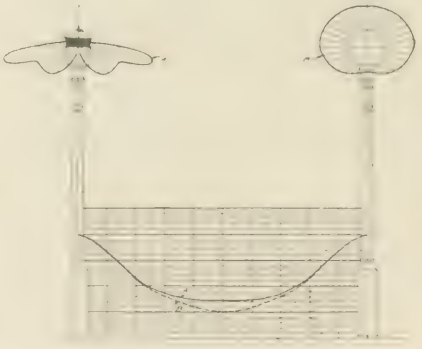


LIGHTING FIXTURE USED ON SEWING MACHINE

N. Y. The lamp can be placed instantly in any desired position or as quickly moved out of the way. It is claimed that by the use of these fixtures the efficiency of the operator can be increased and that the eyesight troubles which are so often caused by poor lighting can be very greatly minimized.

Street-Lighting Units

An artistic street-lighting fixture which contains a prismatic reflector for collecting the rays which extend above a horizontal plane through the lamp and re-directing them slightly downward to illuminate the street surfaces has been developed by the General Electric Company of Schenectady, N. Y. The poles should be arranged alternately on opposite sides of the street. The light from each unit is thrown toward the next, so that there is increased illumination of the roadway and sidewalk. In the accompanying illustration are curves showing the average amount of light distributed at any point between light sources. For comparison data were plotted for a series of the new-type units and an equal number of the old round-globe type. The units of light and distance are represented by horizontal and vertical lines respectively. The former read upward. It



ILLUMINATION AT DIFFERENT DISTANCES

may be noticed that the solid line representing the lighting power of the new units is above the other almost throughout its length, thus indicating the greater illumination at various distances.

Trade Notes

THE ALLMUR MANUFACTURING COMPANY has changed its address from Evansville, Wis., to Marion, Ind.

FERDINAND W. ROEBLING, secretary and treasurer of John A. Roebling's Sons Company, Trenton, N. J., died March 16.

HEBER COOPER HEWITT has removed from Madison Square Garden Tower, Twenty-sixth Street, to 15 East Thirty-third Street, New York City.

THE JEFFERSON ELECTRIC MANUFACTURING COMPANY of Chicago announces that Thomas C. Hawkins is affiliated with the Sales force.

THE TERRY STEAM TURBINE COMPANY, Hartford, Conn., announces that L. S. Shaw is now handling the company's interests in Detroit, Mich., and that Victor L. Sondstrom is now connected with the Philadelphia office.

THE DIXIE DEVICE CORPORATION of 170 Liberty Street, New York City, has purchased the entire vibrator business of the Rubes Electric Devices, Brooklyn, N. Y., and will continue to market the same electro-magnetic vibrator.

THE CRESCENT INSULATED WIRE & CABLE COMPANY, Trenton, N. J., with headquarters at 240 West Fifty-fifth Street, New York, has increased its capital from $2,000,000 to $4,000,000 for expansion. General C. Edward Murray is president and E. T. Phillips secretary.

THE METROPOLITAN ELECTRICAL SUPPLY COMPANY, now at 76 West Thirty-sixth Street, New York City, announces that about April 1 it will occupy its new quarters at 124-36 West Thirty-sixth Street. The company has built special showrooms for the display of lighting fixtures.

EDWIN G. HATCH, consulting engineer, New York City, is arranging to have a large quantity of nickel-steel turbine buckets manufactured in this country for the South African plant of the Victoria Falls & Transvaal Power Company, Ltd. These buckets were originally supplied by the Allgemeine Elektricitäts Gesellschaft of Germany.

BARBER-JAMES-DWINNELL ELECTRIC & MANUFACTURING COMPANY will maintain offices both at Topeka, Kan., where the company's new factory is situated, and at the old address, 600 East Fifteenth Street, Kansas City, Mo. Sales force will be kept at Kansas City and a stock of apparatus and supplies carried at that place.

THE WESTINGHOUSE LAMP COMPANY has closed its option on a factory site in Milwaukee, Wis., which it has occupied under lease from Nathan Pereles, Jr., since 1911. The plant has an output of around 1,000,000 lamps per month. Four hundred men are employed. The company, it is understood, is planning the erection of a big addition.

THE COMBUSTION ENGINEERING CORPORATION announces that Walter H. Wood, mechanical engineer, has become associated with its staff of combustion experts as engineer of tests and research. G. E. Learnard, vice-president and general manager of the company, states that over 1,500,000 hp. is now being developed with its type "E" stokers, in addition to which considerably over 500,000 hp. of its Coxe stokers for anthracite coal is in use.

THE FRANK H. STEWART ELECTRIC COMPANY, Philadelphia, Pa., has made some changes in its board of directors. The directors now are Frank H. Stewart, president; W. Burnett Stewart, vice-president; Frank E. Hacker, secretary; Lewis M. Creighton, treasurer; William T. Walker, general manager; Samuel Bordman, sales manager; J. Bayard Kelley, George H. Carnall, C. Bertran Vanderslice, J. Elmer Barton, Raymond J. Courtenay and Edward D. Saint.

H. W. EVES, who for the last two years has been assistant manager of the Chicago office of the Hamilton-Beach Manufacturing Company and secretary of the Consolidated Manufacturers' Company, has resigned to become Chicago manager of the Arnold Electric Company of Racine, Wis. In his new quarters at 923 Marquette Building Mr. Eves will also handle the account of the Electric Controller Company of Indianapolis and the Sterling Corporation of Cleveland.

W. S. RUGG, formerly district manager of the New York office of the Westinghouse Electric & Manufacturing Company, has been appointed successor to Charles S. Cook as manager of the railway department of the company, with headquarters at East Pittsburgh, Pa. E. D. Kilburn, manager of the power department of the company's New York office, succeeds Mr. Rugg, and L. F. Dillon, formerly assistant to the manager of the railway and lighting department at East Pittsburgh, succeeds Mr. Kilburn as manager of the power department of the New York office.

THE ASTRA ELECTRIC NOVELTY WORKS, Inc., 45 East Seventeenth Street, New York City, have been formed to manufacture dry batteries for flashlights, for dispersal both in America and in foreign countries. The war has caused a great demand for these batteries. The factory at 152-156 Wooster Street, New York, is equipped with modern machinery and is prepared to turn out goods at short notice. The laboratory connected with the factory, the company states, has every up-to-date device for testing and experimental purposes and orders for any quantity can be handled for early delivery. Territorial agencies are being allotted.

New Incorporations

THE CARL ELECTRIC CONSTRUCTION COMPANY of Akron, Ohio, has been incorporated with a capital stock of $10,000 by George E. Carle.

THE ELECTRIC EQUIPMENT COMPANY of Nashville, Tenn., has been incorporated with a capital stock of $10,000 by J. T. Shannon, J. H. Conn and others.

THE MANCHESTER (TENN.) ELECTRIC LIGHT & POWER COMPANY has been chartered with a capital stock of $5,000 by T. H. Webb, J. B. Wall and others.

WALKER TOWNSHIP ELECTRIC COMPANY of Bellefonte, Pa., has been granted a charter, with a capital stock of $5,000, to operate in Juniata County. A. J. Musser of Clearfield, Pa., is treasurer.

THE MILFORD TOWNSHIP ELECTRIC COMPANY of Bellefonte, Pa., has been chartered, with a capital stock of $5,000, to operate in Juniata County. A. J. Musser of Clearfield, Pa., is treasurer.

THE THOMPSONTOWN ELECTRIC Company of Bellefonte, Pa., has been incorporated, with a capital stock of $5,000, to operate in Juniata County. A. J. Musser of Clearfield, Pa., is treasurer.

THE DELAWARE TOWNSHIP ELECTRIC COMPANY of Bellefonte, Pa., has been incorporated, with a capital stock of $5,000, to operate in Juniata County. A. J. Musser of Clearfield is treasurer.

THE MILLER TOWNSHIP ELECTRIC COMPANY of Bellefonte, Pa., has been granted a charter with a capital stock of $5,000 to supply electricity in Perry County. A. J. Musser of Clearfield, Pa., is treasurer.

LAWTON & MONK, INC., of Syracuse, N. Y., have filed articles of incorporation with a capital stock of $25,000 to deal in auto batteries, electrical auto supplies, etc. The incorporators are: L. S. Chapman, W. G. Monk and E. E. Lawton of Syracuse, N. Y.

THE TIP-TOP LIGHTING FIXTURE COMPANY of Brooklyn, N. Y., has been incorporated with a capital stock of $5,000 to manufacture and deal in electric-lighting fixtures, etc., by P. G. Widockler, H. Hoffman and L. Sandak, 535 Graham Avenue, Brooklyn, N. Y.

THE LEISURE ELECTRIC COMPANY of Elwood, Ind., has been incorporated, with a capital stock of $10,000, to supply electricity to the farmers in Duckcreek Township. The incorporators are: B. F. Leisure, O. E. Leisure, I. W. Carr, Harry Sells, D. Wordwell and Arthur R. Hiatt.

PIERCE & SKOGMARK, INC., have filed articles of incorporation with a capital stock of $50,000 to do a general consulting engineering business, electricians, contractors, chemists, etc. The incorporators are: C. U. North, N. Skogmark and F. E. Pierce, 35 Nassau Street, New York, N. Y.

THE CONSUMERS' LIGHT & POWER COMPANY of Ringling, Okla., has been incorporated with a capital stock of $1,000,000 for the purpose of acquiring electric and gas plants and ice factories in that vicinity. William H. Baehr of Chicago, Ill., and others are interested in the company.

THE KRICK ELECTRIC COMPANY of Sinking Spring, Pa., has been granted a charter, with a capital stock of $10,000, to supply electricity for lamps, heaters and motors in Spring Township. The incorporators are: William F. Krick, Dr. H. S. Dissler of Denver, and George J. Root of Reamstown.

THOMPSON & BINGER, of New York, N. Y., have filed articles of incorporation, with a capital stock of $250,000, to do a general contracting, engineering business and electrical work. The incorporators are: E. M. Reufer, 248 Central Avenue, Brooklyn, E. M. James, 2 Rector Street, New York City, and A. R. May, 356 Hooper Street, Brooklyn, N. Y.

THE BLACK RIVER POWER COMPANY has been incorporated by Robert J. Bain, Edward A. Markley and Charles B. Bradley. The company is capitalized at $10,000 and proposes to build dams on the Black River at Hackleburg, in Morris County, and furnish electrical power and water power. The office of the company is located at 213 Washington Street, Jersey City, N. J.

MILWAUKEE ELECTRIC CRANE & MANUFACTURING COMPANY of Millbrook, N. Y., has been incorporated by A. E. Moore, 20 Arden Street; G. F. Jebbett, 120 Sherman Avenue, New York City, and F. H. Butchorn, 761 St. John's Place, Brooklyn, N. Y. The company is capitalized at $35,000 and proposes to manufacture electrical machinery and appliances, electric cranes, hoists, etc.; also mining coal, iron, steel, etc.

THE RAPID CONTROLLER CORPORATION of New York, N. Y., has been incorporated with a capital stock of $120,000 to do a general mechanical engineering business, deal in elevator dispatchers' time recording machines, clocks, etc.; also an electrical engineering business, dealing in apparatus for radio-activity. The incorporators are: P. Cooksey, 126 East Twenty-fourth Street, New York City; J. C. Myers, 122 Hicks Street, Brooklyn, N. Y., and L. Reid, 808 St. Nicholas Avenue, New York City.

Trade Publications

SOCKETS.—The Arrow Electric Company of Hartford, Conn., is distributing a leaflet descriptive of its Arrow E interchangeable Mogul sockets.

WASHING MACHINE.—The Easiest Way Manufacturing Company of Sandusky, Ohio, is distributing a folder descriptive of its "Easiest Way Home Washer."

CONDULETS.—The Crouse-Hinds Company of Syracuse, N. Y., is distributing bulletin No. 1000 D, descriptive of its safety-first ironclad switch condulets.

METAL COATING MATERIALS.—Hess & Son of Philadelphia, Pa., are distributing a bulletin descriptive of their "Epicassit" for tin, lead and zinc coatings.

LIGHTING FIXTURES.—The Keith Manufacturing Company of Clinton, N. Y., is distributing a leaflet descriptive of its adjustable light fixtures for sewing machines.

STORAGE BATTERIES.—The Electric Storage Battery Company of Philadelphia, Pa., is distributing bulletin No. 164, descriptive of its storage batteries for stationary and semi-portable types for railway signal service.

FANS.—The Sprague Electric Works of the General Electric Company, New York City, is distributing a bulletin descriptive of its direct-current and alternating-current fans.

REFLECTORS.—The National X-Ray Reflector Company of Chicago, Ill., is distributing a bulletin descriptive of its reflectors. The title of this bulletin is "The Magnets of Trade."

MOTORS.—The Sprague Electric Works of the General Electric Company of New York City is distributing bulletin No. 41514, descriptive of its varying-speed single-phase motors, type BSS.

WIRING APPLIANCES.—The Trumbull Electric Manufacturing Company of Plainville, Conn., is distributing a leaflet descriptive of its attachment plug, flush receptacle and side outlet current taps.

TANK BLOCK.—The Laclede-Christy Clay Products Company of St. Louis, Mo., is distributing a small card for wall mounting with the words, "The War 'Tank' Has Nothing on the Glass Tank in Efficiency."

METAL MOLDING.—The National Metal Molding Company of Pittsburgh, Pa., is distributing bulletin No. 151, descriptive of its non-metallic flexible conduit; bulletin No. 350, descriptive of its locknuts and bushings, and bulletin No. 50, descriptive of its rigid steel conduit.

SEW-MOTOR.—The Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., is distributing its campaign book (Small Motors No. 27) printed in two colors, which includes a complete description of all dealers' helps for its sew-motor. Included with the book is a requisition post card on which to order the various sales helps.

New England States

NEWPORT, VT.—Work will soon begin by the Newport Electric Light Company on the construction of a masonry dam, 600 ft. long and 20 ft. high, near Arnold's Mills, to cost approximately $40,000. About 1000 hp. will be developed.

BARNSTABLE, MASS.—Bids will be received by the Commissioners of Barnstable County, Barnstable, Mass., until April 3 for heating, electric wiring, pumping and water storage, refrigerating apparatus, plumbing and sewage disposal for the County of Barnstable Infirmary buildings in the village of Pocasset, town of Bourne. Separate bids to be submitted on each division of the work. Plans and specifications are on file in the office of James Purdon, architect, 8 Beacon Street, Boston, Mass.

BEVERLY, MASS.—The Beverly Gas & Electric Company has applied to the City Council for permission to place and maintain wires and underground conduits in Hale and Thissell Streets.

WORCESTER, MASS.—The Worcester Electric Light Company is contemplating the purchase of a 20,000-kw. turbine to be installed in the Webster Street plant, which will increase the output of the station to 55,000 kw.

HARTFORD, CONN.—The State Legislature has passed the bill amending the charter of the Housatonic Power Company of New Haven so that it may be taken over by the Rocky River Power Company, subject to the approval of the Public Utilities Commission, and the two consolidated under the name of the Connecticut Light & Power Company. The Rocky River Power Company owns four valuable water rights on the Housatonic River and another one on one of its tributaries. Under the proposed arrangement the company will have the advantage of the flow of the Housatonic River all the way to the Sound. The second advantage lies in the establishment of a steam power plant that will supplement the river during low water periods.

PUTNAM, CONN.—The Legislature has passed a bill authorizing the Putnam Light & Power Company to increase its capital stock to $100,000.

Middle Atlantic States

BINGHAMTON, N. Y.—The Binghamton Light, Heat & Power Company is building a new power plant at Johnson City. The equipment wil consist of two General Electric turbines, one 5000-kw. and one 3500-kw. and five 500-hp. Babcock & Wilcox boilers. The company has also under construction a 33,000-volt transmission line from the new plant to the proposed substation in Binghamton. P. A. Staples is manager.

GROTON, N. Y.—The proposal to sell the municipal electric-light plant to the Cayuga Power Company is under consideration.

LACKAWACK, N. Y.—The installation of an electric-light plant in Lackawack is reported to be under consideration. J. S. Shields of Lackawack is reported interested.

NEW YORK, N. Y.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until April 9 for removal of existing elevator equipment and furnishing and installing a modern electric passenger elevator and operating mechanism at the naval hospital, New York, N. Y. Drawings and specifications (No. 2336) may be obtained at the above bureau or from the commandant of the navy yard, New York, N. Y.

NEW YORK, N. Y.—Bids will be received by the Department of Public Charities, tenth floor, Municipal Building, New York City, until April 4 for furnishing and installing fire signal systems in the various groups of buildings under the jurisdiction of the Department of Public Charities. Blanks and further information may be obtained at the office of Porter & Himmelwright, engineers, Fifth Avenue Building, Manhattan, where plans and specifications may be seen.

NIAGARA FALLS, N. Y.—Application has been made to the Public Service Commission by the Clipps Electric Distributing Company of Niagara Falls for authority to issue $13,200,000 in capital stock to be used to acquire all the common stock of the Hydraulic Power Company of Niagara Falls and also for permission to merge the latter company with the new corporation.

DUNCANNON, PA.—The managers of the municipal electric-light plant are planning to establish a 24-hour service throughout the borough.

ERIE, PA.—Plans are being prepared for the construction of a new power plant for the Erie Lighting Company. Day & Zimmerman, of Philadelphia, are architects.

HARRISBURG, PA.—The Pennsylvania Railroad Company is planning to install an underground system on North Seventh Street to place its overhead wires underground.

HARRISBURG, PA.—The new creamery building and refrigerating plant now being erected by the Hershey Creamery Company, South Cameron Street, will be equipped with electrically operated machinery.

HARRISBURG, PA.—The Harrisburg Light & Power Company is planning to install underground conduits on Pine, Locust, Chestnut and other streets in the business section, at a cost of about $150,000.

HAZLETON, PA.—The Lehigh Valley Railroad Company contemplates the installation of an electric plant in connection with its local repair shops.

MEADVILLE, PA.—Bids, it is reported, will soon be received for addition to boiler room and laundry, to cost about $20,000, for the Independent Order of Odd Fellows' Home. J. W. Yard & Son of Erie are architects.

PHILADELPHIA, PA.—Within the next few weeks arrangements will be made to place contracts for the construction of a power plant for the Philadelphia General Hospital at Byberry Farms. Philip H. Johnson is architect in charge of the city hospitals.

TARENTUM, PA.—Bids will be received by the electric light and water committee of the borough of Tarentum until April 5 for furnishing one 1000-kw. steam turbine generating unit, one surface condenser and auxiliaries. Specifications may be obtained at the office of Sidney B. Martin, consulting engineer, 401 Penn Building, Pittsburgh, Pa.

WILKINSBURG, PA.—Bids will be received by James G. Sansom, secretary of the school board at the Wilkinsburg High School Building, Wallace Avenue, until April 13 for lighting fixtures for the new Horner school building, now under construction. Plans, etc., may be obtained on application to Ingham & Boyd, architects, 323 Fourth Avenue, Pittsburgh.

ASBURY, N. J.—The Atlantic Coast Electric Railway Company is considering the construction of an addition to the boiler room at its power plant and the installation of four Badenhausen boilers, having a total capacity of 2440 hp., stokers, etc.

HACKENSACK, N. J.—The Gas & Electric Company of Bergen County has been granted permission by the Board of Public Utility Commission to issue $500,000 in bonds for extensions and improvements to its system. The company is leased to and operated by the Public Service Corporation of New Jersey.

McAFEE, N. J.—A new crushing plant and electrically driven shovel equipment will be installed at the local limestone quarries of the Bethlehem Steel Company of South Bethlehem, Pa. The proposed plant will be operated by electricity and will cost about $350,000.

NEWTON, N. J.—The Newton Electric & Gas Company will remodel both its electric and gas plants. The gas engine in the electric plants will be replaced with steam turbine generators or purchased power. The electric and gas distributing systems will be rebuilt. Negotiations are under way for a new street-lighting system, which will cover about 100,000 cp. in incandescent lamps, units from 60-cp. to 600-cp. ratings. Paul D. Hawkins is manager.

TRENTON, N. J.—Bids will be received by the City Commission until April 4 for furnishing and installing a conduit and cable system in Mahlon Stacy Park, to be used for operation of street lamps to be installed later. Plans and specifications are on file in the office of the Department of Parks and Public Property.

TRENTON, N. J.—The Westinghouse Lamp Company, it is reported, contemplates the construction of a new power house, 50 ft. by 100 ft., one story high. The Stone & Webster Engineering Corporation, 147 Milk Street, Boston, Mass., has charge of the engineering work.

BALTIMORE, MD.—Plans have been made by the Municipal Electric Commission for an additional system of conduits through Southwest Baltimore to the Westport power house of the Consolidated Gas, Electric Light & Power Company.

BALTIMORE, MD.—The Consolidated Gas Electric Light & Power Company, it is reported, contemplates the erection of a new generating station at Westport, to be known as station "C." The building will be equipped with six 1047-hp. boilers and will be similar in design and construction as stations A and B. The cost of building and equipment is estimated at $500,000.

FAIRMONT, W. VA.—Arrangements have been completed whereby the Monongahela Valley Traction Company of Fairmont will take over the property of the Kanawha Traction & Electric Company of Parkersburg, which operates electric light and power plants, street railways and interurban railways in West Virginia and Ohio.

MARTINSBURG, W. VA.—Extensive improvements are contemplated by the Potomac Light & Power Company of Martinsburg, involving an expenditure of from $150,000 to $200,000. The work will include rebuilding of dam No. 5 and the installation of hydraulic machinery. Emory L. Coblentz of Middletown is president.

NORFOLK, VA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until April 9 for self-contained refrigerating, piping, connections and accessories necessary for replacing the existing plant in the naval hospital at Norfolk, Va. Drawing and specifications (No. 2335) can be obtained at the above bureau or to the commandant of the navy yard named.

WASHINGTON, D. C., Bids will be received by the Board of Awards, Department of Agriculture, Washington, D. C., until April 3 for furnishing an electric motor for the bureau of animal industry and also for chemical industry. For further information address R. M. Reese, chairman of board of awards.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Puget Sound, Wash., Schedule 857—two forced draft blowers; Schedule 856—one steam steering engine, miscellaneous ventilating fans. Brooklyn, N. Y., Schedule 851—miscellaneous ventilating fans and spares Mare Island, Cal., Schedule 851-14—ventilating fans and spares. Brooklyn, N. Y., and Mare Island, Cal., 21 disk heaters. Philadelphia, Pa., Schedule 850—one 10-hp. and one 15-hp. motor; Schedule 849—one electric windlass. Application for proposal should designate the schedule desired by number.

North Central States

ALMA, MICH.—The Central Michigan Light & Power Company, it is reported, contemplates the construction of a power plant on Pine River, to cost about $150,000

CALUMET, MICH.—The installation of a new street-lighting system, to cost about $75,000, is under consideration. W. E. Smith is reported interested in the project.

DETROIT, MICH.—Work has started on the construction of the proposed buildings and storage yards of the Detroit United Railway Company on the River Rouge, near Detroit. The cost of the work is estimated at $400,000 and will include a machine shop, car shops, foundry, office headquarters and other departments.

SIDNAW, MICH.—The Northern Michigan Power Company, it is reported, will begin work on its Sturgeon development in April. The present plans provide for the construction of two large dams near the headwaters of the Sturgeon River and to develop about 20,000 hp. Several years ago surveys were made for the erection of a transmission line to Houghton. Walter S. Prickett of Sidnaw is interested in the company.

AKRON, OHIO.—Bids will be received at the office of the director of public service of Akron, Ohio, until April 18 for furnishing turbo-centrifugal pumps as follows: Item 1—High lift unit: one horizontal steam turbine reduction gear-driven centrifugal pumping unit complete with water-works type condenser and auxiliaries, normal capacity of 10,000,000 gal. daily capacity against a total head of 220 ft.; Item 2—Low lift unit: One horizontal steam turbine reduction gear-driven centrifugal pumping unit, normal capacity of 25,000,000 gal. daily against a total head of 12 ft The city will furnish foundations. Specifications may be obtained from the Engineering Department, Water Works office, 102 East Mill Street, Akron, Ohio, upon deposit of $5. G. G. Dixon is engineer.

CINCINNATI, OHIO.—Bids, it is reported, will soon be asked by W. Baldwin, care of Union Distilling Company, Third and Race Streets, Cincinnati, for addition to power plant.

DILLONVALE, OHIO.—The Sunnyside Electric Company contemplates extending its electric transmission line from Dillonvale to Amsterdam, a distance of 25 miles.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

FINDLAY, OHIO.—The Findlay Steel Casting Company has purchased the plant of the Logan Motor Company and, it is understood, will install equipment for manufacturing castings by the use of electrical energy. E. J. Edwards of Detroit, Mich., is president of the company.

MARIETTA, OHIO.—The City Council has adopted an ordinance providing for the purchase of a new boiler for the municipal electric-light plant, the cost not to exceed $1,425.

MARION, OHIO.—The Fairbanks Steam Shovel Company of Marion is planning to erect a steel foundry, 65 ft. by 300 ft. A power plant will also be erected which will be equipped with a 1,000-hp. engine and an 800-kw. generator.

NEWTON FALLS, OHIO.—The Village Council has passed an ordinance authorizing an issue of $5,300 in bonds for the installation of an electric incandescent street-lighting system.

OBERLIN, OHIO.—Investigations are being made by W. F. Shikler, engineer, for the City Council as to the advisability of establishing a municipal electric-light and power plant. The contract with the Oberlin Gas & Electric Company expires in 1926.

RAVENNA, OHIO.—The City Council is considering the installation of a new street-lighting system at the expiration of the present contract with the Ravenna Gas & Electric Company next June. R. Z. Kirk is resident manager of the company.

COVINGTON, KY.—The City Commissioners are considering an ordinance compelling all public service corporations to place their wires underground in the business section of the city.

PADUCAH, KY.—Additional equipment, it is reported, will be purchased for the municipal electric-light plant, including two 300-hp. water-tube boilers and two 60-cycle, three-phase generators directly connected to non-condensing engines.

FORT WAYNE, IND.—The Board of Public Works, it is reported, has rejected all bids submitted for a 5000-kw. generator for the municipal electric plant and has decided to install a 3000-kw. turbine instead. Bids for the 3000-kw. machine will soon be asked for.

LEISURE, IND.—The Leisure Electric Light Company, recently incorporated with a capital stock of $10,000, is planning to erect an electric transmission line from Elwood to Leisure, a distance of 6 miles, to secure energy from the Indiana General Service Company. This electric company proposes to distribute electricity for lamps and motors to the farmers of Duckcreek Township.

NEW CASTLE, IND.—Work has begun on the reconstruction of the distributing system of the Inter-State Public Service Company, which was put out of commission by the recent tornado in central Indiana.

WALKERTON, IND.—The Plymouth Electric Light & Power Company, it is reported, has submitted a proposal to the Council offering to purchase the municipal electric-light plant in Walkerton.

ANCHOR, ILL.—Steps have been taken to organize a company under the name of the Anchor Electric Light Company to construct and operate an electric-light plant. Edward Riecks, Frederick A. Riecks, Jr., and Hedweg Riecks are interested.

CULLOM, ILL.—Work has started on the construction of a new power house, 25 ft. by 60 ft., by the Cullom Electric Company. The new power plant will be driven by oil engines. The company will also rebuild its distribution system. Arthur G. Walter is secretary and treasurer.

DE KALB, ILL.—The City Council is considering engaging an electrical engineer to prepare plans for the ornamental lighting system for the Horse Shoe addition.

ELKVILLE, ILL.—The local electric-light plant has been purchased by the Central Illinois Public Service Company of Mattoon. The Elkville plant will be abandoned and energy transmitted from Carbondale, 13 miles distant, as soon as the high-tension transmission line is completed.

HILLSBORO, ILL.—Plans are nearly completed, it is reported, for construction of a section of the proposed interurban electric railway between Pawnee and Hillsboro. Owing to the high cost of copper wire, gas-electric cars will be used instead of trolley cars.

KEITHSBURG, ILL.—The installation of a municipal electric-light plant in Keithsburg is reported to be under consideration.

METROPOLIS, ILL.—Bonds to the amount of $82,000 have been voted for extensions and improvements to the municipal electric-light plant and water-works system.

MONTGOMERY, ILL.—Plans have been prepared for the construction of a power plant on Fox River for the Montgomery Hydro-Electric Power Company. H. A. Strauss, 11 West Monroe street, Chicago, Ill., is engineer.

MOUNT VERNON, ILL.—The property of the Citizens Gas & Electric Company is reported to have been purchased by the Southern Illinois Light & Power Company of Hillsboro. Improvements it is understood, will be made to both plants.

PEORIA, ILL.—Various franchises of the Peoria & Chillicothe Electric Railway Company have been submitted to the Public Utilities Commission for approval. If present franchises prove satisfactory work will begin on the proposed line as soon as the weather permits. The company will build a power plant at Rome. E. S. Woolner of Peoria is president.

QUINCY, ILL.—Bids will be received by the Commissioners of the Indian Grave Drainage District at the office of L. H. A. Nickerson, secretary, Quincy, until May 1, for construction and equipment of a drainage pumping plant, consisting of a brick building, equipped with one 54-in. and one 36-in. centrifugal pump to be driven by electric motors, oil engines or steam engines. Plans may be obtained upon application to W. F. Bushnell, engineer, Quincy, upon the deposit of $10.

ROCK ISLAND, ILL.—Bids will be received at the Rock Island Arsenal, Ill., until April 5 for furnishing one hydraulic turbine unit complete and one additional curb ring.

BRODHEAD, WIS.—The Council is considering the reconstruction of the municipal electric-light plant at a cost of about $20,000.

KILBOURNE, WIS.—The Wisconsin Gas & Electric Company is reported to be securing the right of way for the erection of an electric transmission line from Lake Mills to Marshall.

MONROE, WIS.—The installation of an ornamental street-lighting system is under consideration by the Council.

MONTICELLO, WIS.—At an election to be held April 3 the proposal to issue $12,000 in bonds for improvements to the municipal electric-light plant will be submitted to the voters.

PORTAGE, WIS.—The City Council is considering the installation of an ornamental lighting system in the business district.

STEVENS POINT, WIS.—The Wisconsin Valley Electric Company is contemplating the erection of an auxiliary transmission line from Stevens Point to Mosinee.

WONEWOC, WIS.—Plans are being considered by the Wonewoc Power Engineering Company, 51 Corn Exchange, Minneapolis, Minn., for the construction of a hydroelectric plant, including repairs to gates at dam, a power house, a 50-kva. generator, and an auxiliary plant, equipped with internal combustion engine.

BLOOMING PRAIRIE, MINN.—The L. G. Campbell Manufacturing Company has recently installed a 125-hp. boiler and contemplates the installation of an additional engine and generator soon. George Upcraft is superintendent.

CHISHOLM, MINN.—Bids will be received by William Ritchel, clerk of Independent School District No. 40, Chisholm, until April 18 for additions and alterations of the old High School building, separate bids to be submitted on general contract, plumbing, electrical work, heating, ventilating, sheet metal, temperature fans, motors and heaters, vacuum heating system, and air washers. Plans and specifications may be obtained at the office of William Ritchel, clerk, Chisholm, and at the office of Tyrie & Chapman, architects, 320 Auditorium Building, Minneapolis, Minn., upon deposit of $15 for general contract and $10 for each of the other divisions of the work.

LANCASTER, MINN.—An election will be called to submit to the voters the proposal to issue $8,000 in bonds for the installation of an electric-lighting system.

ST. VINCENT, MINN.—James Kneeshaw is contemplating installing an electric-light plant at his farm in the near future.

WINONA, MINN.—The installation of a municipal electric-lighting plant in Winona is under consideration. W. P. Murphy is chairman of lighting committee.

CEDAR RAPIDS, IOWA.—The City Council has authorized electric lamps to be erected along the main drives in Ellis Park and Daniels Park.

CLARINDA, IOWA.—The property of the Lee Light & Power Company of Clarinda has been purchased by the Continental Gas & Electric Corporation of Cleveland, Ohio.

ELKADER, IOWA.—Schmidt Brothers & Company have been granted a franchise to erect and operate electric transmission lines in Clayton and Delaware Counties for a period of 25 years. The company proposes to extend its lines to Boardman, Co Creek, Volga and Mallory townships and to the towns of Littlepoint, Garber, Elkpor and Colesburg.

OTTUMWA, IOWA.—Preparations are being made for improvements to the power plant of the Ottumwa Railway & Light Company, including the installation of a 12,500-kw. turbo-generator and auxiliaries.

COLE CAMP, MO.—The City Electric Company has purchased two Mogul oil engines, one 50 hp. and the other 25 hp., directly connected to jackshaft by friction clutches. A new building is now being erected and will be completed in about 30 days. D. C. Intelman is proprietor.

ELDON, MO.—At an election to be held April 3 the proposal to issue bonds for the installation of a municipal electric-light plant will be submitted to the voters.

KANSAS CITY, MO.—Bids are being asked by C. B. Sloan, architect, 321 East Eleventh Street, Kansas City, for the erection of a storage building, 55 ft. by 81 ft., five stories, and a garage, 30 ft. by 55 ft., one story, to cost about $40,000, for the Monarch Transfer & Storage Company.

KANSAS CITY, MO.—Bids will soon be asked by Smith, Rea & Lovitt, Finance Building, Kansas City, Mo., architects, for electric wiring for business building and theater, to be erected at Thirty-first Street and Troost Avenue, to cost about $170,000, for J. C. Wirthman, Eighteenth Street and Troost Avenue.

MACON, MO.—A petition is being circulated asking the Town Board to call an election to vote on the proposal to issue $5,000 in bonds to erect a transmission line and install an electric-lighting system in Macon.

ST. LOUIS, MO.—The Union Electric Light & Power Company is planning to erect a substation at Broadway and Osage Street, South St. Louis. The station will have an ultimate capacity of 15,000 kw. and will receive electricity at 13,200 volts from the Ashley Street plant which it will step down to 2400 volts for distribution. The company will erect a high-tension transmission line from the new station to Continental, 3 miles distant, and to Festus, a distance of 30 miles. Space will also be provided for street-lighting equipment in the substation. The cost of the work is estimated at $200,000.

UNIONVILLE, MO.—One 37½-hp. Fairbanks-Morse oil engine and a 30-kva. Fairbanks-Morse generator have been purchased for the municipal electric-light plant, which will be installed about July 1. M. Flynn is superintendent.

INDIANOLA, NEB.—At an election to be held April 3 the proposal to issue $14,000 in bonds for the construction of an electric-lighting system and the erection of a transmission line, 12 miles long, will be submitted to the voters.

STELLA, NEB.—The oil engine in the local plant of the Nebraska Gas & Electric Company was recently destroyed by an explosion.

ALTOONA, KAN.—At an election to be held April 2 the proposal to issue $15,000 in bonds for the installation of a municipal electric-light plant will be submitted to the voters.

BALDWIN, KAN.—An election will be held in April to submit to the voters the proposal to issue $20,000 in bonds for rebuilding the municipal electric-light plant and water-works system.

CHERRYVALE, KAN.—Plans are being prepared, it is reported, for construction of a generating station for the Cherryvale Electric Company, to cost about $7,000. F. F. Fletcher, 112½ Myrtle Street, Independence, is architect.

ELLIS, KAN.—The proposal to issue $10,000 in bonds for improvements and extensions to the municipal electric-light plant will be submitted to the voters on April 2.

IRVING, KAN.—The Council is considering a bond issue of $7,000 for the construction of an electric distributing system and the erection of a transmission line to Blue Rapids.

TOPEKA, KAN.—The Legislature has appropriated $75,000 for rebuilding the east wing of the State House and carrying out the scheme for lighting the dome. Contracts for flood-lighting the State House dome will soon be let. Not less than sixty large reflectors will be used. The present lighting system in the State House will be removed and a new system of indirect lighting will be installed. Charles Chandler is state architect.

WICHITA, KAN.—The Kansas City Gas & Electric Company, it is reported, is asking for bids on switchboard equipment, four 1350-kva., four 750-kva. and two 3000-kva. transformers. Contracts have recently been awarded by the company for

addition to power house, one 10,000-kw. turbine, two 550-hp. boilers, condensing equipment, etc. Sargent & Lundy, 72 West Adams Street, Chicago, Ill., has charge of the engineering work.

Southern States

CARY, N. C.—Contract has been awarded by the city of Cary to Tucker & Laxton of Charlotte for the erection of an electric transmission line to connect with the lines of the Carolina Power & Light Company of Raleigh.

CHARLESTON, S. C.—About July 1 the Charleston Consolidated Railway & Lighting Company expects to have in operation the new substation equipped with three 750-kva. 2300/13,200-volt transformers; also three 400-kva. 2300/6600-volt transformers. In connection with this station the company will erect a three-phase, 60-cycle, 13,200-volt transmission line, 2 miles long, to connect with its present line at North Charleston, now 6600 volts, but to be changed to 13,200 volts. By the end of the year the company expects to have in operation in the power house an additional 528-hp. Franklin boiler. John G. Felton is superintendent of electrical department.

FOUNTAIN INN, S. C.—The city of Fountain Inn has engaged John N. Ambler of Winston-Salem, N. C., to prepare plans for electric-light plant, water works and sewer system.

EASTMAN, GA.—The property of the Eastman Light & Ice Company is reported to have been purchased by Marshall & Company (bankers) of Boston, Mass. Extensive improvements to the system, it is said, are contemplated by the new owners.

FELLSMERE, FLA.—The City Commissioners are considering the installation of an electric light plant, the equipment to consist of a 50-hp. oil engine and generator.

JACKSONVILLE, FLA.—Bids will be received by the Board of Port Commissioners, Realty Building, Jacksonville, until April 7 for furnishing material and installing electric transmission lines in conduit in both steel warehouses at the municipal docks and terminals on Talleyrand Avenue; main lines to be approximately 1700 ft. total length, suitable for transmitting 50 hp., three-phase current at 220 volts and with branches having outlets for connecting portable motors. J. C. O'Dell is manager.

NEW PORT RICHEY, FLA.—Plans are being considered to enlarge the municipal electric-light plant and water-works system. George R. Sims, president of the Port Richey Company, is reported interested.

WAUCHULA, FLA.—The Wauchula Light & Power Company is reported to be considering the installation of two additional generating units, consisting of 100-kw. (each), 60-cycle, 23,000-volt generators directly connected to high-speed engines. E. L. Dunn is general manager.

WATERTOWN, TENN. — Arrangements have been made whereby the local electric-lighting system will be extended to Alexandria to furnish electrical service in that town.

BIRMINGHAM, ALA.—Within the next few months the Birmingham Railway, Light & Power Company expects to install three new 1000-kw. rotary converters.

JASPER, ALA.—The property of the Jasper Water, Light & Power Company has been purchased by Weakley & Fies of Birmingham. The new owners will develop and improve the property.

BEARDEN, ARK.—The City Council has granted the Bearden Electric Light Company a franchise to construct and operate an electric-light plant in Beardon.

McGEHEE, ARK. — Improvements are being made to the municipal electric-light plant, which will double the output of the station and include remodeling the power station, the installation of an additional 120-hp. Diesel engine, one 100-kw. General Electric alternator with necessary switchboard apparatus, etc. H. W. Wright is manager.

GLENMORA, LA.—The Glenmora Light & Power Company is planning to install an additional 15-hp. crude-oil engine and install 20 more street arc lamps in about 90 days. The company is also considering the installation of a 10-hp. three-phase, 60-cycle motor with a 100-gal. per-minute pump in the latter part of the year. F. P. Joseph is manager.

KENNER, LA.—Bids will be received at the office of the Mayor and Board of Aldermen of Kenner until April 9 for lighting the town and furnishing electricity for lamps and motors for commercial, residential lighting and other purposes.

NEW ORLEANS, LA.—The contract for electric work in connection with the construction of the Elks' Home has been awarded to the Douglas Electric Construction Company, 626 Julia Street, New Orleans, by John Thatcher & Son, 60 Park Avenue, Brooklyn, N. Y., general contractor. The cost is estimated at $12,000.

BUTLER, OKLA.—At an election to be held April 3 the proposal to issue $6,000 in bonds for the installation of a municipal electric-light plant will be submitted to the voters.

COVINGTON, OKLA.—The City Trustees have granted a franchise to private parties to construct and operate an electric-light plant in Covington.

SKIATOOK, OKLA.—As soon as estimates of cost of improvements to the electric-light system can be obtained the Board of Trustees will call an election to vote on the proposal to issue bonds for same.

STRATFORD, OKLA.—The installation of a municipal electric-light plant and water-works system in Stratford is under consideration.

HOUSTON, TEX.—The Ship Channel Transportation Company, recently organized with a capital stock of $60,000, proposes to construct an interurban railway from Houston to Goose Neck. E. Kennedy of Houston and L. B. Mitchell of Chicago, Ill., are reported interested.

Pacific and Mountain States

CHARLESTON, WASH.—The City Council has appointed a committee to make arrangements for the purchase of the local system of the North Pacific Public Service Company. The city will purchase electricity and operate the system.

COLLVILLE, WASH. — The Stevens County Power & Light Company, which recently completed its new plant at Myers Falls, has placed an order for an additional generating unit to meet the increasing demand for electrical service.

EPHRATA, WASH.—The Nelson lighting system, which supplies electrical service in Ephrata, is to be enlarged and the transmission lines extended to Soap Lake. The cost of the proposed improvements is estimated at $10,000.

HOQUIAM, WASH.—The City Council is considering calling a second election to submit to the voters the proposal to take over the present electric-light and power plant and distributing system in Hoquiam or to construct a new plant.

NORTH YAKIMA, WASH.—The Commissioners of Yakima County have granted the Pacific Power & Light Company a franchise to erect electric transmission lines on 7 miles of county roads for a period of 50 years.

TACOMA, WASH.—The Tacoma Railway & Power Company has been granted a franchise to erect electric transmission lines from the Pierce County line to the A. L. Brown farm, near Nisqually, to serve farmers in that district.

KLAMATH FALLS, ORE.—The California-Oregon Power Company has leased the Keno irrigation canal from the United States Government for a period of 10 years. The lease provides for improvements to be made by the company and also permits the erection of a dam at the head of Link River, if the company so elects, the dam to revert to the government. Alex Rosborough is vice-president.

PORTLAND, ORE.—The contract for the complete electrical installation of the proposed shipbuilding plant to be erected by the Columbia Shipbuilding Corporation in South Portland has been awarded to the Morrison Electric Company, 109 West Park Street, at about $40,000.

BISHOP, CAL.—Preparations are being made by the Round Valley Tungsten Company for the installation of an electric furnace for the purpose of manufacturing ferro-tungsten.

FRESNO, CAL.—Work will soon begin on the erection of a new substation for the San Joaquin Light & Power Company at Jensen and Cornelia Streets, to cost about $15,000. The company is now erecting an auxiliary transmission line to supply electricity to operate the pumping plants in the Kerman region.

LOS ANGELES, CAL.—Plans are being considered by the Great Western Milling Company, Ninth and Alameda Streets, Los Angeles, for the construction of an addition to its plant, 50,000 sq. ft., to cost about $200,000. All machinery in the new plant will be equipped with electrically driven machinery. H. E. Woolner is president.

SAN FRANCISCO, CAL.—The State Railroad Commission has authorized the Trinity Gold Mining & Reduction Company to sell to the California-Oregon Power Company its hydroelectric plant, including the transmission and distribution system, near Carrville, for $22,000. The power company has extended its transmission line from Caste to Trinity Center and proposes to use the Trinity County's plant as an auxiliary.

BOISE, IDAHO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 11, for a new system of conduit and wiring and alterations in heating system in the United States assay office at Boise, Idaho. For details see proposal columns.

SALT LAKE CITY, UTAH.—Surveys are being made for the route for a proposed addition to the transmission line of the Utah Power & Light Company between Salt Lake City and Grace, Idaho, a distance of 130 miles. The cost of the line is estimated at about $300,000.

GLOBE, ARIZ.—The output of the hydroelectric power plant of the Salt River irrigation project, built in connection with the Roosevelt Dam, it is understood, will be increased to 25,000 hp. The Salt River Valley Water Users' Association, which is composed of land owners embraced in this system, is promoting the construction of a dam across the Verde River, about 80 miles below the stream's junction with the Salt River. The proposed dam will cost about $1,000,000 and the water storage will enable the reclamation of about 40,000 additional acres. The association also has in view the utilization of the water power at Horse Shoe Bend on Salt River, about 20 miles below the Roosevelt Dam, which it is estimated will develop about 20,000 hp. This plant would be made a part of the Roosevelt Dam system.

PRESCOTT, ARIZ.—The Arizona Power Company has entered into a contract with the Consolidated Smelting Company to furnish a minimum of 1000 hp. for a period of three years. The company has also closed a contract with the Gadsden Company and has made new contracts with the Jerome Victor Extension and the Verde Combination companies.

POPLAR, MONT.—The City Council has decided to call a special election to vote on the proposal to grant a franchise for the installation of an electric-lighting system in Poplar.

BURNS, WYO.—Plans are being prepared by C. C. Carlisle of Cheyenne for the installation of a municipal electric-light plant.

THERMOPOLIS, WYO.—During the coming summer a complete electric light and water system will be installed on the State Reservation. The contract for the work, including machinery, pumps, generators, etc., it is understood, has been awarded to the Hendrie-Bolthoff Manufacturing & Supply Company of Denver, Col., at a cost of between $14,000 and $15,000. The cost of the entire work is estimated at about $25,000.

PUEBLO, COL.—The electric-light plants at Ordway and Sugar City have been purchased by the Arkansas Valley Railway, Light & Power Company of Pueblo. A new district will be formed by the company to include Olney Springs, Crowley, Ordway and Sugar City with headquarters at Ordway. Improvements will be made to both plants. The extension of the electric transmission line from Avondale to Boone and thence to the ranch of the Thatcher Cattle Company, 11 miles long, where electricity will be furnished for a 400-acre irrigation project, is contemplated by the company. A street-lighting system may be installed at Boone.

HANOVER, N. M.—The Hanover Bessemer Iron & Copper Company, it is reported, will rebuild its mill and power plant, which was recently destroyed by fire, causing a loss of about $100,000.

Canada

MEDICINE HAT, ALTA.—The installation of a new street-lighting system is under consideration by the City Council. Single lamp standards mounted with nitrogen lamps, maintained by underground wires, are being considered. G. R. Taylor is superintendent.

NEW WESTMINSTER, B. C.—A permit has been taken out by the Brunett Saw Mills Company for construction of an engine and boiler house.

PENTICON, B. C.—A power development to cost about $60,000 is under consideration by the town of Penticon. The equipment will include a 250-hp. Diesel engine, two generators, etc. F. L. McKeever is engineer.

OTTAWA, ONT.—A bill has been passed by the Private Bills Committee of the

legislature authorizing the city of Ottawa to expend $1,[illegible] without submission to the ratepayers. Among the proposed work to be included the construction of an electric power plant for the Deseaux Island pumping plant to cost about $[illegible]

STAMFORD, ONT.—The Township Council has granted the Ontario Hydro Electric Power Commission permission to make certain extensions to its system in Stamford. The Council has entered into a contract with the Commission for 400 hp. to be used by the township for street lighting and other purposes.

LEVIS, QUE.—At an election to be held in April the proposal to construct a 1,500,000 gal. reservoir and a centrifugal pump with an electric motor on one side and a steam-driven turbine on the other side to cost about $[illegible], will be submitted to the ratepayers. C. C. Lessard, 14 Cote de la Montagne, Quebec, is city engineer.

MONTREAL, QUE.—Work has been started on the construction of a new foundry, 2[illegible] ft. by 200 ft., one story high, for the Thomas Davidson Manufacturing Company in Montreal. The building, 20 ft. by 150 ft., will be equipped with two motor-generator sets, etc., to furnish electricity to operate the electric furnaces. Four 6-ton electric furnaces will be installed in the main building. A 20-ton overhead crane will be erected in the main bay.

Miscellaneous

MATANZAS, CUBA.—The Compania Anonima Electrica Alemana-Cubana of Havana is erecting a new power house in Matanzas, to be equipped with a 1000-hp. Nordberg steam engine, one 1000-hp. Babcock & Wilcox boiler and one Burke Electric Company direct-current, three-wire generator. D. M. Moya, 21 Santa Teresa, Matanzas, is local manager.

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until April 11 for furnishing Babbitt metal, bronze, brass tubing, sheet, sheet copper, pinions, steel cable, electric cable, wire, etc., under circular (No. 1134). Bids will also be received until April 6 for furnishing bolts, cable, tool steel, cable thimbles, screw shackles, wire, hydraulic gages, air whistles, etc., under circular (No. 1133). Blanks and general information relating to these circulars may be obtained at the above office or the offices of the assistant purchasing agent, 24 State Street, New York, N. Y., and 611 Whitney Central Building, New Orleans, La.; also from the United States Engineer offices in the principal cities throughout the United States.

Record of Electrical Patents

Notes on United States Patents issued on March 18, 1917

1,219,139. Starting Device for Internal-Combustion Engines. William W. Dean, Chicago, Ill. App. filed Nov. 15, 1912. Improvements.

1,219,172. Selenium Bridge and Method for Making Same; Fay C. Brown, Berkeley, Cal. App. filed July 2, 1916. Object is to produce a light selenium bridge of greatly increased sensitiveness.

1,219,180. Insulator. Frank F. Fowle, Chicago, Ill. App. filed March 25, 1911. Improvements.

1,219,189. Telephone Mouthpiece. Seth M. Hino, Lander, Wyoming. App. filed Aug. 29, 1916. Antiseptic.

1,219,166. Method of Manufacturing Metal Articles by Deposit. Henry C. Kirk, Jr., Roland Park, and George H. Dumler, Baltimore, Md. App. filed June 3, 1915. Improvements.

1,219,470. Electric Switch; George N. Lemmon, Greensburg, Pa. App. filed Feb. 1, 1915. Means of securing contact between a solid metal surface and a metallic flexible brush opposed thereto.

1,219,497. Incandescent Lamp Socket. Martin V. Smith, Hartford, Conn. App. filed July 17, 1915. Improvements.

1,219,517. Testing System; Ray Seth Wilbur, Jersey City, N. J. App. filed July 6, 1914. Measures the capacity of line wires so as to determine the approximate location of faults therein.

1,219,518. Igniting and Lighting Generator; James M. Wilson, Newark, N. J. App. filed April 17, 1914. Improvements.

1,219,519. Automatic Switching Mechanism; James M. Wilson Newark, N. J. App. filed Aug. 26, 1915. Used in connection with generators.

1,219,520. Electric Generator; James M. Wilson, Newark, N. J. App. filed Oct. 8, 1915. Improvements.

1,219,522. Telegraph System; John E. Wright, New York, N. Y. App. filed Jan. 15, 1916. Improves the character and carrying quality of the signal impulses of current sent over telegraph lines.

1,219,524. Electric Railway System; Andrew Yurow, New York, N. Y. App. filed Oct. 15, 1915. Improvements in current-supplying rails of electric railways of the underground conduit type.

1,219,528. Block Signal System; Harry W. Balcom, Worcester, Mass. App. filed April 3, 1915. Single-line wire is used to connect the signals at opposite ends of the block.

1,219,531. Telephone Line Disconnector; Milton S. Bricka, Milan, Ind. App. filed Aug. 23, 1912. For cutting out telephones or other electrical apparatus.

1,219,548. Electric Switch Mechanism; David D. Gordon, Chicago, Ill. App. filed June 8, 1916. For use in electric lamp sockets or the like.

1,219,550. Antenna Structure on Aeroplanes for Wireless Signaling; Walter Hahnemann, Kitzeberg, Kiel, Germany. App. filed Jan. 13, 1915. Increases the range over which wireless waves may be transmitted from and received by an operator on the aeroplane.

1,219,554. Electric Signaling System; Robert J. Hewett, Westfield, N. J. App. filed Dec. 24, 1910. Designed for use on roads where track circuits are employed to control the signals.

1,219,561. Quadruplex Telegraph; Isidor Kitsee, Philadelphia, Pa. App. filed Dec. 30, 1916. Submarine cables.

1,219,562. Electric Fan and Generator. Haroutinum K. Kouyoumjian, Cleveland, Ohio. App. filed Dec. 23, 1912. For motor vehicles.

1,219,563. Motor Vehicle Construction; Haroutium K. Kouyoumjian, Cleveland, Ohio. App. filed July 19, 1913. Cooling system.

1,219,564. Electric Generator; Haroutium K. Kouyoumjian, Cleveland Ohio. App. filed Aug. 5, 1913. Inherently and automatically self-regulating.

1,219,565. Commutator Construction; Haroutium K. Kouyoumjian, Cleveland, Ohio. App. filed Dec. 18, 1913. Occupies a minimum of space axially in the motor.

1,219,569. Starting Mechanism for Hydrocarbon Engines; Albion D. T. Libby, Orange, N. J. App. filed April 12, 1913. For engine used in an automobile.

1,219,587. Telephone Exchange System; John Newberry Reynolds, Greenwich, Conn. App. filed March 4, 1915. Line testing in telephone exchange systems.

1,219,617. Galvanometer; William Herbert Apthorpe, Cambridge, England. App. filed Aug. 14, 1914. Conducting fiber is maintained in a magnetic or electrostatic field and its movements observed or recorded when a current passes therethrough.

1,219,620. Telephone Instrument; Frederick E. Bentley, Maplewood, Mo. App. filed Nov. 29, 1915. Adapted to operate as a loud-speaking telephone in which the receiver and transmitter are structurally combined in a unitary instrument.

1,219,629. Method of Forming Electrical Heat Units; Ransom W. Davenport, Detroit, Mich. App. filed April 8, 1915. Embedded resistor type.

1,219,632. Connector for Electrical Conductors; Ernest B. Fahnestock, Plandome, N. Y. App. filed Sept. 22, 1914. Improvements.

1,219,648. Electricity Meter; Robert C. Lanphier, Springfield, Ill. App. filed Jan. 8, 1914. Mercury motor meters.

1,219,650. Electric Toaster; Edwin N. Lightfoot, New York, N. Y. App. filed Dec. 26, 1912. Improvements.

1,219,656. Telephone System; Talbot G. Martin, Chicago, Ill. App. filed March 17, 1913. Semi-automatic type.

1,219,666. Signaling System; Harry O. Rugh, Chicago, Ill. App. filed April 8, 1916. Railway.

1,219,671. Device for Aiding the Hearing; Eugene W. Schneider (deceased), late of New York, N. Y. App. filed Sept. 9, 1916. Simplified rheostat.

1,219,679. Electric Barometer Switch; Peter Ernest Stoft, New York, N. Y. App. filed April 25, 1916. Improved means for actuating the switch when the temperature rises to the predetermined point.

1,219,700. Telephone Exchange System and Apparatus Therefor; Albert M. Bullard, New York, N. Y. App. med July 17, 1906. Improved organization of circuits and apparatus whereby a line to which connection is desired may be selected with speed and accuracy.

1,219,704. Ignition System. Frank Conrad, Pittsburgh, Pa. App. filed Aug. 16, 1916. In connection with internal-combustion engines.

1,219,713. Trolley Retriever; Austin D. Eberly, Spokane, Wash. App. filed March 13, 1916. Prevents a trolley from causing damage when it leaves the wire.

1,219,723. Pneumatic Alarm System; Frank T. Gracey and Thomas W. Landers, Eddyville, Ky. App. filed Aug. 10, 1916. For operating a plurality of alarms in certain cases of emergency, such as fire, burglary, etc.

1,219,727. Telephone Repeating System; Elwood Grissinger Buffalo, N. Y. App. filed June 3, 1916. Provides telephone repeaters in which the difference in phase between the exciting force (represented by speech waves) and the displacement of the vibratory system is controlled within a desired range.

1,219,732. Trolley Wire Hanger; Robert F. Hamilton, Wheeling, W. Va. App. filed Aug. 27, 1915. Improvements.

1,219,746. Insulator Bracket; Lewis F. Keppler, Harlan, Iowa. App. filed Aug. 6, 1915. Made entirely of metal.

1,219,820. Vincent K. Johnson, Indianapolis, Ind. App. filed May 8, 1916. Adapted to remove ice and sleet rapidly.

1,219,888. Combined Receiver and Detector for Wireless Use; Frank Wallberg, New York, N. Y. App. filed Sept. 21, 1915. Detector bridges across the terminals of the electromagnet of the telephone receiver and is mounted within the casing of the receiver just under the diaphragm.

1,219,952. Alternating-Current Motor. Willem C. Korthals-Altes, Schenectady, N. Y. App. filed April 11, 1916. Improved polyphase, alternating-current commutator motor of the brush-shifting type having compound excitation.

1,219,955. Quadruplex Telegraph; Isidor Kitsee, Philadelphia, Pa. App. filed Dec. 30, 1916. Simple arrangement for transmitting two messages simultaneously.

1,219,957. Burglar Alarm; Theophil Koschade, North Adelaide, South Australia. App. filed Feb. 12, 1914. Improvements.

1,219,961. Means for Indicating Electrical Characteristics of Alternating Currents; Irving Langmuir, Schenectady, N. Y. App. filed July 20, 1914. Invention relates to apparatus of the type known as the Braun tube.

1,219,965. Plate Holder for X-Ray Exposures; Henry G. Leisenring, San Diego, Cal. App. filed May 2, 1916. Takes one or more, preferably four, exposures in quick succession.

1,219,966. Electrolytic Gas Generator. Isaac H. Levin, Newark, N. J. App. filed Nov. 18, 1916. Designed to produce hydrogen and oxygen gases.

1,220,005. Wireless Signaling System. James Harris Rogers and Henry H. Lyon, Hyattsville, Md. App. filed Nov. 10, 1916. Improvements.

1,220,072. Method of Wireless Signaling. Louis Cohen, Washington, D. C. App. filed Nov. 13, 1915. Interrupting the current in a high-frequency oscillatory circuit for wireless signaling purposes.

1,220,152. Fuse Device; Nicholas J. Conrad, Chicago, Ill. App. filed April 4, 1914. Adapted for extra-high-potential service.

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Meeting the Crisis

THE nation is now at war. Be it short or long, aggressive or defensive, there can be but one outcome, and that a glorious one. Accustomed to rely on engineers for its upbuilding, the country now looks to them for its defense. As the mouthpiece of the electrical industry the Electrical World can pledge that in that defense electrical engineers will be foremost in service and in achievement. Mighty as is the force of electricity in construction, it can be made mightier in destruction; and while in a sense it is unfortunate thus to apply science, there is a nobility even in strife and a loftiness of purpose in chastisement. The lesson of more efficient living and production we shall learn, for it is needful for us to apply some quickening leaven to our civic and industrial life to win the race set before us. Our engineers, we are happy to say, have already played an important part in marshaling the manufacturing industries of the country for preparedness and on the Naval Consulting Board. They are now prepared to render greater service, commensurate with the necessities of the occasion and in keeping with American manhood and ideals.

Improving Our Service

EFFECTIVE with the present issue, the Electrical World will hereafter insert in parentheses after every measurement expressed in English units its metric equivalent. This departure is no novelty so far as regards the literature of American science and engineering. It was first adopted by the American Institute of Electrical Engineers for the text of papers and proceedings in 1911 and has since been employed by half a dozen other American scientific and engineering societies. Fortunately for electrical workers, the international electrical units which we all use alike, as the volt, ohm, ampere, joule, watt, coulomb and henry, are already metric and need no parenthetical expression.

One of the discontinuities which keeps the minds of nations out of phase and synchronism is the lack of conformity between the units of weights and measures in the English-speaking countries on the one hand and the rest of the civilized world on the other. Leaving the European continent aside from consideration, Central and South America, with their twenty republics, are entirely bound up with the metric system in their everyday life. The total annual trade of the South American republics amounts in normal times to nearly $2,500,000,000 in money value. American workers desire to increase their trade relations with these metric countries. Any improvement in the service of the Electrical World in South America would therefore benefit American electrical industries. Moreover, electrical engineers in foreign countries are usually prepared to wrestle with the difficulties of the English language provided that the units referred to in the text are their own international metric units. The change, however slight, will, we hope, help the cause of international relations everywhere.

A Good Public Servant

CHANGING conditions bring new problems, and they demand a new viewpoint and, if necessary, new men who understand them. For several decades the central station industry has forged ahead with obstacles clearly sensed and surmounted. It has formulated and followed large policies. Through a public policy committee it has been wisely advised. The public requirement of regulation has been met and accepted. Revolutionary improvements in generating apparatus and lamps have been absorbed into the operations without financial disaster and with marvelous benefit to the public in efficiency and economy in service. But other problems remain. It will not be easy to meet and answer all the questions of policy that lie ahead. In the present period of flux, strong, able counsel will be needed to guide company affairs. The government will want and need a free hand and a loyal support to anticipate its desires before they are even expressed. The public will expect the fullest consideration. And the companies, harassed though they may be by material shortage, by imperative demands requiring heavy exertions, must respond with breadth of mind in policy and detail. If there are risks, there are also opportunities to show what a good public servant does.

Control of Wireless

IT looks very much as if the government, always loath to interfere with legitimate private activities, would have in self-defense to take a very firm stand in assuming absolute control of the wireless activities of the country. Of course in an actual state of war such would be the first necessary step toward safety from illegitimate sending of information to the enemy; but in any event, at a period when hostilities are impending, it is high time that all wireless plants, big and little, should be put out of business or under the strictest kind of supervision. The great transatlantic systems are, of course, censored, but there is danger in some of the smaller installations. It is so simple a matter to string an aerial and to set up an equipment

capable of reaching 100 or 200 miles out at sea that too much care cannot be exercised in putting a stop at once and completely to everything of the kind. It is practically impossible to prevent the use of equipment for listening in on the government plants, so that the use of code is the only method of escaping espionage; but if the sending plants having any appreciable range of action were caught the chief source of danger would be removed. There have been from time to time reports of considerable installations in remote quarters, some of them doubtless fakes, others as certainly realities. The time has now come when the many legitimate experimenters with wireless will have to put up with some perhaps serious inconvenience in the interest of national security, and they should do it cheerfully and patriotically, lending their aid to such branches of government service as may be in need of them. There will be plenty of opportunity for their good offices in the near future. It is perhaps just as well that extreme measures have not been taken up to the present time, for the gains in the training of men in wireless work probably fully compensate the losses from such odd scraps of information as may have been passed about improperly. Time has now come, however, to put the lid on tight and to keep it on until the national crisis has passed. Every wireless equipment, dangerous if improperly used, can be of service to the government when confined to legitimate or patriotic functions.

Making Scattered Service Pay

WE have often in these columns raised the issue that a proper consolidation of electric service in small towns and villages could be made to pay when wisely administered. An interesting example of the working out of this thesis to a successful solution is given in the description by A. Hardgrave of the service of a little group of towns in the Middle West. There are five small communities concerned, with the main plant in the largest, which contains a population of 3500. The other four are scattered within five or ten miles and range from 400 to 700 in population. The interconnection of the service is accomplished through an iron line 22½ miles in length strung on cedar poles. The conductor is only No. 6, and with 25-ft. and 30-ft. poles, spaced forty to a mile, the line costs are evidently modest. The results are the best proof of the success of an enterprise of this sort. In the case before us on a total investment in the system of $16.50 per capita the gross earnings for the last complete year reported rose to $5.40 per capita, a figure of which some larger systems might be envious. The operating ratio was less than 60 per cent and the net earnings were more than 12 per cent on the investment. The four villages to which energy was distributed brought upon the station no additional operating force or station capacity.

Mr. Hardgrave very properly says that there are hundreds of such towns lying within easy reach of existing stations to which a modest but thoroughly good service could probably be extended. When a still larger group than that here considered is thus linked up into a united system the relative gains are still greater. It has more than once happened that isolated communities are glad indeed to bear in some form part of the expense of the extensions necessary to reach them, or at all events to guarantee enough load to justify the costs. A village must be isolated indeed that is not within fair reach of some electric system, and it certainly seems to be well proved that a paying load can generally be found even in an apparently insignificant community.

Publicity Problems

WHEN a central station executive considers a publicity campaign for the purpose of acquainting his community with the utility's affairs, he finds himself between two fires. If he advertises the fact that his company is making plenty of money, the unscrupulous will pervert his words to his disadvantage. His company will become known as a corpulent corporation. If he advertises that his company is not making money, he will increase the difficulty he already has in getting additional capital. It is on the horns of this dilemma that many well-intended general educational campaigns have fallen.

Such campaigns do not deserve to fall. The fact that the central station industry seems to lack the facilities for putting the public in a place to see the industry's problem from its own viewpoint, and that central station executives sometimes find difficulty in seeing things from the public's point of view, does not present insurmountable difficulties. It is a task, of course, to make the public understand the fundamental difference between the utility business and other big businesses. The public does not understand that a department store to make a 20 per cent net profit may make an average profit of only 4 per cent on its sales because it turns over its capital five times a year, while a utility company making perhaps an 8 per cent net profit turns over its capital only about once every five years. Such a proposition is difficult of comprehension to the wage-earner who in his life does not have "turn-overs" to contend with. It is also surprisingly difficult to explain to the average business man.

Since the central station industry realizes these facts, the natural optimism of its people should lead them to seek a different angle of approach for the publicity campaign. They might publicly propound the principle that a utility company must be prosperous if the city in which it is located is to grow; it must be prosperous if it is to do the things a utility should do for its patrons; it must be prosperous if it is to bear its share of the expense of civic improvements and at the same time attract new capital for its own betterments. That idea might provide one different angle which would allow a discussion of the necessity of prosperity of the company without speaking of rates. It should also be possible to present an admirable explanation of the adequacy of the

company's service without going into the details of the cost of producing that service.

After all, the things of vital importance to any community are the adequacy of the service provided to it, not the cost of producing that service, and the prosperity of its utilities, not the rates its citizens pay. Information on utility service costs should, of course, always be available to the public, but a publicity program might well omit these and be devoted to more vital topics.

Service and Public Ownership

IT is a fundamental of central station business that the thing actually sold is something more than electrical energy. Electricity nowadays is sold with an implied guarantee of perpetual good service, and it is the business of the operating company to see that the consumer gets it, and not to rest satisfied when a contract has been closed. This moral is vigorously enforced in the paper by Prof. C. E. Clewell on the relation of poor service to the propaganda for public ownership.

The interesting case which he cites is in its general character by no means infrequent, and its results are likely often to be duplicated. Briefly the situation was this. A small town with a run-down electric lighting system found itself taken over into the territory of a central operating plant covering considerable territory. The old plant was inefficient, equipped with antiquated meters, and loose and shiftless in its manner of billing. The new company came in, promising better light and cheaper service. It lowered its kilowatt-hour rate, installed new meters, and looked after its business efficiently. The result was in many instances an increase of monthly bills and a shower of protests from the patrons of the company.

Then the service in the town was carefully inspected by Professor Clewell himself, and recommendations were made for improvements. It was found that, although the substation voltage was kept well regulated, the old distribution circuits gave large variations from place to place. The voltage rating of the lamps was loose. Tungsten lamps were coming into use, usually installed bare in old fixtures, and in general the illumination was bad. The physical difficulties were remedied, lamp voltage was standardized, and some effort was made by the local solicitor to improve lighting.

The result of two years of these conditions showed in a formal petition for permission to establish a municipal plant on the ground that the service rendered was unsatisfactory, a petition on which the result of the hearings is now pending. Evidence at the hearings and investigation of conditions showed that the chief trouble in the community which served as a basis for complaints of poor service was that, while the distribution of electrical energy had improved, the community had not bettered the illuminating service and the company had not been sufficiently active in this cause to effect a change for the better that would have been neither difficult nor expensive if properly followed out.

It is all very well for the central station manager complacently to say that the people were at fault, but the proper use of light, especially when derived from the modern high-intensity lamps, is a matter involving technical skill which the community cannot fairly be expected to have. If the operating company does not institute a campaign for better illuminating engineering work, its customers are bound to be discontented and "easy marks" for politicians who may find it for their immediate benefit to institute a movement for municipal lighting.

The time has gone by when the salesman can take the attitude that his duties have been completed by getting the contract. His efforts must be backed up, and backed up vigorously, by the central station if it is to do its plain duty by its customers. The change from carbon to tungsten lamps brought an evil harvest of improper illumination. The change now in progress to the gas-filled lamps will produce even more serious results, and the company which neglects its illuminating service at this time may rest assured that it is thus sowing the seeds for the growth of complaints.

It is well for managers to realize that some consumers are first, last and always kickers, but on the whole the increase of complaints on an electric lighting system constitutes a serious indictment of the management. They are usually the result of following the policy of let well enough alone, when the fact is that in the march of improvement nothing can safely be left alone for any consideration. The case to which Professor Clewell calls attention was pushed to its legitimate conclusion rather more speedily than usual, but in the present temper of commissions and other regulating bodies there is trouble ahead for the company that does not follow up its sales of energy by persistent and intelligent service work among its customers.

The Coming Issues

AMONG the leading articles which will be presented in the operating issue of the ELECTRICAL WORLD for April 14 will be one giving the experience of a public utility company with the use of high-voltage aerial cable. The results which have been obtained with this installation have led the company to adopt aerial cable for all special work requiring transmission pressures as high as 26,400 volts. The third issue of April, which is the engineering number, will contain an article explaining methods of calculating values required in the layout and revision of direct-current networks and will point out the effects of adding new conductors to an existing system. In addition to central station commercial problems of a managerial nature, there will be taken up in the April 28 issue in symposium form the broad question of "Should the Central Station Make Free Repairs on Customers' Appliances?" There will also be the regular departments for the engineering and operating men.

Poor Lighting Promotes Public Ownership

Unsatisfactory Illumination Jeopardizes the Reputation of Commercial Central Station Service—A Lesson from a Pennsylvania Case in Which Change in Control Was Involved

BY C. E. CLEWELL

Assistant Professor of Electrical Engineering, University of Pennsylvania

IT is felt that illumination service is becoming an element of importance in central station work and that a neglect of this element may be the means of increasing the tendency to use poor light as an argument favoring municipal ownership. To illustrate this point, the difficulty experienced by a large company with the patrons in one of the boroughs included in its service is used as the basis of the following discussion.

As a matter of record it should be stated that the company concerned felt that, although testimony as to poor illumination was used by the applicant for a municipal plant, it had little, if anything, to do with the starting of the idea; but that it was unquestionably an exceedingly convenient argument with which to boost the case. It is to be noted also that the idea of a municipal plant was put under way immediately after the new company took over a very much run-down property and before it had time to get things into shape and to educate the customers properly in the use of light. Furthermore, in justice to the company it should be known that the difficulty experienced in this particular borough is not representative of the conditions in the remaining 98 per cent of the company's territory, where no such difficulty has been met.

This actual experience teaches the necessity of educational work in illumination.

"An interest must be taken in the way light is used," says the author.

"If this responsibility is avoided or neglected," he adds, "the company may find itself confronted unexpectedly in a hearing for a municipal plant by many witnesses who might have become satisfied customers."

Prevention is easier than remedy.

The underlying thought in this article, irrespective of any of these points, is that consumers better educated in the proper use of light will result in a lessened tendency for such a community to advance a poor lighting plea as a basis for any efforts which may be started for municipal ownership, particularly where the service of the public utility company is adequate and satisfactory in all other respects. The main purpose is thus to encourage active and intelligent efforts on the part of the companies to see that the good service extends all the way into the homes of their customers and includes efficient and suitable illumination as a distinct part of their program. With the foregoing points in mind it is believed that no injustice will be done to the company in question by a selection of one of the weak points in an otherwise excellent system, merely in order to use this case as an illustration of an influence which may be faced by others in applications for municipal ownership.

In May, 1915, the writer made an inspection of residence lighting conditions in the borough of Catasauqua, a municipality with a population of about 5000 situated in eastern Pennsylvania, for the purpose of discovering the basis of numerous complaints regarding the service. Two years later this borough filed a petition before the State Public Service Commission for a permit to install a municipal electric lighting plant. The hearing on this application took place on Feb. 8, 9 and 10, 1917, at Allentown, Pa. The history of this case is interesting in that it shows this rather new influence tending toward municipal ownership.*

Shortly before 1915 the old privately owned plant which supplied light and power to this borough was bought by the Lehigh Valley Light & Power Company, a central operating plant which supplies twenty or more municipalities in the eastern part of Pennsylvania in and about Allentown. About this time the Lehigh Valley Traction Company, operating a network of trolley lines in the same general section of the State, increased the fare between Allentown and Catasauqua from 5 to 10 cents, a step which was bitterly resented by the community affected. It is to be noted that one of the incentives offered by the Lehigh Valley Light & Power Company for its entry into this borough was better light, coupled with cheaper service, this feature being referred to repeatedly by the numerous witnesses for the applicant.

Antiquated meters and lax methods in rendering, modifying and collecting bills by the old company for several years prior to 1915 had given the consumers an incorrect idea of the actual value of the service rendered, and the installation of new and accurate meters about 1915 resulted in many cases in higher net monthly bills in spite of the decrease in the kilowatt-hour rate which was instituted by the new company. To the average citizen higher monthly bills were incompatible with reduced rates, and this, with the increased trolley fare, produced a widespread opinion that something was wrong, and in consequence the lighting service became the target of much criticism.

Change in Lamps

At or about the date of the writer's inspection of these conditions there was a general substitution of tungsten lamps for the older carbon-filament lamps which had been used almost universally prior to that time. The inspection showed that bare tungsten lamps were being used without reflectors in many instances; in fact, among the residences of those making the chief complaints the use of bare unprotected tungsten units might be referred to almost as the rule at that time. Voltage records at the substation showed practically constant voltage, and graphic voltage records at one or

*The reference in these notes to the case of the borough of Catasauqua is made through the courtesy of A. H. S. Cantlin, vice-president and manager of the Lehigh Valley Light & Power Company, Allentown, Pa.

two typical service points indicated reasonably close voltage regulation during the evening hours.

It should be stated in fairness to the new company that the distribution circuits of the old company were in a very bad condition and these had been modified only slightly in 1915 at the time of the report. As a result, voltage readings on an indicating voltmeter at various service points indicated considerable variations from a standard value, although the substation voltage showed no appreciable variations during evening hours. The conditions in this borough in 1915 presented some very interesting features. A reduction in rates coupled with accurate meters was resulting in somewhat higher monthly bills in certain cases, and the substitution of the improved tungsten lamps for the old carbon-filament units was accompanied by bitter complaints against the service rendered. Poor light (with brighter lamps) and higher bills (with lower rates) were, in short, the text of practically all of the testimony from the large number of witnesses who occupied a great proportion of the time during the three days' hearing.

In further fairness to the new company, it may be stated that essentially all of the writer's recommendations were carried out during the two years following the inspection, and some strenuous efforts were made to conduct certain educational work among the consumers with which they themselves could remedy much of the bad lighting in their own homes. Even with these efforts and the many improvements made by the new company, public opinion favored a municipal plant, and in about two years after the central station began its service the application for the municipal plant was filed and the hearing conducted.

The Essential Features Summarized

The essential features of the report on the lighting condition as found in 1915 have a bearing on what follows and are herewith summarized briefly as indicated below:

(1) Voltage regulation in substation at end of the high-tension feeders satisfactory.

(2) Graphic chart at typical service point shows satisfactory regulation.

(3) Indicated voltage readings in the residences show a considerable variation from a standard voltage. Distribution circuits probably at fault.

(4) Voltage rating of lamps employed shows wide variations.

(5) General use of bare tungsten lamps for residence lighting.

(6) Education among consumers should be started so that proper shades and reflectors will be used and the lighting rendered effective and pleasing for domestic purposes.

(7) Consumers should be told that lighting is best judged by the way the objects to be seen are illuminated, not by the glare from the lamps.

(8) Appearances indicate that the consumers are, in general, using tungsten lamps of sizes larger than necessary. Smaller lamps with suitable reflectors may actually result in improved illumination.

(9) Discourage the use of clear glass reflectors.

(10) Rearrange distribution circuits so as to supply some standard voltage to all residences.

(11) Standardize on some definite lamp voltage to correspond with the standard distribution circuit voltage.

(12) Instruct consumers to note that illumination depends on contrast. The illumination in the late afternoon, when the artificial light is mixed with daylight, may appear less satisfactory than after dark. Some of the complaints may be due to a cause like this.

Consumers Did Not Profit by Advice

As suggested above, practically all of these recommendations were carried out by the new company in the two years which followed the original inspection. The service conditions were definitely improved, meters calibrated, distribution circuits placed in good working condition, feeder regulators installed on the high-tension lines, and a solicitor was stationed in the community to render what assistance he could in remedying minor complaints and in making suggestions for improved methods of illumination. The events of these two years showed very little disposition on the part of the consumers to profit by such advice, and it is doubtful if any material improvement was effected in the illumination of the homes, although many improvements were made in the external service conditions.

The three days' hearing of this case at Allentown was presided over by the chairman of the State Public Service Commission, and the numerous witnesses for the borough gave almost uniform testimony that the bills were higher and the service was poorer than formerly. There was, of course, much psychology in this testimony.

A community which was already prejudiced by a trolley fare increase, and still further wrought up by an intense feeling that an injustice of some kind had been done by the new lighting company in not reducing its monthly bills and in not materially improving the illumination, could easily work itself up to a belief in imaginary wrongs, and this was definitely proved in a number of cases where testimony as to consistent increases in monthly bills was shown to be false by the monthly record of individual charges which the company had available in court.

It is the special purpose of this article, however, to emphasize the very evident weakness of those responsible for the service in refuting the many statements as to the bad lighting. The accuracy or the inaccuracy of statements about monthly bills was easily checked and immediately refuted in some cases where necessary, on a basis of tangible records in the hands of the company's auditor. For all of the testimony about the bad lighting, however, there was difficulty in formulating an immediate answer which could be used to refute these arguments or critical statements. Many of them were obviously absurd, but, as far as the consumer was concerned, they were expressed as firm beliefs. A typical example will illustrate the idea which was expressed by consumers on this point.

"I Find the Light Worse with Reflectors"

One of the many witnesses for the applicant stated that his light was poor; "wasn't what it ought to be."

Question: "Do you use tungsten lamps?"

Answer: "Yes, in important parts of my hotel."

Question: "Do you use reflectors on these lamps?"

Answer: "No, I never use reflectors or shades; I find that the light is worse with reflectors than without them."

The actual conditions in this hotel in 1915 were about as bad from the lighting standpoint as one can well

imagine. Bare tungsten lamps were mounted on a relatively low ceiling, or were placed in low fixtures where bare carbon filament lamps were formerly used. The question is, why, after two years, was this consumer not shown that such lighting conditions are atrocious and will always be so, no matter how perfect the station service may be made? In other words, why was he not shown that he, as a consumer, had a vital share to perform in the work of improving the illumination conditions in his own home or place of business?

Consumers Prejudiced

This is not said in criticism of the particular company in question. It had a difficult problem to handle and the class of consumers who made most of the complaints were almost impossible to deal with under the conditions of prejudice, the responsibility for which could not be placed entirely at the door of the new company at a time when every effort was being made to improve the bad state of affairs inherited from the old company. Furthermore, an aggravating feature was the fact that this small borough represented only a small percentage of the total load on the central station, so that the difficulties appeared to be exaggerated to those in charge of this division of the service.

It is evident, likewise, that these conditions of the complaints against poor light are found on every hand in other plants, although perhaps not in so pronounced a form, and hence this special case is given merely as typical. Looked at squarely, however, this case is strictly one in which poor illumination was a major factor in an application for a municipal plant. Poor illumination was a complaint placed at the door of the operating company, and the company was held responsible by the consumers in the community for this condition of affairs.

With better lighting conditions the tendency toward public ownership in this case could not have been so strong, since one of the principal features of the testimony of practically every witness for the applicant, as shown above, was complaint of bad lighting.

Central Station Must Give Illumination Service

It is the intention of this discussion to suggest that the central station must face the problem of improved illumination service if it wishes to avoid the difficulty experienced by this company. Systematic records and efficient methods in the auditor's office and competent service up to the meter are no longer the whole story. It is hardly proper to undertake a prophecy concerning the future based on an isolated case of this kind, but in this single instance the facts stand out forcibly.

The remedy must lie in educational efforts on the part of the public utility company. An interest must be taken in the way light is used in addition to the question of how much is consumed. If this responsibility is avoided or neglected, the company may find itself confronted unexpectedly in a hearing for a municipal plant by many witnesses who might have become satisfied customers, and it may pass through the not altogether pleasant experience of hearing from its own customers the charge of inferior service, which is likely to be an embarrassment, because often so impossible to answer, and because the Public Service Commission may look upon this condition as more the fault of the company than such a company has in the past been willing to admit.

HALFORD ERICKSON DISCUSSES FAIR RATE OF UTILITY RETURN

Former Chairman of the Wisconsin Commission Says That the Investors Appear to Require Occasional Extra Dividends

"In interpreting what is meant by the term 'fair return,' some hold that it is the return or cost at which the necessary capital for proper developments can be had; others say that the fair return is measured by the income basis upon which the existing securities of an enterprise, or similar securities of other enterprises, are selling in the open market. There are also many other views. The former of these two views seems to be in line with the best interests of both the public and the investor; the latter appears unjust to both." In these words Halford Erickson of Chicago addressed the Wisconsin Electrical Association.

In explaining his views Mr. Erickson said in part:

"Investors, in order to furnish capital on bonds on a 5 to a 5½ per cent interest basis, appear to require that the principal of such bonds shall be protected by property and equities worth not far from twice as much as the par value of the bonds; that the interest charges on such bonds shall be protected by net earnings that amount to about twice as much as such interest charges; that the future prospects of the road or utility shall be such that as far as can be judged the financial condition of the plant is likely to improve rather than otherwise; that the above income basis shall not, as a rule, include the cost of discounts, commissions and issuing expenses. Such expenses must, therefore, be borne by the plant in addition to the interest charges.

"The terms and conditions upon which investors are willing to furnish capital as developed from the prices at which the securities have been selling in the market, and from the value of the property and the amount of net earnings by which these securities had to be backed up in order to sell at such prices, apply for the most part to the larger and better-known railways and utilities. The securities of the smaller utilities under similar conditions as to the property and earnings by which they are protected sold at lower prices than those quoted, or at prices on which the yield obtained was considerably higher than the yields herein given.

Return Must Be at Least 8 Per Cent

"The full meaning of the facts which have been presented is best brought out when they are applied to specific cases. They indicate very closely that under ordinary conditions the roads and utilities, in order to meet the demands upon which the investor is willing to supply additional capital, must have net earnings for interest on the bonds, dividends on the stock and a surplus for safety; which altogether amount to not less than about 8 per cent on the fair value of the plant, its equities and business. With such net earnings as these and when the bonds do not cover more than from 50 to 75 per cent of the total value, the bonds would probably sell in the market on about a 5 to 5½ per cent income basis, while the stock would likely sell at prices on which the yield would amount to from 1 to 1½ per cent more than this. With a much lower net income than about 8 per cent on the fair value of the plant and its business, the plant could not, in the light of the facts here presented, very well be placed in the investment class."

Small-Town Interconnection That Paid

How Iron-Wire Transmission Lines and Inexpensive Distribution Systems Were Employed to Serve Small Communities That Would Otherwise Prove to Be Unprofitable Consumers for the Company

BY A. HARDGRAVE
Construction and Operation Engineer, Middle West Utilities Company

ACCORDING to the United States Census of 1910, there are in this country 12,956 incorporated towns with less than 5000 population each and with a combined population of 12,224,000, or 13.3 per cent of the total population of the United States. Eleven thousand seven hundred and eighty-four of these communities, with a combined population of 8,118,825, or 8.8 per cent of the total population of the United States, have fewer than 2500 inhabitants each. A great number of these towns are supplied from isolated electric plants, and with night service only, while many are not receiving the benefits of electric service at all. In order to serve these small communities profitably a system of transmission and distribution lines must necessarily be designed and installed at a cost proportional to the revenue which can be secured. As a general rule the ratio of investment to the annual gross revenue must decrease in direct proportion to the size of the community.

The commercial transmission and distribution of electrical energy in small properties present many more complex problems than are found in properties in larger cities. The word "commercial" has been used in this instance to differentiate between the use, on the one hand, of high construction and operating standards, which may be termed high-class engineering, carrying high initial investment costs and annual fixed charges, and, on the other hand, of systems constructed and designed at a moderate cost, commensurate with the development possible in the smaller towns. This in many cases is the difference between profitable and losing ventures in this class of properties.

The average small town, ranging from 500 to 2500 population, does not offer the opportunities for development existing in larger cities, and consequently the revenue received per capita or per customer is much less. It is therefore necessary to limit the investment in such towns in proportion to the revenue received, taking into consideration in each case the cost of production and distribution. It is purely a question of economics, and due consideration should be given to the fact that as a rule such communities do not have the rapid increase in population which is constantly going on in larger cities and industrial centers. In fact, many such communities have not increased in population during the last decade. Therefore in this class of towns great care should be exercised when designing and laying out transmission and distribution systems to keep in mind the fact that in most cases development is limited to existing business and does not depend upon the town's future growth. It is usually necessary and profitable in large cities to construct transmission and distribution lines not only for the present requirements but with sufficient capacity to provide for future growth. In such cases a very high degree of saturation can usually be obtained. This is, however, not true in small properties, and therefore systems must be installed at moderate cost if profits are expected for the investors.

To bring out more clearly the conditions which affect the economy of small-town interconnection a specific case may be instanced. The property consists of five small communities interconnected with a 22.5-mile (36.2-km.) 13,200 volt transmission line constructed with No. 6 B. B. galvanized-iron wire strung on 25-ft. (7.62-meter) and 30-ft. (9.15-meter) cedar poles spaced forty to a mile (approximately 25 per km.) Half the line is single-phase and the rest three-phase. The power station, which consists of high-speed, non-condensing units and return tubular boilers, is situated in the largest town of the group, with a population of 3500.

The other four towns, lying within five to ten miles (8.05 km. to 16.09 km.) of the central station, are of 400 to 700 population. The total investment in the system amounts to approximately $16.50 per capita. The gross and net earnings per capita for the year 1915 amounted to $5.40 and $2.27 respectively, notwithstanding the fact that during the period one of the small towns was receiving dusk-to-midnight service from an isolated oil-engine plant. The operating ratio for the year was 58.2 per cent, while the net earnings amounted to 12.57 per cent of the investment.



FIG. 1—TYPICAL 13,200-VOLT IRON-WIRE LINE IN SPARSELY SETTLED DISTRICT

The total investment apportionable to the four small towns, including the 40-kw. station rating and 12 per cent supervision and engineering charges, amounts to $11.31 per capita, as against $16.50 per capita for the entire group.

The gross earnings for three of the towns for the year amounted to $7,044, or $4 per capita. The total operating expenses and taxes, including energy at 2.85 cents per kw.-hr., amounted to $1,896. The

net earnings for the year amounted to $5,148, which is equivalent to a return of 20.5 per cent on the investment. The net earnings from these towns amounted to about 40 per cent of the total net for the entire system.

The value of the four small villages to the initial property can be fully realized when it is understood that no additional operating force or additional station ca-



FIG. 2—COMMUNITIES THAT WERE INTERCONNECTED BY IRON-WIRE LINE

pacity has been required. In this specific instance the three-phase transmission line cost approximately $450 per mile ($280 per km.), while the single-phase line, exclusive of the right-of-way, cost $386 per mile ($240 per km.).

Notwithstanding any criticism which might be made concerning the use of this class of construction, the actual losses on the system are under 20 per cent. One of the most important factors to consider is the profitable showing on the balance sheet.

Other similar groups of properties with which the writer is familiar are to-day laboring under extremely heavy fixed charges owing to large initial investments in high-class transmission and distribution systems—a class of construction which is entirely unjustified in such communities. In such towns using high-class ex-

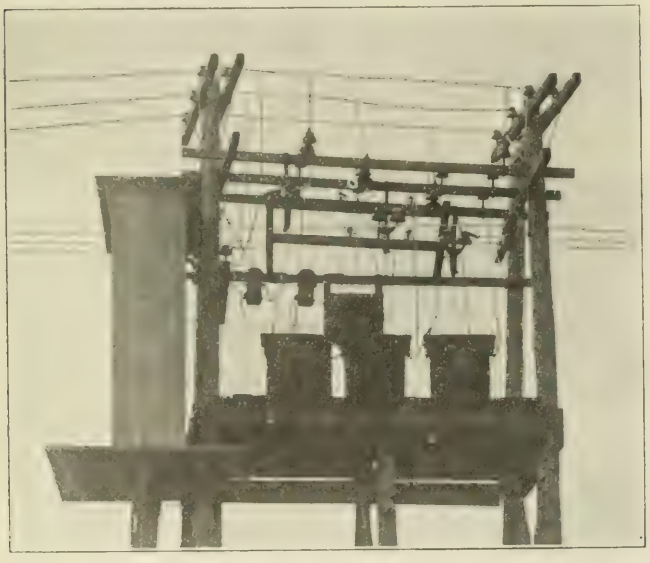


FIG. 3—OUTDOOR TRANSFORMER STATION SERVING ENTIRE TRANSMISSION SYSTEM

pensive methods the total transmission losses have not decreased, the maintenance is no lower, and the continuity of service is no better than that of the small iron-wire transmission system heretofore referred to.

There are to-day hundreds of towns ranging in population from 300 to 2500, lying within commercial-transmission distance of existing stations and transmission lines, that are entitled to and should enjoy the advantages of twenty-four-hour unlimited supply of electrical energy. Obviously, if such small towns are to enjoy these advantages it is essential to provide transmission and distribution lines and equipment at much lower cost than has previously been done. No doubt, when the value of such communities to existing systems is fully realized, manufacturers and engineers will be quick to design and provide lower-cost equipment and material, and thereby make possible the development of these small towns.

The grouping of small properties in this manner diversifies the financial risk of the business, gives greater stability to the entire financial structure, and makes the

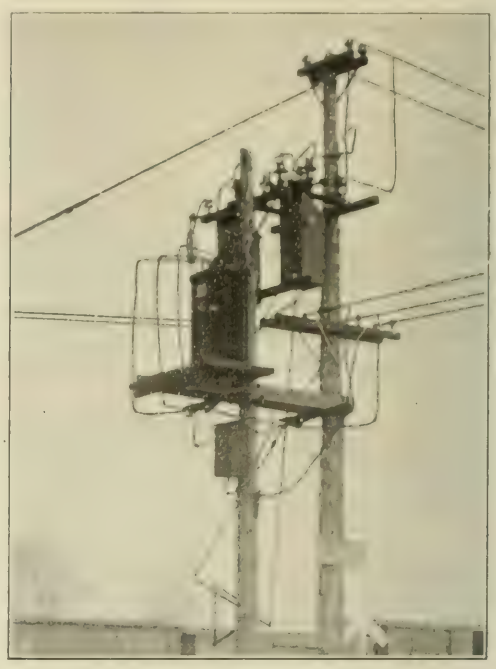


FIG. 4—TYPICAL OUTDOOR TRANSFORMER AND SWITCHING STATION SERVING SMALL COMMUNITY

securities of such companies more attractive to the investor. It may be readily seen, therefore, that concentration of management in both production and distribution is, considering the present development of generating and distributing apparatus, the essential economic factor that makes for successful and profitable operation of small properties.

Reducing Use of Gasoline to Safeguard Workmen

To safeguard its workmen the street department of the Commonwealth Edison Company has abandoned the use of gasoline where possible and in its place is using kerosene, which is considerably safer. The increased cost of gasoline was also a factor, but a comparatively unimportant one. Under the present arrangement gasoline is used only for operating engine-driven pumps and by the cable splicers for washing their hands. Each splicer is allowed a 1-gal. (3.785-l.) can for this purpose. All furnaces and torches are operated on kerosene. With the elimination of gasoline came an attempt to make the handling of kerosene safer by providing cans with special safety tops like those commonly used on gasoline cans.



MAIN GENERATING STATION OF THE EMPIRE DISTRICT ELECTRIC COMPANY AND AUXILIARY STEAM PLANT—A TYPICAL HOLDING COMPANY INVESTMENT

Enlarging Field of Holding Companies

Tendency of Financing Corporations to Step Beyond Control of Public Utility Operating Companies and Engage in Independent Industrial Activities Not Subject to Regulation

HOLDING companies occupy a position of large importance and influence in the public utility industries. They have developed phenomenally in both the number and the extent of their operations, and there are no present indications that the movement which they represent will be lessened in scope. Like other forms of corporate ownership, they are of course open to abuse or to the alternative of progress along recognized lines of economic value to the community. If the lines of their growth are guarded with care, they are capable of rendering useful service to the operating properties in physical standardization and in economy of operation and financing. If they are directed with a loose regard for their obligations to the public, they will bring serious disaster to the public utility industries in which they now have so powerful a part.

The purpose of the "Electrical World" is to call attention to a developing movement which, if applied generally, will substantially alter the character and position of holding companies.

While other properties are embarking in similar activities, the most conspicuous example is the Cities Service Company. It has done more in this direction than any other of the large holding corporations.

The latest significant development in the operations of these aggregations of utilities has such far-reaching possibilities that it merits special attention at this time. This tendency is turning the holding companies toward investment in fields of industry somewhat allied but not directly connected with their primary operations. It is leading them to supplement their ownership of public utility properties by extension to activities which are more private than quasi-public in nature and are hence not subject to regulation. Such activities are, in fact, a further application of the principle of investment, which is one of the best reasons for the existence of the holding type of company—that is, the distribution of risk.

The average holding company of the character under consideration here has its subsidiary operating companies situated in a number of different localities in the country. By thus diversifying its investment interests it lessens the chance that all may be affected in the event of unexpected depression. The business selection of properties in, say, cotton-growing districts, general agricultural communities, mining centers, specialized manufacturing districts and iron and steel industrial communities widely separated geographically will almost certainly result in combined fair average gross returns; it is extremely unlikely that reaction in business conditions would affect a great many communities, remote from each other, so unfavorably that all of their public utilities would suffer at the same time.

Another consideration has an equally important bearing when "boom" times come. Then the thriving state of industry causes more than the normal increase in the use of public utility service, and there is a very good chance that some properties will make exceptionally large gains in gross earnings. Just which of the properties will make these gains is a question of prophecy until the facts are revealed, but the prospects are always there. A special demand, due to unusual market conditions affecting the products of a particular community, will attract a prosperity to it which will be

reflected in the mounting gross earnings of the public utilities serving that community. And it is not uncommon to find that at the time when one subsidiary of a holding company is showing a large gain another subsidiary, owing to some local disturbance entirely disconnected from general business conditions, is suffering a decrease of noticeable proportions.

It is the fair average return secured from the combined operations of properties thus open to the effect of different influences which affords the best justification for the existence of the stabilizing holding company.

Long ago the holding company was extended to the three most conspicuous forms of public utility service generally furnished by private capital, that is to say, electric central station, artificial gas and electric railway. Naturally the electric central station has been a particularly desirable form of investment for these companies because its normal rate of growth is larger than that of the gas company or the electric railway

Enlargement of Holding Company Activities

It is only recently that the field of activity of the holding company, based primarily on investment in public utilities, has been enlarged still further. This enlargement of activities is still a matter of experiment with some properties, although with others it is held to be a definite policy and an assured success. In addition to the companies which have actually gone into additional forms of industry, others have similar enterprises under consideration and still others are believed to be looking into the possibilities offered.

The Cities Service Company is the most conspicuous of the holding companies which have gone into a new class of business on a large scale. This company has introduced into its operations an element of possible profit which has turned out to be of far greater importance than any other operations of current times in the stable and regulated public utility industries. Following a settled policy formed several years ago, this company has stepped logically from the production of natural gas, which it was furnishing to several communities in the West, to the production of petroleum.

Drilling for natural gas, one of its subsidiary properties found oil in large and profitable quantities. Controlling large areas of land which were capable of producing both natural gas and petroleum, it then took the second step of purchasing refineries in order to treat its crude petroleum. Later there followed the most recent action of the company in acquiring control of an old-established corporation engaged in marketing petroleum products in world-wide markets, the Crew-Levick Company, the headquarters of which are in Philadelphia.

Theories of Mr. Doherty

An official of the Cities Service Company states to the Electrical World that the policy of entrance into a new industry was not haphazard or accidental. Many years ago Henry L. Doherty, president of the company, formed theories that the location of deposits of natural gas and petroleum would be found by study of geological strata. With the organization of the Cities Service Company and its successful development of subsidiary natural gas properties in the Kansas fields it was decided to conduct practical experiments along the lines suggested by the theories developed by Mr. Doherty a number of years ago.

One of the first steps was the purchase of control of some companies producing natural gas. This was in 1912, and it was taken with the definite object of enlarging the production of natural gas, of conserving the production and use of this commodity and of testing the theories that, in connection with the deposits of gas, oil also would be located in profitable quantities. At the time the company began operations of this character a geological department was organized in the Doherty Operating Company, which operates the Cities Service Company. Where this department had at the beginning only three men, it is significant of its growth in importance to the company that it has at present a total of 150.

While drilling for gas in the fall of 1914 the Empire Gas & Fuel Company, a subsidiary of the Cities Service Company, discovered oil in the so-called Augusta field, Kansas, in which it had large holdings. As a result of subsequent geological study and practical tests the company enlarged its operations steadily until it now has 144 wells in the Augusta field and 386 in another district, known as the Eldorado field. With these extensive interests the Empire Gas & Fuel Company has become one of the largest producers of oil in the country. To supplement the petroleum-producing activities thus assured the Cities Service Company purchased the stock of six refining companies and practically all of the stock of the Crew-Levick Company, which, although also a producing and refining company, is essentially a distributor of petroleum products. The latter company will add petroleum-carrying steamships to its plant so as to provide better for its European markets.

Co-operation with Universities in Research

In conjunction with the operations in gas and oil fields the Cities Service Company, for the purpose of conducting research work, has co-operated with the staffs of the technical universities in the sections in which the gas and oil fields are situated. Its electrical engineers have worked with the oil operators to enlarge the possibilities of pumping by electrical energy, a development of recent years which is believed to promise economical and desirable results.

A similar extension of activities by the United Gas & Electric Corporation is the purchase of an interest in a natural gas and oil development, situated chiefly in Louisiana, but partly in Mississippi, Texas, Oklahoma and Kansas. This investment comprises an interest in Louisiana Gas & Fuel Company, Inc., bonds and stock.

Other public utility holding company interests which have made definite plans for entering fields of activity outside of the old scope of operations have not in all cases announced their arrangements publicly. Some of these, however, are giving careful study to the subject and have expended money in experimental work. The high prices prevailing for petroleum products and the continued demand from consumers in those markets have turned attention in that direction. Holding-company interests have been investigating conditions in the oil producing, refining and marketing industries to measure the possibilities and the danger of investment after so great an expansion and rise in selling prices as have taken place recently.

In other directions also investigations are in progress to determine what allied lines of industry can be conducted profitably in connection with public utilities. Progress has been made, and it is evidently only a question of time when actual developments will follow.

Output of Large Generating Systems

Approximately Two-thirds of the Central Station Energy of the Country Generated by Forty-one Companies, Chiefly in Hydroelectric Stations Increase More Than 2,000,000,000 Kw-hr. for Year

STATISTICS for 1916 on the outputs, peak loads and load factors of the largest generating systems of the country are given in the accompanying table. The total output of the companies listed was 17,500,000,000 kw.-hr., the combined outputs of the companies in the United States approximating 15,500,000,000 kw.-hr. The greater part of the electrical energy was generated from water power. Similar statistics for the years 1915 and 1914 were published in the ELECTRICAL WORLD of March 11, 1916.

With two exceptions, every one of the companies shows an increased output over 1915. Instances of increases due to war conditions are to be noted in the cases of the three Canadian companies (the Ontario Power Company of Niagara Falls, the Shawinigan Water & Power Company and the Toronto Power Company) and of the Montana Power Company, the Detroit Edison Company, the Duquesne Light Company, the Utah Power & Light Company, the Philadelphia Electric Company and the Public Service Electric Company of New Jersey.

Returns from three companies not heretofore listed in this compilation, the Cleveland Electric Illuminating Company, the Virginia Railway & Power Company and the Empire District Electric Company, are published for the first time. As has been the case for a number of years now, the Commonwealth Edison Company of Chicago shows a larger output than any other generating company in the country and may claim without question the distinction of being the largest generating company in the world.

The figures for the Ontario Power Company have to do only with the energy actually produced in its own station. The company purchased in addition a large

DATA ON OUTPUT AND LOAD FACTOR OF LARGEST GENERATING SYSTEMS IN AMERICA

System	1916				1915			
	Peak Load (Kw.)	Date of Peak Load	Yearly Output (Kw.-Hr.)	Yearly Load Factor (per Cent)	Peak Load (Kw.)	Date of Peak Load	Yearly Output (Kw.-Hr.)	Yearly Load Factor (per Cent)
Commonwealth Edison Company	369,740	Dec. 19	1,341,964,000	43.20	337,900	Nov. 29	1,198,636,900	42.50
Niagara Falls Power Company	143,360	Nov. 24	1,015,525,680	80.64	126,320	Dec. 27	899,427,550	81.28
Ontario Power Company of Niagara Falls	123,900	Oct. 12	942,221,900	86.80	.....	.....	757,713,600	.....
New York Edison Company & United Electric Light & Power Company	254,824	Dec. 20	856,385,319	38.30	239,416	Dec. 6	740,873,162	35.30
Montana Power Company	149,740	Dec. 19	867,940,326	84.50	89,000	Dec. 20	489,831,218	84.10
Pacific Gas & Electric Company	141,008	Dec. 19	768,304,907	62.20	139,540	Dec. 1	725,715,620	59.40
Hydraulic Power Company	89,275	Dec. 26	717,079,320	91.50	87,395	Dec. 16	695,619,456	91.00
Toronto Power Company	129,000	Dec. 20	660,873,579	58.40	102,000	Dec. 29	348,000,000	39.00
Public Service Electric Co. of N. J.	174,000	Dec. 14	608.018,729	39.82	143,000	Dec. 10	490,684,988	37.73
Detroit Edison Company	130,200	Dec. 19	546,925,300	47.80	101,800	Dec. 17	393,129,850	44.10
Tennessee Power Company	81,650	Dec. 14	483,354,162	67.00	*	.....	.....	.....
Shawinigan Water & Power Company	108,000	Dec. 14	478,540,000	50.00	*	.....	.....	.....
Duquesne Light Company	101,000	Dec. 21	463,537.660	52.30	83,000	Nov. 29	347,514,317	48.00
Philadelphia Electric Company	142,260	Dec. 12	444,785,884	35.6	*	.....	.....	.....
Pennsylvania Water & Power Company	77,000	.....	417,837,600	61.8	76,000	Dec. 12	.....	51.90
Utah Power & Light Company	68,894	Dec. 6	412,726,000	67.8	.....	.....	.....	.....
Great Western Power Company	74,100	Dec. 14	408,391,067	62.65	62,100	Nov. 15	337,264,400	62.00
Mississippi River Power Company	82,400	Nov. 27	393,400,000	54.3	77,300	Nov. 18	370,330,660	54.60
Pacific Light & Power Corporation	82,765	Dec. 22	376,308,731	51.76	76,150	Oct. 28	316,098,189	47.39
Puget Sound Traction, Light & Power Co.	77,030	Nov. 28	353,697,263	51.8	66,000	Dec. 30	295,766,712	51.20
Cleveland Electric Illuminating Co	84,999	Oct. 25	340,670,721	45.8	*	.....	.....	.....
Electric Company of Missouri / Union Electric Light & Power Co	88,544	Dec. 11	333,964,652	43.1	76,303	Nov. 29	308,759,186	42.60
Commonwealth Power, Railway & Light Co.	.....	.....	315,964,337	.....	66,930	Dec. ..	245,300,654	42.50
Southern California Edison Company	60,930	Dec. 28	299,950,513	56.04	56,625	July 13	286,985,095	57.80
Buffalo General Electric Company	65,500	Dec. 14	299,306,640	57.00	62,460	.....	273,950,000	.....
New England Power Company	64,000	Dec. 12	246,000,000	44.00	49,300	Dec. 29	172,863,764	40.05
Edison Electric Illuminating Co. of Boston	80,539	Dec. 12	238,557,144	33.72	72,802	Dec. 13	208,358,400	32.70
Edison Electric Illuminating Co. of Brooklyn	67,200	Dec. 19	233,452,500	38.1	62,000	Dec. 23	188,516,851	34.70
Wisconsin Edison Company / Milwaukee Electric Railway & Light Co.	64,170	Dec. 5	218,421,711	39.00	52,458	Nov. 19	158,089,543	35.00
Portland Railway, Light & Power Co	47,335	Nov. 29	194,146,555	46.5	47,150	Dec. 30	186,372,553	45.10
Sierra & San Francisco Power Company	.....	.....	191,620,000	.....	40,560	Feb. 26	190,147,804	53.5
Alabama Power Company	40,500	Dec. 11	184,345,360	51.07	28,750	Dec. 21	123,882,040	48.00
Georgia Railway & Power Company	.....	.....	172,000,000	.....	77,100	Dec. 17	179,976,596	26.65
Minneapolis General Electric Company	43,640	Dec. 14	171,672,890	44.9	33,100	Dec. 6	128,941,588	44.50
Great Northern Power Company	38,200	Nov. 21	163,807,560	48.8	32,000	Nov. 23	142,249,020	50.80
Washington Water Power Company	30,440	Dec. 14	162,825,400	60.80	28,691	Jan. 20	165,913,500	66.00
Adirondack Electric Power Corporation	41,575	Dec. 12 & 22	151,128,310	41.40	38,400	Dec. 13 & 29	128,640,000	38.20
Rochester Railway & Light Company	40,250	Dec. 16	146,069,428	41.00	37,000	Dec. 15	123,401,451	38.00
Toledo Railways & Light Company	36,428	Dec. 22	134,842,360	42.2	33,373	Dec. 31	100,168,375	.....
Virginia Railway & Power Company	33,900	Dec. 18	132,275,000	44.54	*	.....	.....	.....
Southern Sierras Power Company / Nevada-California Power Company	22,400	April 28	131,084,265	66.5	20,300	July 29	114,187,385	64.20
Potomac Electric Power Company	38,600	Dec. 18	122,158,818	36.1	36,200	Nov. 30	111,082,725	35.03
Empire District Electric Company	26,900	Mar. 26	119,280,363	49.7	*	.....	.....	.....
Southwestern Power & Light Company	25,600	Oct. 5	95,740,000	43.0	16,600	Dec. 22	87,089,000	44.00
Southern Power Company*	.....	.....	.....	.....	.....	.....	.....	.....

*No data received.

amount of energy from outside sources and therefore actually handled and delivered very much more than the figures given would indicate. It will be noted that the load factor of the Hydraulic Power Company of Niagara Falls is this year 91.5 per cent. This figure was obtained by using the average output for the whole year compared with the highest single reading for the year. The company reports that its ordinary daily load factor is usually above 98 per cent. In the case of the Commonwealth Power, Railway & Light Company the returns for 1916 show the actual sales of electricity in kilowatt-hours rather than the amount generated.

All of the companies have, of course, felt the increased cost of material and labor, and with one or two exceptions all of the steam generating systems have suffered considerably for want of coal and also because of the great increase in the price of it. The hydroelectric stations at Niagara Falls and also those in the West are still handicapped by want of legislation which will enable them to use water power up to their needs and to take care of increasing demands on their systems. It is hoped that the session of Congress now convened may grant relief in water-power matters, especially as the coal situation is bound to become more and more acute.

Having a wider diversity of uses for electricity than any other section of the country, the Pacific Coast companies still enjoy much better load factors than the companies in the interior states and along the Atlantic seaboard.

In view of the high cost of material, which has compelled many companies to keep down extensions, the outputs recorded are most excellent. They indicate more intensive development on the part of the various companies.

THINGS TO CONSIDER WHEN MAKING LINE EXTENSIONS

Three Points That Should Be Borne in Mind by Managers to Avoid the Losses Due to Lack of Fixed Policy and Preliminary Investigation

BY R. A. LANGWORTHY

Many existing distribution lines are being operated at a loss because they were built without proper preliminary investigation and without any fixed policy regarding line extensions. To avoid making such unprofitable investments, therefore, three things become necessary:

(1) The adoption of a standard policy as to the return required from any proposed line extension; (2) a system of investigation, report and approval for a particular extension which will compel the gathering of proper data and their submission in such a way as to allow of easy inspection and checking before approval by the proper executives; (3) no extensions or promises of them should be made until an approval has been received. If a proper system is worked out covering the three points mentioned most of the troubles attending line extensions will be avoided, thereby saving money and strengthening the prestige of the operating company.

While the system described in what follows was worked out for the use of a large company, it should be of interest also to smaller companies. With holding companies, the requests for line extensions are usually brought to the attention of a local manager, who perhaps has already made up his mind that the extension should or should not be made, so that his subsequent decisions may be biased. However, if this man only collects the

LINE EXTENSION RECOMMENDATION

_____ DISTRICT _____ DATE _____

WE WOULD RECOMMEND THAT OUR LINES BE EXTENDED

FROM _____ TO _____ A DISTANCE OF _____ FEET TO SUPPLY _____

VOLTAGE _____ PHASE _____ SERVICE MUST BE FURNISHED BY _____

EMPLOYEES ARE CAUTIONED NOT TO PROMISE IMPOSSIBLE DATES.

SURVEY BY _____ APPROVED _____ DIST. MANAGER

COST OF EXTENSION

FEET NO POLES	FEET WIRE	POUNDS	UNIT COST	TOTAL

data and sends them in detail to the higher executives for approval, a much better decision results for the following reasons:

(1) A larger number of the men in the organization will pass upon the proposition, or by applying the old saying "two heads are better than one"; (2) the men higher up, being unfamiliar with all local details, are in better position to pass on the cold, hard facts presented without sentiment or prejudice.

The adoption of a standard policy varies somewhat with different organizations. As a general rule, however, it should be required that the gross revenue from an extension shall pay therefor in from two to three years. One company has decided to "pay out" in one year, but this policy in some cases proved unsatisfactory and discouraged a lot of good business. In the opinion of the writer, a policy of "paying out" in two and one-half years will take care of nearly all ordinary conditions and permit taking on all proper business. The adoption of a definite policy, known to all employees, will prevent the building of unprofitable lines and what is nearly as bad the promise of extensions when they cannot be financially considered and when later a refusal to build will cause resentment and injure the standing of the company in the community.

Having adopted a policy, the next step is to provide a system whereby extensions can be made only after careful investigations, estimates of cost and revenue and approval by the proper executive have been made. A form devised by the writer for the purpose of making recommendation for line extensions is shown in Figs. 1 and 2. The front of the sheet, shown in Fig. 1, contains spaces for itemized estimates on the cost of the extension, while space on the back (Fig. 2) is provided for estimates of the revenue. Since both estimates are made out in detail they may be readily checked by any one as an assurance that the cost of the work has not been over- or underestimated. In making estimates of the revenue it is required that an actual canvass of the prospective customers be made and provisional contracts signed. These arrangements are shown in detail in Fig. 2, together with the minimum amount guaranteed in part payment of the cost of the line, etc. With this form, properly filled out, the approving executive can promptly and accurately gage the situation, check any of the details and pass upon the extension with a minimum of risk.

In the organization for which this system was devised the local managers report direct to a district manager, who in turn is responsible to the main office. The forms are made out in triplicate by the local managers, who forward them to the district manager. When they are approved by him they are forwarded to the main office for the respective signatures of the chief engineer and the president. If the extension is approved, the original copy is retained for the main office records and the other two copies returned to the district manager. One of these is retained by him and the third copy returned to the local manager, thereby authorizing him to proceed with the work. The system requires a minimum amount of labor and "red tape," provides for proper inspection and approval by different officials, leaves a record in the files of all persons who should have information thereon, protects the company against "wildcat" extensions, and withal is simple and easily understood and applied. In actual practice it has worked out very satisfactorily.

DATA AND OPINIONS ON UNDERGROUND PRACTICE

Cable Jointing and Ventilation of Underground Electrical Equipment Discussed at Committee Meeting of Ohio Electric Light Association

Ventilation and construction of manholes, laying and splicing of cables, and the trend of engineering opinion and practice on underground systems were among the topics discussed at a recent meeting of the transmission and distribution men of the Ohio Electric Light Association. To ventilate its underground system one company has installed a pipe from the top of the manhole to a point near a building, at which point it is extended above the ground to emit gases and warm air. Another company found it necessary at times of excessive heat to tear up the paving and spray water on the surface of the ducts. An artificial cooling system in which water was circulated around the walls of a manhole containing heavily loaded cables created considerable comment. According to opinions expressed, 125 deg. Fahr. (51.7 deg. C.) is a dangerous temperature for cables. F. Kendig, Dayton Power & Light Company, said he found that whenever steam mains are close to underground cables it is advisable to replace varnished-cambric insulated cables with paper-insulated cables.

Owing to the fact that there is a tendency for city officials to limit the sizes of manholes, this topic was discussed at length. A popular size seemed to be 7 ft. (2.13 meters) by 9 ft. (2.74 meters) by 8 ft. (2.44 meters) deep. The fact that earlier designers of manholes did not provide for the subway transformers and the excessive heat of cables was cited as a cause for trouble now. When considering the transformer space in manholes to-day, an average of 4.5 cu. ft. (12.72 cu. dm.) per kva. seems to have generally worked out very satisfactorily. It was decided, however, that the larger the manhole can be made the more flexible will be its use.

F. W. Funk of the Mahoning & Shenango Railway & Light Company, Youngstown, Ohio, opening a discussion on cable joints, stated that the joint in a cable when properly made is considerably stronger than any other point in the cable. In relatively heavy cables it is necessary to make a joint about every 500 ft. (152.4 meters) to facilitate the installation without introducing undue strain. Comparing the advantage of oil-filled joints and compound-filled joints, W. E. Richards of the Toledo Railways & Light Company pointed out that the oil-filled type can be refilled from time to time and is entirely free from voids. On the other hand, compound-filled joints contain voids in which loose particles become carbonized and in time cause breakdowns between conductors. Attention was also called to the fact that the characteristics of any joint depend on the personal element involved in making the joint.

M. E. Grah of the Toledo Railways & Light Company suggested that high-tension cables be placed in the lower ducts of a duct run in order that the heat-producing circuits (*i.e.*, the lower-voltage cables) may have the least effect on the high-tension cables. This location also provides an additional factor of safety from damage by workmen digging into the more dangerous and vital circuits.

M. H. Wagner of the Dayton Power & Light Company and F. M. Hibben of the Cleveland Electric Illuminating Company also spoke, discussing the question of safety precautions as applied to manholes.

January Earnings Reach $41,000,000

Results of Central Station Operation During First Month of Current Year Show Increase Over January, 1916, of 14.3 Per Cent in Earnings and 27.7 Per Cent in Output—Coal Shortage and Railroad Congestion Factors

FOR the first month of the present year the results from operations of electric light and power utilities in the United States, according to returns received by the ELECTRICAL WORLD, show very gratifying increases over the results obtained during the first months of 1916. In comparison with January, 1916, the January, 1917, earnings show an increase of 14.3 per cent and the output an increase of 27.7 per cent. Based on the returns received from about 55 per cent of the rated capacity of the central stations of the country, the earnings for January, 1917, were in round numbers $41,000,000. For the same months the output was 2,170,000,000 kw.-hr.

With the exception of the Atlantic States, all sections

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE-MONTH PERIOD

	Percentage of Industry Represented	Income from the Sale of Energy			Kw.-Hr. Output		
		1916	1915	Per Cent Increase	1916	1915	Per Cent Increase
Feb	65	22,133,000	19,175,000	15.3	1,121,452,000	869,537,000	29.1
March	65	22,027,000	18,722,000	17.8	1,212,363,000	969,888,000	25.2
April	64	21,206,000	18,375,000	15.5	1,137,602,000	920,464,000	23.1
May	64	20,345,000	17,559,000	16.0	1,170,143,000	944,681,000	24.0
June	64	20,254,000	17,551,000	15.4	1,170,679,000	968,724,000	21.0
July	64	19,760,000	17,301,000	14.2	1,174,374,000	976,704,000	24.4
Aug	64	20,502,000	17,861,000	15.0	1,262,575,000	1,015,805,000	22.4
Sept	64	21,432,000	18,600,000	15.2	1,268,339,000	1,037,976,000	21.2
Oct	64	22,882,000	20,164,000	13.5	1,347,502,000	1,125,132,000	19.9
Nov.	64	24,819,000	21,744,000	14.4	1,396,537,000	1,148,221,000	21.7
Dec.	60	24,173,000	21,076,000	14.6	1,287,524,000	1,072,648,000	20.0
1917		1917	1916		1917	1916	
Jan.	55	22,587,000	19,742,000	14.3	1,194,183,000	935,812,000	27.7

TABLE III—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR UNITED STATES—CITIES GROUPED BY SIZE

	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.
INCOME:										
Group 1	13.9	14.4	14.9	13.8	13.9	15.0	11.6	13.0	14.7	13.6
Group 2	17.0	17.5	17.7	16.8	15.7	20.4	19.2	17.7	16.9	16.3
Group 3	24.7	26.2	21.8	19.5	20.9	18.4	18.5	18.2	15.2	15.7
Group 4	17.4	15.1	11.0	9.0	9.5	11.3	13.5	12.8	12.3	15.4
Group 5	16.1	24.0	15.3	12.2	14.9	13.3	16.0	12.8	9.5	20.7
OUTPUT:										
Group 1	20.0	21.3	18.7	18.1	21.4	18.5	16.6	18.2	17.1	24.5
Group 2	25.5	18.0	17.5	22.9	33.0	32.9	31.1	27.2	21.9	28.6
Group 3	37.7	40.0	21.8	27.8	31.1	19.3	24.0	32.0	28.8	35.3
Group 4	22.7	23.0	19.3	16.1	23.0	26.0	20.4	19.7	21.0	30.5
Group 5	32.0	33.2	19.0	11.6	16.8	15.3	18.3	33.0	25.4	21.5

TABLE IV—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR NEW ENGLAND STATES—CITIES GROUPED ACCORDING TO SIZE

	April	May	June	July	Aug.	Sept.	Oct.	Nov	Dec.	Jan.
INCOME:										
Group 1	16.0	17.0	16.4	12.6	9.6	16.5	12.1	13.5	12.5	12.5
Group 2	21.2	19.5	19.8	20.6	15.1	25.5	21.3	20.0	30.2	16.1
Group 3	15.5	24.0	18.2	21.2	15.0	20.5	18.0	19.4	16.5	17.8
Group 4	13.2	13.5	7.2	6.2	11.1	10.5	15.4	16.0	16.0	22.0
Group 5	27.6	27.0	21.7	14.9	17.5	18.3	18.2	18.6	12.2	24.0
OUTPUT:										
Group 1	25.0	28.2	30.0	19.2	31.3	34.0	17.5	18.0	10.8	20.7
Group 2	31.4	33.2	26.3	14.1	32.0	37.7	35.0	24.7	18.2	24.8
Group 3	38.1	43.0	15.0	31.4	45.5	32.4	42.6	35.9	22.0	20.9
Group 4	36.1	30.0	21.0	26.6	39.4	32.9	48.9	40.0	55.2	73.8
Group 5	71.8	54.4	31.7	13.5	21.3	27.4	22.0	17.0	35.7	29.2

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	Percentage of Industry Represented	New England States			Percentage of Industry Represented	Atlantic States			Percentage of Industry Represented	Central States (Illinois Excluded)			Percentage of Industry Represented	Pacific and Mountain States		
			1916	1915	Per Cent Increase		1916	1915	Per Cent Increase		1916	1915	Per Cent Increase		1916	1915	Per Cent Increase
INCOME	February	66	2,599,000	2,185,000	18.8	67	8,978,000	7,854,000	14.3	57	6,660,000	5,568,000	19.7	88	3,761,000	3,443,000	9.3
	March	66	2,595,000	2,122,000	22.0	67	8,998,000	7,660,000	17.5	57	6,470,000	5,394,000	20.1	88	3,787,000	3,386,000	11.9
	April	64	2,221,000	1,898,000	17.0	67	8,794,000	7,596,000	15.8	56	6,289,000	5,292,000	19.0	88	3,825,000	3,520,000	8.8
	May	65	2,103,000	1,788,000	17.0	67	8,226,000	7,131,000	15.4	56	6,085,000	5,123,000	18.7	88	3,874,000	3,469,000	11.6
	June	65	2,208,000	1,906,000	16.0	67	8,045,000	6,905,000	16.5	56	6,007,000	5,143,000	16.9	88	4,017,000	3,539,000	13.5
	July	65	2,130,000	1,875,000	13.7	67	7,832,000	6,621,000	16.4	56	5,926,000	5,095,000	16.3	88	3,755,000	3,493,000	7.6
	August	65	2,203,000	1,935,000	13.7	66	8,000,000	6,875,000	16.4	56	6,195,000	5,266,000	17.7	88	3,883,000	3,582,000	8.4
	September	65	2,315,000	1,982,000	16.8	66	8,631,000	7,445,000	16.0	56	6,505,000	5,537,000	17.8	88	3,979,000	3,644,000	9.2
	October	65	2,684,000	2,331,000	15.2	65	8,887,000	7,930,000	12.1	56	6,968,000	5,895,000	18.2	87	4,213,000	3,889,000	8.3
	November	65	2,912,000	2,516,000	15.7	65	10,061,000	8,859,000	13.5	56	7,410,000	6,313,000	17.4	87	4,246,000	3,947,000	7.5
	December	65	3,203,000	2,814,000	14.0	60	10,033,000	8,490,000	18.4	56	7,791,000	6,899,000	13.0	75	2,987,000	2,735,000	9.3
	1917		1917	1916			1917	1916			1917	1916			1917	1916	
	January	64	3,181,100	2,762,000	15.1	59	9,864,000	8,619,000	14.5	42	5,806,000	5,044,000	15.2	75	3,601,000	3,205,000	12.4
KW.-HR. OUTPUT			1916	1915			1916	1915			1916	1915			1916	1915	
	February	66	92,855,000	68,982,000	34.8	67	411,715,000	320,924,000	28.1	57	339,326,000	252,816,000	34.1	88	268,653,000	220,662,000	22.1
	March	66	97,321,000	74,958,000	29.9	67	439,660,000	349,347,000	26.0	57	360,872,000	282,179,000	28.0	88	304,327,000	255,450,000	19.3
	April	64	84,769,000	64,816,000	30.8	67	403,223,000	326,574,000	23.4	56	344,866,000	273,367,000	26.4	88	302,386,000	253,778,000	19.2
	May	65	84,719,000	64,318,000	31.8	67	409,529,000	333,585,000	22.0	56	345,860,000	275,328,000	25.6	88	328,793,000	266,599,000	23.2
	June	65	87,829,000	69,506,000	27.6	67	396,630,000	327,541,000	21.2	56	350,015,000	288,982,000	21.2	88	328,996,000	277,915,000	18.6
	July	65	85,317,000	71,160,000	19.8	67	401,179,000	333,771,000	20.3	56	350,708,000	287,407,000	22.2	88	325,647,000	279,285,000	17.4
	August	65	97,197,000	72,900,000	33.4	66	433,129,000	344,730,000	25.7	56	374,327,000	295,866,000	26.5	88	333,468,000	279,976,000	19.1
	September	65	98,350,000	73,343,000	34.2	66	446,534,000	369,815,000	20.8	56	387,626,000	307,485,000	26.2	88	335,817,000	288,332,000	16.4
	October	65	107,756,000	83,705,000	28.8	65	426,151,000	373,705,000	14.2	56	408,364,000	324,509,000	25.9	87	355,014,000	306,828,000	15.8
	November	65	111,873,000	89,015,000	25.7	65	533,252,000	424,746,000	25.6	56	415,491,000	334,044,000	24.4	87	346,847,000	293,518,000	18.2
	December	65	117,763,000	97,387,000	21.0	60	483,129,000	410,744,000	17.8	56	419,532,000	348,815,000	20.2	75	256,006,000	206,838,000	23.8
	1917		1917	1916			1917	1916			1917	1916			1917	1916	
	January	64	120,211,000	93,163,000	29.1	59	487,466,000	381,271,000	28.0	42	281,209,000	218,800,000	28.4	75	295,395,000	234,614,000	25.7

of the country show for January greater percentages of increase in earnings when compared with the same months of the previous year than in December. All sections, however, show a greater rate of growth for January than December so far as output is concerned. In fact, with the exception of February, 1916, the increase in output in January over January, 1916, was greater in per cent than in any previous month in the history of the industry."

The totals which are presented here represent strictly electric light and power operations. Earnings represent only that income received from the actual sale of energy, and do not in any case include merchandising sales or income derived from any other source. In like manner the output is merely that energy for which income is received. As far as possible all duplications are eliminated from these compilations.

TABLE V—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR ATLANTIC STATES—CITIES GROUPED BY SIZE

	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.
INCOME:										
Group 1.....	15.1	14.5	16.4	16.8	16.1	16.2	10.7	13.7	18.8	14.9
Group 2.....	81.5	21.7	21.9	18.5	21.6	19.0	21.0	22.5	21.7	13.4
Group 3.....	15.3	17.7	12.0	14.2	15.0	14.0	14.6	13.0	13.4	12.8
Group 4.....	19.5	14.0	15.4	10.0	14.4	9.8	13.5	13 1	14.4	13.5
Group 5.....	15.6	13.0	15.2	13.0	19.4	8.9	14.3	16 0	14.3	11.1
OUTPUT:										
Group 1.....	26.1	25.5	13.1	23.4	28.5	23.6	19.2	20.8	17.4	28.5
Group 2.....	35.6	11.3	31 8	27.4	32.5	26.7	33.0	31.9	28.2	28.3
Group 3.....	13.7	18.0	13.2	11.5	16.0	24.7	4.5	19.0	15.9	27.2
Group 4.....	19.0	12.6	19.7	16.3	29.5	18.6	17.5	14.6	16.0	24.8
Group 5.....	8.9	35.0	11.1	13.5	20.4	1.3	1.5	5.8	6.9	9.4

TABLE VI—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR CENTRAL STATES—CITIES GROUPED BY SIZE

	April	May	June	July	Aug.	Sept	Oct.	Nov.	Dec.	Jan.
INCOME:										
Group 1.....	18.2	18.0	16.4	15.8	16.5	16.6	18.0	16.5	13.0	14 3
Group 2.....	18.0	17.4	17.5	17.3	21.8	21.5	21.0	17.0	16.4	18.8
Group 3.....	26.7	27.2	20.5	18.6	18.4	13.4	10.9	13.0	1.8	5.5
Group 4.....	22.8	24.1	17.5	17.5	10.7	20.0	19.7	16.8	15.5	19.8
Group 5.....	9.4	21.3	12.6	6.1	11.8	11.0	18.4	14.3	†....	19.3
OUTPUT:										
Group 1.....	24.7	25.0	23.8	21.0	24.3	22.3	24.9	24.8	22.3	31.6
Group 2.....	23.9	19.5	12.3	25.7	36.4	40.0	31.7	29.7	21.0	31.5
Group 3.....	43.5	41.0	31.8	26.0	25.7	20.7	17.3	19.7	1.2	6.4
Group 4.....	39.2	38.5	34.3	21.1	23.0	33.8	26.1	21.2	21.4	24.5
Group 5.....	10.1	14.7	4.0	8.6	6.1	13.7	28.2	16.8	9.9	15.5

†Results omitted owing to insufficient returns.

TABLE VII—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT HOUR OUTPUT FOR PACIFIC AND MOUNTAIN STATES—CITIES GROUPED ACCORDING TO SIZE

	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.
INCOME:										
Group 1.....	3.9	7.2	7.5	4.7	5.5	6.2	4.2	1 5	4.0	8.6
Group 2.....	3.5*	2.3	1.2	0.6*	0.7	4.9	1.3	3.0	3.6	7.5
Group 3.....	40 0	39.0	39.5	28.3	32.5	28.5	32.4	31.0	30.0	27.6
Group 4.....	11.7	13.8	3.6	1.0	0.5	11.5	7.2	0.4	0.6*	8.6
Group 5.....	12.0	19.1	12.8	13.2	13.0	11.7	13.5	17.1	11.1	20.0
OUTPUT:										
Group 1.....	8.0	12.0	8.0	10.0	6.3	7.1	5.2	8.0	8.6	14.0
Group 2.....	3.6*	2.2	1.0	2.0	6.5	7.8	9.7	11.4	8.7	11.8
Group 3.....	80.0	79.0	74.5	56.1	57.5	60.0	63.7	61.3	48.0	59.5
Group 4.....	10.3	21.8	10.0	4.0	7.5	12.0	*0.5	4.2	2.6	15.2
Group 5.....	11.7	17.5	16.0	10.8	16.5	7.0	14.7	42.3	5.4	15.6

*Decrease.

The effect of the tremendous sale of motors to industrial establishments is readily seen from the tremendous growth in output over the previous year. Motors ordered many months ago are now finding their way onto the lines of the central stations. Furthermore, motors of a very great total rating are still in the process of manufacture.

The increased rate of growth shown by the January returns serves to indicate in a measure to what extent central stations were called upon to supply industrial establishments owing to the high price of coal and the inability in some sections of the country to obtain any. There is no doubt that the coal shortage was responsible for many isolated plants taking central station service—

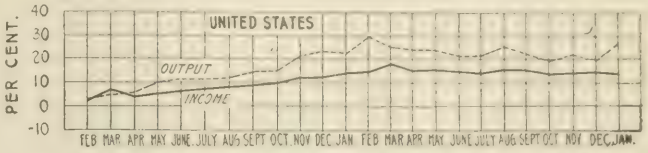
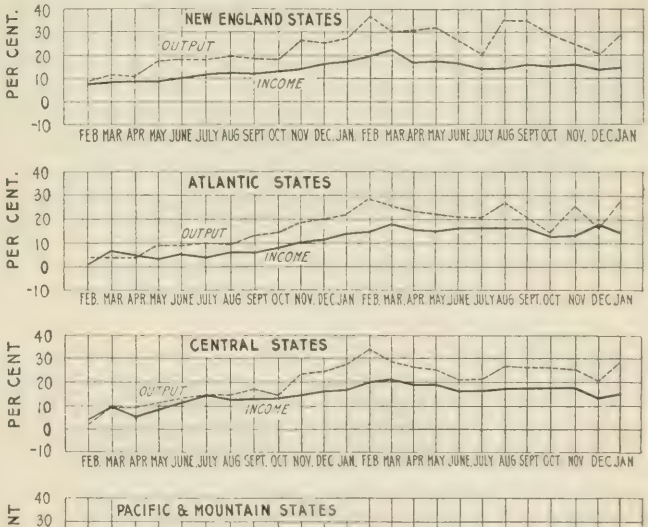


FIG. 1—CENTRAL STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT FOR UNITED STATES

plants that in many instances were economically and efficiently operated before fuel difficulties arose. To a certain extent, however, the January operations were curtailed owing to weather conditions, railroad congestion and embargo and insufficient supply of raw material and labor. During January industrial operations were cut down to a considerable extent by these factors. In addition there was a certain falling off due to the winding up of a large number of big munition contracts in different sections of the country.

Earnings did not present any such acceleration in the rate of growth, owing in large measure to decreases in rates which went into effect at the beginning of the new year.

The accompanying curves show graphically the rate of increase both in income and output in per cent as contained in Tables I and II. The remaining tables show the percentages of increase in income and output by companies, grouped according to the size of the com-



FIGS. 2 TO 5—CENTRAL STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT SECTIONALLY

munity served. Group 1 represents those companies operating in cities of 100,000 inhabitants and over; group 2 those companies operating in cities having a population between 50,000 and 100,000; group 3 in cities between 25,000 and 50,000; group 4 in cities between 10,000 and 25,000, and group 5 in cities between 5000 and 10,000.

STATION AND OPERATING PRACTICE

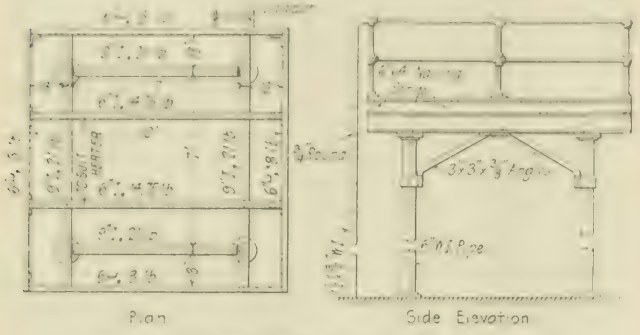
A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

PLATFORM BUILT FOR FEED-WATER HEATERS

Designed to Conserve Floor Space and Provide Ample Room Around Heater for Inspection and Operation

BY T. W. REYNOLDS

A feed water heater platform designed so as to conserve floor space and provide ample room around the feed water heater for inspection, operation and repairs is shown herewith. Access is afforded thereto by



DETAILS OF FEED-WATER HEATER PLATFORM

means of a permanent iron ladder. For the protection of station attendants a pipe railing is installed around the entire platform. Six-in. I beams transfer the weight of the heater to the platform columns, which are made of 6-in. wrought-iron pipe. These may be of any height required for clearance or to produce the proper static head upon the suction of the boiler-feed pumps. The columns should be anchor-bolted to concrete foundations. The outer edges of the platform are formed by 6-in. 8-lb. channel irons, on which are laid 4-in. by 1½-in. boards for flooring.

EMERGENCY OUTFIT FOR STREET-LIGHTING CREWS

Arrangement for Providing Emergency Men with Electrical Repair Supplies in the Shortest Possible Time

In order to minimize the time required for assembling an outfit to remove any cause of trouble on its street-lighting system, the electrical department of Lincoln Park, Chicago, has arranged an emergency board, which is placed in the company's main substation, from which emergency crews are dispatched. The board carries the following materials:

Triple-braided cable, block and tackle, rope slings, pike pole, water wrenches, man-power manhole pump, linemen's climbers and safety belt, handsaw, hacksaw, rubber tape, friction tape, linen tape, sledge hammer, pick, two shovels, axe, pipe cutter, monkey wrench, pipe wrench, water plug keys, ball peen hammer, long and short cold chisel, "come-alongs," bull point and tongs, crowbar, globes and lamps, pot-head jumpers, manhole ladders, and three emergency fixtures for isle of safety lighting.

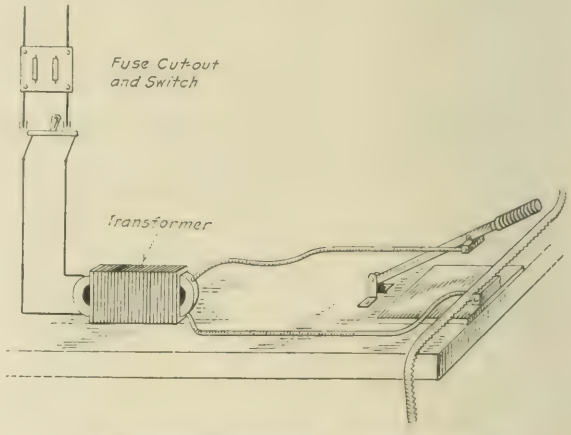
Each piece of this equipment is painted red so that it will not become mixed with the regular assortment of tools and material. The emergency fixtures for the isle of safety lighting are wired and ready to set up in place of a wrecked standard, the connection to the circuit being made through a standard plug-type receptacle, which is a part of the equipment.

WELDER FOR REPAIR WORK

Apparatus Made by Replacing Secondary Winding of 1-Kw. Transformer with Few Turns of Heavier Wire

BY H. S. RICH

Small repair work may be easily performed with the practical welder shown in the accompanying illustration, which is made by rebuilding a 1-kw., 220-volt transformer. The secondary winding was removed and replaced by one wound with three or four turns of about No. 4 stranded slow-burning wire so as to deliver from 30 to 40 amp. at 5 to 10 volts. A 25-amp. knife switch fused for 15 amp. is used on the primary line. The secondary flexible leads should be carried to the welding vise, as shown in the illustration, where they are tipped with large copper lugs and securely screwed to two copper blocks about 2 in. long by 1 in. square on the ends. By connecting directly to the copper electrodes the voltage is not lowered by resistance. Large elec-



METHOD OF REPAIRING A BROKEN SAW

trodes are used so that the heat of the welding arc will not damage them.

The lower electrode is screwed to the bench, which is first covered with 1 sq. ft. of ⅛-in. asbestos board. The upper electrode is bolted to a flat iron bar 18 in. long, 1 in. wide and 0.25 in. thick. A wooden handle is riveted one-half to each side, and then covered with two or three layers of friction tape. The object to be welded

as well as a piece of hard silver solder must be in place before closing the secondary circuit. The joint to be welded is placed on the lower electrode and the lever carrying the upper electrode lowered. The circuit should be kept closed only a few seconds with a heavy hand pressure on the lever. After opening the circuit, the joint should be filed and cleaned.

BASIS FOR FEEDER SIZES

Relation Between Demand and Connected Load as Basis for Determining Size of Conductor

BY G. SOUTHERN
Engineer for Mills, Rhines, Bellman & Nordhoff, Toledo, Ohio

In determining the sizes of feeders for building and industrial wiring systems a proper consideration should first be given to the question of whether or not an increase in the load is likely to be made after the feeder system is installed. It is better economy to install feeders of adequate size at first than to have to increase the cross-section later. Naturally, there are many classes of installation where the actual demand is considerably less than the connected load, which permits reducing the size of the feeders. The ratio of the demand to the connected load varies in every case and is governed to a very great extent by the nature of the load.

For instance, in a building where three or more passenger elevators are operated in a group, the entire demand will not exceed 70 per cent of the connected load for the main feeders. This is due to the fact that at no time will all the elevators be started simultaneously in one direction. Actual tests on a direct-current elevator installation showed a pumping back of current amounting to from 30 per cent to 50 per cent of the connected load. In such a case there is no reason why feeders should be installed larger than the load requires.

Similar conditions are found in most industrial power installations, particularly where groups of machines are operated from line shafting and where several motors are used to furnish the necessary power. In many cases several machines will be idle at all times, due to operations in setting up, changing over, making adjustments, etc. This in turn will lessen the demand over the entire equipment. The actual demand load under such conditions can only be determined by testing.

Many lighting installations also are of such a nature that the demand is less than the connected load. In office buildings where the entire space above the first floor is used for offices only, the demand will be about 80 per cent, but the sizes of feeders for the first floor of such a building should, in general, be determined according to the connected load. In residences with a connected load of 8 kw. and over the demand will be about 75 per cent.

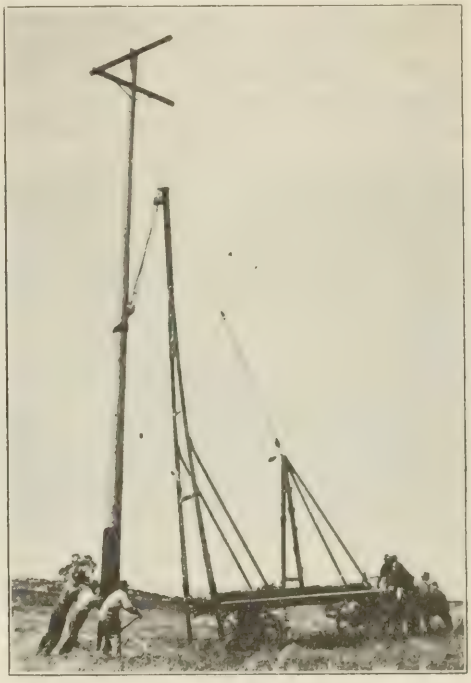
The selection of the size of conductors to supply various installations should always be consistent but not excessive. The factor of safety should be sufficient to provide the necessary protection. In many cases the cost of the installation is so high that the engineer is unable to specify any safety devices that are not required by the National Electrical Code. Where sizes of feeders are determined according to the demand, it should be generally recommended that they be protected with circuit breakers or similar devices. This will prevent abuses that might otherwise arise.

RAPID ERECTION OF POLES

How 50-Ft. Cedar Poles Have Been Erected in an Average Time of Twelve Minutes per Pole

By the use of equipment which is partly home-made, the San Diego (Cal.) Consolidated Gas & Electric Company has been able to raise poles on three transmission lines in an average time of twelve minutes per pole. One line consisted of an 18-mile (28.97 km.) stretch of 66,000-volt circuit, and the other two were 11,000-volt circuits, 12 miles (19.31 km.) and 16 miles (25.75 km.) long respectively. Most of the poles were 50-ft. (15.24 m.) Western red cedar, with not less than 9-in. (22.86-cm.) tops and an average weight of 1600 lb. (725.7 kg.) each. In some places 55-ft. (16.76-m.) and 60-ft. (18.29-m.) poles were used. All of the lines stretch across rough, brush-covered country.

The equipment which was used consisted of a Matthews pole erector with an extension built on the peak



DROPPING A 1600-LB. POLE INTO ITS HOLE WITH LESS THAN THIRTEEN MINUTES' WORK

of the gin, as shown in the accompanying illustration. It was found necessary to increase the effective height of the gin because of the 55-ft. (16.76-m.) and 60-ft. (18.29-m.) poles, which had to be raised occasionally, and because, in rough country, it is not always possible to place the bed of the pole-erector wagon on a level site and thus obtain the advantage of the full normal height of the gin. At first the increased height was obtained by putting a channel-iron extension on the peak of the gin. Later, when this extension was bent, it was replaced by another made from two pieces of Douglas fir measuring 3.75 in. by 5.75 in. by 10 ft. (9.53 cm. by 14.6 cm. by 3.04 m.).

Experience with this outfit has shown that it is advisable to haul the pole-erector wagon with a team and to use an automobile truck for pulling the rope. Where the earth is soft the wagon has to be blocked up so that the feet of the erector will have a solid bearing. In speaking of the use of this apparatus under severe conditions in rough country, L. M. Klauber,

superintendent of the electrical department for the San Diego company, pointed out that even on the first day this outfit was used the line crew required an average of only thirteen minutes from pole to pole, including the time consumed in setting the erector and in traveling from hole to hole. The pole spacing was 350 ft.

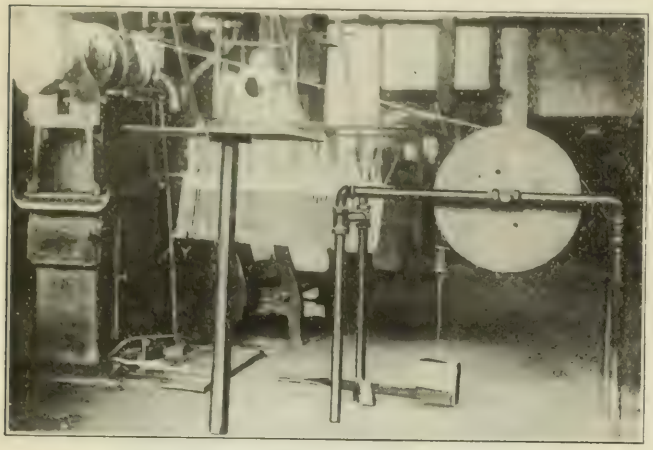
COIL-WINDING MACHINE MADE FROM TURRET LATHE

Home-Made Outfit Reduces Expense of Winding Coils, and the Buying of New Apparatus Is Avoided

BY J. S. MILLS

Foreman Electrical Department, Morris Park Shops Long Island Railroad

About a year ago it became necessary to rewind a great many old compressor armatures. This meant obtaining a coil-winding machine or using more help to wind the coils by hand. Instead of purchasing new apparatus, an old Jones & Lamson 2-in. (5.08-cm.) bar, friction-head-drive turret lathe too badly worn to be used in the machine shop was put in operating condition and used successfully as a coil-winding machine.



HOME-MADE COIL-WINDING OUTFIT

The lathe bed was cut off flush with the pulley-cone bearing so that any form on which a coil is to be wound can be fastened to the face of the spindle and driven without striking any part of the lathe. The three-cone pulley and the friction drive in the lathe head permit a range of six speeds. To provide a means of starting and stopping the machine by a foot control so that the operator can use both hands for guiding the wire, etc., the original operating handle of the friction drive was removed, and in its place a connecting rod, lever and foot pedal was arranged as shown in the illustration, so that when the operator's foot is removed from the pedal a spring instantly brings the lever to the off position.

To assist the operator to feed the wire, the reel is mounted on a stand of 1-in. (2.54-cm.) iron pipe. This is equipped with a tension device consisting of a piece of band wire fastened to the back cross pipe of the stand and passing along a groove in the circumference of the end of the reel. Two weights are attached to the wire as shown. The large weight is fastened to a lever so that the pressure of the operator's foot releases the tension in the band wire, which in turn releases the tension on the wire which is being unreeled. The smaller weight, which is 4 lb. (1.81 kg.) keeps the band wire from coming out of the groove in the edge of the reel when the large weight is raised. One feature of this tension device is the fact that friction is applied to the circumference of the reel and not to the cotton-covered wire itself, thus injury to the insulation is avoided. At the same time the tension is easily controlled by the foot.

Short pieces of cotton sleeving are used for additional insulation on the free ends of the coil. It is necessary to slip these sleeves over the wire before winding the coil as they have to be glued under the fish paper which holds the coil in shape after being taken off the form. One of these sleeves is used when the coil is started while the other is slid along the wire to the other end. Considerable time was consumd in threading the ends of the wire into the sleeves as the insulation backed away from the ends and became jammed in the sleeving. This is remedied by dipping the end of the wire in melted paraffin and pulling the insulation past the end of the conductor and twisting it. This made it easy to slip on the cotton sleeve.

This coil-winding machine with the simple reeling device and the use of paraffin in putting on the cotton sleeves has cut the expense of winding coils in our shops in half.

OPERATING COSTS FOR TRUCKS

Data Compiled by a Western Company Taking Into Account Depreciation and Interest

The Lincoln (Neb.) Telephone & Telegraph Company has made the following comparisons in the costs of operating automobile trucks and employing teams to transport its men. The cost of operating a Buick 0.75-ton truck from July 13, 1914, to Jan. 31, 1916, including the wages and expenses of driver, oil, gas and tires, was $1 per day for depreciation, and the expenses amounted to $2,343.48. This expense may be divided as follows: Cost of operating truck, $1,688.48; depreciation, $562; interest on investment, $93; or an average of $6.16 per day for the 381 days the truck was actually used.

The cost of employing teams to transport the men on this work would have been approximately $2,300, as the total cost per day of a team varies from $5.80 to $6.28. The increased speed of the truck, which was regulated to a maximum of 22 m.p.h. (3.54 km.p.h.), made it possible to save an average of slightly more than two hours per day of the time of each man (an average of slightly more than eight hours) in the gang, which, including overhead charges, amounted to $2,288.38. It was also possible, between necessary trips with the men, to deliver material on which extra team transportation charges would have amounted to $298.05, making a total earning for the truck of $2,576.43, or a total net saving of $1,946.85, or more than 150 per cent of the cost of the truck.

Method of Replacing Steam Trap

By T. W. Reynolds

Where the expense of a steam trap for receiving condensate which can be thrown away is prohibitive, it is recommended that the discharge pipe be extended outside the building and its open end buried a few inches below the surface of the ground. The resistance of the earth will be sufficient to prevent the free passage of steam into the atmosphere and yet afford ample drainage.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

EDUCATION IN USE OF ELECTRIC COOKING GROWS

Electric Luncheon Given to Indiana Authors Results in Immediate Free Publicity for Electric Labor-Saving Devices

When the Indiana Woman's Press Club, comprising about sixty-five Hoosier women who earn their living by writing for papers and periodicals, held its March meeting at Indianapolis a feature of the day was an electrically cooked luncheon served hot from an electric range by the Merchants' Heat & Light Company. Forty-two feminine members of the press were present, and after the luncheon L. G. Rothchild of the lighting company made a short talk on electric cooking.

Tangible results of that little educational effort have already begun to come to light in the shape of newspaper articles on electric cooking written by women. For instance, a March issue of the *Carroll County Citizens-Times*, Delphi, Ind., carried a five-column story by Mindwell Crampton Wilson—a woman known in her community as a graduate of Purdue University, an author and the president of the Indiana Woman's Press Club. The article not only extols the wonders of electric cooking, but also points to electricity as the universal servant. It provides an excellent example, the representatives of the Merchants' company believe, of the ease with which effective and wide circulation can be given to information on electric cooking in the present day of its popularity.

TAKING SERVICE TO THE CUSTOMER'S FRONT DOOR

How a Central-Station Company with a Large Number of Both Electric and Gas Properties Called on 23,202 Customers

BY E. E. SOULES

Basing its action on the theory that a contented customer is a direct asset to a company, the Illinois Traction Company has adopted a new plan whereby instead of waiting for its patrons to ask for "service" it takes service to their front doors. Instead of waiting for troubles, it anticipates them and heads them off before they have time to develop. This service is rendered without cost to customers.

The Illinois Traction Company operates seven electric and thirteen combination gas and electric central stations serving sixty-six cities with gas or electricity in the States of Illinois, Iowa, Missouri and Kansas. Each of these plants has its own organization with general superintendent, who reports to the office of the vice-president executive in Peoria, Ill.

Realizing that a local property of moderate size is necessarily handicapped in the giving of "service" in addition to actual supplying of gas and electricity because of the small organization, H. E. Chubbuck, vice-president executive, evolved the idea of organizing a "service crew," composed of experts in the handling of gas and electric equipment, and sending them from one property to another. The plan was placed in operation July 15, 1916, and the crew was placed in charge of the manager of the commercial department, with headquarters in Peoria.

This crew consists of six expert service men in charge of a supervisor. Ordinarily the crew remains in a city from three to five weeks, this depending upon the size of the city and the number of patrons of the local property. Their arrival and the purpose for which they are sent to the local property are announced about a week prior to their coming in a half-page advertisement in the newspapers. During their stay in the city the company carries in all newspapers at least three liberal display advertisements each week bearing on the campaign and the progress being made. This copy is prepared in the office of the publicity department.

Address .....

Occupant .....

Owner .....

ELECTRIC	GAS
On Main	On Main .....
Service Run	Service Run .....
Wired	Piped for Light .....
Fixtures	Piped for Fuel .....
Iron	Fixtures .....
Toaster	Range .....
Percolator	Plate .....
Pad	Water Heater .....
Fan	Bath Room .....
Washing Mach.	Miscel. .....
Miscel.	Miscel. .....

Light ..... Fuel ..... Power .....

Check Items in Use
Abv. E-Electric G-Gas

BY CHECKING ALL APPLIANCES IN USE AN EXCELLENT LIST IS OBTAINED FOR SOLICITING NEW BUSINESS

In introducing the service crew the advertisements make clear the fact that the representatives will call on each gas and electric customer in the city. The ad-

vertisements also urge customers who have complaints to make in regard to any equipment to "save up their troubles and tell them to the man with the badge." It is made plain that these representatives will be designated either by a badge or a credential card, and that they are at the service of customers without charge. Besides, it is explained that they have nothing to sell and that they are not demonstrators. Their object, as stated in this advertising, is to assist the customer in bringing his electric and gas equipment up to a high state of efficiency. It is announced that the men will replace broken sockets, repair flatirons where possible, adjust gas stoves, clean gas burners, and, in short, make a thorough inspection of the electric or gas equipment.

The men attached to the service crew are given thorough training in a school of instruction before they are allowed to act as representatives of the company. They are ordinarily picked men from the local properties of the company, men who understand the adjustment and handling of both electric and gas equipment. They carry with them a complete kit containing the necessary tools and parts for small repairs.

RESULTS OF SIX MONTHS' WORK OF SERVICE CREW

Service to Customers				Prospective Customers	
Electric Repairs		Gas Repairs		Electric	Gas
Irons repaired	191	Burners adjusted	2,881	460	396
Iron cords repaired	227	Burners cleaned	2,768		
Lamp cords furnished	123	Burners cemented	665		
Lamp cords repaired	179	Fixtures tightened	269		
Fuses	348	Handles tightened	999		
Switches furnished	510	Irons adjusted	79		
Switches repaired	167	Leaks fixed	637		
Sockets repaired	434	Lights adjusted	743		
Sockets replaced (snap)	820	Pillars and tips furnished	198		
Sockets replaced (chain)	134	Valves adjusted	1,775		
Attachment plugs replaced	186	Valves cleaned	1,610		
Attachment plugs repaired	96				
Wall sockets replaced	47				
Totals	4,326		12,124	460	396
Grand total			16,450		856

The supervisor precedes the service crew by a week, acting in the capacity of "advance man." The method of operation in this respect is very similar to that of a theatrical organization. In addition to securing quarters for the men and arranging with the local superintendent and newspapers for the preliminary advertising, the supervisor makes a preliminary survey of the city. A map is drawn up and the city to be covered is divided into territories, which are assigned to various members of the crew. By the time the crew arrives all preliminary arrangements have been made and no time is lost.

In addition to the service rendered to the customers the men also turn into the company's office data cards which give in brief the entire electric or gas "layout" in each house or place of business called upon. The men are also instructed to be on the lookout for prospective customers for both electric and gas appliances and service, and as a result the local company has a thorough electric and gas survey of the city when the crew has finished its work.

The Results of the Plan Are Encouraging

It is the experience of the company that, while the maintenance of the service crew is costly, the advantages resulting more than offset the expense. Not only do customers appreciate the service rendered, but the innovation has invariably been commented upon most favorably by the press both in its news columns and editorially. During the six months that this service crew has been in operation it has "covered" six cities ranging in population from 7000 to 28,000. In these six cities, with a total population of about 110,000 people, the crew called on 23,202 utility service customers. On the premises of these customers they found 16,450 jobs they could do to make service better. Of these jobs 4326 were electric and 12,124 gas. This means that probably more than one-half of the customers called on had something that needed fixing; something was out of service and was returning no revenue merely because it needed repair. Some patrons had more than one source of trouble. It is true that most of the repairs were small ones. Most of them the owner could have repaired himself, but owners, it has been found, generally will not make these repairs until after actual trouble results. So the Illinois Traction Company, taking the initiative, did this work gratuitously for the customers. And as its return it has received increasing good will and 856 prospective customers, 460 for electric and 396 for gas appliances and service.

CHART FOR REDUCING THE COST OF BILLING

Kansas Company Uses Scheme Adaptable to Small Utilities Whereby 50 Per Cent of Billing Time Is Conserved

A large amount of tiresome work in office routine is necessary during the billing days of each month. The operation furthermore is a costly one. To reduce the cost of such work a billing chart, particularly adaptable to small companies, has been worked out by H. H. Fenton, superintendent of distribution of the Marshall

BILLING CHART TO BE USED WITH BLOCK RATE

0	0	1	2	3	4	5	6	7	8	9
10	$1.00	$1.10	$1.20	$1.30	$1.40	$1.50	$1.60	$1.70	$1.80	$1.90
20	2.00	2.09	2.18	2.27	2.36	2.45	2.54	2.63	2.72	2.81
30	2.90	2.99	3.08	3.17	3.26	3.35	3.44	3.53	3.62	3.71
40	3.80	3.88	3.96	4.04	4.12	4.20	4.28	4.36	4.44	4.52
50	4.60	4.68	4.76	4.84	4.92	5.00	5.08	5.16	5.24	5.32
60	5.40	5.47	5.54	5.61	5.68	5.75	5.82	5.89	5.96	6.03
70	6.10	6.17	6.24	6.31	6.38	6.45	6.52	6.59	6.66	6.73
80	6.80	6.86	6.92	6.98	7.04	7.10	7.16	7.22	7.28	7.34
90	7.40	7.46	7.52	7.58	7.64	7.70	7.76	7.82	7.88	7.94
100	8.00	8.06	8.12	8.18	8.24	8.30	8.36	8.42	8.48	8.54
110	8.60	8.66	8.72	8.78	8.84	8.90	8.96	9.02	9.08	9.14
120	9.20	9.26	9.32	9.38	9.44	9.50	9.56	9.62	9.68	9.74
130	9.80	9.86	9.92	9.98	10.04	10.10	10.16	10.22	10.28	10.34
140	10.40	10.46	10.52	10.58	10.64	10.70	10.76	10.82	10.88	10.94
150	11.00	11.06	11.12	11.18	11.24	11.30	11.36	11.42	11.48	11.54
160	11.60	11.66	11.72	11.78	11.84	11.90	11.96	12.02	12.08	12.14
170	12.20	12.26	12.32	12.38	12.44	12.50	12.56	12.62	12.68	12.74
180	12.80	12.86	12.92	12.98	13.04	13.10	13.16	13.22	13.28	13.34
190	13.40	13.46	13.52	13.58	13.64	13.70	13.76	13.82	13.88	13.94
200	14.00	14.06	14.12	14.18	14.24	14.30	14.36	13.42	13.48	13.54
210	14.60	14.66	14.72	14.78	14.84	14.90	14.96	15.02	15.08	15.14
220	15.20	15.26	15.32	15.38	15.44	15.50	15.56	15.62	15.68	15.74
230	15.80	15.86	15.92	15.98	16.04	16.10	16.16	16.22	16.28	16.34
240	16.40	16.46	16.52	16.58	16.64	16.70	16.76	16.82	16.88	16.94
250	17.00	17.06	17.12	17.18	17.24	17.30	17.36	17.42	17.48	17.54
260	17.60	17.66	17.72	17.78	17.84	17.90	17.96	18.02	18.08	18.14
270	18.20	18.26	18.32	18.38	18.44	18.50	18.56	18.62	18.68	18.74
280	18.80	18.86	18.92	18.98	19.04	19.10	19.16	19.22	19.28	19.34
290	19.40	19.46	19.52	19.58	19.64	19.70	19.76	19.82	19.88	19.94
300	20.00	20.06	20.12	20.18	20.24	20.30	20.36	20.42	20.48	20.54
310	20.60	20.66	20.72	20.78	20.84	20.90	20.96	21.02	21.08	21.14
320	21.20	21.26	21.32	21.38	21.44	21.50	21.56	21.62	21.68	21.74
330	21.80	21.86	21.92	21.98	22.04	22.10	22.16	22.22	22.28	22.34
340	22.40	22.46	22.52	22.58	22.64	22.70	22.76	22.82	22.88	22.94
350	23.00	23.06	23.12	23.18	23.24	23.30	23.36	23.42	23.48	23.54
360	23.60	23.66	23.72	23.78	23.84	23.90	23.96	24.02	24.08	24.14
370	24.20	24.26	24.32	24.38	24.44	24.50	24.56	24.62	24.68	24.74
380	24.80	24.86	24.92	24.98	25.04	25.10	25.16	25.22	25.28	25.34
390	25.40	25.46	25.52	25.58	25.64	25.70	25.76	25.82	25.88	25.94
400	26.00									

County Power & Light Company, Blue Rapids, Kan., for use by his company.

It is found that the time of billing, so far as deriving the amount of the bill is concerned, can be cut 50 per cent by the chart. A test was made to obtain the time required to calculate the various amounts of the bills, and then a comparative time test was made using the chart. An average of ten seconds was required to calculate, while only five seconds was consumed by use of the chart. Also, the list of consumers used was the lesser ones, which means less time required to calculate than would have been necessary with the larger consumptions.

In the left-hand column of the chart as shown here are tabulated the amounts of consumption by tens, while the intermediate values are found in the respective succeeding columns. The operation is thus: The bill for a consumption of 42 kw.-hr. is found by sliding the finger down to 40 and thence to the right to the column headed "2," reading $3.96. Similarly, the bill for a consumption of 118 kw.-hr. is found in column "8" opposite 110, reading $8.48. The cause for the particular figures on this chart is a block-rate system of charging for energy used, as follows: First 20 kw.-hr., 10 cents; second 20 kw.-hr., 9 cents; third 20 kw.-hr., 8 cents; fourth 20 kw.-hr., 7 cents; all over 80 kw.-hr., 6 cents.

Small companies having block rates can easily adapt this scheme to their own use by changing the figures in the chart so that they will correspond to their respective rates, whatever these may be.

CHANGING FROM DIRECT TO ALTERNATING CURRENT

Some Plans for Handling Customers' Equipment That Have Been Successfully Employed by Ohio Central Stations

When the electric service for a small town or a section of a large city is to be changed from direct to alternating current, the manager in charge of the property faces the problem of getting changes made in each customer's equipment on a basis satisfactory alike to the customer and the company. A discussion of ways and means of conducting such a change in a recent Ohio central station committee meeting brought out the following ideas:

The Toledo Railways & Light Company places the entire job in the hands of one man selected from the sales department. He becomes acquainted with all of the customers who will be affected by the change. Then he makes bargains separately with each one, endeavoring to get the equipment changed with as little expense to the company as possible. Sometimes he is very successful; sometimes he is forced to spend considerable money.

Another company reported that it had tried this same plan with the additional provision that a cost bogie was set and the man in charge received a percentage of the difference between this bogie and the lesser cost of the change if he made the change in less than bogie. This supplied an incentive for the company's representative, but he was not always able to make the bogie that had been set.

The Ohio Light & Power Company has found it expedient in most changes of this kind to take the direct-current equipment and sell alternating-current apparatus to replace it at very low prices. It reports little trouble with this plan. Another company interests a reputable second-hand dealer in electrical machinery in the proposition and gives him a free hand in dealing with the customers. This plan was tried several times with success, the W. G. Nagle Electric Company of Toledo acting as the second-hand firm. In closing the discussion one central station engineer advised investigating the possibilities of serving the direct-current load with a synchronous motor-generator set before deciding to go ahead with the change.

COMMISSION PAID EMPLOYEES ON APPLIANCE PROSPECTS

St. Louis Company Inaugurates System with Commissions Ranging from $2 on Ranges to 10 Cents on Small Appliances

That employees are in the possession of or in a position to obtain information of value to the new-business department of any central station company, especially the names of prospective purchasers of appliances, is undoubtedly true. It is equally true that this information will seldom get to the commercial department unless "the ways are greased" either by commissions, bonuses or some other tangible means.

The commission plan for the sale of appliances through employees has been adopted by the Union Elec-

Form 271. APPLIANCE LEAD

Interested in Appliances checked	
Electric Range	
Electric Grill	
Electric Toaster	
Electric Fan	
Electric Percolator	
Household Iron	
Tailors Iron	
Vacuum Cleaner	
Washing Machine	
Sewing Machine Motor	

Name.....

Address.....

Remarks.....

From..... Date.....

Department.....

Appliance department, please return to sales department with report on back hereof if sale is made.

EMPLOYEES IN ORDER TO OBTAIN COMMISSIONS MUST FILL OUT A BLANK FORM LIKE THIS AND THEN FILE IT WITH COMMERCIAL DEPARTMENT

tric Light & Power Company, St. Louis. Employees knowing of people who are contemplating buying an electric range or other electric appliances are required to fill in a special form, reproduced herewith, and file it with the chief clerk of the commercial department. It will then be checked and, provided that it is not already of record and being worked on by some one else, will be placed to the credit of the employee furnishing the lead. The lead is followed promptly, and if the sale is made within fifteen days the employee turning in the lead receives a commission thereon. The commissions are as follows: Electric range, $2; electric washing machine, $1; electric vacuum cleaner, 50 cents; on all other appliances, 10 cents. The range commission will not be paid until the forty-five day guarantee period expires and the range sale becomes permanent.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

WINDING SYSTEMS IN MINES

Comparison Between Electric and Steam Winding Systems and Between Direct-Current and Three-Phase Systems for Hoisting in South African Mines

AT a meeting of the South African Institute of Electrical Engineers held at Johannesburg on Dec. 21, 1916, two interesting papers on winding systems in South African mines were presented by Harold W. Clayden and S. E. T. Ewing respectively. Both papers are printed in the December, 1916, issue of the *Transactions* of the South African Institute of Electrical Engineers.

Mr. Ewing compares the Ward-Leonard system and the three-phase winding system with respect to the different requirements of mine hoisting, and reaches the following conclusions:

For shaft sinking both systems are equally effective on all points at approximately equal capital cost.

For rock winding from one level with tail ropes the relative economy of the two systems depends on the frequency of winding; the lower the frequency of winding the greater the gain to the alternating-current system, and conversely the higher the frequency the greater the gain to the Ward-Leonard system. The alternating-current system has the lower capital cost. The systems are of equal safety and ease of handling.

For rock winding from one level without tail ropes the alternating-current system has lower capital cost, while the Ward-Leonard system has superior over-all economy and is easier to handle.

For rock winding from several levels, for raising and lowering men, for lowering supplies, and for dead-slow winding the alternating-current system has lower capital cost, while the Ward-Leonard system has the superior over-all economy and is easier to handle.

The paper by Harold W. Clayden gives comparative efficiency and cost figures from practice for three winding plants—a 5-ton (4.5 metric ton) Ward-Leonard winder, a 5-ton (4.5 metric ton) three-phase winder, and a 4-ton (3.6 metric ton) steam winder at three different mines. The horsepower is 500 for the Ward-Leonard winder, 550 for the three-phase winder and 800 for the steam winder; the size of drums is 10 ft. by 3 ft. 6 in. (3.05 by 1.06 meters), 10 ft. by 3 ft. 6 in. (3.05 by 1.06 meters), 9 ft. by 3 ft. 3 in. (2.74 by 0.95 meters); the maximum rope speed 2000 ft. (609 meters), 1500 ft. (457 meters), 1500 ft. (457 meters); the capacity of the skip, 5, 5, 4 tons (4.5, 4.5, 3.6 metric tons); the maximum vertical depth of wind 2060 ft. (627 meters), 1583 ft. (483 meters), 1323 ft. (403 meters); the maximum length of wind 3902 ft., (1189 meters), 2420 ft. (738 meters), 2072 ft. (632 meters). These figures are near enough to give a fair comparison.

Diagrams are given in the paper showing curves of the shaft horsepower-hours, the kilowatt-hours, the load factor and the over-all efficiency. From these curves it appears that the Ward-Leonard winder has a 6.7 per cent higher over-all efficiency than the three-phase winder; but in the case of the former only two shifts are worked and the converter set is shut down for seven hours each day. This set requires 20 kw.-hr. per hour running light, so that comparing the two winders on a twenty-four-hour service the Ward-Leonard efficiency will be only 3.5 per cent better than the three-phase winder.

The steam winder was started in September, 1915, but up to March, 1916, a temporary electrical plant was supplied by the same boiler plant, therefore only three months' accurate figures as to steam consumption are available. For the three months ended June, 1916, this winder required 99 lb. (45.6 kg.) of steam per shaft hp.-hour, but this must not be taken as a representative figure for steam hoisting, as owing to the small amount of work done by this hoist the standby losses are exceptionally high. Only a very rough efficiency comparison can be made, and therefore the comparative figures of cost are more important.

The average monthly cost of each of the three winders over the three months April, May and June, 1916, is given in the table, and it is stated that the figures for the next three months are practically the same, there being only a difference in the third-place decimal.

AVERAGE MONTHLY COST OF WINDERS

	Ward-Leonard	Three-Phase	Steam
Average shaft horsepower-hours	25,436	26,124	20,425
Attendance, oil and engine-room stores, per useful shaft horsepower, cents	0.316	0.322	0.352
Repairs, wages and stores per horsepower, cents	0.194	0.584	0.070
Power, electric and air or steam per horsepower, cents	1.786	2.076	3.492
Total cost per horsepower, cents	2.296	2.982	3.914

The first item, attendance and engine-room stores, includes all engine-room wages and stores except winding-engine drivers' wages, which are charged direct to hauling and do not come into the power account.

The second item, "repairs," includes all electrical and mechanical supervision, inspection and repairs.

The third item "power," for the electric hoists, includes the cost of electricity and air power. The power required for the brake engines is taken from the general mine air supply, the small compressor in the winding-engine room coming into operation only when the mine pressure drops below 60 lb. (27 kg.) per square inch. "Power" for the steam hoist includes coal, oil, water, wages and maintenance of the boiler-house plant and is the cost of steam power delivered to the engine house.

The Ward-Leonard costs need no comment, and are representative of the cost of this hoist for the last two years.

In the three-phase costs the repairs item is slightly above the average over two years, and the excess over

the Ward-Leonard hoist is chiefly accounted for in extra maintenance of the high-tension contactor panels and the liquid controller, also extra supervision. The power cost is a reflection of the over-all efficiency. The air power charged to this hoist is in excess of the Ward-Leonard, as with a three-phase hoist considerably more braking is required.

On the steam hoist the low repair cost is due to the hoist being new, no repairs being yet required. The present charge is chiefly the cost of examination. Regarding the power cost, it is said that this hoist was delivered and erected in 1915 and embodies all the latest improvements of the makers for an efficient steam hoist. It is at a disadvantage compared with the two electric hoists so far as length of wind is concerned, and would no doubt show a lower figure if the average wind were increased. Against this must be taken into account the fact that the whole plant is practically new, and any saving in steam consumption will probably be counterbalanced by extra repairs and maintenance to the boiler-house plant. Therefore, although the work done on this winder will increase, the cost of power will probably not fall below the present figure. On the other hand, the repair cost will increase.

Comparing the three types of winders, the Ward-Leonard is not only the most efficient and cheapest both in power and maintenance, but is by far the easiest winder to operate.

The three-phase costs more in power and maintenance, and when winding at low speeds, or lowering loads of men and material, requires very careful handling.

The steam winder is easy to operate, but so far as power is concerned appears more expensive than the electric hoists. This is, however, a question of price per kilowatt-hour and load factor. With the present high power rate in South African mines, based on a 70 per cent group load factor, any additional low-load-factor supply that reduces the group factor may increase the price of supply. It is only fair to the other mines of the Group that any mine installing new winding plant shall be debited with the extra cost of its supply based on load factor.

The two electric winders were installed when the general electrification of the Rand took place, and although the load factor of the Ward-Leonard is below 25 per cent and the three-phase 32 per cent, the present power charge is at the base rate of 1.05 cents per kilowatt-hour, other high load-factor plant bringing the group factor up to 70 per cent.

The steam winder has a load factor below 25 per cent and was installed in preference to an electric winder partly on account of the extra power cost, and for a fair comparison the author states that the cost of the electric winders must be increased by the extra power cost based on the low-load factor. He figures that if additional cost of power is assumed for a 25 or 32 per cent load factor, this would bring the total cost of the Ward-Leonard system to 4.406 cents and that of the three-phase system to 4.372 cents per shaft per horsepower-hour.

"In conclusion, for surface winding, given the same capital cost for installation and the present ruling high power rate on a low load factor, it appears that steam is the cheaper power with a load factor below 35 per cent and electricity above 35 per cent, and from figures obtained on hoists on the Group mines this appears to hold good for hoists up to 800 hp."

Generators, Motors and Transformers

Rotary Converters.—G. A. Juhlin.—The first part of a paper read before the (British) Institution of Electrical Engineers on the voltage regulation of rotary converters. Several different schemes have been devised for the purpose of voltage regulation, but of these only two have found extensive use in Great Britain. They are described by their characteristic features as (1) reactance control, and (2) booster control.—London *Electrician,* March 9, 1917.

Parallel Operation of Transformers.—J. Lindley Thompson and S. Austen Stigant.—The conclusion of their long illustrated article on the parallel operation of static transformers. The present installment deals with polyphase transformers. The "phasing out" of three-phase transformers is described, tables and diagrams being given which show possible voltage measurements obtainable. Results of paralleling dissimilar groups of transformers are described, and in conclusion the effects of position of junctions to busbars or main cables, temperature and power factor are discussed.—London *Electrician,* Feb. 16, 1917.

Balances for Three-Wire Direct-Current Systems.—Thomas Carter.—The conclusion of his long illustrated serial on this subject. In this installment the author gives a general rule for an easy method of finding tapping points on lap-wound or wave-wound armatures, with numerical examples.—London *Electrician,* March 9, 1917.

Traction

Glasgow Tramways.—An editorial note commenting on the Glasgow tramways as the ideal municipal traction system of Great Britain. In 1894 the tramways, which were then run by private enterprise, were taken over by the city, and in 1901 the system was converted from horse traction to electric traction on the overhead trolley. Since then there have been various extensions, and the capital expenditure has risen to a total of $19,175,780. Now the whole capital debt, including that for all extensions, additions to and improvements of rolling stock, etc., has been wiped out in the short period of sixteen years, and it is stated that "the whole undertaking is in excellent condition, and the tramway fares are said to be the lowest in the world."—London *Electrician,* Feb. 16, 1917.

Installations, Systems and Appliances

Non-Inflammable Switch Oil.—G. Stern.—Experiments have recently been made by Vogelsang with carbon tetrachloride with a view of using it in oil switches. The present author describes what has been done along the same line by the A. E. G. On the occasion of a visit in 1910 to Chicago the author found that carbon tetrachloride was being used with high-tension fuses to suppress the arc which is formed on the blowing on the fuse. It was supposed to have advantages over oil on account of the fact that it was not so easily inflamed. However, it was found that the arc caused a considerable carbonization of the fluid, and that the particles of carbon were liable to restart the arc if a heavy load was carried by the fuse. Moreover, free chlorine was always present. Further experiments with carbon tetrachloride were, therefore, discontinued, because it was found that the chlorine always attacked the fuse steadily, and after a short time the fuse was

liable to blow while carrying the normal current. In fact, different metals were left lying in the laboratory for lengthened periods in carbon tetrachloride, and all were found to be attacked till they gradually became unrecognizable. Other chlorine combinations were, therefore, tried, adding various substances, which were intended to fix the free chlorine. One of the switch oils of this character, said to be non-inflammable, consists of pentachlorethane (C_2HCl_5), which is better than carbon tetrachloride, inasmuch as it boils only at 160 deg. C. The specific gravity is 1.658, and the dielectric constant is 2.25. The fluid begins to solidify at —18 deg. C. At ordinary temperatures it does not attack copper, iron or lead, though it does so if heated. If heated for a length of time in contact with water, hydrochloric acid is formed. It decomposes very decidedly under the action of the electric arc. A direct-current arc, carrying 25 amp. at 110 volts, was formed in the fluid, and large quantities of chlorine and hydrochloric acid were formed and remained in solution, giving a strongly acid reaction. The copper electrodes were also much attacked. Short-circuit tests showed that the non-inflammable oil is a much less satisfactory extinguisher of the arc than the normal oil. Under similar condition in the two cases the arc lasts three times as long with the non-inflammable oil as with the normal oil. Taking the insulating resistances of the two at 18 deg. C., with non-inflammable oil when fresh it is 1200 megohms and after the short-circuit it is 120 megohms, whereas with the normal oil it is 28,000 megohms in both cases. In the author's opinion it is hardly likely that any advantages would result from the use of non-inflammable oil, even if mixed with normal oil in any proportions. Any such mixture might quite possibly accentuate the failings of both without producing any good result whatever.—From *Elek. Zeit.*, No. 22, 1916, translated in abstract in London *Electrician*, March 9, 1917.

Electrophysics and Magnetism

Effect of Previous Filtering Upon the Absorption Coefficients of High-Frequency X-Rays.—S. J. ALLEN and L. M. ALEXANDER.—An account of an experimental investigation in which the absorption coefficients were measured for the high-frequency X-rays from a Coolidge tube after filtering through various elements at a voltage of 120,000. These absorption coefficients show clearly the presence of the *K* radiation of platinum, gold, lead and bismuth. With a tin filter the values of the absorption coefficients for the "end rays" show harder rays than any that have been published up to this time. Experiments on the scattering were made, showing that the low-atomic-weight atoms scatter more than the high.—*Phys. Review*, March, 1917.

Lecher System.—F. C. BLAKE and CHARLES SHEARD.—The fourth paper in their serial on the free vibrations of a Lecher system. This installment deals with the effect which the kind of induction coil and the current strength have upon the wave system. The sharpness of the wave peaks of a Lecher system depends very much upon the induction coil used as a source of power, the best effects being obtained with a coil giving a fat spark. The peak intensity is directly proportional to the current strength. The tone intensity is dependent upon the edge-on distance between the capacity plates, there being for any given tone an optimum edge-on distance. The logarithmic law for the capacity per unit length of two parallel wires also holds for the change in capacity of a condenser as the distance between it and an equal condenser is varied edge-on.—*Phys. Review*, March, 1917.

Units, Measurements and Instruments

Measuring the Voltage and Frequency of Alternating Currents.—JOHANN SAHULKA.—The author describes a frequency meter somewhat similar to the recent instrument of Peukert. As shown in Fig. 1, a hot-wire instrument is connected between the conductors L_1 and L_2.

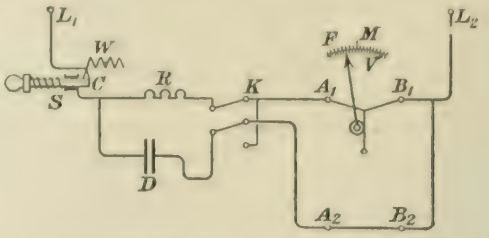


FIG. 1—CONNECTION FOR USING A VOLTMETER AS A FREQUENCY METER

In the one arm there is the hot-wire A_1B_1 and an inductionless resistance, *R;* in the parallel branch there is a similar hot-wire, A_2, B_2, and a condenser or inductive resistance *D*. If the change-over switch *K* is moved over, the active hot wire, A_1, B_1, which is connected to the instrument, is then connected to *D*, and the hot wire A_2, B_2, is in series with *R*. Both branches are connected to a sliding resistance *W*, which, owing to the action of a spring switch *S*, is normally switched out of circuit. If the switch *K* has the position shown in the drawing, the voltmeter scale *V* can be made to read the frequency. This is done by the following procedure: The switch *S* is closed and the sliding contact *C* is so adjusted on the resistance *W* that the pointer on the apparatus points to a certain position *M* on the scale. The switch *K* is then changed over; the frequency can then be read off on the frequency scale. If *D* is a condenser, then the frequency scale can be calculated. Let us call the voltage corresponding to the position *M* on the scale by the symbol E_n. When the switch *K* is moved over and the instrument is used as a frequency meter, let the reading be *E*. Let *r* be the resistance of the apparatus when used as a voltmeter—*i.e.*, the sum of the resistance *R* and A_1B_1; let *C* be the capacity of the condenser, and *p* the periodicity. Then

$$p = \frac{E}{E_n 2\pi C_r}.$$

The readings on the frequency scale vary inversely with the value of the capacity chosen, so a simple adjustment requires to be made if another capacity is taken. The value of the resistance of the hot wire has nothing to do with the reading of the frequency meter, because the reaction of the condenser, even at the lowest frequencies, can be made equal to the impedance of the condenser branch. If the capacity is gradually decreased in value, the range of the frequency meter can be raised as much as is desired. A disadvantage of the hot-wire instrument is that it takes a fairly high current; therefore, in the measurement of low frequencies a condenser of considerable capacity is needed, and it is difficult to find space for this inside the meter.—London *Electrician*, March 2, 1917.

Compound Thermo-Element.—Fig. 2 shows the construction of a useful compound thermo-element permitting temperature measurements to be made simul-

:aneously at two points *A* and *B*. The couple terminating at *A* is composed of platinum and platinum-rhodium wires, and to the other ends of the latter there are connected respectively a silver wire and a constantan-silver thermo-couple. The three branches thus obtained are connected through terminals, I, II, III, to two galvanometers, *A'*, *B'*. Such a combination has many useful applications, particularly for the measurement of flue-gas temperatures at the front and back of a section of flame-table filled with pieces of refractory material on the Bonecourt system. The compound

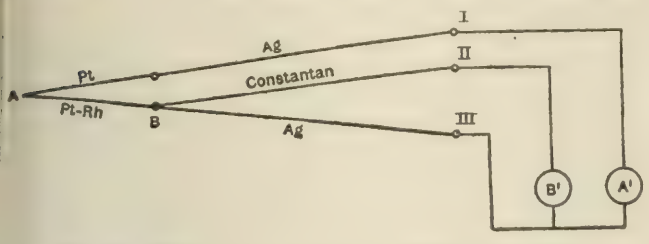


FIG. 2—DESIGN FOR COMPOUND THERMO-ELEMENT

thermo-element is cheaper and more compact than two separate couples, and for the above purpose the platinum couple was made 60 cm. (24 in.) long, and the silver-constantan couple was made 160 cm. (63 in.) long. The whole was mounted in a steel tube of 8 mm. internal and 12 mm. external diameter, which was so small as not to disturb appreciably the gas flow in the flame tube under observation. The high-temperature end of the compound instrument was protected by a quartz sheathing. The couples being calibrated separately for a cold-junction temperature of, say, 20 deg. C., the reading of the galvanometer, *B'*, in conjunction with the calibration temperature, gives the temperature of *B*, and this being known, the reading of galvanometer *A'* (which measures the temperature difference between *A* and *B*) permits the temperature of *A* to be deduced. In the special application noted above the couple *A* measured the temperature of flue gases at the entrance to a flame tube, while *B* measured the temperature at the back of the refractory "filling" in the latter.—From an article by Hilliger in *Zeit. des Vereins deutscher Ingen.*; translated in abstract in London *Elec. Review*, March 9, 1917.

Miscellaneous

National Electric Light Association.—In a long editorial on "Some Points in American Progress," the last volume of reports of the (American) National Electric Light Association is reviewed, with special reference to the progress report of the secretary, T. C. Martin. "The 'Proceedings of the Convention of the National Electric Light Association' form a volume showing that the association pays attention to matters which the technical societies in this country [England] leave out of their programs. It is largely the human element that counts, and we are inclined to think that our societies would do well to pay greater attention to this side of industry than they have in the past."—London *Electrician*, March 9, 1917.

Springs.—C. E. SQUIRE.—An abstract of a paper read before the (British) Junior Institution of Engineers. After enumerating the six principal types of springs, the author discusses some principal facts of manufacture and testing, characteristics of spring steel, stresses in springs, energy diagrams and limits in manufacture.—London *Electrician*, Feb. 16, 1917.

Book Review

HYDROELECTRIC POWER. By Lamar Lyndon. New York: McGraw-Hill Book Company, Inc. Vol. I. Hydraulic Development and Equipment. 500 pages. 235 illustrations. Price, $5. Vol. II. Electrical Equipment and Transmission. 360 pages. 194 illustrations. Price, $3.50.

Vol. I of this work is about the most concise treatment of hydraulic engineering from the standpoint of design and construction that is now available. The volume has been written by a consulting engineer of experience, and the design viewpoint rather than operation and maintenance prevails throughout. The work is notable for its completeness rather than the newness of material presented, since it incorporates fundamental and standard formulas that have been used in the design of water-power developments. In interpretation of this information lie the practical difference and usefulness of the book as compared with other works available. The section on dams is perhaps the most distinctive chapter of the book and occupies 112 of the 471 pages of text matter. In this section are found several formulas for solid dams which the author rightly claims as new. Other subjects treated include: Flow in streams; weirs and orifices; power variation and storage; artificial waterways; pipe lines and penstocks; dams, movable crests for dams; headworks; waterwheels and speed regulation of waterwheels.

Vol. II, which deals with the electrical equipment of stations and the main features of transmission systems, is considerably more general in its discussions on design than Vol. I. The author has evidently not attempted to treat the electrical design of hydroelectric systems in detail, for only general considerations are given on station design in some thirty-seven pages, with the layout and installation of transmission lines treated in forty-five pages. Of the remainder of the book sixty-four pages take up the theory on which transmission lines are calculated and 180 pages deal with the descriptive classifications of the equipment now available for hydroelectric plants. System operation and the fundamental requirements thereof are only slightly touched upon in the book in connection with a chapter of twenty-five pages on line protection and the one on insulators. Features of the design, installation and operation of substations are very briefly dealt with in eight pages of text, which include seven illustrations. This volume forms a very good supplement to the first volume but cannot be considered an adequate treatise on the electrical design and installation of station equipment or on transmission systems. Taken as a whole the two volumes form a very good reference text on features of the modern hydroelectric power plant and will probably serve a useful purpose as a practical text-book for schools and colleges.

Books Received

PRELIMINARY MATHEMATICS. By Prof. F. E. Austin. Published by the author at Hanover, N. H. 174 pages. Price, $1.20.

THE "MECHANICAL WORLD" ELECTRICAL POCKET BOOK FOR 1917. Baltimore: The Norman, Remington Company. 240 pages. 120 illustrations. Price, 45 cents.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

BUSY MEN AID N. E. L. A. CAMPAIGN FOR NEW MEMBERS

Walter Neumuller, Telegraphing to the Electrical World from Kansas City, Reports Success of Country-Wide Solicitation

Walter Neumuller, chairman of the membership committee of the National Electric Light Association, telegraphed to the ELECTRICAL WORLD from Kansas City, Mo., on April 5 in regard to the progress of the campaign for new members the following optimistic message:

"The truth of the old saying, 'When you want something done well go to a busy man,' has been proved again during the week just closed. More than 200 busy central station executives in all parts of the country, all enthusiastic members of the National Electric Light Association, have given freely of their time to visit central stations in neighboring communities and invite them to join this thoroughly representative organization of the industry.

"While it is still too early to make any definite statement upon the total result of this novel and interesting campaign, as reports have not reached the chairman of the membership committee in New York from all the Western cities, the applications already in hand indicate that after the smoke has cleared practically every central station in cities of 10,000 population and over will have been enrolled, in addition to many in the smaller communities.

"The co-operation from the geographic sections has been most enthusiastic and has greatly simplified the preparation for this work."

DALLAS FRANCHISES ARE APPROVED BY THE PEOPLE

Measures Supported by Messrs. Strickland and Hobson Are Approved by Two to One Vote—Waiting for Court Decision

Lighting and traction franchises sought by J. F. Strickland and C. W. Hobson and submitted to vote of the people of Dallas, Tex., were approved in the election on Tuesday of this week by a vote of two to one, or by a majority of about 3600. Regardless of the vote, Messrs. Strickland and Hobson will not begin reorganizing the systems until the contest of the city election on the charter amendment of last April is decided. The old charter prohibited the granting of new franchises until the old franchises expired, and the charter amendment was to repeal this.

"The franchises adopted in Tuesday's election are absolutely dependent on the charter amendment adopted last spring," Mr. Strickland said. "Franchises will be void and we will await the court's decision. If it is in our favor consolidation plans will be carried out immediately.

"The old city charter prohibited the granting of franchises except with 4 per cent gross production tax, and also prohibited an indeterminate franchise."

C. W. Hobson said: "We will do nothing toward carrying out our agreement in reorganizing traction lines until this contest is decided in our favor."

Ninety days are provided for traction and lighting consolidations to be carried out and a decision is expected before that time expires.

"WIRE YOUR HOME WHILE YOU CAN" IS THE SLOGAN

J. M. Wakeman Says that We Should Realize that High Prices Are Here and that the Great Campaign Will Be Successful

The Society for Electrical Development reports that great interest is being shown in the "wire-your-home time" campaign, which made its official and auspicious beginning on April 1.

James M. Wakeman, general manager of the society prepared the following statement at the request of the ELECTRICAL WORLD:

INDICATIONS POINT TO SUCCESS

"Every indication points to a very successful 'wire your-home-time' campaign this year. The $1,250 contest for society members is arousing enthusiasm on the part of salesmen of the central stations and contractors. This contest will also give us an excellent opportunity to check results of the drive.

"A few companies—but really very few considering—contend that, owing to the high cost of materials and labor, they will not be able to enter into the movement. Those who make this contention, however, are not at all comparable with the number entering the drive.

"In my opinion, based upon a general knowledge of conditions in the industry and the best information available, I do not think that prices of electrical products will decrease materially for months, possibly for years to come. History shows that when prices go up and remain up for any considerable period, they very seldom go down, especially with conditions such as exist to-day. This is true in the food and textile industries and will prove equally true in the electrical industry.

"PRICES WILL BE HIGHER"

"The day of high prices is here. The central stations and contractors are beginning to realize this and to go after the business as though they were at low basic prices. Undoubtedly next year, and possibly for two or three or more years to come, prices will be so much higher that people will be glad they went after the business in the spring of 1917, when there was more prospect of adding customers to the lines than there will be then.

"It is quite safe to say that with war throughout the world, with men taken from industries and put into war

endeavors, labor costs will go up, prices will go up, and we will look back reminiscently to the ante-bellum prices of electrical products.

"'Wire-your-home-time,' April 1 to May 15, is the time for the industry to unite in the greatest of all housewiring drives. The society will gladly provide the ideas on how to get the business. It is up to the individual central stations and contractors to cash in."

GIFTS OF FLAGS TO SCHOOLS BY ALABAMA POWER COMPANY

Third Town, Having Fulfilled Conditions of Securing Ten New Sign Customers, Is Presented with an Electric Flag

In accordance with its policy of presenting school authorities with flags in towns which have complied with the requirements that it has set, the Alabama Power Company has presented the school board in Attalla, Ala., with a 10-ft. double-face electric sign showing a waving electric American flag. This sign was installed on the top of the school building, where it can be seen from all parts of Attalla.



"OLD GLORY" ON AN ALABAMA SCHOOL

The sign burns from dusk until 10 o'clock every night except Sundays, when it burns until 12 o'clock, and serves as a reminder of the duties that all owe to their country in the present time of need. The sign is equipped with red, white and blue color caps, and is also painted so as to show to advantage in the daytime as well as the night. The energy for the flag is supplied free by the Alabama Power Company.

This is the third town on the Alabama Power Company's system which has been presented with a flag of this type, having fulfilled the conditions of securing ten new sign customers.

W. E. Mitchell, operating manager of the Alabama Power Company, writes to the ELECTRICAL WORLD: "The management of the company has felt for the last two years that it is the proper thing to assist in increasing the loyalty and patriotism of all people in the district in which we serve and this is one way to do it."

SYMPOSIUM AT BOSTON ON POWER PLANT PRACTICE

Convention Under Joint Auspices of the Local A. I. E. E. and A. S. M. E. Sections Listens to Papers on Recent Developments

A largely attended and enthusiastic convention of power plant engineers was held this week at Boston under the auspices of the Boston sections of the American Institute of Electrical Engineers and the American Society of Mechanical Engineers. The meetings were held at the Engineers' Club and at the Wentworth Institute, under the chairmanships of Profs. Arthur L. Williston and F. R. Hutton.

The first session on Wednesday evening, devoted to recent developments in steam generation, was opened by a paper on "Developments in Fuel Oil Versus Coal," by Frederick Ewing, mechanical engineer of the Mexican Petroleum Company, New York. This was followed by papers on "Modern Stoker Practice," by R. Sanford Riley, president Sanford Riley Stoker Company, Worcester, Mass.; "High Pressures and Temperatures in a Modern Station," by Irving E. Moultrop, assistant superintendent of construction, Edison Electric Illuminating Company of Boston; "Some New Investigations on Combustion in Boiler Furnaces," by Prof. Lionel S. Marks of Harvard University, and "High Temperature Insulation of Boiler Settings," by P. A. Boeck, New York.

Isolated plants and central stations were the general topic of a session Thursday afternoon. The papers listed were: "Principles of Power Plant Management," by Walter N. Polakov, consulting engineer, New York; "Interesting Isolated Plants," by A. R. Meek, Eastern manager Ridgway Dynamo & Engine Company, Boston, Mass., and David A. Chapman, efficiency engineer, Boston; "Engineering Features and Results at the Holyoke Municipal Plant," by John J. Kirkpatrick, manager gas and electric department, Holyoke, and "Co-operation Between Isolated Plants and Central Stations," by P. P. Moses, consulting engineer, New York.

Developments in prime movers, condensers and auxiliary equipment were featured at the final session Thursday evening, the program containing the following papers: "Purchased Power," by John A. Stevens, consulting engineer, Lowell, Mass.; "Engineering Features of a Combined Heat and Power Distribution," by R. A. Langworthy, Boston, Mass.; "Developments in Steam Turbines," by Richard H. Rice, General Electric Company, Lynn, Mass., and "Recent Developments in Condensers and Modern High Vacuum," by C. H. Bromley, *Power*, New York.

A get-together dinner was held Thursday evening.

JOVIAN PROBLEMS AND THE ELECTRICAL LEAGUE

Two-Day Session of Special Commission Appointed by Jupiter Doherty to Consider Their Relation Proves Enthusiastic

The special commission appointed by Reigning Jupiter Henry L. Doherty to study Jovian problems in relation to the electrical leagues met in the club rooms of the Cleveland Electrical League on April 5. The sessions extended through that day and the next one. The members were enthusiastic in their work, and many subjects were taken up and exhaustively discussed.

Electrical Industries Ready to Serve

Conferences Held and Plans Made to Determine the Best and Most Effective Methods of Aiding the Nation

ALL branches of the great electrical industries are keenly alive to their duty and responsibilities in the national crisis. Reports to the ELECTRICAL WORLD from all parts of the country show that the electrical industries are actively engaged in formulating measures which are necessary for the public safety. For the ELECTRICAL WORLD to divulge or discuss these measures in their relations to individual properties would not be in the public interest.

It is sufficient to say that both in physical measures and in conference the different sections of the industries are responding to the call for defense of the nation. The measures taken vary in different localities and are tempered or strengthened according to the necessities in particular cases, but are being pushed with vigor.

The great importance of maintaining central station service is of course a foremost consideration in all that is done. This demands military assistance and hearty co-operation. Military measures, however, can be supplemented by engineering advice which will accentuate sharply the ordinary steps for safety. Among the highly essential accessories to ordinary means of protection are flood-lighting, barbed wire or wire charged heavily with energy, the posting of sharpshooters at vantage points, etc.

GIVE AND ASK CO-OPERATION

It will be the aim of the central station officials generally to give to and ask from the police and military authorities the fullest degree of co-operation.

Among the questions that press for solution is that of the maintenance of organization of the operating staffs of the central stations and of the manufacturing establishments which can be of service in the production of needed supplies. This question will probably receive definite attention. There is a general sentiment that operating staffs will be able to show returns which will prove of great ultimate military value while remaining in their present positions.

As an instance of the attitude of large companies there may be cited the announcement of President Herbert A. Wagner of the Consolidated Gas, Electric Light & Power Company to men in the employ of the company who are called into the army or navy or who shall hereafter volunteer or be called into the service. Such men will be paid full wages during active service with the government less the government pay, and will be given employment by the company upon their return.

The Worcester Electric Light Company has given the use of one of the windows in its store for an exhibit to stimulate recruiting.

The New York Edison Company has placed a great fleet of vehicles at the service of the police authorities.

At the National Defense Convention, held in New York, the Seventy-first Infantry escorted fifty prominent persons in electric vehicles up Fifth Avenue.

A. I. E. E. APPOINTS COMMITTEE OF DEFENSE

Many conferences have been held in the Engineering Societies Building, New York, to further steps by the engineering industries to support the government. A special committee of national defense, appointed by the executive committee of the American Institute of Electrical Engineers, is as follows:

John H. Finney, chairman; F. C. Bates, secretary; B. J. Arnold, A. H.

THE INDUSTRY'S PLEDGE

As Expressed by Its Leaders

FROM E. W. RICE, JR., PRESIDENT GENERAL ELECTRIC COMPANY

To the ELECTRICAL WORLD:

The President's message expresses in simple but powerful words the solemn and final judgment of a great peace-loving people on the issues of this great war.

While every thoughtful citizen must realize the gravity of the step which we are now taking, there will be no holding back, and no matter what trials the future may have for us, the knowledge that we are fighting in defense of all that makes life worth living will enable us to persevere until victory for ourselves and our natural allies has been obtained.

Men of the electrical industry, representing every phase of scientific and engineering activity, will be able to render invaluable service, as a modern war, as is well known, cannot be won by courage and strength alone, but demands skill in control of complicated machinery and the use of scientific methods all the time and everywhere.

This is not a war between peoples, but a mighty conflict of irreconcilable ideals of government and of life, and there can be no question, therefore, that every citizen of this country who treasures our ideals will welcome the solemn privilege, which has been forced upon him, of fighting for them. We all devoutly hope and believe that the entrance of our nation on the side of liberty and humanity will bring to a speedy end this terrible scourge of the world.

E. W. RICE, Jr.

Schenectady, April 4, 1917.

FROM SCHUYLER SKAATS WHEELER, PRESIDENT CROCKER-WHEELER COMPANY

To the ELECTRICAL WORLD:

It is evident that the war activity of this country will considerably increase its industrial activity, although, as has already been pointed out in connection with two or three industries, such as steel and copper, the total new demand will not for some time form much of a percentage of the total capacity of individual industries, except in a few cases, such as shipbuilding.

I believe, however, that the present or immediate demand will be followed by a general and increasing one which will lead to great and continued industrial activity, to which the work of furnishing supplies to the Allies in increased quantities and varieties will contribute largely. The Allies will draw more of their supplies from us, because the conditions will be more favorable to them.

What is equally interesting is the great impetus that electrical invention and industrial activity will receive in this, already the leading electrical country of the world. SCHUYLER SKAATS WHEELER.

Ampere, N. J., April 4, 1917.

Babcock, Philander Betts, H. W. Buck, J. H. Cuntz, J. J. Carty, D. C. Jackson, John W. Lieb, P. M. Lincoln, Ralph D. Mershon, A. M. Schoen and J. Franklin Stevens.

A sub-committee of the foregoing, composed of Messrs. Buck, Finney, Mershon, Arnold and Bates, was appointed to co-operate with similar committees of the other national engineering societies.

The A. I. E. E. is sending out this week circulars giving instructions to members of engineering societies who contemplate offering their services to the army and navy, with a résumé of data regarding the different classes of service.

PREPAREDNESS ACTIVITIES OF THE A. I. E. E.

F. L. Hutchinson, secretary of the A. I. E. E., stated:

"The American Institute of Electrical Engineers has taken an active part in various movements for national preparedness.

"Early in 1915 a suggestion was made that several of the national engineering societies appoint committees for the purpose of co-operating with the War Department in the formulation of a plan for the organization of a Reserve Corps of Engineer Officers. Committees were accordingly appointed by the American Society of Civil Engineers, American Institute of Mining Engineers, American Society of Mechanical Engineers, American Institute of Electrical Engineers and American Institute of Consulting Engineers.

"The formation of the Engineer Officers' Reserve Corps was authorized by Congress under Sections 37, 40, 49 and 51 to 53 of the national defense act, approved June 3, 1916.

"The committees of the Institute and the other societies actively co-operated with each other and with the War Department both before and since the passage of the act.

"On July 19, 1915, the Institute was invited by President Wilson to select two members for appointment by the Secretary of the Navy upon a proposed advisory committee, to be presided over by Thomas A Edison.

"In January, 1916, the Institute received an invitation from the President of the United States to nominate a representative in each State in the Union subject to the approval of the Secretary of the Navy, to act in conjunction with representatives of the American Society of Civil Engineers, American Institute of Mining Engineers, American Society of Mechanical Engineers, and American Chemical Society, in collecting data for use in organizing the manufacturing resources of the country for the public service in time of emergency. A list of these nominees was subsequently submitted to the Secretary of the Navy and the appointments were made.

AVAILABILITY OF MEMBERS

"On Feb. 8, 1917, the executive committee of the Institute issued a circular to the membership in the United States, together with a data sheet, with a view to tabulating the experience and availability of its members for military or naval service, as officers or enlisted men, and assisting them in obtaining appropriate positions in the various organizations to be formed in the event of war. About 1800 members have thus far responded to this appeal, and the sheets continue to be received daily.

"The latest action taken by the Institute was the appointment of a committee on national defense."

THE INDUSTRY'S PLEDGE

As Expressed by Its Leaders

FROM H. W. BUCK, PRESIDENT OF AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

To the ELECTRICAL WORLD:

The formal acknowledgment of a state of war in this country now seems to be a question of only a few hours. This colossal enterprise which we are about to undertake must bring into play to a superlative degree all of the forces which have worked for the development of this country during recent years.

In this great evolution no class of men have contributed more than the electrical engineer, and his work in the war must continue to be of equal importance.

War as now fought is largely fought by engineers directly or indirectly, and the electrical engineers of America will doubtless soon show that they can rise to the occasion and live up to the best traditions of the profession in initiative, energy, inventiveness and patriotism. H. W. BUCK.

New York, April 4, 1917.

FROM HERBERT A. WAGNER, PRESIDENT NATIONAL ELECTRIC LIGHT ASSOCIATION

To the ELECTRICAL WORLD:

In this time of national crisis, on the eve of our entering into the world war, it behooves us, as employers and individuals in the great electrical industry, to consider it our first and most important duty to take stock of our ability and facilities to assist the government in its prodigious task of preparation and organization to uphold successfully the principles for which we stand before the world.

The spirit of patriotism and loyalty to our country should be our inspiration, and the desire to be of service our first consideration.

Organization and preparation for the most efficient use of the trained men in every community are the first essentials. In the electrical industry we have brought organization to a most advanced degree, and "preparedness" for the demands of the public has been our watchword. Before us now lies the possibility for the organization of our forces for assisting the government, through our power facilities and engineering ability, in promoting the most efficient production of supplies and munitions by local industries; in assisting the railroads, through the supply of power and otherwise, in solving the new transportation problems confronting them; and in electric service and engineering assistance in perfecting local defenses.

We pride ourselves on being leaders among our local industries, and we should now be leaders in encouraging patriotism and service to our country. It is highly probable, however, that a large number of the employees of central station companies can be used to better advantage, in view of their special training, for local work in connection with the most efficient organization of industrial production. Organization on this basis should be promptly and carefully studied before numbers of our specially trained men enlist for ordinary service. The National Electric Light Association can be depended upon to offer its services, and its organized facilities, for every assistance possible along these lines.

In this great crisis in the history of our country and in the upholding of the principles of democracy throughout the world we should not be backward in emulating the spirit of the patriots of '76 in pledging to the cause our lives, our fortunes and our sacred honor. HERBERT A. WAGNER.

Baltimore, April 4, 1917.

IT IS A "NECESSITOUS DUTY" TO PROVIDE FOR DEPRECIATION

Georgia Commission Points to Importance of Including an Allowance for Gradual Loss in Value and for Bond Discount

An application of the Georgia Railway & Power Company, Atlanta, Ga., for approval of the issue of $420,000 non-interest-bearing scrip in payment of dividends on its first preferred cumulative 6 per cent stock was denied by the Railroad Commission of Georgia. Through the opinion of Chairman Candler the commission directs attention to the "necessitous duty" of a public utility to provide for depreciation. The opinion says:

Discounts and Expenses in Selling Bonds

"Included among the book assets of the company as of Nov. 30, 1916, under 'Suspense Account' are three items aggregating $279,722.31, representing unextinguished balances of discounts and expenses in the sale of bonds at less than par.

"These items are to be extinguished during the life of the bonds by annual charges against them, to be taken out of earnings. Since Nov. 30, our understanding is that there have been additional sales of bonds of both the Railway & Power Company and the Railway & Electric Company, issued against constructions and acquisitions prior to Oct. 31, 1916, upon which there are discounts which must be extinguished in the same way.

"It does not appear to us that mere book assets, as indicated above, can be properly included in a divisible surplus.

"There is not included among the liabilities of the company any charge or provision for depreciation in the properties of either the Railway & Power Company or the leased property of the Railway & Electric Company.

"Every just and reasonable rate prescribed by this commission contemplates such provisions out of the earnings thereunder. Ordinary maintenance and repairs do not and cannot take care of depreciation and obsolescence. No utility can, year after year, pay out every dollar of its earnings above operating expenses and fixed charges without facing disaster when the life of its plant has been spent and no accumulation or provision has been made against exhaustion, decay or out-of-dateness.

Revolutionary Inventions Possible

"The properties of the Railway & Power Company are, as a whole, comparatively new and up to date, but new discoveries and new applications in hydroelectric developments are frequent and may be revolutionary at any time. This is also true as to the entire field of electricity and its uses.

"We cannot undertake to say what sum should have been charged against the claimed surplus in the present case, as no evidence has been submitted on this subject. We are satisfied, however, that a depreciation charge or reserve should have been set up against the claimed surplus.

"These preferred stockholders can have no dividend on their stock unless there are in fact net earnings. Assuming that there are net earnings, the directors of the company have the discretion and power to use the profits of any given year in the improvement of the company's property to the exclusion of any dividend.

"We cannot escape the conviction that dividends ought not to be declared when there are no net earnings available for prompt payment; that a dividend ought not to be allowed to become a long-term obligation, particularly of a public utility owing services to the public the adequate and sufficient discharge of which might be seriously affected or rendered impossible at some time by an accumulation of deferred debts of this character.

"We doubt the policy and question the propriety of assenting to the spread of payments of a dividend over a number of years in the future.

"If this company has sufficient net earnings, after providing for operating expenses, taxes, fixed charges, proper maintenance and sufficient depreciation reserve and working capital, to insure the operation of its properties and the discharge of its duties to the public, it has the right and its directors the power to pay dividends out of such earnings. There can be, under such conditions, no necessity for the giving of the scrip obligations under discussion, and the commission is without power to authorize their issuance."

PUBLIC SERVICE CORPORATION CHANGES IN ORGANIZATION

Mr. Farrand Assistant to the President, Mr. Young Vice-President, and Mr. Osgood Vice-President and General Manager of Electric Company

Changes in the personnel of the Public Service Corporation of New Jersey and its subsidiaries were announced on April 2. George J. Roberts, first vice-president of the companies, retired of his own volition. He had been vice-president for nearly ten years, but underwent a serious operation last November and has never fully recovered his strength.

Mr. Roberts and P. Farmer Wanser, who is also in poor health, retired as directors. These withdrawals, together with the deaths of John J. Burleigh, Edgar B. Ward and Ferdinand W. Roebling, left five vacancies on the board. The membership was reduced from twenty-one to eighteen, and Percy S. Young and former Senator Edmund W. Wakelee were elected directors and also appointed members of the executive committee of the corporation and the operating companies.

Thomas N. McCarter was re-elected president of all of the companies. The vice-presidents of the corporation will not be designated numerically hereafter. Randal Morgan, Anthony R. Kuser and Messrs. Young and Wakelee were elected vice-presidents. Other changes were:

General Edwin W. Hine received a leave of absence for one year. Dudley Farrand and John L. O'Toole were appointed assistants to the president. T. Wilson Van Middlesworth was elected to succeed Percy S. Young as treasurer. William S. Barker, former assistant treasurer, was appointed comptroller. F. A. Neis was elected assistant treasurer. William H. Feller was elected assistant secretary to succeed Harry C. Stevenson, who was appointed assistant to the vice-president in charge of public relations. Farley Osgood was elected vice-president and general manager of the Public Service Electric Company to succeed Dudley Farrand. Martin Schreiber, engineer of maintenance of way of the Public Service Railway Company, was given the title of chief engineer.

NGINEERING CO-OPERATION CONFERENCE IN CHICAGO

hird Annual Conference Voices Need of More Democracy in the Societies and of Attention to Employment Problems

The third annual conference on engineering co-operaon, held in Chicago on March 29 and 30, laid down ten undamentals, resolved to keep going, and urged that ne national engineering societies make the engineering ouncil democratic and take up the work. More than orty delegates registered, representing societies with membership of 50,000. Nearly 300 engineers atended the banquet, which was participated in by pracically all the Chicago engineering societies. The tentave plans of the Chicago Engineers' Club for a building o house all engineering societies were received with nthusiasm.

How the Canadian societies met the war crisis, as resented by J. S. Dennis, president of the Canadian ociety of Civil Engineers, was the most prominent ingle feature of the conference. A tablet being erected n the society house in Montreal, on which 786 memers are enrolled, indicates the extent to which Canadian ngineers responded to the call. The desirability of rther development in this country and in Canada along ne line of professional unity was scarcely debatable, the peaker held. He would favor a democratic federation f all societies and pledged his support toward bringing n the Canadian organizations.

Suggestions from Various Societies

The roll call of societies showed:

Cleveland is assigning to each committee an energetic oung man as secretary. The other committee men have ot much time to collect data, and the fact of giving a oung man something to do spurs him to action.

The civic activities of the Association of the South nclude killing a bond issue for water works, promoting ne Muscle Shoals project, advice to city on proposition o buy a bankrupt railroad, and good-roads legislation.

The Indiana Society of Engineers has a legislative ommittee with a strenuous record, but C. Francis Harding, president, thinks that the state society would ave no place if national societies were more active. He said that the branches of the national societies were ot democratic and did not handle the employment roblem efficiently.

The Society for the Promotion of Engineering Edu-ation wants to imbue the graduate with the ideals and urposes of various societies.

Peter Junkersfeld, for the American Institute of Electrical Engineers, stated that too many join a soiety to get a fixed reward. The A. I. E. E. publishes a nonthly bulletin, provides a forum for the presentaion of new ideas and an opportunity to form acquainances. It has fifty lectures available and has an emloyment bureau.

Attention to Employment Problems

At the end of E. E. Olp's paper on "Employment, How It Is Accomplished," describing the machinery of n employment agency serving a high-grade clientele, uggestions were made to have a national committee on mployment representing all engineering societies with ub-committees in larger centers and employing a paid ecretary.

Prof. F. H. Newell and C. E. Drayer were reappointed chairman and secretary respectively of an administrative committee of five, three to be appointed by the chair, to continue the work outlined and to provide ways and means for its accomplishment.

ADDITIONAL DEVELOPMENT ON KERN RIVER, CALIFORNIA

Southern California Edison Company Project Involves an Estimated Cost for Completion of $4,000,000

The Southern California Edison Company of Los Angeles applied recently to the California State Water Commission for permission to appropriate 600 sec.-ft. (16.8 cu. m. per sec.) of water on the North Fork of the Kern River and on Salmon Creek in Tulare County. Since the first appropriations on this stream were filed about $881,700 has been expended in development. The estimated cost of completing the project, exclusive of transmission lines, is $4,118,295.

The new development would be known as Kern River No. 3. It would utilize a total fall of 800 ft. (243.8 m.) and generate 30,000 kw. The project calls for the construction of a concrete diversion dam 60 ft. (18 m.) high and 240 ft. (73 m.) long on top. The conduit from the diversion dam to the forebay would be 13.4 miles (21.6 km.) long. Part of this distance would be traversed in tunnel, part in open concreted flume, and part in an inverted siphon consisting of a steel pipe 9 ft. (2.7 m.) in diameter. The two penstocks varying from 7 ft. (2.1 m.) in diameter at the top to 5 ft. (1.5 m.) at the lower end would be installed.

The proposed plant is to supplement the present plant meeting increased demand. The installation is to be completed by July 1, 1922.

UTILITY AND WATER-POWER LEGISLATION IN IDAHO

Idaho Legislature Continues Regulatory Body and Takes Away Its Jurisdiction Over Municipal Public Utilities

As the Idaho Legislature has adjourned, its action regarding the Public Utilities Commission can be summarized.

The attempt to abolish the commission by repeal of the act which created it was a failure. In fact, it was never given serious support. The effort to eliminate the "necessity and convenience" clause met the same fate. Two unsuccessful efforts were made to amend the law so so as to give the commission supervision over securities of public utilities.

The Legislature passed a law, which the Governor approved, taking from the jurisdiction of the commission supervision over municipal public utilities and non-profit mutual telephone companies. In the future public utilities of these two classes will not have to secure a certificate of public convenience and necessity before they are allowed to install gas, water or light distributing plants.

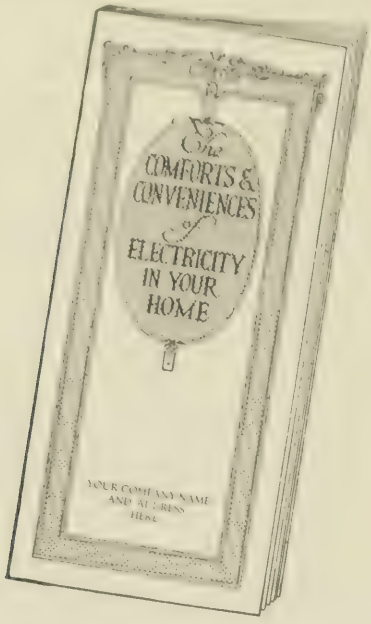
The Legislature passed a memorial to Congress urging an investigation of the alleged water-power monopoly of Western States.

COMFORT AND CONVENIENCE IN TERMS OF ELECTRICITY

A New Booklet of the Commercial Section of the N. E. L. A. Describes the Lighted and Equipped Home

"The Comforts and Conveniences of Electricity in Your Home" is the expressive title of a house-wiring booklet which is being issued by the publications committee of the Commercial Section of the National Electric Light Association.

This booklet is available to members with the imprint of the company name and address at prices varying in



BOOKLET OF COMMERCIAL SECTION, N. E. L. A.

accordance with the quantity. In addition to its explanation of wiring it tells simply of the principles of lighting and of the enjoyment and privileges of electrical appliances.

PROGRESS TOWARD AGREEMENT IN LOS ANGELES SITUATION

Obstacles Are Being Removed One by One, and Final Agreement Is Now Believed to Be Almost in Sight

The Los Angeles Chamber of Commerce appointed recently a committee of fifty prominent citizens to confer with the Public Service Commission, the City Council and the power corporations regarding the obstacles to agreement on the proposed purchase of the distributing systems. The committee was to undertake the task of adjusting these differences.

The power companies had taken the stand that more than ten years would be required to develop the city's plans for generating power. On this account they asked that the city agree to buy from the companies all the steam plant power needed for another twenty years at prices to be fixed each five years by the State Railroad Commission, the city to be bound to this agreement only if the companies could offer the power at a rate less than that at which the city could manufacture it. The power companies held out for this feature of the contract in the belief that if they could supply the excess power cheaper than the city could make it the should be given opportunity to do so by contract and thereby satisfy the bondholders.

As a counter proposal the Public Service Commissi drafted a tentative contract providing that the city pu chase from the two companies for ten years all the ele tric energy needed in excess of that generated by t aqueduct plants and the steam plant of the Los Angel Gas & Electric Corporation in case the latter plant purchased and that for these ten years the city sh buy at least 25,000 hp. from the companies on the sli ing scale of prices determined by Prof. W. F. Duran city consulting engineer.

It was further proposed that during these ten yea the city, at the demand of the companies, should sell excess power at a price to be fixed by the State Ra road Commission and that the city should buy all t extra energy needed from the companies at prices be fixed by the commission. Subsequently the Ci Council approved this contract as drawn up tentative by the Public Service Commission.

Still later reports from Los Angeles state that aft further meetings of representatives of the city and t power companies there was agreement on further min amendment of the proposed contract. The represent tives of both sides were then of the opinion that the amendments would make the contract acceptable. T next step will be to arrange a vote by the people the proposal to issue $12,000,000 bonds.

NATIONAL CONDUIT & CABLE COMPANY FINANCIN

Issues of $5,000,000 Bonds and 250,000 Shar Without Par Value Are Offered—Proportion of War Orders Small

An offering of securities of the National Conduit Cable Company has been made in New York. Heret fore the stock of this company has been held closely.

Through the National City Company and Montgo ery, Clothier & Tyler $5,000,000 of ten-year 6 per ce sinking fund first mortgage bonds were offered. T bonds will have a sinking fund of 2½ per cent. Aft 4 per cent is paid on the stock 50 per cent of exce earnings will be used to retire bonds. Millett, Roe Hagen and Pritchitt & Company have offered 250,0 shares of no par value at $35 per share. It is expect that 4 per cent dividends will be paid on the new sto in the near future.

This company was started in 1888 with an investme of $4,000. Net earnings in 1915 were about $2,000,0 and in 1916 about $3,000,000, while for 1917 they a estimated at about $4,000,000. The new company whi is to be formed to acquire the business will have asse of $13,500,000, of which $8,000,000 will be quick. A no time have war orders exceeded 8 per cent of t gross business.

Harrison W. Craver Appointed Librarian United Engineering Societies

Harrison W. Craver, chief librarian of the Carneg Library of Pittsburgh since 1908, resigned on April 1, order to become director of the library of the Unit Engineering Societies of New York.

CENTRALIZED HYDROELECTRIC SUPPLY MAKES LOWER RATES

Experience of Central Maine Power Company, Which Serves Thirty Municipalities, Shows Advantage of Large-Scale Operations

The service of the Central Maine Power Company has been extended lately into the Brunswick-Bath district, following the approval of the Public Utilities Commission of the company's request to be allowed to acquire control of the Bath & Brunswick Light & Power Company. At the hearing before the commission the advantages of centralized hydroelectric development were discussed.

Harvey D. Eaton, president of the Central Maine company, stated that each of the additions to the system had resulted in some enlargement of the field for power distribution and in some cases in additions to the company's power resources. At present the company is carrying important undeveloped power resources, and it seeks a market through which it can increase its business and lower its costs of supply.

The company now serves about thirty municipalities in five counties and has developed about 12,000 hp. of hydroelectric energy and about 5000 hp. in steam facilities. On account of restricted business the Bath & Brunswick company could not materially reduce its rates, and it was estimated that a physical connection between the two properties would result in saving about $18,000 per year in water previously wasted over the dam at the Brunswick plant.

Large Water-Power Development Forecast

Walter S. Wyman, general manager of the Central Maine company, said that the company's policy has been to develop business without constructing additional plants, making the most of existing steam and water-power stations; but that the next step is to get enough business so that a large water power can be developed, say 15,000 hp. or 20,000 hp., on the upper Kennebec River. If this can be done, both costs and prices can be reduced.

"Our scheme is to develop our water powers to a point where we have to use considerable steam before we make a hydraulic development," said Mr. Wyman, "so that when we make it we will have some income by shutting down that steam. We will have some income to support that development the first year. If we start out and build a million-dollar plant and don't have any business for it, there is an interest charge of some $75,000 or $100,000 added, and our scheme is to build up that load until we have $50,000 or $75,000 of business running on steam.

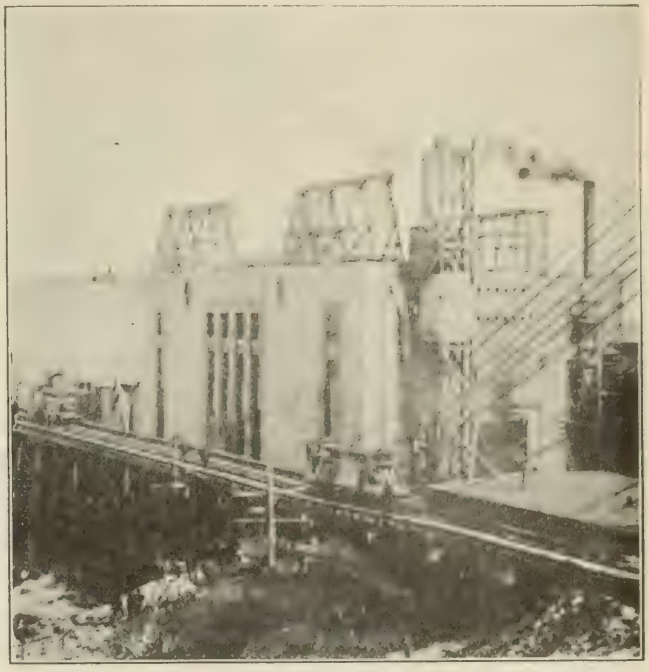
"About 25 miles of 33,000-volt transmission lines, costing about $40,000, were involved in the extension of service into the Bath territory."

Mr. Wyman said that as a result of the company's taking in local properties rates had been reduced in many communities. In Dexter, Maine, the maximum rate was 14 cents per kilowatt-hour, which has been cut to 12 cents for the first hour's use, 10 cents for the second and 5 cents for all in excess of this. The power rate was 5 cents flat, but now the iron and woolen mills in Dexter purchase power for 1.85 cents. The rates were materially reduced in the Augusta district, in Skowhegan and Bingham.

DEDICATION OF WISSOTA DAM AT CHIPPEWA FALLS, WISCONSIN

Hydroelectric Project of Wisconsin-Minnesota Light & Power Company Generates 45,000 Hp. and Furnishes Energy for Twin Cities

With the dedication of the new Wissota dam on the Chippewa River, 2 miles above Chippewa Falls, Wis., the Wisconsin-Minnesota Light & Power Company, of which J. H. Brewer of Grand Rapids, Mich., is the president, has completed a hydroelectric project that provides 45,000 hp., next in size to the Keokuk dam. More than 1000 men have been employed constantly on the construction of the dam since October, 1915.



NEW WISSOTA DAM

City officials from Eau Claire and Chippewa Falls, members of civic associations from these cities, and 200 employees of the Wisconsin-Minnesota company attended the dedication. A banquet was served in the dining hall at Wissota, at which President Brewer was the principal speaker.

MERCHANDISING COMMITTEE FOR CONTRACTORS' ASSOCIATION

National Organization Forms Body to Consider Problems of Vital Interest to Members Who Have Retail Electrical Stores

A merchandising committee of the National Electrical Contractors' Association has been appointed by Col. Robley S. Stearnes, the president. Its work will be to solve problems which are of vital interest to the members of the association who have retail electrical stores. The members are:

George Weiderman, New York, N. Y., chairman; W. G. Reuter, Cincinnati, Ohio; L. W. Cleveland, Portland, Me.; A. L. Swanson, Evansville, Ind.; Carl Heilbron, San Diego, Cal.; Rush Brothers, Hot Springs, Ark.; Robert Nickles, Madison, Wis.; E. T. Borden, Houston. Tex., and Edward Kunkle, Davenport, Iowa.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Ill-Health Resulting from Stagnant Back-Water.—In an action against the Towaliga Falls Power Company for injury, sickness, loss of time, etc., caused by stagnant back-water the Court of Appeals of Georgia held (91 S. E. 442) that evidence that pond caused water to stagnate and mosquitoes to breed and produced offensive odors showing general conditions of pond and not necessarily local conditions was admissible. The evidence was held to support a verdict for the plaintiff.

Negligence.—Evidence in an action for the death of a lamp trimmer employed to lower large suspended arc lamps, wipe off the glass globes and renew the carbon pencils, he having no duty to inspect the wires or to test them for the presence of leaks, sustained the jury's finding that he was killed by an electric shock and that the defendant was negligent in not taking sufficient precaution to secure the wires to a cross-arm, it was held by the Supreme Court of New York in Bishop vs. Kingston Gas & Electric Company (162 N. Y. S. 1097).

Duty of Utility to Supply Customers.—The broad question of how far a utility company can be reasonably expected to open its service to undeveloped and new territory received the consideration of the Supreme Court of Errors of Connecticut in the case of the New Britain Gaslight Company vs. Root (99 A. 559). The court held that a gas company should not be required to give enlarged service at a considerable cost where the prospects of return for many years are so meager as to be out of proportion to the cost, but, in the exercise of rights essentially monopolistic, it cannot withhold desired service until it promises immediate adequate return. Whether a gas company should be required to extend its mains to give service to individuals depends upon the test whether it should reasonably be called upon to give such service and not whether the service will be remunerative. A mere showing that the petitioner lived in a growing community, that it might fairly be assumed that the users of gas would materially increase, that the community lies between two cities in the direction of the natural growth of one of them, and that introduction of gas would contribute to increase the population, and thereby increase consumers sufficiently to make the proposed extension ultimately profitable, is insufficient to warrant the court in passing on the question whether the Public Utilities Commission was justified in making an order granting an extension of service to the community concerned.

Double Taxation.—That a gas company has already paid a license tax does not prevent the governing body of the municipality investigating the business for the purpose of imposing a proper tax; for, as the municipality could increase or diminish the tax, the imposition of a new tax would not amount to double taxation, it was held by the St. Louis Court of Appeals (191 S. W. 1109).

Removal of Poles Interfering with Highway Improvement.—It is the duty of a telephone company occupying a public highway under a franchise from the county court to remove and reset its poles and lines at its own expense, when notified to do so, if they are so situated as to interfere materially with the work, lawfully prosecuted, of permanently improving such highway, it was held by the Supreme Court of Appeals of West Virginia (91 S. E. 350). The franchise of such telephone company is subordinate to the rights of the traveling public in the highway. The pendency of a suit brought by the telephone company simply to enjoin the county court and its contractors engaged in making permanent highway improvement from willfully and wantonly destroying its poles and wires, and the granting of a temporary injunction order restraining such willful trespass, is no impediment to the right of the county court to apply for a writ of mandamus to compel such telephone company to remove its poles and lines.

Validity of Debt.—A corporation in which the defendant was interested was indebted to the Alabama City, Gadsden & Attalla Railway Company for motor rental, lights, etc., and at defendant's request the plaintiff removed his motor and installed it at defendant's new mill upon his promise to pay the old debt of the corporation in installments. The Supreme Court of Alabama held (73 S. 494) that such a debt became existent as a condition precedent to the removal and installation of the motor in the new mill. In assumpsit to recover amount due for electric energy and rental on the motor, testimony as to the failure of the new mill to run at certain times was properly excluded, the failure not being shown to be due to any fault of the power company or non-compliance on its part with its duty to furnish energy. Since a written contract governed the charges for energy and provided for the measurement of energy and for the determination of the reasonableness of the measurement should the meter charges appear to be excessive, the method prescribed by the contract was held to be the only method that could be used to dispute the meter reading and compute the charges. If the defendant promised to pay the old debt, his termination of the contract for energy at the new mill did not relieve him from the obligation to pay such debt when the amount thereof became due. Where energy was furnished to the defendant and he was bound to keep the motor in good condition, he was liable for excess energy used owing to his failure to keep the motor in proper condition.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Deposit Rule Under Discussion in Pennsylvania.—Conferences of various classes of public utilities have been held recently with the Public Service Commission of Pennsylvania on a general rule for deposits of consumers.

Value for Purchase.—Value for purchase is discussed by the Illinois Public Utilities Commission in a decision relating to the Illinois Terminal Railroad. "Should a regulatory commission," it asks, "give its approval to the sale of a utility property at a sum greater than that found to be the true present value of the property for purposes of rate fixing? Should it do so and the property later become the subject of a rate inquiry, the higher value thus set by the commission for the purposes of sale and purchase may become the subject of adverse criticism. On the other hand, to deny the sale of the property to a bona fide purchaser at such price as he is willing to pay may appear to work an injustice to him and constitute an interference with his proper pursuit of business. This commission, among others, has heretofore recognized the difference between the value of a utility when used as a basis for fixing schedules of rates and when it is made the object of a sale or purchase. The allowance of a higher value in the latter case may easily be justified upon the ground that a prospective purchaser may be satisfied with a smaller return upon his money than he may believe the commission would allow him in a possible future rate-making inquiry; he may foresee greater possibilities of development in the property than do the present owners; or for various other reasons which he may not be bound to disclose, he may be willing to pay a sum for the property that is greater or less than the value placed by a commission in a rate-making proceeding. Certain it is that a commission should do all in its power to encourage the legitimate growth of all business enterprises. Whenever then, the restrictions which may be placed by a regulatory commission upon a property furnishing a public service are well understood, these limitations form a proper source of consideration for a prospective purchaser. And when such commission may have set a price at which such sale or purchase may be consummated, even though this price may be reasonably in excess of that value determined in a rate-making inquiry, then has its full duty been done for notice has been served upon both parties to the transaction of the reasonable judgment thereon of impartial persons having full and complete knowledge upon all phases of the matter."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Opposition to Electricity for Taking Animal Life.—The Humane Society of Kansas City, Mo., publishes notes opposing the use of electricity for taking animal life. President Edwin R. Weeks wrote an introduction to a number of letters from teachers of physics and electricity, physicians and electrical engineers who do not approve of animal electrocution.

Chippewa Falls Power for Northern States Power Company.—The Wisconsin-Minnesota transmission line extending from the Chippewa Falls development of the Wisconsin-Minnesota Light & Power Company to Minneapolis has been placed in operation. This enables the Northern States Power Company to secure a large amount of energy, under a favorable contract. Substantial operating economies will be effected through the reduction of steam-generated electrical energy.

Appliance and Power Business Growth in Brooklyn.—The Edison Electric Illuminating Company of Brooklyn reports a 61 per cent increase in power business in the first two months of 1917 over the corresponding two months of 1916. The total horsepower amounted to 6734 as against 4194 hp. in 1916. Included in these figures are fifteen isolated plants and steam engines replaced by Edison service. The appliance business of the Brooklyn Edison company for the first two months of 1917 also showed a marked increase. The percentage increase in gross sales for these two months in 1917 was 34 per cent over the corresponding two months in 1916. The number of articles sold during this period in 1917 was 1769, against 1081 in 1916, an increase of 63 per cent. The wattage of appliances sold during the same period was 312,000, or 30 per cent better than in 1916. These increases were general throughout most of the different classes of appliances with a few exceptions.

Cost of Keokuk Power in St. Louis.—The Union Electric Light & Power Company of St. Louis is advertising as "The Electric Company" a series of "electric service editorials." One is on "How St. Louis Got Keokuk Power." It says that the North American Company has never owned more than a very small minority interest in the Mississippi River Power Company. The advertisement adds: "The Mississipi River Power Company contracted to deliver to the Mississippi River Power Distributing Company (organized by the North American Company for that purpose and later absorbed by Electric of Missouri) 66,000 hp. of energy at $16.34 per horsepower-year, or a total annual sum of $1,078,200. The power company's prospectus, issued early in 1908, declared that company's belief that 200,000 hp. of hydroelectric energy could be developed and delivered at a total plant cost of $18,546,582. Its engineers' cost estimates were too low. Thus far the power company has been able to develop only about 100,000 hp., at a plant cost several millon dollars above $18,546,582. Including an estimated—but not yet paid—fair return to the stockholders in the Keokuk plant, the actual cost to the power company of producing and delivering energy to Union Electric's transformer station at Page Avenue is $6.42 per horsepower-year higher than the rate at which Union Electric buys it, and is higher than the rates at which the Union Electric sells it to large St. Louis industries."

Colorado Power Company New Directors.—The following new directors have been elected by the Colorado Power Company: Charles J. Paine of Boston; C. N. Mason, vice-president of the Electrical Securities Corporation; Edward D. Page of New York and George E. Claflin, vice-president of the Electric Bond and Share Company, to succeed A. C. Bedford, I. W. Bonbright, J. R. McKee and Frederic C. Walcott.

New Jersey Utility Bond Law Vetoed.—Governor Edge has vetoed Senate Bill No. 170, introduced by Senator McCran, Passaic, providing that public utility companies operating in the State should not be required to obtain authority from the Board of Public Utility Commissioners to issue stocks, bonds or other securities for work and expenditures outside of the State. The veto says that while the Governor is in sympathy with the purpose of the proposed law to limit the jurisdiction of the board over the issuance of stock and bonds of utility companies to their property in New Jersey, the plan is not a practicable one.

Public Utility Bonds for Savings Bank Investment in Maine.—Maine has amended the law so as to include certain bonds of public utility corporations not heretofore recognized as legal for investment. The amendment provides that savings banks may invest in the first mortgage bonds of any public service corporation located wholly or in part in States other than Maine (New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, Pennsylvania, Maryland. Ohio, Indiana, Kentucky, Michigan, Wisconsin, Minnesota, Iowa, Illinois, Missouri, Kansas and Nebraska) engaged in producing and distributing electric light and power when they otherwise comply with provisions specified, provided that the average gross income for three years next preceding such investment shall have been not less than $200,000 each year, and the average net income for the same period shall have been not less than twice interest charges on bonds outstanding secured by such mortgage and all "prior liens," and further provided that such net income for the last preceding year shall have been not less than one and one-half times the interest charges on all the interest-bearing indebtedness of the corporation.

Ohio State University Engineering Students Off on Inspection Trip.—On March 29 forty-five electrical and mechanical engineering students of the Ohio State University, Columbus, left on a special car for an inspection of a number of manufacturing plants. In Pittsburgh on the following two days they visited the plant of the Westinghouse Electric & Manufacturing Company and other industrial establishments. Other plants to be visited included power stations and factories at Niagara Falls and the General Electric Works at Erie, Pa.

Advertising Hydroelectric Energy on a Window.—Mapping its transmission lines on glass, the Central Maine Power Company calls attention to the magnitude of its hydroelectric system on the front of its main office window in Augusta, Me. The high-tension lines are shown in red and gold bands ¾ in. wide, rivers, lakes and the coast line bounding the company's territory on the east being shown in blue. The map occupies a space about 5 ft. wide by 8 ft. high, and the location of the company's power plants and substations is precisely indicated, as well as the watercourses.

Receivership of Northern Idaho & Montana Power Company.—By agreement of the company and its creditors the Northern Idaho & Montana Power Company has been thrown into a receivership by the federal court. Elmer Dover has qualified as receiver. This company operates light, gas, water and telephone systems in thirty-five towns in Idaho, Montana, Washington and Oregon. The complaint says that the company has outstanding $4,715,500 bonds, that it had been compelled to borrow money to meet the interest payments, that the expenditure of $300,000 for new apparatus and plants is necessary and that the money cannot be secured under the conditions at present existing.

Smoke Abatement Succeeding at Boston.—In the four years ended Nov. 30, 1916, the number of recorded observations on stationary boiler plant stacks in the Boston district increased from 27,423 to 60.243, according to the latest report of the Massachusetts Gas and Electric Light Commission. Despite the adverse fuel conditions of 1916, excessive smoke was noted in but 704 of the above cases by the board of inspectors, compared with 930 in 1913. The percentage of observed violations fell during the period from 3.3 to 1.2 in stationary stacks. Of the stationary stacks recorded observations were made on 123 public service plant chimneys, 661 manufacturing plants, 502 office buildings and 11 residences. The number of stacks showing excessive emission was: Public service, 26; manufacturing plants, 178; office buildings, 67. All public service stacks on which violations were checked had remedied their conditions at the end of the year. The report of the smoke inspection department refers appreciatively to the difficulties under which plant owners and operators have labored with respect to fuel supply.

Niagara Falls Section, N. E. L. A.—Arthur Frederick Sheldon of Chicago spoke on "Where I Am and Where I Want to Be" at a meeting of the Niagara Falls Section of the National Electric Light Association held on March 30.

Pittsfield Electricians Hear Lecture on Transformers.—Thornton Victory of the engineering department of the General Electric Company gave an interesting lecture on transformers in Pittsfield, Mass., March 28, before members of the Electrical Workers' Local 496. Slides of the large transformers which the General Electric Company is putting on the market were shown.

Radio Club of America.—Dr. H. O. Taylor, research engineer of the National Electric Signaling Company, presented a paper on "Motional Impedance Circle of the Telephone Receiver" before the Radio Club of America in New York on March 23. He explained a method of greatly increasing the efficiency of the telephone receiver by properly tuning the natural periods of the diaphragms.

Officers Minnesota Electrical Association.—The following officers were elected to serve the Minnesota Electrical Association for the coming year: President, Fred A. Otto; first vice-president, D. J. Fleming, Red Wing; secretary-treasurer, H. E. Young, Minneapolis; executive board: Fred A. Otto, St. Paul; R. M. Howard, Winona; H. E. Swanson, Rochester; T. C. Gordon, Little Falls, and H. E. Young, Minneapolis.

Coming Meeting of Minneapolis Jovian League.—The Minneapolis Jovian League will meet on April 12 at the main engineering building of the University of Minnesota. The program will include a motion-picture film, "King of the Rails," showing pioneer as well as present-day methods of transportation up to the electrification of the Chicago, Milwaukee & St. Paul Railroad over the Rocky Mountains. Other views will also be shown.

Pittsburgh Section, A. I. E. E.—"Voltage Regulation of Large Transmission Systems" will be the subject of the meeting of the Pittsburgh Section of the American Institute of Electrical Engineers to be held April 10. Short, original illustrated papers will be read by E. C. Stone, system operator of the Duquesne Light Company; J. E. Thomas, system operator of the West Penn Power Company, and H. L. Fullerton, electrical engineer of the Duquesne Light Company.

Engineering Society Presidents Speak at Brown University.—Three engineering society presidents addressed the monthly meeting of the Providence Engineering Society, held March 28 at the Arnold Biological Laboratory, Brown University. Ira N. Hollis, president of the American Society of Mechanical Engineers; George H. Pegram, president of the American Society of Civil Engineers, and Harold W. Buck, president of the American Institute of Electrical Engineers, were the speakers, the general topic being "The Engineer and Organization."

Associations and Societies

The Directory of Electrical Associations, which is regularly printed in the first issue of each month, appears on page 687 of this number.

Steam Railroad Electrification.—W. T. Whalen of the railroad department of the Westinghouse Electric & Manufacturing Company gave an illustrated lecture on "Steam Railroad Electrification" before the Detroit Engineering Society on March 9.

Institute of Radio Engineers.—The Institute of Radio Engineers held a meeting on March 4 in the Engineering Societies Building in New York City. Dr. F. H. Millener of the Southern Pacific Railroad presented a paper on "Radio-Telephony." This paper described the radiophone work undertaken by Dr. Millener for railroad communication.

Export Situation Discussed Before St. Louis Jovians.—D. S. Kramer, head of the export department of the Century Electric Company, who has recently returned from an extended tour of the world, addressed the St. Louis Jovian League at the Mercantile Club on March 27. One of the important points he made was that the low-price German and English electrical apparatus and appliances exported into some countries is of a very inferior and unsatisfactory grade, and though it may meet temporary success will not permanently satisfy. He advised American manufacturers to refrain from attempting to compete with European manufacturers in low-grade goods, and to attempt to establish a trade for reliable products. Once a reputation for reliable products is established trade expansion will result, he declared. R. J. Russell, secretary of the Century Electric Company, presided as chairman of the meeting.

Westinghouse Employees Hold Annual Dinner.—Nearly 500 Westinghouse employees attended a dinner on March 24, in the English Room of the Fort Pitt Hotel, Pittsburgh, under the auspices of the Westinghouse Club. The first speaker of the evening was E. M. Herr, president of the Westinghouse company. He praised the loyalty of men who have been with the firm for years. Farley M. Osgood, vice-president and general manager of the Public Service Electric Company of New Jersey, called attention to an interpretation put on the term "engineering," saying that it means 90 per cent horse-sense and the rest horse-sense. In addition, he pointed out that engineers are becoming better recognized publicly as shown by the selection of the five principal engineering societies to compile data on the manufacturing facilities of all industrial plants. A "Challenge to Engineers" was the subject of an address by Rev. Daniel L. Marsh.

New England Section, I. E. S.—M Luckiesh will speak on "Linking Science and Art with Practice in Lighting" before the New England Section of the Illuminating Engineering Society on April 11, at the Massachusetts Institute of Technology, Cambridge, Mass.

Westchester Lighting Company Section, N. E. L. A.—The second regular meeting of the Westchester Light Company's section of the National Electric Light Association was held in Mount Vernon, N. Y., on March 21. The speakers were as follows: H. M. Brundage assistant secretary Consolidated Gas Company of New York; W. L. Secord new-business manager Westchester Lighting Company, Mount Vernon, and C. F. Bryant, auditor Westchester Lighting Company. Mr. Secord spoke about employees' benefits derived from N. E. L. A. membership. He mentioned the various activities carried on through the monthly bulletin, and the great educational advantages to be derived from its pages. Mr. Brundage spoke about "Personal Initiative" in business. He said that the best way an employee can show and develop personal initiative is by working for some particular object as well as by taking advantage of the many educational opportunities offered to-day which were unheard of ten years ago.

A. I. E. E. Annual Convention.—Five technical sessions have been decided on tentatively for the annual convention of the A. I. E. E., to be held at Hot Springs, Va., June 26-29. The convention will open on the afternoon of Tuesday, June 26, with president H. W. Buck's address, followed by reports of the various technical committees. The transmission and distribution committee will have charge of the two sessions on Wednesday. The morning will be devoted to the subject of high tension cables. Three papers will be presented thereon as follows: "Certain Insulation Characteristics of High Voltage Cables," by W. S. Clark and G. B. Shanklin; "Problems in Operation and Maintenance of Underground Cables," by John L. Harper; "Fundamentals of High-Tension Cable Joints" by D. W. Roper. The afternoon session will be devoted to high-tension insulators, and four papers will be delivered, as follows: "The Insulator Situation," by W. D. Peasley; "Porosity of Electrical Porcelain," by H. J. Ryan "Expansion Effects as a Cause of Deterioration in Suspension-Type Insulators," by J. A. Brundige, and "Present Practice in the Design and Manufacture of High-Voltage Insulators," by A. C. Austin. The morning of Thursday June 28, has been designated as the mining session and the following papers will be presented: "Forms of Power Best Suited for the Various Loads Encountered in the Operation of Bituminous Coal Mines," by R. L. Kingsland and "Test of a Large Mine Hoist," by R. S. Sage. The fifth and last technical session, which will be a railway session, will be held Friday morning June 29. Preparations for the convention are rapidly being completed, and a very large attendance is indicated

James Walter Gillette, who has been made general manager of the Lee Light & Power Company, Clarinda, Iowa, to succeed Rufus E. Lee, was born at Burlington, Mich., on June 28, 1871. He was educated at the public schools of Kalamazoo, Mich., and Wyoming, Ohio. After a special course in drafting at the Ohio Mechanics' Institute of Cincinnati, he spent three years at DePauw University, Greencastle, Ind. Mr. Gillette's first electrical experience was with the American Hoisting & Derrick Company as draftsman. After a year of this work he became first assistant to the designing engineer of the California Electrical Works, San Francisco, and later installed a number of plants for that company. He then entered the engineering and construction business for himself in Southern California. In 1895 he rebuilt the lighting system and station equipment at Fond du Lac, Wis. The following year he became general superintendent of the



JAMES W. GILLETTE

Marinette Gas, Electric Light & Street Railway Company, Marinette, Wis., but resigned two years later to become manager of the West India & Columbia Electric Company, Barranquilla. During that time he also acted as resident engineer for the Rio Bogua Mining & Trading Company. He next headed an expedition into the interior of Antigua in company with two mining engineers. Returning to the United States he was appointed superintendent of the electrical department of the Evansville (Ind.) Gas & Electric Light Company. In 1902 he became resident engineer of the Phoenix Gas & Electric Company, Phoenixville, Pa., which included the gas works, electric-light station and street railways. He later went with the Fort Smith (Ark.) Light & Traction Company, where he was manager for a number of years. During that time he served as president of the Arkansas Association of Public Utility Operators. Later he became manager of the Brisbane Tramway Company, going from this country to England and thence to Australia. The war having brought many changes in that country, he returned to America and accepted management of the Clarinda property.

Men of the Industry

Changes in Personnel and Position— Biographical Notes

L. A. White has been promoted from superintendent to general superintendent of the Muskogee (Okla.) Gas & Electric Company.

J. F. Owens has been promoted from superintendent to manager of the Muskogee (Okla.) Gas & Electric Company, succeeding H. C. Hoagland.

W. R. Emerson, secretary and treasurer of the Muskogee (Okla.) Gas & Electric Company, has been appointed assistant manager of the company.

N. I. Garrison, formerly auditor of the Fort Smith Light & Traction Company, has been transferred to the management of the El Reno (Okla.) Gas & Electric Company, succeeding F. H. Tidnam.

F. H. Tidnam, formerly treasurer, general manager and contract agent of the El Reno (Okla.) Gas & Electric Company, has been appointed assistant secretary of the Central Oklahoma Light & Power Company, with headquarters at Oklahoma City.

L. R. W. Allison, for the last five years associated with the Rice Electric Display Company, New York, has resigned, effective April 1, with the intention of engaging independently in electrical and technical writing and research work at Newark, N. J. He was formerly stationed at Los Angeles, Cal., and has been a contributor to the ELECTRICAL WORLD.

A. J. Authenreith, who has been chief engineer for the Central Illinois Public Service Company at Mattoon, Ill., since the formation of the company, and prior to that was engineer of the Mattoon Electric Light Company, has been appointed chief mechanical engineer of the Middle West Utilities Company, Chicago, Ill., in charge of the engineering of the company's ice plants and waterworks.

James M. Barry, chief of the department of electricity at San Francisco for the last three years, has resigned to take a position with the Great Western Power Company as engineer of distribution. Mr. Barry had charge of design in connection with the building of the Northwestern Electric system in Portland, Ore., which is also controlled by the Fleishhacker interests, and the offer of the position with the San Francisco properties comes as a result of his work with this company in the North. The Great Western plans a number of extensions in San Francisco, Oakland and Sacramento. Mr. Barry's work will be the design and supervision of extensions to overhead and underground distribution. Arthur Kempston, now in charge of overhead construction for the city, will succeed Mr. Barry.

H. S. Foley recently left the Ebro Irrigation & Power Company of Barcelona, Spain, where he has been in charge of the distribution system and steam plants for the last three years. His subordinates presented him with a silver tablet upon which was engraved a testimonial of their affection and the names of the donors. Mr. Foley has been identified with the late Dr. F. S. Pearson's interests for the last thirteen years, ten of which were spent in Mexico City, where he was with the Mexican Light & Power Company and the Mexico Tramways Company as general superintendent of power and distribution. Mr. Foley is now connected with the Compagnie Générale d'Electricité and will in future make his headquarters in Paris, but is in this country at the present time arranging for the purchase of machinery and supplies for some of the properties which his company operates in France. Mr. Foley has been a contributor to the ELECTRICAL



H. S. FOLEY

WORLD during the past year on the subject of introducing American electrical goods in foreign markets.

Obituary

Fridolin C. Jenny, late of Zurich, Switzerland, died suddenly in New York City on March 26. He contracted a cold about a week before he died which confined him to his hotel and rapidly developed into pneumonia. Mr. Jenny was a director of the prominent engineering firm of Escher, Wyss & Co. of Zurich and was in this country on the way back from Japan, staying here for a short time in connection with his company's business. He was born October 14, 1878, and was well known in engineering circles both here and in Europe.

Rollo B. Kinsman, chief engineer of the Greenfield station of the Greenfield (Mass.) Electric Light & Power Company, was electrocuted March 25 while repairing a lightning arrester at the plant. Edward Leurkahardt, an assistant in the station, also lost his life in an attempt to rescue his chief's body.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

LARGE VOLUME OF TRADE IS CARRIED BY JOBBERS

Prices Generally Are Steadier, with Advances in Lines Employing Steel in Their Construction—Collections Somewhat Slow

Conditions in the electrical supply and jobbing field appear to be very steady, with a large volume of trade being carried. Generally speaking, the falling off in business ordinarily felt at this time is manifest, but not so acute as under ordinary conditions. Buying, however, for future deliveries is being placed a little further ahead than ordinary, tending as a result to smooth out hollows in the sales curve. In New England a slight recession in the volume of business is noticeable at present, particularly in relation to building installation equipment. On the whole, there appears to be a little diminution in orders, chargeable to the prospect of a vigorous war between the United States and Germany. There is also a particularly noticeable demand for electric motors for industrial service, owing in a large measure to the increased price of coal in this region. It is also noted in New England that preparedness measures have increased the sale of flood-lighting equipment and that the demand for electrical flags is increasing. In the Northwest buying or ordering is about the same as reported for the previous months of the year and is about normal. There is a noticeable increase in this section in purchasing of some material, especially in those lines used for shipbuilding, this industry being very active throughout the Northwestern territory. Building construction appears to show a satisfactory advance over last month.

There seems to be a feeling among the Middle Western jobbers that the demand for goods eased up a trifle during March and that the month of April will see a very active business in spring construction materials. With the possible exception of what may be termed the spring buying habit, "wire your home time" is looked upon in the Middle West as the greatest single factor by those who are anticipating a spring construction rush. Lamps throughout the Middle West continue to be in good demand and are still very difficult to obtain. Throughout California and the Southwest there has been a considerable office and residence building construction in the past month, sufficient to bring this line of business up to a higher level than the volume of industrial business reported as favorable for the earlier part of the year.

In the East and South conditions are about normal, with a continued large demand around New York for construction materials, particularly for factory construction. There has also been recently in the Middle Eastern States a very noticeable demand for electrical materials from utilities for new construction work. In the South, however, it has been noted that the high prices of building materials, particularly the price of copper, has caused many of the smaller utilities to abandon for the time being plans for additions and betterments. In a number of cases, it has been pointed out, communities which had anticipated building lighting plants have, because of the higher prices, been forced to defer actual construction work while these conditions prevailed. This same condition is known to hold good where extended improvements in electrical equipment have been planned.

On the whole, prices for electrical equipment continue to advance, particularly in those lines where steel and copper enter. Iron conduit is much higher, and practically all lines using steel have advanced. With few exceptions there have been no noticeable advances in materials employing brass. In the Southwest prices are more stable than last month, there being fewer changes, but those changes which did occur were all increases. The same holds true for the Middle West, where the particular lines which have increased lately were steel and copper products. Some jobbers in the Middle West are expecting higher prices for copper in the future. In the Northwest a sharper increase in prices is noted by the large supply houses as compared with the preceding months of the year. The upward trend is particularly noticeable over prices for February. On March 8 new prices on several different lines became effective. New England jobbers forecast further advances in prices, especially in lines of equipment which would tend to move more rapidly in the event of hostilities. In the East and South prices are becoming somewhat steadier, but there are still advances in certain lines, particularly those using iron and steel in their manufacture.

Jobbers' stocks throughout the country are from normal to large. Deliveries, of course, have been an important factor in this connection. It has been generally true, though, that stocks of construction material are particularly large right now. In this connection it has been noted that jobbers' stocks of line hardware are in a very favorable condition. In New England the problem of securing deliveries is becoming still more acute, and manufacturers are urging distributors of electrical equipment to do whatever they can to postpone deliveries. The demand for standard equipment is being filled by manufacturers to the best of their ability, but inquiries and orders for special equipment stand little chance, it is stated, of early consideration at present. Throughout the Atlantic States and the South stocks are generally larger than they were before the war although there is still some difficulty in obtaining certain lines of equipment. Broadly speaking, the stocks of the Middle West are about normal, but even those which are below normal are heavily supplied with construction material. Orders that were placed many months ago are now being filled and helping out to a large extent. Large stocks are reported by some jobbers of pole-line material, these stocks having been ordered many months ago. Other jobbers, however, who have not large stocks of this material it is understood, have bought heavily on sockets and wiring devices and will be able to supply heavy demands for this class of goods.

In California and the Southwest the condition of stocks remains about the same. There is recognition on the Pacific Coast of the likelihood of being unable to get deliveries in the event of factories being tied up with government orders but this likelihood is not given weight enough to warrant placing larger orders and thereby taking greater chances of loss that would attend the decrease from the present abnormal high prices of materials. Some of the larger dealers in the Northwest report a few lines as being easier to obtain than during the past two months, but they are so few that they scarcely deserve mention. Factories report extreme difficulty in securing materials with which to manufacture. Several large concerns months ago placed orders and to-day are carrying exceptionally heavy stocks, particularly in the hardware line.

In spite of the fact that war has been declared, the outlook by jobbers is optimistic. While the classes of electrical goods sold may change somewhat because of the war it is felt by well-informed observers of jobbing conditions that the outbreak of hostilities will soon be followed by intense productive activity which will spell extremely busy times for the wholesale distributor. Reports from the Pacific Coast show that jobbers there will continue to hew close to the line in placing orders only for the volume of business which they feel that they are fairly certain of transacting.

Collections are good in some sections of the country but poor in others. Where they are poor it is generally felt

that the entrance of this country into the war will bring so many uncertainties that creditors are holding up payment. In the larger centers in New England credits and collections are about normal, but in smaller jobbing centers it is reported that collections are a little slow. Generally, credits and collections are still good in the Middle West, but a few jobbers report that collections are a trifle slower owing to the uncertainty created by the international situation. The same is true of the Southwest. In contrast to this, however, the conditions on the Pacific Coast are extremely good, owing, it is understood, to a better extension of credit. Collections are uniformly excellent in this section of the country.

WAR PRESENTS MOMENTOUS PROBLEMS TO MANUFACTURERS

Trade Supremacy in the Markets of the World Now Held in the Balance, with Labor Playing Important Rôle

War has been declared, and the industries of the nation are now face to face with what are probably the most momentous problems ever presented to a people. A false step made at this time may set American industries back many years in international trade. Patriotism, which now runs high, is apt to deaden for the moment the far-sighted business sense of many manufacturers. Some of the more level-headed ones are counseling carefulness.

Already contracts for shells amounting to many millions of dollars have been awarded to and accepted by a prominent electrical manufacturing company. Fortunately this order can be apportioned by this company in its various shops so as not to cause any embarrassment in production. However, should electrical manufacturers generally rise to this bait of war orders under the lure of patriotism with the same or greater eagerness than that with which they accepted contracts from Europe in 1915, the result would be a paralysis in the market for goods other than those intended for war use. Already electrical factories are congested with legitimate orders for apparatus badly needed by both the electrical and non-electrical industries of this country.

There is a large market for electrical material, and while electrical manufacturers should assume their share of the government's needs it would be folly to jeopardize future business by clogging the works right now with war contracts. Europe has wisely farmed out as much of the business in war materials as possible, giving home factories an opportunity to regain their foreign trade.

While the President's call for a declaration of war was for humanity's sake, underneath the entire world situation is another war of far greater significance, namely, world industrial and commercial supremacy. If American goods are to be a factor in the greatest commercial struggle that has ever taken place, then it is evident that the American factories must be prepared to turn out goods in the volume demanded and at the time wanted.

In addition, the advent of war opens a serious situation in regard to labor, and the solution will rest largely with the manufacturer. American labor will be quick to enlist unless there is some restraining hand. If manufacturers are to serve the government in her time of need, if American goods are to be a factor in the world commercial struggle, then the skilled labor of America must be kept in the shops. Producers are more valuable producing goods than fighting in the trenches.

To the electrical manufacturers there is unusual significance in the action of other manufacturers. Foreign trade in electrical goods is not large, but the sale of electrical goods to those shops making other goods for export is large. Should the other manufacturers not be in a position to take their place in the world's trade because of shop congestion, electrical manufacturers will suffer accordingly.

The economic life of the nation is now at stake, and the subsequent action of American manufacturers will determine to what extent the United States will retain after the war the grip which it now holds on the markets of the world.

FOREIGN TRADE IS BRISK IN LIGHTING FIXTURES

Despite Troubles with Transportation and Communication Facilities Business Is Good—Healthy Growth Is Expected to Continue

Manufacturers of lighting fixtures with plants in the Middle West report that business with foreign countries during 1916 and the early part of 1917 was exceptionally good. With the restoration of normal transportation and communication facilities the majority of men in this branch of the trade see a real boom so far as foreign business is concerned. In summing up the situation as regards his company one large manufacturer said: "During the year 1916 we enjoyed the best foreign business that this company has ever known, and during the first two and one-half months of this year we have received some very nice foreign contracts. If conditions remain the same as they are at the present time, we look for even a bigger year in foreign business in 1917 than we had in 1916."

While there are here and there some who have "fears" of various kinds, it seems to be the general impression that export business is good, will become better with improvement of freight, mail and telegraphic conditions, and will be very good for at least a few years after the end of the war.

From other companies there come reports of equally successful foreign ventures, sprinkled with anecdotes of certain widely advertised fixtures in the palaces of Oriental dowagers, extraordinarily favorable contracts with Scandinavian agents, etc. Occasionally a company reports failure to profit on foreign business. This is especially true where small companies maintain independent foreign agents.

COPPER MARKET QUIET WITH QUOTATIONS EASIER

Uncertainty Regarding Effect of War on Business Generally Prevents Any Active Offering or Buying

Owing to the prevailing uncertainties regarding the effect on business generally of the entrance of the United States into the war, the copper market during the past week has been very quiet, and prices have eased off a cent or more. There has been no activity in the market in any direction that would tend to show whether higher or lower prices are anticipated. In electrical circles there is a very definite feeling that actual prices will not only not be lower, but that higher prices will prevail soon. This feeling is based on the amount of work now in progress and on the books, and on the amount of work which there are good reasons for believing will be undertaken in the near future.

Market quotations for electrolytic on Tuesday were nominally as follows: Prompt, 34 cents; May, 33.25 cents; second quarter, 33 cents; third quarter, 30.25 cents; fourth quarter, 29.25 cents.

NEW YORK METAL MARKET PRICES

	March 27 Selling Prices Bid	March 27 Selling Prices Asked	April 3 Selling Prices Bid	April 3 Selling Prices Asked
Copper:	£ s d		£ s d	
London, standard spot	136 0 0		136 0 0	
Prime Lake	35.00 to 35.50†		34.00 to 34.50†	
Electrolytic	34.50 to 35.50†		33.75 to 34.25†	
Casting	31.25 to 31.50†		30.75 to 31.25†	
Copper wire base	39.00 to 41.00†		39.00 to 41.00†	
Lead	9.00		9.00	
Nickel	50.00		50.00	
Sheet zinc, f.o.b. smelter	21.00		21.00	
Spelter, spot	10.80 to 10.92½		10.55 to 10.67½	
Tin, straits	56.00		54.37½	
Aluminum, 98 to 99 per cent	55.00 to 57.00		55.00 to 57.00	

OLD METALS

Heavy copper and wire	29.00 to 30.00		28.00 to 29.00
Brass, heavy	17.00 to 17.50		17.50 to 18.00
Brass, light	13.00 to 13.50		13.00 to 13.50
Lead, heavy	7.25 to 7.50		7.50 to 7.75
Zinc, scrap	7.50 to 7.75		7.75 to 8.00

†Nominal.

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Instantaneous Voltage Regulator

Among recent inventions which should prove of considerable interest to central station companies employing a large number of distribution transformers is a compensating device known as the

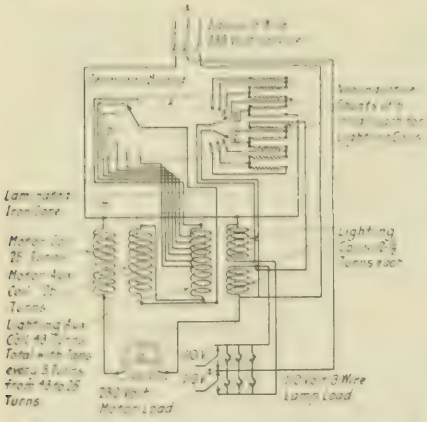


FIG. 1—INTERNAL AND EXTERNAL CONNECTIONS OF REGULATOR

Schweitzer instantaneous voltage regulator. By means of this apparatus it is possible to connect single or polyphase power loads to the transformers supplying lamps and still maintain good regulation on the lighting circuits irrespective of the disturbances caused by starting motors or by variations in the loads on motors. The regulator may be mounted on a pole alongside the service transformer and connected in series with the low-voltage circuit ahead of the light and power load.

The regulator consists of two main windings, having a common magnetic circuit, one in series with the motor load and the other in series with the lighting load. On a three-wire lighting circuit the lighting service coil is divided in halves and each half is connected in series with one of the outside lighting-service wires. Two auxiliary windings, one on the same leg with the main-motor winding and the other on the leg with the main lighting winding, are employed to vary the amount of boost required to compensate for the voltage drop in the lighting transformer caused by starting of motors or variations of load on the motors. The auxiliary windings are connected in series with each other in such a manner that their induced voltages are opposed. The variation in compensation of the regulator is obtained by varying the number of turns in the auxiliary lighting coil by means of a multipoint switch. In order to reduce the impedance drop in the main lighting coil and maintain good regulation on the lighting circuits when the lighting load changes, a non-inductive variable shunt is connected across the main lighting coils. Besides reducing the impedance of the main lighting coils, this shunt also serves as an additional means for adjusting the amount of compensation of the voltage regulator.

According to tests which have been made with one of these regulators in circuit, no appreciable voltage fluctuation occurred on the lighting circuit, although it was connected to the same transformer that served some motors and a water heater. The transformer was rated at 5 kw., the heater at 750 watts, and the motors had an aggregate rating of 4 hp. and drew relatively large starting currents frequently.

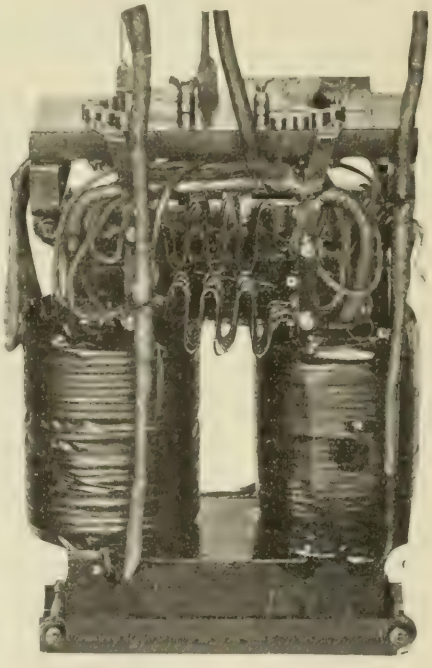


FIG. 2—CORE AND WINDINGS OF REGULATOR

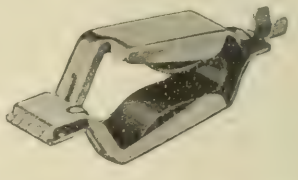
The regulator is of a core-type design, is oil-cooled and has the same appearance as a pole-type transformer. Since the regulator has no moving parts, it requires no more attention than a pole transformer when once adjusted to give correct compensation. The use of the regulator enables a saving of one transformer and the primary cut-outs where a consumer ordinarily has separate transformers for light and power. Since motor and lighting service can be supplied from a single transformer with this equipment installed, the load factor on the distribution transformer is considerably improved, resulting in a higher all-day efficiency. By the employment of the instantaneous voltage regulator it is possible to connect any size of motor to a lighting transformer regardless of the character of the motor load or motor-starting current so long as the capacity of the motor itself is within the rating of the transformer and regulator supplying the load. The regulator can be made in any size to operate on any load and with any size of service transformer. This regulator was developed by E. O. Schweitzer, chief testing engineer, Commonwealth Edison Company, Chicago, Ill.

Storage Battery

The Vesta Accumulator Company of Chicago, Ill., has developed a method of locking the plates of a battery which it claims prevents warping under heavy electrical loads. The batteries are also furnished with impregnated wood separators, which, it is claimed, prevent the formation of lead filaments in the pores of the wood and thus eliminate short circuit of the plates from this cause. The impregnating compound permits the separators to absorb the electrolyte as freely as untreated wood fiber, the manufacturer declares, so a low-resistance path is afforded inside the battery.

Test Clips

Test clips with which lighting and starting batteries may be charged without disconnecting the batteries from the car have been developed by R. S. Mueller & Company, 423 High Street, Cleveland, Ohio. With these clips it is claimed that it is not necessary to clean dirty terminals, as the teeth of the clip bite through the corrosion and make a good contact. The clips are made of lead-plated steel. The clip shown in the accompanying illustration is designed to carry 35 amp., and the jaws have a spread of 1½ in. (3.81 cm.). Other clips are made in 15-amp., 20-amp. and 100-amp. sizes. Rubber insulators for covering the clips are also furnished when specified.



LEAD-PLATED STEEL TEST CLIP

Electric Radiator

The electric radiator shown in the accompanying illustration has been developed by the Rutenber Electric Company, Marion, Ind., for use in bathrooms, offices, moving-picture cashiers' offices, and other similar places. The radiator is built in sizes rated from 660 watts to 2000 watts, according to the amount of



PORTABLE ELECTRIC RADIATOR

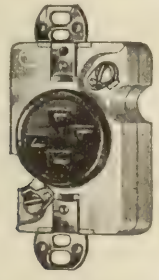
space to be heated. It is finished in polished nickel and is furnished with or without a control switch.

Resistance Material

Nickel-chromium alloys for electrically heated devices have been developed by the Electrical Alloy Company of Morristown, N. J. One of these alloys has a specific resistance of 600 ohms per mil-foot (1.27 ohm cir. mm.-meter), a temperature coefficient of 0 00019 deg. Fahr. (0.000006 deg. C.), and the melting point is above 2800 deg. Fahr. (1538 deg. C.). The other alloy is for use in electric ovens, electric furnaces and other applications where continuous high temperatures are required. The specific resistance is 565 ohms per mil-foot (1.20 ohm. cir. mm.-meter), the temperature coefficient 0.00009 deg. Fahr. (0.000003 deg. C.), and the melting point 3000 deg. Fahr. (1701 deg. C.).

Side-Outlet Service Tap

The Trumbull Electric Manufacturing Company of Plainville, Conn., has joined the movement for standardization of contacts in plugs, receptacles and simi-



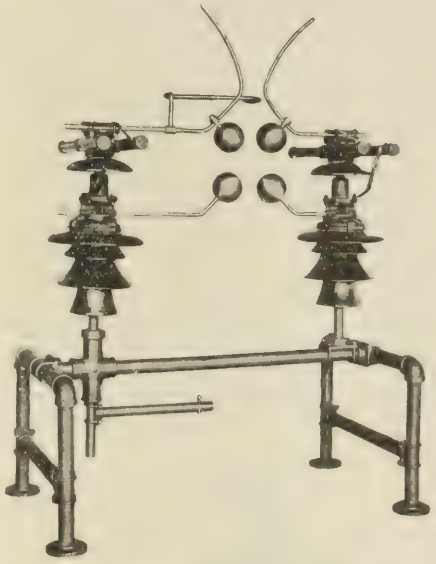
SERVICE TAP FOR SERIES CONNECTION

lar devices and has recently brought out a number of devices that are interchangeable with corresponding products of other makes of "standard" devices. In the accompanying illustration is shown a porcelain side-outlet current tap with standard composition cap. The side outlet is for series connection. Another device is a compact separable attachment plug with standard cap. This plug is made of fireproof and durable composition material.

Sphere-Gap Electrolytic Arresters

Sphere gaps have been provided on all aluminum-cell electrolytic lightning arresters made by the General Electric Company of Schenectady, N. Y., for service above 7250 volts. For lower voltages the diameter of the copper rod used to form the horn gap is so large in proportion to the gap that the effect is the same. The upper set of spheres have horn extensions to assist the arc to rise and thereby extinguish it quickly. Horns are not necessary on the lower spheres as the arc rises from them to the upper ones and is thus extinguished.

The sphere gap discharges faster for sudden impulses than the horn gap and has a shorter dielectric spark lag. These characteristics are necessary for protection against the sudden impulses of electrical disturbances, the manufac-

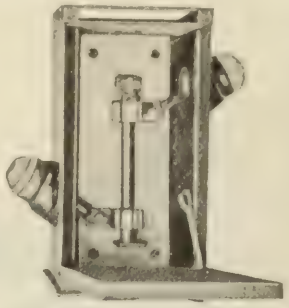


SPHERE HORN GAP FOR 70,000-VOLT ARRESTERS

turer points out. Protective gaps should be as "fast" as possible and the insulation of the other apparatus as "slow" as possible because a definite time is required to flash over or rupture all insulations, such as air gaps, surface and solid dielectrics. The time interval varies with the nature of the insulation, the shape and spacing of the surfaces or electrodes and the frequency and magnitude of the applied voltage. Differences in the dielectric spark lag, although infinitesimal, are appreciable when the rate at which the abnormal voltages can be applied is of the order obtained with lightning or similar disturbances. Because of this phenomenon attending dielectric spark lag, a voltage wave in the form of a sudden impulse may not break down what is apparently the easiest path. For example, the voltage may rise beyond the discharge voltage (60 cycles) of the protective gaps and arc over or puncture insulation having a much higher discharge test voltage.

Combined Fuse and Switch

W. N. Matthews & Brother of St. Louis, Mo., point out several improvements that are embodied in their "fu-



INTERIOR VIEW OF "FUSWITCH" FOR DISTRIBUTION CIRCUITS

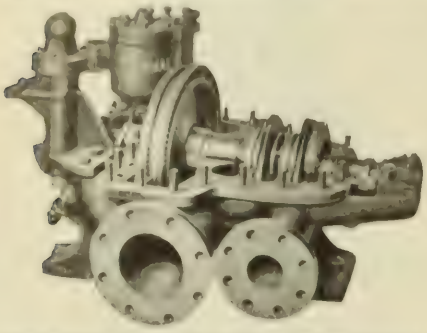
switch" shown in the accompanying illustration. The rating of the device has been increased from 60 amp. to 100 amp. The maple fuse carrier ordinarily used with such switches is eliminated and the switch blade and fuse cartridge are combined in one piece. This type of fuse switch is much lighter than types formerly made. The inclosing box has an asbestos board bottom and roof, which, it is claimed, cannot crack, warp or check as wooden roofs do. In case the switch blades are not pushed fully into the contact jaws the door will do so when opened automatically. This feature, it is claimed, also prevents the blade from jumping out of the jaws. In case an unusual explosion of the fuse occurs (as during lightning) and gases cannot get out of the bottom vent hole quickly enough, the door will fly open and automatically shut itself again, thus relieving the pressure on the box and saving it from damage. The boxes are also safer for the linemen to operate, the manufacturers point out.

Luminous Attachment for Switches

The luminous "Radieye" attachment developed by the General Electric Company of Schenectady, N. Y., for pull-socket chains and flush-plate switches shows the location of switches in a dark room by means of the luminous rays emitted from its radium composition. Since the luminant is a composition containing radium and not phosphorus, the light is permanent. No replenishing of the composition is necessary, it is claimed. The radium is protected by glass, while the attachment itself has a brass body, which affords additional protection. If used with a pull-chain attachment, the luminous indicator is substituted for the usual ball at the end of the chain. When used with a flush-plate switch the indicator is substituted for one of the screws which attached the plate to the wall.

Turbine-Driven Centrifugal Boiler-Feed Pump

A 3000-hp two-stage centrifugal boiler-feed pump combined in one casing and on one shaft with a velocity stage steam turbine, is shown in the accompanying illustration. This unit, which has been developed by the De Laval Steam Turbine Company of Trenton, N. J., weighs only about one-tenth as much as a duplex reciprocating pump having the same rating, and occupies



COMBINED TURBINE-DRIVEN CENTRIFUGAL BOILER FEEDER WITH CASING REMOVED.

only about one-eighth of the floor space and one-fifteenth of the cubical space. The pump is hydraulically balanced, and only one pair of labyrinth rings, surrounding the suction opening, is required for each impeller except the last, which has two sets of rings. The last impeller, that is, the one from which the water is finally discharged, is equipped with two sets of wearing rings, one on the suction side and one on the reverse side of the web. As some water from the discharge of this impeller will leak between the wearing rings into the space back of the web, this impeller would be as unbalanced as the other impellers in the pump if there were no escape for the leakage water. Consequently a leakage outlet is provided, from which water can be conducted back to the suction of the first impeller.

The outlet leakage takes place between two collars, one attached to the casing and the other carried on the shaft. When the shaft moves toward the discharge end of the pump, this escape is closed off and the pressure builds up in the balancing chamber. If the shaft, on the other hand, moves toward the suction, the escape passage is opened wider, allowing the pressure in the balancing chamber to fall. At the same time the inleakage between the labyrinth wearing rings is decreased. The labyrinth wearing rings are readily renewable, the stationary ring of each pair being held in a seat in the casing, and the rotating ring being screwed upon the impeller. The suction end of the pump is adjacent to the turbine, and the shaft packing between the turbine and pump chambers is hence subjected to turbine-exhaust pressure on one side and the suction pressure on the other. A simple packing is therefore sufficient.

The steam end of the unit consists of a velocity-staged turbine with either two or three rows of moving buckets, according to the steam economy desired. The nozzles can be proportioned for either high-pressure steam exhausting to feed heater or to condenser or for low-pressure steam exhausting to condenser, or the unit can be made interchangeable, thus permitting of a great degree of flexibility in plant design. Where the exhaust steam from the boiler feeder is consumed in heating feed water, the thermal efficiency of the turbine-driven boiler feeder is much greater than that of a boiler feeder driven by electric motor, or even than that of the main unit itself. Ordinarily, a pump governor controlled by the pressure at some point in the feed line near the boilers is employed to control the speed, giving a practically uniform pressure at all deliveries. To guard against any possibility of racing, an emergency governor is also provided. The bearings are of the straight, ring-oiled type, and all of them are made interchangeable.

100-Watt Reading Lamp

A reading lamp is being offered to the trade by the Uno-lite Company of America, Indianapolis, Ind. The specifications for the lamp are: Length of the base, 7.5 in. (19.05 cm.); width of the base, 5 in. (12.7 cm.); extreme height, 19.5 in. (49.53 cm.); diameter of white-lined, green dome, 10 in. (25.4 cm.); diameter of the milk-white semi-inclosing under globe, 6 in. (15.24 cm.); standard finish, Japan bronze; recommended lamp equipment. 100-watt nitrogen-filled, blue-glass daylight lamp.

The field for this type of reading lamp as its manufacturer sees it is in homes and in offices equipped with flat-topped desks. The fact that it is inexpensive and that it is designed to be equipped with a 100-watt lamp is said to make the lamp a device that can be "campaigned" with methods similar to those used in selling electric irons. It is estimated that the central-station revenue which will result per lamp per year from this device will be $6.

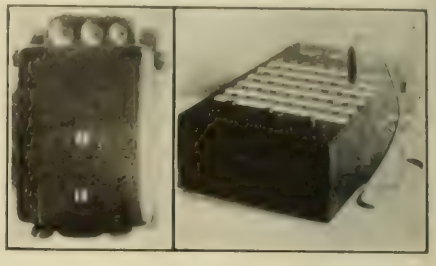


100-WATT READING LAMP FOR FLAT-TOPPED DESK

From the standpoint of the user the lamp is also utilitarian, being designed to harmonize with any period or design of furnishings. The filament of the lamp is entirely hidden from the eye. The white-lined green porcelain shade, which has become so closely associated with gas and oil portable lamps, provides an inexpensive means of securing the localized light of high intensity which illuminating engineers are generally favoring.

Machine for Collecting Telephone Tolls

A device used as an accessory to telephone systems and which, it is claimed, simplifies the collection of telephone tolls among tenants in apartment



COIN COLLECTOR AND CONTROL DEVICE FOR COLLECTING TOLLS

houses, hotels or other buildings has been developed by the Coin Device & Signal Company, 1269 Broadway, New York City. The device may be placed on the switchboard ledge and connected with a coin collector in every apartment. The machine enables the operator to determine whether a coin is deposited in any particular machine. Such notification will correspond with the different denominations of the coins used. The operator can also cause any number of deposited coins to be delivered to a customer, either for the purpose of making change or for returning the equivalent of any deposited coin or coins. If a tenant does not have the necessary money with which to pay for a call, the operator can cause a check or checks to be issued to the tenant, who in turn deposits them in the machine. The value indicated on these checks is redeemed by the customer when the regular monthly or weekly collections are made.

Resistance Materials

The Independent Lamp & Wire Company, 1737 Broadway, New York City, is now marketing tungsten and molybdenum in sheet, ribbon and plate form. This development makes these metals suitable for new uses and opens to them a much wider field of usefulness than has heretofore existed. The tungsten and molybdenum ribbon is being made in widths of about ¼ in. (6.35 mm.) and in lengths of several yards. In this shape the ribbons ought to be ideal material for the manufacture of heaters of various descriptions and suitable for high temperatures, the manufacturer points out. The United States government has placed an order with this company for plates of these metals for spark gaps on wireless outfits to be used on its Mosquito Fleet.

Trade Notes

HARMON CHESTER CHAPPEL, Ohio representative of the Manhattan Electrical Supply Company, Chicago, Ill., died March 12.

LEON O. HART, electrical engineer for the Driver Harris Wire Company, Harrison, N. J., has recently been appointed assistant treasurer of the company.

HENRY R. STEVENS and Robert L. Rockwell have formed the consulting engineering firm of Stevens & Rockwell, 955 Empire Building, Seattle, Wash.

THE TWINVOLUTE PUMP & MANUFACTURING COMPANY has removed its main office to its new factory at 216-228 High Street, Newark, N. J. The New York sales office will be at 55 William Street.

THE CROCKER-WHEELER COMPANY has declared an extra dividend of 1 per cent in addition to the regular 2 per cent quarterly dividend on the common stock for the quarter ended March 31. The regular quarterly dividend of 1¾ per cent was declared on the preferred stock.

THE INDEPENDENT LAMP & WIRE COMPANY, Inc., 1737 Broadway, New York City, has recently considerably enlarged its facilities to turn out tungsten and molybdenum in sheet form. The tungsten and molybdenum ribbon is being manufactured in a width of about ¼ in. and a length of several yards.

EDGAR M. MOORE & COMPANY, dealers in new and second-hand electrical and steam machinery, Pitsburgh, Pa., are, following recent organization changes, continuing in business at 709-710 Farmers' Bank Building, Pittsburgh, Pa., with warehouse and yard at 916-922 Behan Street, North Side, Pittsburgh.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY has adopted a plan of employee insurance whereby the insurance increases with the length of service until a maximum of $1,000 has been reached. The insurance policy contains a disability clause. It is the intention of the company in taking this step to protect those dependent upon its employees.

THE STANDARD ELECTRIC COMPany, 239 Plymouth Building, Minneapolis, Minn., which for the last two years has been operating as a partnership between Fred G. Dustin and Charles W. Arrick, has been incorporated under the name Standard Electric Service Company, with Messrs. Dustin and Arrick, together with Emil Anderson, as incorporators. Mr. Dustin is president, Mr. Arrick vice-president and treasurer, and Mr. Anderson secretary.

THE NORTHERN CEDAR COMPANY announces this change in its corporate name from Northern Mercantile Company, Ltd., and says: "Spokane is now the real center of the cedar industry, and that we may keep in closer touch with the trade and with our stocks we are changing the location of our general offices from Sandpoint, Idaho, to Spokane, Wash." These changes do not, in any, way, affect the personnel of the organization. The company states that this year its stocks will be the largest and most complete that it has ever carried.

THE ELECTRICAL SUPPLY COMPANY, New Orleans, La., announces that L. L. Hirsch, who has served for the last four years as vice-president, has recently been appointed by the board of directors as general manager of the company and has assumed active charge of the management. Mr. Jumonville, who was formerly active head, has disposed of his interests in the company and has retired. M. J. Elgutter, formerly city sales manager for the Interstate Electric Company, has acquired an interest in the Electrical Supply Company and will immediately assume active charge of the selling organization.

FOOTE, PIERSON & COMPANY, 160 Duane Street, New York City, which has done business under that name for twenty years past, has been dissolved by the retirement of George L. Foote. The business has been taken over and indebtedness assumed by a corporation formed for that purpose under the laws of the State of New York, entitled Foote, Pierson & Company, Inc., under which name the business will be carried on, with offices and works as heretofore at the above address. H. G. Pierson has accepted the presidency and Morris N. Liebmann, who has been with this firm for sixteen years, has been made vice-president and will be in immediate charge of the company's works.

ORANIZATION OF GEAR MANUFACTURERS.—An organization known as the American Gear Manufacturers' Association was formed at Lakewood, N. J., at a meeting held there March 25 and 27. The purposes of the organization are to advance and improve the gear industry in a general way by standardization of gear design, manufacture and application. This association includes in its membership the foremost and better known manufacturers of gears. The executive committee is composed of the following: F. W. Sinram, Van Dorn & Dutton Company, Cleveland, Ohio; H. E. Eberhardt, Newark Gear Cutting Machine Company, Newark, N. J.; F. D. Hamlin, Earle Gear & Machine Company, Philadelphia, Pa.; Frank Horsburgh, Horsburgh & Scott, Cleveland, Ohio; Biddle Arthur, Simonds Manufacturing Company, Pittsburgh, Pa.; George L. Markland, Philadelphia Gear Works, Philadelphia, Pa., and Milton Rupert, R. D. Nuttall Company, Pittsburgh, Pa. The officers elected at the Lakewood meeting are the following: President, F. W. Sinram; vice-president, H. E. Eberhardt; secretary, F. D. Hamlin; treasurer, Frank Horsburgh. The next meeting of the association will be held at Pittsburgh, May 14 and 15.

New Incorporations

THE FAIRMONT (W. VA.) ELECTRIC COMPANY has been incorporated with a capital stock of $10,000 by James A. Knight, D. E. Van Fleet, R. Earl Knight and others.

THE AUTOMATIC CONTROLLER CORPORATION of New York, N. Y., has been incorporated, with a capital stock of $10,000, by F. L. Harris, T. Foster and F. G. Tusa, 76 Central Avenue, New York, N. Y.

THE CAMPBELLSVILLE (KY.) ELECTRIC LIGHT & POWER COMPANY has been chartered with a capital stock of $40,000 by Charles Walls, W. G. Hesser, C. L. Hesser, C. L. Hesser and Bertha Walls.

THE UNITED STATES ELECTRIC COMPANY of Trenton, N. J., has been incorporated by N. W. Nutt, T. and A. Salamandra to manufacture electric appliances. H. M. Hartmann, 228 Tyler Street, Trenton, N. J., is agent for the company.

THE VERMONT & QUEBEC POWER CORPORATION of Richford, Vt., has been incorporated with a capital stock of $500,000 by Charles H. Thompson of Montpelier; Sheldon R. Boright and E. A. Boright of Richford, Vt., and Robert L. Ryder of Boston, Mass.

THE ROWAN CONTROLLER COMPANY, 308 Holliday Street, Baltimore, Md., has been chartered by Wilbur C. Jackson, John S. Rowan and Henry Vogt. The company is capitalized at $100,000 and proposes to deal in electrical machinery, devices and equipment.

THE ELECTRICAL EQUIPMENT COMPANY of Butte, Mont., has been incorporated with a capital stock of $100,000 to do a general electrical business in Butte. A von Dachenhausen is president and general manager. Michael Sullivan will have charge of the structural department.

THE PROGRESSIVE EQUIPMENT COMPANY of New York, N. Y. has been chartered by L. A. Anderson, Courtlandt Nicoll and D. A. Frasey, 61 Broadway, New York City. The company is capitalized at $275,000 and proposes to do a general manufacturing, contracting and electrical engineering business.

THE OVERSTATES MACHINE COMPANY of New York, N. Y., has been incorporated with a capital stock of $25,000 by A. J. McKenzie, Jr., A. Sundh and D. M. Baldwin, Short Terrace, Short Hills, N. J. The company proposes to deal in machinery, mechanical apparatus, pumps, mill, electrical and hydraulic machinery.

THE MITCHELL VANCE COMPANY of Millbrook, N. Y., has been chartered by W. A. Stevens, A. W. Knauth and E. L. Steckler of 61 West Eighty-eighth Street, New York City. The company is capitalized at $105,000 and proposes to manufacture and deal in gas, electric fixtures, supplies, appurtenances, metallic figures, clocks, etc.

THE VICTORIA ELECTRICAL APPLIANCE MANUFACTURING COMPANY of New York, N. Y., has been incorporated with a capital stock of $100,000 by N. Messenger, L. E. Shickerling and A. Schaab, 333 East Eighty-eighth Street, New York City. The company proposes to do a general electrical contracting business, deal in supplies and accessories.

THE PFANSTIEHL COMPANY of Millbrook, N. Y., has been incorporated with a capital stock of $405,000 to manufacture metals of all kinds, electrical and mechanical devices, machinery, etc. The incorporators are: A. E. Moore, 20 Arden Street; G. F. Gebbett, 120 Sherman Avenue, New York City, and F. H. Butehorn, 764 St. Johns Place, Brooklyn, N. Y.

THE LALLEY ELECTRO LIGHTING CORPORATION of New York, N. Y., has been chartered with a capital stock of $115,000 for the purpose of constructing electric-lighting plants, machinery, dynamos, etc. The incorporators are: W. H. Lalley of Detroit, Mich.; T. J. Whalen, 57 West Ninety-second Street, and W. F. Gordon, 61 Broadway, New York, N. Y.

THE WISE-McCLUNG MANUFACTURING COMPANY of Canton, Ohio, has been incorporated, with a capital stock of $200,000, for the purpose of manufacturing electric vacuum sweepers and electrical household appliances. W. J. Wise, formerly connected with the Wise-Harold Company of New Philadelphia, and William McClung are interested in the company.

THE AMERICAN GENERAL ELECTRIC CORPORATION OF CHINA has been incorporated, with a capital stock of $250,000, to manufacture incandescent electric lamps and electrical apparatus. The directors are: Darius E. Peck of Schenectady, A. W. Burchard and E. A. Carlton of New York, N. Y. The principal office of the company is in Rotterdam, N. Y.

THE BURGESS BATTERY COMPANY of Madison, Wis., has been incorporated, with a capital stock of $200,000, to take over the electric battery, flashlight and electrochemical business of the C. F. Burgess Laboratories of Madison. The officers are: C. F. Burgess, president; Duncan Keith, vice-president and sales manager; W. B. Schultze, treasurer, and Benjamin S. Reynolds, secretary and manager.

Trade Publications

LINE APPARATUS.—W. N. Matthews & Brother of St. Louis, Mo., have issued a descriptive leaflet of their pole erector.

FLOOR BOX.—W. R. Ostrander & Company, 371 Broadway, New York City, have issued a leaflet descriptive of their enameled iron floor boxes.

LAMPS.—The Franklin Electric Manufacturing Company of Hartford, Conn., has distributed a leaflet descriptive of its lamps, entitled "A Look Ahead."

CORD CONNECTORS.—Harvey Hubbell, Inc., of Bridgeport, Conn., is distributing bulletin No. 15-23, descriptive of the firm's composition cord connector and small polarized cord connector.

LIGHTNING ARRESTER.—Burke Series horn-gap lightning arresters are illustrated and described in a leaflet prepared by the Railway & Industrial Engineering Company of Pittsburgh, Pa.

CORK.—The Armstrong Cork & Insulation Company of Pittsburgh, Pa., is distributing an illustrated bulletin entitled "Reducing Vibration and Noise." This bulletin describes "Nonpareil" cork machinery isolation for reducing the noise and vibration of fans, motors, printing presses and machinery generally.

REFLECTORS.—The National X-Ray Reflector Company of Chicago, Ill., is distributing a colored folder announcing its nation-wide campaign for X-ray lighting. The purpose of this campaign is to educate the public to demand good light and to bring about wherever possible the establishment of a lighting specialist in each community.

SPRAY EQUIPMENT. — A condensed summarization of the principal Spraco developments is given in bulletin No. 501, recently prepared by the Spray Engineering Company of Boston, Mass. This bulletin includes spray cooling equipment, air washing and cooling equipment, paint-spraying equipment, park sprinklers, flow meters and nozzles for all purposes.

SEW-MOTOR.—An attractive eight-page folder (4152-B), printed in two colors, is supplied to lighting companies and dealers for distribution to prospective customers by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa. This folder illustrates the little sew-motor, emphasizing its compactness, utter simplicity, pleasing appearance and the ease with which it can be installed.

BUCKETS.—Catalog No. 43, descriptive of Hayward buckets and digging machinery, is being distributed by the Hayward Company, 40 Church Street, New York City. This catalog contains descriptions of orange-peel buckets, clamshell buckets, electric motor buckets, drag scraper buckets, scraper clamshell buckets, excavators, counterweight drums, derrick fixtures, traveling derricks, coal-handling machinery, dredges, etc.

New England States

AUGUSTA, ME.—The Public Utilities Commission has granted the Vassalboro Chase & Wyman Light Company permission to issue $15,000 in capital stock. Water rights on Seavey's mill stream have been secured by the company, which it is estimated, will develop about 110 hp. The cost of the proposed plant and distribution system is estimated at about $60,000.

LEWISTON, ME.—The Lewiston, Augusta & Waterville Street Railway Company contemplates extensions to its power facilities this year, involving an expenditure of about $100,000.

NEW BEDFORD, MASS.—The directors of the New Bedford Gas & Electric Company have voted to authorize the purchase of an additional generator of 15,000 kw capacity and in addition to its new power house, now under construction. This means an addition of about 60 ft. to the building and an expenditure of about $500,000.

NEW BEDFORD, MASS.—Mayor Ashley has authorized electric lamps to be placed all along the line of the pipe line between High Hill Reservoir and the pumping station near Lakeside. Electric wires will be strung on the telephone poles along the pipe line. It is also proposed to erect signal stations at certain points and to mount powerful searchlights. The New Bedford Gas & Electric Company furnishes electrical service here.

PROVIDENCE, R. I.—The erection of an electric transmission line along the New London Turnpike is contemplated by the Narragansett Electric Lighting Company.

BRIDGEPORT, CONN.—The United Illuminating Company contemplates extending its transmission lines to Trumbull.

SEYMOUR, CONN.—The Seymour Electric Light Company has petitioned the State Legislature for permission to increase its capital stock to $250,000.

WATERBURY, CONN.—The United Electric Light & Water Company has applied to the State Legislature for permission to increase its capitalization to $3,000,000. The company contemplates extending its high-tension transmission lines to New Britain and Berlin.

Middle Atlantic States

BUFFALO, N. Y.—A permit has been granted to the Buffalo Union Furnace Company for the erection of addition to furnace "A" and generator for power house, to cost about $8,000.

NEW YORK, N. Y.—Plans have been filed by the Interborough Rapid Transit Company for the erection of a boiler plant at its 239th Street yards, to cost about $70,000. The plans also provide for the erection of a signal tower and storage house.

NEW YORK, N. Y.—Part of the plans of the Long Island Lighting Company for consolidating small independent lighting plants on Long Island have been approved by the Public Service Commission. The company will now take over the Suffolk Gas & Electric Company, the South Shore Gas Company and the Huntington Gas Company. Improvements and extensions will be made in the territory now served.

NEW YORK, N. Y.—Bids will be received by the Board of Water Supply, twenty-second floor, Municipal Building, New York City, until April 24, for furnishing and installing and testing complete electric-lighting apparatus at various structures at reservoirs and along the Catskill Aqueduct; also for furnishing and installing a motor and gearing and an electrically driven pump. Contract, drawings, etc., may be obtained at the office of the secretary upon deposit of $10.

NIAGARA FALLS, N. Y.—A bill has been introduced in the Senate by Senator Ross Graves of Buffalo creating the Niagara Hydro-Electric Power Commission. The proposed commission is to construct, maintain and operate a state power plant on the State Reservation at Niagara Falls and to generate and distribute electricity to the communities of western New York. The commission may take from the Niagara River 4400 cu. ft. per second of water, the same to be returned to the river at some convenient place. An appropriation of $850,000 is provided, of which not more than $275,000 is made available during 1917.

PATCHOGUE, N. Y.—The Public Service Commission has authorized the Patchogue Electric Light Company to issue $60,000 in capital stock, the proceeds to be used for new equipment and to reimburse the treasury for expenditures made.

UNION SPRINGS, N. Y.—At an election held March 2 the proposal to purchase the electric plant of the Union Springs Light & Power Company, to be owned and operated by the municipality, was carried.

CLOSTER, N. J.—The Board of Public Utility Commissioners has granted the Rockland Electric Company permission to extend its transmission lines in East Crescent Avenue, Allendale.

DOVER, N. J.—The New Jersey Power & Light Company is planning to install a 3,000-kw steam turbine and two 500-hp high-pressure boilers in its local plant. The company has discontinued its Boonton plant.

HOPEWELL, N. J.—The Board of Freeholders has granted the Eureka Power Company of Hopewell permission to erect a new transmission line to Washington's Crossing and Titusville in Hopewell Township to furnish electrical service.

SALEM, N. J.—The City Council is considering the installation of electrically operated pumping equipment at the water works station at Quinton.

TRENTON, N. J.—Bids will be received by the City Commission until April 11 for one 8-in. horizonal double-suction centrifugal type pump, with one 35-hp. motor, two phase, 60 cycles, 220 volts, constant speed, squirrel cage type. Leon D. Hirsch is city clerk.

ALTOONA, PA.—The Penn Central Light & Power Company has applied to the Public Service Commission for permission to issue $120,000 in bonds for extensions and improvements to its plant.

CLEARFIELD, PA.—The Penn Public Service Company has applied to the Public Service Commission for permission to issue $338,000 in bonds for extensions and improvements to its plant and system.

ELLWOOD CITY, PA.—Application has been made to the Public Service Commission by the Pennsylvania Power Company for authority to issue $10,000 in bonds for extensions and improvements to its plant.

HARRISBURG, PA.—The City Council has authorized the installation of new single and five-lamp cluster standards in the business section in connection with the new underground conduit system. Clark E. Diehl is city electrician.

LANCASTER, PA.—The Penn Steel & Iron Works is contemplating the installation of new boilers and equipment at its local plant.

LANSFORD, PA.—The Panther Valley Electric Company is contemplating the erection of a new transmission line to connect with its local substation.

NEW BRIGHTON, PA.—The Town Council is reported to have authorized plans prepared for the installation of an electrical distribution system, to cost about $40,000.

READING, PA.—The Reading Transit & Light Company contemplates improvements and extensions this year, involving an expenditure of about $30,000.

NEWARK, DEL.—Two proposals are being considered by the Town Council for increasing the electrical service, one submitted by the Wilmington & Philadelphia Traction Company and one by the Continental Fibre Company.

BALTIMORE, MD.—The Baltimore Car & Foundry Company is planning to install a power plant at its new car and structural steel works now under construction at Curtis Bay.

BALTIMORE, MD.—The Carnegie Steel Company, Bush and Wicomico Streets, contemplates the erection of a power house, 42 ft. by 62 ft., at Gunpowder and Severn Streets, to cost about $5,000.

BALTIMORE, MD.—The property of the Mineral Products Company of Wilmington, Del., has been acquired by the Taber-Davidson Company, manufacturer of fiber, which will establish a plant, to be equipped with motor-driven machinery. Harry B. Taber is president.

GRANTSVILLE, MD.—The town of Grantsville has entered into a contract with the Boynton (Pa.) Electric Company for lighting the streets of the town.

HAVRE DE GRACE, MD.—Plans have been prepared for the construction of a metal tie plant for the Maryland Metal Cross Tie Company. Two buildings will be erected, one 600 ft. by 70 ft., the other 350 ft. by 60 ft., equipped with open-hearth furnaces, molding machines, conveyors, electric cranes, etc. Thornton W. Price, Woolworth Building, New York, N. Y., is architect and engineer.

HARRISONBURG, VA.—The City Council has decided to install an additional generating unit at the municipal hydroelectric plant, at a cost of about $18,000. The plant is located on the Shenandoah River about 14 miles from the city.

NEWPORT NEWS, VA.—Preparations are being made for extensions to the water and light plant of the Newport News Light & Water Company, involving an expenditure of about $200,000. Contracts have been placed for material, etc.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Charleston, S. C., Schedule 879—two sets of storage batteries. Brooklyn, N. Y., and Mare Island, Cal., Schedule 888—three exhausting blowers; Schedule 889—eight oil coolers. Philadelphia, Pa., Schedule 878—100,000 duct ft. vitrified clay conduits; Schedule 886—two generating sets. Portsmouth, N. H., Schedule 862—9600 steel boiler tubes. Puget Sound, Wash., Schedule 865—328 oil and grease cups; Schedule 867—410 lb. soft copper wire, 5900 lb. black galvanized iron or steel wire, 195 lb. crucible spring steel wire. Application for proposal blanks should designate the schedule desired by number.

North Central States

DETROIT, MICH.—The Ireland & Matthews Manufacturing Company of Detroit, manufacturer of stove trimmings, automobile supplies, etc., is building a plant on a site bounded by Beard, Chatfield and Green Avenues and the Michigan Central Railroad, at a cost of about $500,000. A power plant, 51 ft. by 178 ft., is included among the buildings.

DETROIT, MICH.—The Council committee has recommended for approval the following items submitted by the Public Lighting Commission: A new lighting system on West Fort Street, to cost $45,304; Mack Avenue, $10,620; John Street, $88,044; Kercheval Avenue, $86,000; Junction Avenue, $54,000; Hamilton Boulevard, $45,000; Lodge Avenue, $6,800; a new substation near Woodmere, with equipment and conduits, $48,354, and new alley lamps, $15,000.

DETROIT, MICH.—Franchises have been granted to the Detroit Edison Company in most of the townships in St. Clair County, among them Port Huron, Kimball, St. Clair, Casco and Columbus. Similar franchises will probably be voted this spring by Riley, Wales and Berlin Townships. The company contemplates the construction of a power plant on Bunce Creek, near Marysville, St. Clair County, and the erection of a substation at South Park, Port Huron, this year.

LAPEER, MICH.—The Lapeer Gas-Electric Company contemplates the construction of a coal-conveying and storage system. C. D. Hulbert is general superintendent.

MONROE, MICH.—The city of Monroe has decided to accept the proposal of the Detroit Edison Company to supply energy here.

ASHLEY, OHIO.—The Ashley Electric Light & Power Company, recently organized with a capital stock of $10,000, proposes to construct and operate an electric-light plant in Ashley. C. F. Sperry, J. B Johnston and others are interested.

CANTON, OHIO.—The Sunnyside Electric Company has completed the erection of a 55-mile transmission line from Wheeling, W. Va., to Canton, Ohio, and is now building a 60,000-kw. substation in Canton. F. A. Pearson is superintendent of construction.

CINCINNATI, OHIO.—A committee, consisting of I. I. Stein, John Steinmueller and J. B. Scheve, has been appointed by the Findlay Market Association to secure a complete lighting system for the new Findlay Market and surroundings.

CINCINNATI, OHIO.—Plans have been completed by the city electrician for the proposed ornamental lighting system for the central part of the city. The proposed system will be installed with the co-operation of the Retail Stores Association of the Chamber of Commerce and the United Boulevard Lighting Committee.

CLEVELAND, OHIO.—The Supreme Court at Columbus has handed down a decision upholding the validity of four bond issues, amounting to $2,300,000, of which $700,000 is for the addition to the municipal electric-light plant.

CUYAHOGA FALLS, OHIO.—Plans are being prepared by the Marathon Tire & Rubber Company for a power house to be erected in the rear of its factory this summer. The proposed plant will have an out-

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

put of 5000 kw. The company is also planning to build a dam and install a 100-hp. hydraulic plant.

DAYTON, OHIO.—The Dayton Power & Light Company has been granted a franchise to erect electric transmission lines oft the Troy Pike to supply electricity for lighting purposes.

DAYTON, OHIO.—The Lindner Brothers Sanitary Milk Company has decided to purchase a site adjoining its property on 723 East May Street, on which it proposes to erect a power house. The total cost of power plant is estimated at $15,000.

LORAIN, OHIO.—The Lorain County Electric Company, it is reported, will soon begin work on the reconstruction of the local distribution system. Plans have been prepared for erecting iron posts in the business district and removing all service lines from Broadway.

MARIETTA, OHIO.—Bids, it is reported, will soon be asked for a new boiler and other equipment for the municipal electric-light plant.

MOUNT GILEAD, OHIO.—Preliminary work has commenced on the reconstruction of the plant of the Hydraulic Press Manufacturing Company, which was destroyed by fire. The plans provide for the erection of a new machine shop, 100 ft. by 200 ft., equipped with large traveling cranes, a power plant, 42 ft. by 60 ft., stock room, 50 ft. by 60 ft., and a large forge shop. E. B. McMillan is general manager.

TROY, OHIO.—The City Council has voted to authorize $30,000 in bonds for the purchase of an additional engine, boilers and other equipment for the municipal electric-light plant.

AUBURN, KY.—The local ice manufacturing plant, owned by R. W. Wilson, was recently destroyed by fire, causing a loss of about $10,000.

HOPKINSVILLE, KY.—The city of Hopkinsville contemplates the installation of an ornamental street-lighting system, consisting of 80 single lamp standards. Plans and specifications may be secured upon application to Frank H. Bassett, commissioner of public lighting.

ALLENDALE, ILL.—A company has been organized to construct and operate an electric-light plant in Allendale. The company is capitalized at $8,000. Elijah Greathouse and Ethel Campbell are among the incorporators.

GIBSON CITY, ILL.—The City Council has decided to compromise with the Central Illinois Utilities Company and the project of installing a municipal electric plant will be abandoned. The company agrees to a general reduction of rates and will also erect a steam plant in Gibson City to provide for local needs.

TOULON, ILL.—The property of the Toulon Light & Power Company has been purchased by the Stark County Power Company of Wyoming. A transmission line to connect the two plants will be erected by the Stark County Power Company.

MILWAUKEE, WIS.—Work will begin during the coming summer on the construction of the new steam electric generating plant of the Milwaukee Electric Railway & Light Company, to be located on the shore of Lake Michigan, just south of St. Francis, a suburb of Milwaukee. The initial installation will provide for a generating capacity of 65,000 hp. The plans provide for an ultimate output of 200,000 kw.

NEENAH, WIS.—The Wisconsin Traction, Light, Heat & Traction Company has awarded a contract to the Blake Construction Company of Appleton for the construction of a substation at Neenah.

ROTHSCHILD, WIS.—Bids are being asked by Vaughn & Meyer, Majestic Building, Milwaukee, consulting engineers, for a turbine-driven centrifugal feed pump, one 3000-hp. feed-water heater and water-meter unit, for the new power plant of the Marathon Paper Mills Company to be erected at Rothschild.

SHEBOYGAN, WIS.—Bonds to the amount of $998,000 have been authorized by the Eastern Wisconsin Electric Company of Sheboygan, of which a large portion of the proceeds will be used for the construction of a steam power plant at Sheboygan, to develop from 5000 to 6000 hp., and the erection of an electric transmission line from Oshkosh to Fond du Lac. The company recently took over the Wisconsin Traction Company of Oshkosh, the Eastern Wisconsin Railway & Light Company of Fond du Lac and the Sheboygan Electric Company.

STEVENS POINT, WIS.—Plans have been submitted by the Jackson Milling Company for the erection of a new hydroelectric plant. The company, it is reported, proposes to transmit electricity to its paper mill in Biron, Wis.

ANOKA, MINN.—Plans are being prepared by the Federal Cartridge Company for the erection of a machine shop and a power house, to cost about $60,000. F. R. Seidell, 1913 Dupont Street, Minneapolis, is president.

CANBY, MINN.—The Citizens' Light, Heat & Power Company has been granted a franchise to erect a transmission line to Hendricks.

FARIBAULT, MINN.—The City Council has instructed the city engineer to prepare estimates of the cost of the installation of a municipal electric-light plant.

LAKE PARK, MINN. — The municipal electric-light plant is being remodeled, the motive power being changed from oil to steam and the system from direct to alternating current. Improvements will be completed about Aug. 1, 1917. James Thompson is manager.

VIRGINIA, MINN.—The Great Northern Power Company has been awarded a contract to supply energy to the Dunwoody Mine, near Chisholm. Work will soon start on the erection of an electric transmission line from Thomson to Hibbing. The local plant of the company is being enlarged.

WATERTOWN, MINN. — The Crescent Electric Company has recently completed a transmission line from Watertown to Mayer, a distance of 7 miles, and from Mayer to New Germany, 3¾ miles, and a distribution system in New Germany. In the latter place the company purchased the old direct current plant and remodeled it for alternating current. Guy E. Halgren is president.

MOUNT AYR, IOWA.—The Mount Ayr Light & Power Company is contemplating extending its electric transmission lines to the towns of Maloy and Benton.

PISGAH, IOWA.—Bonds to the amount of $14,000 have been voted for improvements to the electric-light plant and water-works system.

KANSAS CITY, MO.—Extensions and improvements are contemplated by the Kansas City Home Telephone Company, including the installation of additional switchboard equipment at the main telephone exchange and cable and equipment for extensions.

BRADLEY, S. D.—The Dakota Northern Power Company, with headquarters in Bradley, has recently turned current on a 24-mile transmission line, which supplies electricity in the towns of Lily, Butler and Bristol. The company has also purchased the plants in the towns of Henry and Raymond and will erect a transmission line to supply energy in those towns. E. H. Lewis is manager.

GETTYSBURG, S. D.—A proposal to establish an electric-light and power plant in Gettysburg is reported to have been submitted to the Council by Hugh Triplett, consulting engineer, of Aberdeen.

WATERTOWN, S. D. — Contracts have been placed by the Watertown Light & Power Company for a 600-kw. General Electric steam turbine with Wheeler Condenser & Engineering Company surface condenser, to be delivered July 1, 1917. C. H. Bell is superintendent.

COLUMBUS, NEB.—At an election held recently the proposal to grant the Columbus Light, Heat & Power Company a new franchise for lighting the city was carried.

NORFOLK, NEB.—The Nebraska Gas & Electric Company contemplates the erection of an electric transmission line from Norfolk to Hadar, a distance of 5½ miles. The installation of a 75-kw. and a 100-hp. steam turbine in the near future is also under consideration. R. L. Ponsler is local manager.

RANDOLPH, NEB.—Plans are being considered by the City Council for the installation of a new 120-hp. oil engine and an 85-kw. generator in the municipal electric-light plant.

STANTON, NEB.—Plans are being considered to extend the service of the municipal electric plant into the farming district, which will require the erection of about 13 miles of transmission lines. Under the present arrangement the farmers will build the line to the city limits.

ABILENE, KAN.—The installation of an ornamental lighting system in the Matteson addition is under consideration.

ARMSTRONG, KANSAS CITY, KAN.—The Union Pacific Railway Company has awarded the George A. Fuller Construction Company, Dwight Building, Kansas City, the general contract for construction of roundhouse, power house, coaling station and turntable pit. The total cost of the work is estimated at $200,000.

CAWKER CITY, KAN.—The installation of an ornamental lighting system in Cawker City is under consideration.

CLAY CENTER, KAN.—Work has begun on the construction of a cold storage and poultry establishment for the Clay County Produce Company on Sixth Street. The main building will be 75 ft. by 200 ft.; the power house, 60 ft. by 35 ft., will be connected with the main building by an overhead steel track.

LAWRENCE, KAN.—Preparations are being made by the Coal District Power Company of Lawrence to enlarge the plants, which it has acquired at Greenwood, Mansfield, Huntington and Hartford, Ark. The company is reported to be in the market for electric generating machinery and water-works equipment, to cost $75,000.

PALCO, KAN.—The installation of a municipal electric-light plant in Palco is reported to be under consideration.

VALLEY FALLS, KAN.—The local electric-light plant is reported to have been purchased by Mexley & Company.

WELLSVILLE, KAN.—The Wellsville Electric Light & Power Company is installing a Snow crude oil engine of about 120 hp. and a 100-kva. Westinghouse three-phase, 60-cycle generator as a second unit for its power house. C. A. Smith is owner.

WICHITA, KAN.—Contracts have been placed by the Kansas Gas & Electric Company for material for the erection of about 50 miles of 66,000-volt transmission line and 50 miles of 22,000-volt transmission line, and also for equipment for increasing the output of its plant by 15,000 kw.

Southern States

KELFORD, N. C.—The installation of an electric-lighting plant in Kelford is under consideration. J. E. Tyler and associates are interested.

CHARLESTON, S. C.—At an election held March 3 the proposal to purchase the property of the Charleston Light & Water Company, for $1,360,000, was carried. An additional bond issue of $140,000 was also authorized for improvements to the water-works system. The light and water plant will be operated by a board of three commissioners.

ATHENS, GA.—The Athens Railway & Electric Company is installing a 2000-kw turbine.

CLEVELAND, GA.—The Henderson Mills and a 150-acre site, it is reported, have been purchased by W. E. White of Jefferson. The new owner, it is said, contemplates the construction of a dam and electric plant.

CENTERVILLE, TENN.—The City Council has engaged Frank Wilcox, consulting engineer, St. Louis, Mo., to make surveys and prepare estimates of the cost of installation of an electric-light plant and water-works system.

JACKSON, TENN.—The Jackson Railway & Light Company has awarded the contract for addition to its power house to E. G. Parrish of Jackson.

NEWPORT, TENN.—Improvements are to be made to the power plant of the Newport Mill Company. A new power house will be erected, repairs made to the dam, and new equipment installed. A 24-hour service will also be established.

MARION, ALA.—The electric plant of the Marion Electric Company was recently destroyed by fire, causing a loss of about $10,000. The plant, it is understood, will be rebuilt.

BRADFORD, ARK.—The construction of an electric-light system in the business section is reported to be under consideration by Messrs. Campbell and Prescott.

LITTLE ROCK, ARK.—J. W. Bleidt, superintendent of the municipal electric light plant, has recommended to the City Council the purchase of a 500-hp. boiler for the municipal electric-light plant at once.

OZARK, ARK.—The local electric-light plant, owned by Bill & Dupriest, has been sold to the Citizens' Service Company of Davenport, Iowa, for $20,000.

MONROE, LA.—At an election held recently the proposal to issue $612,000 in bonds for improvements to the water and light plants, construction of a filtration plant, sewer system, etc., was carried.

RAYNE, LA.—Bids will be received by the city of Rayne until April 23 for furnishing and installing machinery at the municipal electric-light and water-works plant. Plans and specifications can be obtained at the office of Harold Raymond, consulting engineer, Interstate Bank Building, New Orleans, La., or from O. P. Bonin, Mayor, Rayne.

CLAREMORE, OKLA.—The Claremore Commercial Club, it is reported, is considering the construction of an electric railway from Skiatook to Pryor, via Collinsville and Claremore, about 40 miles in length.

FREDERICK, OKLA.—Bonds to the amount of $35,000 have been voted for the purchase of the local electric-light plant and improvements to same.

LAWTON, OKLA.—The Enid (Okla.) Electric & Gas Company is contemplating a number of new extensions and extensions to its local system.

OKEMAH, OKLA.—Preliminary plans are being prepared by the Benham Engineering Company, Colcord Building, Oklahoma City, for municipal improvements, including improvements to electric lighting system, to cost $75,000, extensions to water works system, $25,000, and sewer system, $15,000. An election will soon be called to submit the proposal to issue bonds for the above work to the voters.

SKIATOOK, OKLA.—Bonds to the amount of $35,000 have been authorized. Of the proceeds $15,000 will be used for the installation of a municipal electric light plant, $5,000 for improvements to water works system and the remainder for sewers.

STRATFORD, OKLA.—Bonds to the amount of $5000 for the installation of an electric lighting system have been authorized.

BROWNWOOD, TEX.—The Texas Power & Light Company is planning to install another 500-hp. Diesel engine directly connected to a General Electric alternator in its local plant.

COLLEGE STATION, TEX.—The general contract for the construction of a power plant at the Agricultural and Mechanical College has been awarded to the Gilsonite Construction Company of Dallas, at $57,100. The appropriation for the power plant was $67,000.

KAUFMAN, TEX.—The Texas Power & Light Company of Dallas has purchased the local plant and has been granted a franchise by the city. The present power plant will be dismantled and electrical service supplied from a transmission line from Trinity Heights and Jenkins.

PRAIRIE VIEW, TEX.—The contract for wiring, and lighting, including the auditorium, veterinary science building and household arts building at Prairie View, has been awarded to A. T. Vick of Houston, at $6,904.

SAN BENITO, TEX.—The Santa Helena Improvement Company is contemplating the construction of a system of canals and ditches for irrigating about 16,000 acres of land at San Benito, and the installation of an irrigation pumping plant on the Rio Grande River. The cost of the project is estimated at about $500,000.

SAN DIEGO, TEX.—The Board of Water Engineers has granted the San Angelo Water, Light & Power Company authority to construct a dam across the Concho River to impound the storm and flood waters of that stream in sufficient quantity to supply the city of San Angelo with water for municipal and domestic purposes.

WELLINGTON, TEX.—The plant of the Wellington Power & Light Company was recently destroyed by fire. A new plant, to cost about $15,000, will be built.

WICHITA FALLS, TEX.—The City Council is considering plans for the installation of an ornamental street-lighting system.

Pacific and Mountain States

ARLINGTON, WASH.—The Washington Coast Utilities Company is planning to rebuild the transmission line between the power plant on Jim Creek and Arlington this spring; improvements are also contemplated at the local plant and substation and also the installation of considerable new electrical equipment. The company has closed a contract with the Stone & Webster interests for extra power that it may need. The Stone & Webster system will be tapped at Fir by a transmission line extending east from Stanwood, via Cedarhome.

BELLINGHAM, WASH.—The Board of Education is considering the installation of an electric-light and power plant in the Whatcom High School.

COLVILLE, WASH.—Notice of location of water rights of 20,000 cu. ft. of water for site for a hydroelectric power plant has been filed by the Big Bend Transit Company of Coville.

PALOUSE, WASH.—The City Council has granted the Washington Water Power Company a new 25-year franchise to supply electricity in Palouse, under the terms of which the company is to rebuild the entire system.

SEATTLE, WASH.—Plans have been completed by the Pacific Construction & Engineering Company for construction of a forge shop, power house and office building, to cost about $20,000.

SEATTLE, WASH.—Bids will be received by C. E. Dole, purchasing agent, Alaska Engineering Commission, Bell Street Dock, Seattle, until April 17 for furnishing wire, equipment, etc., for the installation of a telephone system at Anchorage, Alaska, and improvements to the government telegraph system in the north under circular No. 761. Among the material to be included are 200,000 lb. copper wire, 61,000 lb. galvanized wire, 2100 ft. copper cable, 4000 cross arms, 7500 brackets, 100 telephones, two 24 telephone switchboards, 31,000 ft. guy wire, 10 barrels of batteries, 15,000 ft. copperweld steel wire, 5000 ft. lamp cord, 50,000 ft. solid wire, 25,000 ft. rubber-covered wire, 18,000 ft. of stranded wire, 10,000 ft. rubber covered wire, 5000 ft. twisted wire, 150 meters, several hundred conduits, several thousand lamps, reflectors, plugs, etc.

SPOKANE, WASH.—Petitions for a new street-lighting system on Second Avenue, from Division to Cedar, are now being circulated among property owners. The proposed system will cover about fifteen blocks and will cost about $60,000. Another effort is being made to obtain an ornamental lighting system on Howard Street, in the business district.

KLAMATH FALLS, ORE.—The Keno Power Company of Kent has filed a petition asking that an ordinance granting the company a 50-year franchise in Klamath Falls be submitted to the voters.

KLAMATH FALLS, ORE.—The City Council has passed an ordinance authorizing the sale of $300,000 in warrants, to provide funds for the construction of the Klamath Falls Railroad to Dairy, 25 miles distant.

KLAMATH FALLS, ORE.—As soon as weather conditions will permit the California-Oregon Power Company will begin work on the completion of its large dam and power plant across the State line at Copco. The new dam is being erected across Ward's Canyon of the Klamath River; it will be 400 ft. long and 110 ft. wide. Water will be carried from the top of the dam to the power house in four steel pipes, 12 ft. in diameter, and will be capable of developing 50,000 hp. Transmission lines from the power house will be erected toward Klamath Falls, Weed, Yreka and Medford.

PORTLAND, ORE.—The City Council has decided to submit to the voters the proposal to issue $1,777,000 in bonds for the installation of a municipal electric plant at the city election to be held in June.

EXETER, CAL.—Preliminary surveys are being made by the Visalia Railroad Company for further extensions of its railway into the foothills east of Porterville, to connect with the Porterville Northeastern Railroad at Adobe station.

LOS ANGELES, CAL.—Electric-lighting fixtures and a telephone switchboard are provided for in an appropriation of $51,500 made by the Board of Education for improvements and equipment for the Los Angeles High School.

LOS ANGELES, CAL.—The City Council has instructed the city attorney, city engineer and city electrician to prepare an ordinance providing for the installation of a lighting system on Lanewood Avenue, between Orange and La Brea avenues.

OROVILLE, CAL.—The United States Exploration Company contemplates the erection of a large mill and power plant at its mine in Granite Basin in the near future.

SALINAS, CAL.—The cost of a distributing system for lighting the city and the erection of a small substation is estimated at $12,868.

SAN BERNARDINO, CAL.—Application has been filed with the State Railroad Commission by Damon Cooley of San Bernardino and V. K. McMains of Los Angeles for permission to build a power plant and distribution system to supply electricity during the summer season to the hotel at Pine Knot and Knight's Camp and to approximately 200 cabins about the lake. It is proposed to install a 50-kw. generator and a 25-hp. oil engine. The cost of the system is estimated at $8,000.

WASCO, CAL.—At an election held recently the proposal to install an electric-lighting system in Wasco was carried.

WEAVERVILLE, CAL.—The Railroad Commission has authorized the Northern California Power Company of San Francisco to extend its electric transmission lines in Trinity County from the Lappin Mine through Lewiston to Weaverville and to sell electricity in all parts of the county with the exception of certain portions of Weaverville.

SALT LAKE CITY, UTAH.—The Utah Power & Light Company is planning to rebuild its electric transmission line from the substation west of the city to the Jordan Narrows to enable the company to give the cities and towns south of this city better electrical service.

CLARKDALE, ARIZ.—Permission has been granted by the Corporation Commission to the Steam Generating Company to install a steam driven electric generating plant in Clarkdale and lease same to the Arizona Power Company.

PEACH SPRINGS, ARIZ.—Preliminary surveys are now being made by engineers under the direction of the W. L. Clark Construction Company of New York with a view of constructing four large dams across the Diamond and other lateral canyons of the Grand Canyon of the Colorado River near Peach Springs. Financial interests connected with the Atchison, Topeka & Santa Fe Railroad, it is stated, are connected with the proposed project. The plans provide for the erection of electric transmission lines that will extend to many cities, towns and mining camps in Arizona.

BUTTE, MONT.—The Butte Electric Railway Company is contemplating the construction of two substations, one 500 kw. and the other 1500 kw. capacity.

DENTON, MONT.—Application has been made to the town of Denton by Messrs. O'Neil & Saunders of Great Falls for a franchise to install and operate an electric-light plant here.

CLOVIS, N. M.—Bids will be received at the office of the City Clerk, Clovis, until April 18, for furnishing material and equipment for electric-light plant and waterworks system, separate bids to be submitted as follows: (1) For one 240-kva. generator, three 40-hp. motors, one 20-hp. motor, switchboard and equipment; (2) one uniflow engine for a 240-kva. generator; (3) four centrifugal pumps; (4) one 500-hp. heater; (5) cast-iron pipe and special castings; (6) hydrants and valves. Specifications are on file in the office of the City Clerk, Clovis, and in the office of Burns & McDonnell, Inter-State Building, Kansas City, Mo.

GALLUP, N. M.—The Board of Trustees has granted George A. Keepers a franchise to supply electricity for lamps, heaters and motors in Gallup for a period of 25 years. Mr. Keepers, it is understood, will erect a power plant.

Canada

ENDERBY, B. C.—The construction of an electric-light plant is under consideration by the Town Council.

CARMAN, MAN.—The installation of a 100-hp. boiler in the municipal electric-light plant is under consideration.

AYLMER, ONT.—The Town Council is considering submitting the proposal to install a hydroelectric system in Aylmer to the voters.

ST. CATHARINES, ONT.—The Hydro-Electric Commission of St. Catharines has decided to erect a new electric transmission line from Niagara Falls to this city.

SPRINGBANK, ONT.—Plans are being considered by the Utilities Commission for a power development, to cost about $20,000. It is proposed to rearrange the pumping station and install additional equipment to develop about 1500 hp. E. V. Buchanan, City Hall, London, is manager for the commission.

SUDBURY, ONT.—The development of the water power at the falls on the French River in order to supply power to the British-American Nickel Refinery will probably be undertaken at an early date. The work will probably be done under the direction of the Ontario Hydro-Electric Commission or by private enterprise.

TORONTO, ONT.—Work calling for a total expenditure of $6,928,790 is contemplated by the Hydro-Electric Power Commission of Ontario for the fiscal year ending Oct. 31, 1917, including Niagara power development, $1,000,000; Niagara system steel tower lines, $985,000; Niagara transformer stations, $2,364,791; Niagara distributing stations and low-tension transmission lines, $344,495; Severn system extensions, $121,238; St. Lawrence system extensions, $52,880; Eugenia system extensions, $217,897; Port Arthur systems extensions, $6,185; Muskoka system extensions, $17,298; Central Ontario system extensions, $1,695,000; miscellaneous expenditures, $112,000, and office building, $12,000. F. A. Gaby is chief engineer.

DRUMMONDVILLE, QUE.—The Southern Canada Power Company of Drummondville has acquired the property of the Richmond (Que.) County Electric Company and the Brome Lake Company of Waterloo, which supplies electricity in the towns of Waterloo, Knowlton and Foster, and has a small developed water power with an ultimate capacity of 2000 hp. This water power will eventually be used as an auxiliary to the main system. The town of Richmond will be connected with the main transmission line of the company, which extends from Drummondville to Sherbrooke.

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, Arthur Kneisel, 29 South LaSalle St., Chicago, Ill.

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ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Affiliated with the N. E. L. A. Secretary, A. Jackson Marshall, 29 West 39th St., New York.

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Printed in the First Issue of Each Month

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WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, 1410 First National Bank Building, Milwaukee, Wis.

1,220,165. Variable Magnetic Coupled Reactance-Coil Electric Circuit; Irving F. Ashe, Lincoln, Mass. App. filed June 11, 1915. Means for electrically operating a plurality of mechanisms or translating devices simultaneously or any of them separately.

1,220,166. Outlet Box; Arthur W. Baker, Danbury, Conn. App. filed Feb. 19, 1915. For detachably connecting electric conductors of any desired type to the outlet box.

1,220,174. Ignition Switch; Stephen F. Briggs, Milwaukee, Wis. App. filed Sept. 15, 1916. For controlling an ignition circuit for automobile gas engines.

1,220,210. Electric Switch Mechanism; David D. Gordon, Chicago, Ill. App. filed Nov. 6, 1915. Quick make-and-break type.

1,220,248. Telephony; David S. Hulfish, Toronto, Ontario, Canada. App. filed Sept. 30, 1912. Application of methods and apparatus for telephone switching in central offices of telephone exchanges.

1,220,279. Ring or Band for Use in Pile-Driving; Henry Hilback, East Orange, N. J. App. filed Aug. 12, 1916. Improvements.

1,220,285. Electric Heater; Eliot Keen, Brooklyn, N. Y. App. filed February 28, 1916. Portable.

1,220,288. Quadruplex Telegraphy; Isidor Kitsee, Philadelphia, Pa. App. filed Dec. 30, 1916. Submarine cables.

1,220,295. Electrical Regulator; Frank W. Merrill, Chicago, Ill. App. filed Dec. 6, 1913. For automatically maintaining constant, substantially, the voltage or amperage, or both, of an electric current.

1,220,260. Sectional Reinforcing Electroplating Machine; George O. Morrison and Wilfred Thompson, Toronto, Ontario, Canada. App. filed June 2, 1916. Continuous automatic machine for reinforcing the electroplating of the sections subject to wear on the back pieces of table silver, etc.

1,220,262. Water-Electrolyzing Apparatus; Rudolph J. J. Mueller and Erroll G. Rowlands, Sheboygan, Wis. App. filed Jan. 17, 1917. Improved construction of the tank and diaphragm frame.

1,220,277. Current Generator and Spark Distributor; David E. Ross, Lafayette, Ind. App. filed Jan. 25, 1916. To produce the necessary current for the charge-igniting sparks, at the proper cyclic time, in the operation of internal combustion engines.

1,220,280. Audible Signaling Device; John R. Simpson, Troy, Ohio. App. filed April 8, 1914. Operating means for changing the tone whereby at least two distinct sounds of different intensity are produced by the same apparatus.

1,220,326. Connecting Device; Arthur H. Fargo, Wilmington, Del. App. filed April 10, 1914. Improvements.

1,220,333. Insulator Clamp; Edwin G. Hatch, Hoboken, N. J. App. filed May 19, 1916. Applicable to insulators carrying high-tension line wires or heavy wires.

1,220,342. Closing Device for Electric Circuits; William A. Kilmer, De Kalb, Ill. App. filed Jan. 2, 1914. Relates to fence-fabric-making machinery.

1,220,370. Constant-Voltage System; Thomas Spencer, Philadelphia, Pa. App. filed Dec. 1, 1913. Primarily intended for car lighting.

1,220,371. Constant-Voltage System; Thomas Spencer, Philadelphia, Pa. App. filed June 11, 1914. Employing opposing fields.

1,220,384. Renewable Fuse; Edgar H. Wilson, Chartiers Township, Allegheny County, and William E. Clark, Coraopolis, Pa. App. filed Nov. 3, 1914. Improved.

1,220,414. Electric-Switch Mechanism; David D. Gordon, Chicago, Ill. App. filed May 13, 1916. Quick-make-and-break type.

1,220,433. Electromagnet; Charles L. Krum and Howard L. Krum, Chicago, Ill. App. filed Aug. 18, 1916. Improved construction.

1,220,484. Centrally Controlled General-Alarm System; Frank W. Wood, Brooklyn, N. Y. App. filed June 7, 1915. Enable all the control mechanism to be concentrated in a convenient place where instant attention can be given to it by the attendant or operator.

1,220,486. Self-Excited Direct-Current Dynamo-Electric Machinery; Paul Amsler, Baden, Switzerland. App. filed Feb. 12, 1912. Relates to the stabilization of self-excited direct-current dynamo electric machinery.

1,220,493. Fire Alarm and Multiple-Circuit Closer; John A. Bunch, Adams, Ore. App. filed June 30, 1916. Provides

Record of Electrical Patents

Notes on United States Patents issued on March 25, 1917

an improved multiple contact circuit closer comprising a stationary member and a movable member.

1,220,701. Screw Adjuster; William W. Dean, Rochester, N. Y. App. filed Aug. 28, 1915. Improvement.

1,220,508. Electric Heater; Ralph R. Grimshaw and La Mar R. Jones, Findlay, Ohio. App. filed July 27, 1916. Installed on the engines of automobiles.

1,220,516. Controlling Mechanism for Fluid Compressors; Oscar H. Pieper and Alphonse F. Pieper, Rochester, N. Y. App. filed Feb. 7, 1914. Air-compressing pump operated by an electric motor.

1,220,569. Switch; Halfdan A. Steen, Milwaukee, Wis. App. filed Sept. 28, 1916. Embodying a blow-out magnet.

1,220,573. Rheostat; Herbert A. Wallace, Pittsburgh, Pa. App. filed Nov. 27, 1916. Improvements.

1,220,587. Electrical Measuring Instrument; Walter E. Beede, New York, N. Y. App. filed May 22, 1915. Adapted to give readings or current indications at opposite sides of zero point.

1,220,598. Electric Welder; Edward A. Buckman, Walkerville, Ontario, Canada. App. filed Sept. 19, 1914. Combined butt and spot welding apparatus.

1,220,603. Storage-Battery Construction; David J. Cartwright, South Bethlehem, Pa. App. filed Jan. 15, 1912. Improved common terminal lug for the plates of a given polarity.

1,220,604. Storage-Battery Plate; David J. Cartwright, Easton, Pa. App. filed Feb. 21, 1916. Provides a Planté plate of such proportions as to lessen the vertical growth in a plate of given capacity.

1,220,607. Testing Arrangement; Henry P. Clausen, Mount Vernon, N. Y. App. filed July 24, 1916. For performing routine tests in telephone exchange systems.

1,220,608. Electric Fitting; John Cuthbert, Chicago, Ill. App. filed July 26, 1915. Improvements.

1,220,627. Automobile-Thief Alarm; William H. Hanssen, Denver, Col. App. filed Sept. 27, 1915. Circuit-forming means and signal-actuating means may be adjusted to any secret working combination to render either actuating means operative or inoperative.

1,220,634. Portable Electric Light; Conrad Hubert, Hewlett, N. Y. App. filed May 29, 1915. Tubular flashlights having an electrically insulative shell or tube forming the principal part of the casing.

1,220,646. Circuit Closer for Fire Alarms; Steven J. Krunyak, Duluth, Minn. App. filed Feb. 29, 1916. Provides a device consisting of a pair of contacts normally held out of engagement by a suitable material which will be easily melted after the degree of heat has increased beyond a predetermined point.

1,220,669. Cusp-Diaphragm Mechanism; Frank E. Miller, New York, N. Y. App. filed Sept. 16, 1916. Bears a close relationship to the organic mechanism of the human ear.

1,220,679. Electrical Contact; Charles Pfeiffer, Milwaukee, Wis. App. filed Nov. 19, 1913. Improvements.

1,220,701. Circuit Closer for Track Switches; Charles W. Squires, Beverly, Mass. App. filed Oct. 17, 1916. Mounted on the trolley wire.

1,220,715. Primary Terminal; Charles W. Beck, Detroit, Mich. App. filed May 15, 1913. End of an insulated current-carrying cord may be fitted for quick and easy attachment to, or detachment from, a binding post or some similar terminal member.

1,220,721. Automatic Release Mechanism; Lynde Bradley and Harry L. Bradley, Milwaukee, Wis. App. filed Aug. 14, 1913. Adapted for use in controlling multiphase circuits in such a manner that an interruption of current in any one phase or line of conduction will automatically cause a complete interruption in all circuits.

1,220,756. Quadruplex Telegraphy; Isidor Kitsee, Philadelphia, Pa. App. filed Dec. 30, 1916. For instance as submarine cables.

1,220,763. Regulating Arrangement for Dynamo-Electric Machines; John Martin Clifton, England. App. filed May 29, 1916. Improvements.

1,220,770. Method of Electrical Welding; Thomas E. Murray, New York, N. Y. App. filed Nov. 29, 1916. Method of electrically welding together two tubes, or pipes, relatively at right angles to one another.

1,220,771. Method of Electrical Welding; Thomas E. Murray, New York, N. Y. App. filed Jan. 10, 1917. Welded joint may be easily and quickly made in thin sheet metal.

1,220,776. Method of Electric Welding; Thomas E. Murray, New York, N. Y. App. filed Jan. 24, 1917. Electrical spot welds.

1,220,779. Electrical Plug Switch; Edward J. Ovington, Newton Center, Mass. App. filed Nov. 29, 1913. Improvement.

1,220,780. Electrical Connector; Edward J. Ovington, Newton Center, Mass. App. filed Dec. 12, 1913. Improvement.

1,220,781. Electric Heating Device; Leon F. Parkhurst, Pittsfield, Mass. App. filed March 17, 1915. Unit is open at one side.

1,220,813. Protective Device for Electric Distributing Systems; Charles J. Barrow, Los Angeles, Cal. App. filed Jan. 30, 1913. Diverts an abnormal current from the transformer by some suitable means so constructed that it will operate instantaneously upon the occurrence of the abnormal current and will be much more rapid in its operation than the circuit breaker.

1,220,826. Relay; John T. Dempster, Schenectady, N. Y. App. filed June 24, 1916. Improvements.

1,220,833. Measuring Instrument; Harry A. Ewen, London, England. App. filed Sept. 30, 1917. Instrument in which the effect of small extensions or contractions of a filament, or of external stresses applied to the filament, may be multiplied for the purpose of measuring the amount of the extension or contraction, or the strength of the applied stress, so as to give a measure thereof.

1,220,839. Method of Making Furnace Hearths; James H. Gray, New York, N. Y. App. filed Jan. 23, 1914. Material is introduced into place in a molten or semi-molten condition progressively and continuously from the bottom to the top.

1,220,842. Combination Electric Lock Switch; Robert O. Hammond, Paterson, N. J. App. filed Nov. 12, 1915. Provides a switch that will complete an electric circuit and at the same time produce a means whereby said circuit can only be completed by one familiar with the proper combination of the same.

1,220,848. Electric Welding Apparatus; Henry S. Holmes, Brooklyn, N. Y. App. filed Jan. 24, 1917. Device for interrupting the welding current after a predetermined amount of metal has been taken up at the welded joint.

1,220,886. Tungsten Contact Point; Carl A. Pfanstiehl, Waukegan, Ill. App. filed April 6, 1914. Improvements.

1,220,920. Wireless Sounder; Archie J. Williams, Covington, Ky. App. filed May 21, 1915. Sounder wherein the magnets are adjustable with relation to the diaphragms.

1,220,954. Circuit Closer for Drip-Pan Alarms; James J. Chapman, Indianola, Miss. App. filed May 9, 1916. Improvements.

1,220,971. Apparatus for Controlling the Voltage in Variable-Speed Illuminating Dynamos; Ernest Fuchs, Billancourt, France. App. filed Aug. 31, 1915. Controller is provided which controls the field of the charging dynamo, so that a constant voltage is maintained.

1,220,981. Indicator; Joseph L. Gunge, Ann Arbor, Mich. App. filed Dec. 17, 1915. Indicates to the driver of a motor vehicle the direction in which a passenger is desirous of traveling.

1,220,993. Plug and Socket Connector; Joseph Sachs, Hartford, Conn. App. filed Feb. 26, 1917. Effective means for rapidly insuring a firm, substantial contact between the metal shell of the plug and the metal shell of the socket.

1,220,997. Combined Spot and Butt Welder; Elihu Thomson, Swampscott, Mass. App. filed Aug. 4, 1916. Machine combining in one structure electrodes for spot welding and clamps for butt welding, all fed from the same transformer secondary.

Electrical World

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The Engineer's Duty in War

THE die is cast and the United States now confronts the gravest situation since the Civil War. From now on it is swords out and strike home until we have a world peace founded on liberty and justice which shall give to coming generations freedom from the horrors of war. No man now can say how formidable or how long will be the combat before the inevitable end comes. Certainly no nation, however ferociously military, can withstand practically single-handed the gathered powers of the rest of the world. Whether the struggle lasts one year or five, it will fundamentally turn on the mustering of industries as well as of fighting men, on the organized skill behind the firing lines as much as upon the heroism of those who form them. It will be peculiarly a war of swiftly developed resources, of rapid gathering of material, of vast engineering skill and ability, and it is to this end that the country calls for the patriotic service of the whole engineering profession to forge the thunderbolts which shall be launched against the enemy. This is no time for half measures. We have lived in a fool's paradise too long. No ocean now guards us, but the fighting ships on it, the batteries that line its shores, and the mustered men who stand ready to strike down every foe within or without. The trumpet has sounded; the hour for waiting has passed.

Electric Trucks for Freight Terminals

NO greater opportunity for electric vehicle application exists than that afforded by freight terminals. If the moment freight arrived it were put on an electric truck and taken to a warehouse or delivered, the vexing and pressing problem of car shortage which now confronts the manufacturers of this country would be solved. Remove congestion at freight terminals and you remove one of the greatest burdens of the railroads and enable them to carry on their business with profit and dispatch. The same applies to piers, factories and storehouses. Transportation delays at any of them mean congestion of goods, a piled-up tangle of barrels and cases which renders speed in handling almost impossible after the trouble has really begun. The electric vehicle and especially the industrial truck have proved themselves almost indispensable in avoiding this particular difficulty. To what extent these can be applied and with what profit is well illustrated in the case of the Bush Terminal Company of Brooklyn.

By the use of storage-battery tractors hauling trains of three or four trailers between ships and the warehouses or factories it is possible to speed up the unloading of ships and the delivery of goods to the railroads to a pace quite impossible with animal-drawn vehicles and fully adequate even to the severe present requirements for rapid loading and unloading of vessels. As soon as a ship comes to her pier hoists swing the incoming freight to the pier deck in large masses stacked on false platforms. Trailers are run under these, and after the train is loaded the tractor pulls them out of the way to a chute, to the freight cars, or by hoists to the car doors. This is done so expeditiously that a car may be loaded and sealed and pulled out of the pier before the winches have lifted out of the vessel's hold another carload of material. The trailers are so easily handled and the tractors are so efficient and economical of space that it has proved possible enormously to increase the practical working capacity of the plant by their use.

The application of electric vehicles and of industrial trucks at the Bush Terminal is merely indicative of the wider and more extensive use to which these bearers of industry will eventually be applied in railroad, warehouse and manufacturing enterprises. The claims made for them by the electrical industry have been amply corroborated in the present instance, and with the general speeding up of many industries because of the war we shall be greatly surprised if such applications are not multiplied many times over. Certainly it shows a use for electricity that central station companies ought to welcome and push hard right now.

Protect Your Property

EXPENSES for adequate protection for power plants against all of the sinister dangers or possibilities of the times are unavoidable. It is a principle of insurance that cost rises as risk increases. If we are faced with greater obstacles to good and continuous service, the real question before us is: "How shall operation be maintained without a break?" There is no wringing of the hands because it takes more dollars. It is a problem now of not only unruptured supply but of keeping the large principal of the investment safe. Generating and distributing systems must be intact. Ask the stockholders who own the property, the bondholders who have a mortgage on it, and their reply is insistent that the officials shall take every precaution. Not every company will or can carry special insurance against the hazards of the period, but all can introduce physical and military or semi-military means of protection. The duty of doing so in this crisis is as plain as is the duty of rendering uninterrupted service in the normal condition of peace.

Interrelations of Technical Societies

IT is the history of evolution in the organic growth and development of scientific and technical associations that they develop to a certain stage, when the diversity of interests causes them to shoot off into separate branches which disengage themselves from the parent stem and form independent societies. Engineering was originally natural philosophy on its scientific side. The basic scientific organization has always been natural philosophy. In England it took early national existence under the name of the Royal Society, whose interests and discussions extended to the whole known universe. There were no subjects too great or too small or too different in the scientific world for the Royal Society to attack and capture for its *Transactions*. Gradually, however, special branches of science fell to the care of special scientific or technical societies, until at the present time there are many such, and the probability is that there will be yet more.

The question arises, therefore, as to what the conditions are that determine the desirable and proper degree of ramification and segregation. On the one hand there are the forces of specialization, tending to separation and urging the localized union of specialists; on the other are the costs and enfeeblement in numbers, tending to combination and opposing disunion from the main body.

The answer is that when the work of the proposed separate branch is sufficiently large to call for separate officers, administration and publications a condition of unstable equilibrium is set up that may result in separation, especially if the activities of the proposed branch naturally extend to fields and individuals not easily reached by the parent organization.

The case of the Illuminating Engineering Society may be cited. Prior to its formation questions concerning electric lamps might have been discussed by the American Institute of Electrical Engineers, questions of photometry by the Physical Society, and questions of physiological optics by medical societies; but the principles and practice of illuminating engineering could not adequately find a hearing anywhere. The formation of the society in 1906 not only brought all these separate questions into the appropriate common field but also added much incidental new material that could not previously have been stimulated into growth. Architects, electric lighting practitioners, gas practitioners, artists, builders, physiologists and optical specialists have all been attracted to the new society, for a common interest, in a manner and for a result which was previously impossible. The result has been a remarkable advance in the theory and practice of illumination, the formation of similar societies abroad, and the formation of an International Commission on Illumination, which has already aided in establishing international units and standards in illumination. All of this would have been impossible of attainment under the pre-existing régime. Moreover, thanks to the work of the society, the prestige of illumination as a science, an art and a profession has been publicly raised, so that good lighting in halls and dwellings begins to be recognized and appreciated—all of which is a national asset attributable almost wholly to the I. E. S., as its dozen volumes of *Transactions* can testify.

It only needs a cursory examination into the history and work of the I. E. S. to recognize that this society has amply justified, and will probably still more justify in future, its independent existence. What calls for attention is the development of interconnection between this and other technical bodies. What is wanted is a mechanism for uniting the aims, the influences and the *esprit de corps* of such separated organizations without hampering their autonomy or individual growth. The advantages of intensive specialization are accompanied by certain disadvantages due to scattering and loss of collective sociological momentum. Efforts should therefore be directed to methods of minimizing such disadvantages without arresting the advantages. A federation of technical and engineering societies is one way of accomplishing this result.

Some Experience with Aerial Cable

A PAPER in this issue by E. B. Meyer on the solution of an important engineering problem in line construction will carry much of value to the student of power transmission. The case in hand, although a somewhat unusual one, is likely, however, not infrequently to be duplicated in the extension of power networks. It was necessary to connect two generating stations by feeders at 13,200 volts. The region to be spanned was exceedingly marshy, so that a duct line unless laid on piles was impracticable, and an ordinary overhead system would have met serious difficulties in crossing trestles, bridges and railway freight yards. The first trial was made with ordinary lead-covered cable run on a pole line with fifty-foot spacing and having additional protection from jute and steel-tape armor. It proved efficient but too heavy, and as a result the special cable described in Mr. Meyer's article was devised and installed. It is a paper-insulated cable in a paper jacket covered with reinforced rubber put together somewhat after the fashion of a garden hose, cloth-vulcanized in the insulation. Outside this is a layer of rubber compound tape and a weatherproof braid finally incased in galvanized-steel tape armor.

This modified construction reduced the weight of the cable approximately 50 per cent and made it practicable to use something like standard transmission line construction with chestnut poles spaced at 90 to 100 feet, in places reaching out to a greater length. The suspension is from the usual messenger cable, in this case of ⅝-inch seven-strand galvanized-steel wire. This messenger cable is strung rather tightly to prevent excessive sag, and when finally in place the cable is cautiously pulled up to it and made fast to the rings. The highly ingenious methods of doing this are fully described, as are also the details of the splicing, a thing which obviously requires particular care in a cable of this character. While necessarily somewhat heavy, a cable of this design has proved thoroughly practicable and desirable in installation. When made up with three conductors of

No. 1 equivalent, the weight is a trifle less than 4½ pounds per foot and the outside diameter is 2½ inches. The messenger cable is thoroughly grounded, and experience has shown that lines installed in this way are exceptionally free from trouble with lightning; in fact, it has not been considered worth the while to install lightning arresters to protect a line of this particular structure. In some instances on the same system ordinary lead-covered cable has lately been used in connection with a true catenary construction to lessen the strains on the line. So successfully has the aerial cable system worked out that in at least one instance it has been employed for working at double the voltage just mentioned. The plan seems to be one particularly well adapted for safe and reliable construction under conditions which render either ordinary aerial lines or underground conduits peculiarly difficult.

The Government Nitrate Plant

THE United States government stands committed to the construction of a fixation-of-nitrogen plant to insure a sufficient and reliable supply for the manufacture of high explosives in time of war, and presumably with agricultural needs in view in time of peace. The whole project is as yet in its formative stage, with much discussion going on as to the proper character of the plant and the most suitable location to obtain the best practical results. For the economical fixation of nitrogen the fundamental requisite is a very large supply of extremely cheap power. Information regarding the actual economy of the various processes which have been worked is rather scanty, but there is universal agreement that remarkably favorable power conditions are the fundamental requisite. The advantages of the Muscle Shoals site on the Tennessee River in Alabama are already very generally known. In a recent issue we printed a study of the situation from the economic standpoint by H. S. Putnam, which deals specially with the desirability of Rock Island, Ill., already the site of an important government arsenal, as the most suitable scene for operations on a great scale. The chief point of advantage at that locality, aside from its good position from a military and transportation standpoint, is the large amount of water power available on the Mississippi, amounting to 100,000 kw. to 125,000 kw. of electrical output. Mr. Putnam estimates that a complete hydroelectric plant can be put into action with an output of 100,000 kw. for a little less than $100 per kilowatt, certainly a low figure for a stream like the Mississippi and a locality so remarkably good for general manufacturing purposes.

An additional recommendation is that Rock Island is within very easy reach of the Illinois coal fields, rich in bituminous coal. A very moderate length of transmission line would make it practicable to establish, for equalization of hydraulic resources and for additional power, power plants at the mouths of the coal mines, utilizing in large measure waste fuel; and such combined plants are part of the project under discussion. Similarly, this coal field could be utilized for the working of fuel-gas plants to feed the boilers of the auxiliary steam service and at the same time to recover the important by-products from the coal itself. There is a further possibility, or rather extension, of the fuel-gas project in the destructive distillation of coal at low temperatures so organized that the maximum amount of valuable products of distillation can be secured, with usable gas as a by-product. The experience of the present war shows the immense importance of great supplies of the benzol and toluene.

Mr. Putnam figures out extremely low costs for energy produced by this general utilization of hydraulic and fuel resources, costs so low as to make the fixation of atmospheric nitrogen a thoroughly economical process. The great virtue of the site thus studied is the fact that coal distillation, steam generation and hydraulic power can be brought together to produce an economy in the final results difficult to attain elsewhere. For an emergency plant for war purposes, production of nitrates, together with the requisite supply of benzol and toluol from the distillation of coal, makes a specially advantageous union of material resources, and the situation of the whole industry in a region where labor is easily obtained and transportation facilities are of the best gives additional weight to the project. The result of so favorable a location would be that the combined industries could be made to work together so that the finished products might be shipped out at a relatively low cost of distribution, making a far better showing than would be the case, even if the hydroelectric part of the enterprise could be still more cheaply carried through, were the plant at a distance from cheap auxiliary steam power and from the invaluable raw material of the coal.

The Coming Issues

THE next issue of the ELECTRICAL WORLD will contain an article explaining a method of calculating the effect of adding conductors to a direct-current network system. This problem is one that arises frequently since distribution systems are not the product of a single design or layout but the result of gradual growth. Another article to be presented in that issue will dwell on features of the largest hydroelectric plant in New England, in which several new and interesting construction schemes have been embodied. The plant serves a 66,000-volt transmission line. Various other contributions of interest to engineers and operators will also be included. In the fourth issue of the month commercial problems from a managerial standpoint will receive especial attention. Of particular interest in that issue will be the discussion on granting free appliance repairs to customers. During the period of war preparations and stress the ELECTRICAL WORLD will seek, in so far as it is expedient and prudent, to chronicle what is being done to safeguard electricity supply, and how electrical engineers and the central station and electrical manufacturing industries may be of service to the nation.



Electric Trucks — A Remedy for Terminal Freight Congestion

Enormous Off-Peak Load in Battery Trucks Available to Central Stations for the Asking—Bush Terminal, Brooklyn, N. Y., Uses 12,000,000 Kw.-Hr. Annually

WITH industrial plants and transportation systems taxing their facilities to make deliveries in reasonable time and with the congestion in traffic more pronounced than it ever has been before, it seems that the psychological moment has arrived for vehicle manufacturers and electric-service companies to urge the use of electric trucks and tractors for handling terminal freight. Wonderful possibilities are open in this line to central stations, as the load may be made off-peak. Not merely a few companies have the opportunity—a field is open in every city which is an industrial or a shipping center. Practically every industrial plant can be advantageously equipped with electric transveyors instead of hand trucks to handle freight inside the plant, and electric vehicles can be used for trucking purposes outside. Examples of what can be done in this line are afforded by some of the factories or wholesale produce houses in several large cities. The advantages of electric trucks and tractors are most obvious, however, in handling terminal freight. They can enter piers, warehouses, etc., without creating a fire hazard; they can be started promptly, and thus save time; they exert high tractive effort and do not get stalled easily in snowy weather; they do not occupy as much space as horse trucks of the same capacity and hence reduce congestion, and they can turn in small space. Furthermore, the length of haul is well within the range permissible with storage batteries.

To be convinced of the remarkable changes which electric trucks can work at terminals, it is only necessary to observe traffic conditions where freight is being handled by electric trucks and tractors and where similar quantities are being trundled by hand and horse trucks. Where electrical equipment is used there is relatively little confusion or congestion, owing to the small space occupied by the trucks when loading and to their ability to wind through traffic. There is practically no delay in loading, as the electric truck can be quickly placed in position and the tractors or transveyors can carry larger loads and move faster than hand trucks. As a result, with the same platform space or pier room freight can be handled much more rapidly with electrical equipment than with hand and horse trucks. Eventually every railroad and ship terminal will turn toward the electric truck as a solution for its transportation problems.

Under present conditions the investment in equipment is not thought such a bugbear as formerly by industrial plant or terminal managers so long as it can be shown that the equipment expedites operations. This has been proved conclusively in past installations and will be evident from the information presented later in this article. Most companies are so engrossed in the big profits they are making that they will not listen to arguments based on economy of operation alone. Expediency is the watchword now.

The use of electric trucks, transveyors, tractors, etc., at terminals is not new. They are being employed on numerous seaboard piers and also inland at railroad terminals. A pioneer among the users of electric vehicles for these purposes, however, is the Bush Terminal Company, Brooklyn, the largest private shipping terminal in the world. As many people know, this terminal consists of factories, warehouses and railroad and steamship transportation facilities so related that the occupants of the factories can receive raw materials and ship finished products almost directly by rail or water. What transportation is needed between piers or railroads and the lofts or warehouses is handled by electric tractors, battery cranes, motor-driven whip hoists, portable hoists, elevators, motor-driven piling machines, and trains pulled by electric locomotives. Delivery and collection of freight outside the terminal are handled with electric trucks.



APPLICATIONS OF ELECTRICITY AT BUSH TERMINAL

A—One of the four electric locomotives used to transfer freight cars between the piers, storehouses, loft buildings and classification yards. B—Battery-crane tractors loading trailers which they will later haul to their destination. C—One of the tiering machines used to pile merchandise in the warehouses. D—Portable hoist, of which there are sixty for unloading lighters, etc. E—Crane tractor hauling four loaded trailers. F—How battery-crane tractor is used to load and unload freight cars.

The terminal is situated on the east shore of New York Bay and covers approximately 200 acres (80.94 hectares), having about one mile (1.609 km.) of water front. Nearly 75 per cent of the area is covered with piers, warehouses, factory buildings and railroad yards. Eight piers, at which ocean-going vessels can load and unload, are provided. Six are 1350 ft. (411.48 m.) long by 150 ft. (45.72 m.) wide, with slips 270 ft. (82.29 m.) wide; and one is 1400 ft. (426.72 m.) long by 270 ft. (82.29 m.) wide and has double decks having a floor

area of 15 acres (6.07 hectares). Under normal conditions, about twenty-eight ships ranging in size from 5000 to 6000 tons (4535 to 5440 metric tons) are berthed at one time. One transportation line plans to load and unload ships of about 6000 tons (5440 metric tons) capacity at the rate of one every seventy-two hours. The average clearing time, however, is five to seven days. The relative positions of the warehouses, piers and lofts are shown in an accompanying illustration. A 1200-car freight classification yard is provided so that cars are always on hand whenever any tenant of the Bush Terminal loft buildings desires one placed at his loading platform. These cars are spotted with electric locomotives, of which there are three 40-ton (36.3 metric ton) and one 65-ton (59 metric ton) trolley-type General Electric units.



BATTERY TRACTOR HAULING LOAD OF CASKS AND ELECTRIC WAREHOUSE ELEVATOR THAT CAN BE LOADED DIRECTLY FROM STREET

Methods of Employing Electricity to Handle Terminal Freight

Shipments received by water may go: (1) direct to freight cars, (2) to lighters that connect with New Jersey and New York City, (3) to trucks making deliveries in Brooklyn or New York City, (4) to warehouses, or (5) to the factories. Similar possibilities are open to the movement of freight received by rail. To illustrate specifically how freight is handled at this terminal it will be assumed that a loaded ship has just made fast at the double-deck pier previously mentioned and that the hatches are open for unloading. The ship's winches hoist the incoming freight to the second deck of the pier. If these are inadequate for the service, use is made of a number of portable electric hoists, like the one shown herewith, by connecting them with outlet boxes placed every 90 ft. (27.43 m.) along the piers. At night, or when the ship's holds are dark, cargo lamps may be connected with outlets similar to those used to serve the hoists and hung over the ship's hatches or wherever desired. Sometimes the cargo is unloaded by the use of slings or rope baskets and sometimes with special crates, depending on the nature of the material.

Suppose that a cargo consisting of canned pineapple, which comes in cases, has arrived. Unloading it by hand, one man could carry only one case, or at best wheel four at one time on a hand truck. At this terminal, however, as many as seventy-two cases are stacked on false platforms, a line is coiled around them, and they are hoisted onto the pier. Without removing the cases from the false platforms, transveyors are run under the platforms. After four or five transveyors are thus loaded and hooked together a storage-battery tractor is used to haul them to the point of disposal. If the cargo consists of material that has to be rehandled in loading or unloading the trailers, the battery cranes are generally used to do the hoisting.

In general, when packages weighing 1000 lb. (453.59 kg.) or more have to be transported one of the crane tractors is used to load and unload the packages. Otherwise the tractors are only used for hauling the trailers (three or four at a time) between the vessels and the warehouses. For every tractor in use there are twelve trailers. Four of these are left at each end of the route for loading and unloading, and the remainder are always in use between the termini. With this arrangement the tractors can be kept moving constantly. Some of the crane tractors cannot enter warehouses because of lack of head room, but otherwise they are run into warehouses and alongside the vessels at the piers.

If the goods are to be shipped out by rail, the tractor pulls the transveyors to a convenient chute down which the cases may be slid into box cars below. If the freight is too bulky to handle by means of chutes, it is lowered through a hatchway to a position opposite the car door by an electric hoist. Meanwhile the transveyors have been slipped out from under the false platforms and taken back for another load. By the time the tractor has made a round trip the hundred or more cases which constitute its load are packed away in the car for final shipment. Thus a freight car may be loaded and sealed and may actually be pulled out of the pier before the winches have hoisted the equivalent of another carload out of the ship's hold.

If the cargo or part of it is intended for local delivery, the battery tractor hauls its train of transveyors to the extreme end of the pier, where the goods are lowered

by traveling electric hoists to a loading platform at which electric trucks are backed up. Since it is impossible to remove all freight from the piers as fast as it comes from the ships, spaces are marked off on the pier on which the freight may be assorted according to its destination. Freight which is intended for storage is generally set aside in this manner until after the first rush of disposing of prompt-delivery lots. It is then carted away to the storehouses by tractors pulling three or four trailers and hoisted to the particular floor desired by elevator, whip hoist or portable hoist.

Use of Electricity in Storing Goods

For hoisting freight into the warehouses, outriggers are provided along the cornice of each building over the doors. Through these run cables which may be operated by portable hoists or group hoists controlled by one man. Three motor-driven hoisting drums are provided for each block of six buildings. Since a man is required at the unloading window in the warehouse, anyway, the Bush Terminal Company is considering installing individual motor-driven hoists over each vertical row of windows and having this man control the motor, thus replacing the whip hoists and the special operators. Sixty portable electric hoists are available for use, there being quite a demand for them on the lighters. Freight which is warehoused must be stored with the greatest speed and economy of space. For this service electric tiering machines are used which automatically pile the merchandise in regular rows clear to the roof. These machines operate on the endless-chain principle and are easily moved from one location to another. Plugs and long, flexible cables permit connecting them with outlets which dot the walls of the buildings.

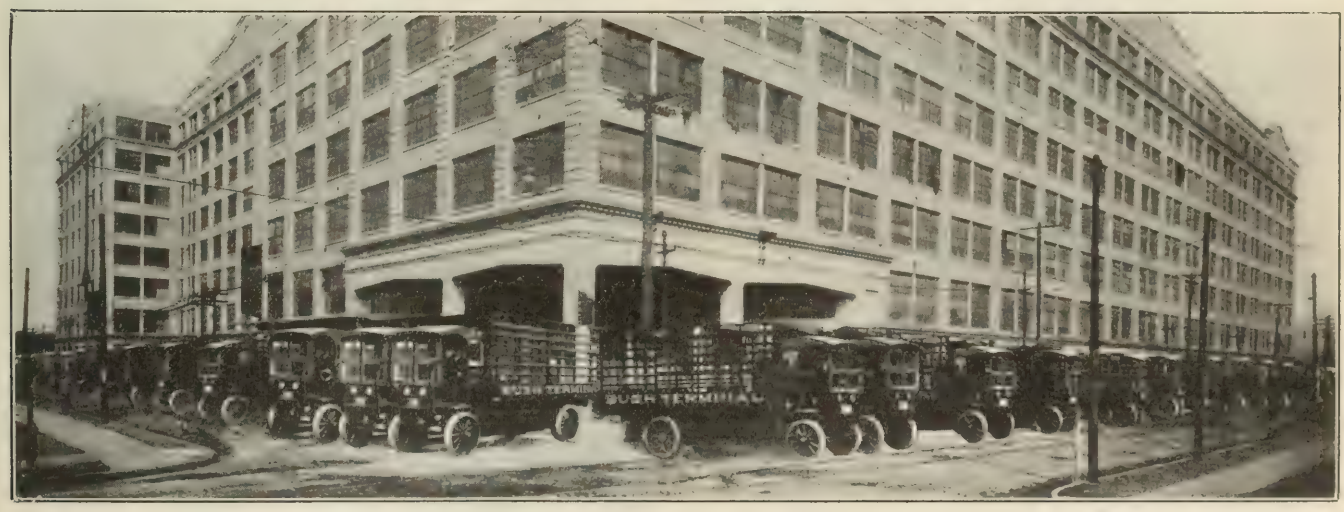
If freight is brought in by rail, it can be delivered directly to the factory or warehouse doors, as tracks are provided alongside every building. Because of these facilities and the car-storage yard it is a simple matter to get a car to a tenant's door within a very short time after he calls for one. All cars are unloaded at platforms which are level with the car floors.

The methods of loading the ships are practically the reverse of those used in unloading. Goods are brought in by trucks, by train and by battery tractors from the stores and are assorted to facilitate stowing in the ship's hold. By the time the ship is free from incoming freight the cargo is alongside ready for the winches. There is no delay, no confusion.

In handling mixed freight by the old methods something like 50 per cent of the operating cost is eaten up by inefficiencies, delays, wastes, excessive labor costs, etc. On the double-deck pier at the Bush Terminal, however, practically all of this waste is eliminated by the mechanical aids mentioned and the better arrangements permitted thereby. Taking into consideration all movements of the freight by tractors and dock trucks, only about 10 per cent of the tractor's time is lost because of coupling, uncoupling and spotting the dock trucks. Thus the trucks are actually in motion 90 per cent of the time.

Electric Trucks for City Delivery

City deliveries are made with electric trucks, which are loaded at night so they are ready to start early in the morning. After a chauffeur has delivered his goods he telephones to the Bush Terminal to ascertain whether some terminal-bound freight can be picked up on the way back. The batteries are charged at night and receive a boosting charge during the day. Some of the trucks are garaged in Manhattan and some at the terminal. The garage which cares for the tractors and for the electric trucks is operated as a separate department which charges the parent company and various tenants for its service according to fixed rates. The chauffeurs and tractor drivers who are on the pay roll of the garage department are responsible for seeing that the trucks are not overloaded and that the equipment is not used for purposes for which it is not intended—such as shifting cars, etc. Every night the foremen, whose duties are to supervise the transportation end of the business, assemble in the office of the superintendent of transportation and decide on what materials have to be moved the following day. Available transporting equipment is then divided among the foremen and requisitions are made on the garage for the equipment for each job. In the morning the drivers report to the different foremen according to these orders. Great economies have been obtained with the tractors, compared with the results of operating mule-drawn trailers, although the latter are still used on small jobs and to supplement tractors at busy times.



SOME OF THE ELECTRIC TRUCKS EMPLOYED TO MAKE CITY DELIVERIES AND COLLECT FREIGHT

So that the tractors and trucks shall not have to be run into fixed positions in the garage for charging, the circuits have been run to outlets on the ceiling and the charging plugs attached thereto and supported by counterweights which permit them to be raised when not in use. Anderson charging plugs and Cutler-Hammer charging boards are employed. Spare truck parts are



SMALL TRACTORS HAULING PIGS OF METAL OVER ROUGH PLANKING

kept in stock for rebuilding one of each kind of truck. At night when a truck is brought into the garage loaded the weight is taken off the springs by jacking up the platform.

Costs of Using Battery Trucks and Tractors

The data thus far available on the energy consumption of the tractors show that they have performed their duties with a current consumption of 3.31 amp.-hr. per ton-mile (2.27 amp.-hr. per metric ton-km.). The average weight transported has been 123 tons (115 metric tons) and the length of haul between 100 ft. (30.48 m.) and 6000 ft. (1828.8 m.), or an average of 0.4 mile (0.64 m.). Four-wheel platform trucks, 14 ft. (4.27 m.) long by 4.5 ft. (1.37 m.) wide and equipped with roller bearings, are employed in this service Among the various forms in which the miscellaneous warehouse commodities are handled in the raw state are bales, bags, cases, barrels, mats, etc. Of the 1,325,000 tons of freight handled at the Bush terminal per year, about 324,000 tons (294,000 metric tons) is moved by tractors between the piers and warehouses. The remainder is transported in trucks or trains handled by electric locomotives.

Several typical examples will serve to show the relative advantage of handling material by electric tractors instead of by hand or with horse trucks. For instance, in loading trailers with bales of fiber the battery cranes and tractors can perform the work at a cost of 7.2 cents per bale, whereas with hand operation it costs 8.8 cents per bale. Three-hundred pound (136-kg.) bags of ore can be loaded onto cars by battery cranes at a cost of 21 cents per ton (23 cents per metric ton), whereas with hand operation it costs 32.4 cents per ton (35.7 cents per metric ton). In addition, the battery crane permits an average increase in speed of handling of about 40 per cent. Comparing the use of horse trucks and tractors for loading and unloading case goods and transporting them, it costs 16.1 cents per case with horse truck and 14.2 cents per case with tractors. The last two values are based on hauling the commodity 450 ft. (137.16 m.).

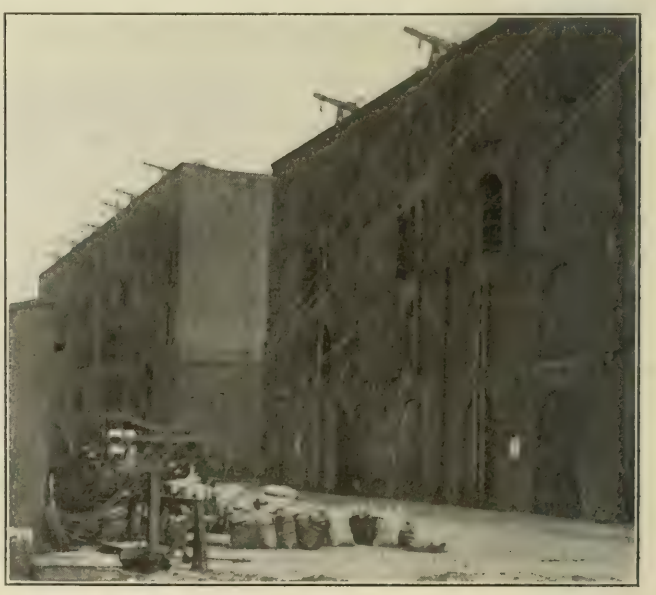
RATING AND BATTERY EQUIPMENT OF TRUCKS AND TRACTORS

Number and Make	Haulage Capacity (Tons)	No. and Type of Cells
Trucks:		
25 Walker	5	60 A-12
3 General Motors	5	60 A-12
2 Walker	2	56 A-8
3 General Motors	2	60 A-8
Tractors:		
4 General Vehicle	10	59 A-8
4 Walker	15	60 A-12
1 Lansden	10	60 A-8

Storage-battery tractors show an advantage also when the cost of operating them is compared with that of moving commodities in box cars. For instance, suppose that 400-lb. (181.4-kg.) bales are to be moved from a lighter to a pile in the storehouse. The complete cost of operation with a battery tractor is 8.7 cents per bale, whereas when moving the material in the box cars the cost is 26.2 cents per bale. At the Bush Terminal the cost of energy for loading, unloading and transporting materials amounts to a small percentage of the total operating cost per year. Labor expense represents 41.7 per cent of the total operating cost. The yearly operating cost of the tractors is 66.3 per cent of their initial cost.

The performance noted in the preceding data is rather remarkable in view of the fact that some of the batteries are operated at 75 per cent overload and are unprotected from the excessive jar and vibration due to the trucks and tractors operating over the rough cobblestones and boards between the piers and warehouses. Edison batteries are used in the trucks and tractors.

In conclusion it might be pointed out that the Bush Terminal company did not wish to use electric trucks and tractors at first. Neither did it buy all of the trucks it now has on the spur of the moment. A few trucks were tried in the beginning. Such satisfactory results were obtained that more were purchased. Some indication of the way in which electric transportation is now considered by the Bush Terminal Company is given by the fact that it has recently ordered twenty more 5-ton (4.53-metric ton) tractors. All of the energy used at this terminal for freight-handling purposes, light and power is furnished by the Edison Electric Illuminating Company of Brooklyn.



MOTOR-OPERATED WHIP HOISTS SERVING WAREHOUSES

Saw-Mill Waste for Generating Electricity

How an Arkansas Lumber Company Has Co-operated with a Central Station by Supplying It with Steam Generated from Wood Waste

BY J. B. WOODS
Malvern, Ark.

UNDER ordinary lumber-manufacturing conditions about two-thirds of the volume of the logs fed to the mills is converted into salable lumber. The rest goes into slabs, sawdust, culled pieces, cut-off ends and the like fit for nothing but fuel. While part of this waste may be burned instead of coal for the production of power in the mill, there is generally more than

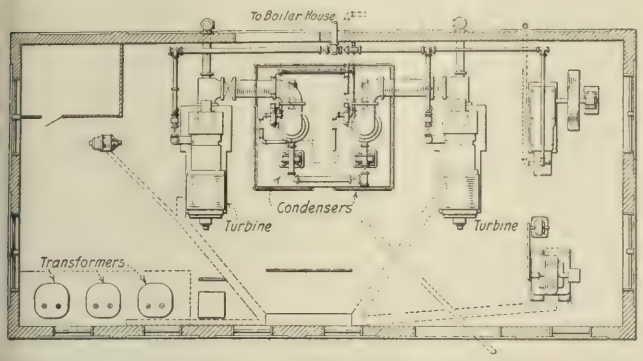


FIG. 1—ARRANGEMENT OF GENERATING EQUIPMENT SUPPLIED WITH STEAM FROM NEARBY SAWMILL

enough for this purpose, so an excellent opportunity is afforded for the manufacture of byproducts, such as paper, chemicals, small wooden novelties, etc. A still simpler method of utilizing the wood waste, however, has been adopted by the Arkansas Land & Lumber Company, Malvern, Ark., which has co-operated with the Arkansas Light & Power Company in producing electrical energy out of waste products from the sawmill. The wood is burned in boilers at the lumber mill and steam conveyed through 8-in. (20.4 cm.) pipe to the control station on the lumber company's property.

There are two sources of fuel at this mill: the sawmill and the planing mill. As the first mentioned is only a few yards from the boiler room, all waste is handled by a system of chain conveyors which conducts the scraps of wood to a grinding machine. After being converted into an easily burnable state, the waste is deposited in a brick fuel house at one end of the boiler room. From the planing department waste is conveyed to the depository through a blow pipe, in which a forced draft is maintained by a high-speed fan. Small pipes reach from the main conveyor to each planing machine, and also to another grinder the purpose of which is to reduce large scraps to the size desired for burning in the fire-boxes. Two other chain conveyors are provided, one of which brings waste from the fuel house to the boiler-room wall, while the other carries it over the boilers in a tube which is equipped with feed chutes. By the pressure of a lever, fuel can be precipitated into any of the fire-boxes. The wood waste which passes across the boilers without being used is carried back on the return chains into the fuel house for future use. As these two chains are operated by an engine inside the boiler room, the firemen can regulate the volume of fuel moved to meet the needs of the boilers.

Special grates are required for burning the sawdust. They consist of units measuring 8 in. by 3 ft. (20.4 cm. by 0.6 m.) on their upper surfaces and containing perforations 0.75 in. (19 mm.) in diameter. The boilers are of the horizontal-tubular type, set in steel casings, with steel fuel chutes discharging into each firebox. They are grouped in batteries of four, and are rated at 200 hp. each when carrying 150-lb. (68 kg.) pressure. Altogether, they consume the waste from a plant which produces about 75,000 ft. (23 km.) of lumber daily, and supply steam to two large mill-drive engines, two smaller auxiliaries, ten dry-kiln chambers, two steam water-pumps and the turbines in the electric-service plant.

The arrangements of equipment in the boiler room and generating station are shown herewith. In the latter are two 2300-volt, three-phase Curtis horizontal turbo-generators, each guaranteed to deliver 500 kw. and using 19 lb. (8.6 kg.) of steam per kilowatt-hour at 125 lb. (56.7 kg.) pressure. The demands upon this plant require only one machine in continuous operation, so that the steam consumption under winter conditions is about equivalent to output of two boilers during peak load.

Three 2300/110-volt Moloney transformers furnish power for the small motors and the station lighting system, while three large 2300/22,000-volt General Electric transformers supply energy for a 30-mile (48.3 km.) line to Arkadelphia.

Exhaust steam is discharged into LeBlanc jet condensers, equipped with 25-hp. Westinghouse induction motors, which take current from the turbines. Cold water for condensing is taken from a nearby creek, while the warm waste discharges into the log pond. The town of Malvern receives energy from this plant at the generated voltage.

The amounts of energy consumed in Malvern and Arkadelphia are in the ratio of 1.5 to 3.5, but Mal-

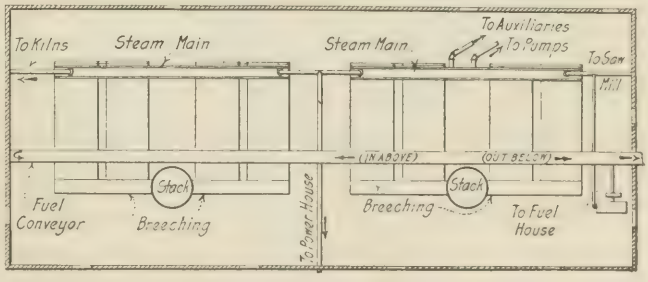


FIG. 2—SAW-MILL BOILER ROOM GENERATING STEAM FROM WOOD WASTE

vern's demands are chiefly for lighting purposes, while those of the latter city are for industrial motors to a large extent. The peak demand in Arkadelphia occurs in daytime, when the sawmill is using a great volume of steam. The critical period is just before 6 p. m., when motors are running and electric lamps are being turned on. After this peak ample steam is available for

operating the generators, since the mill machinery is shut down and only the dry-kilns, pumps and conveyor engine require steam. This co-operative arrangement between the lumber and central-station company has existed more than two years and has proved successful and satisfactory to both parties. The electric-service company is relieved of buying coal, while the lumber company has solved the waste-disposal problem at fair profit.

THE EFFECT OF SULPHUR ON THE VALUE OF COAL

How Different Forms of Sulphur Affect the Heating Value of Coal, Produce Corrosion and Augment Clinkers

BY ALBERT MARTINEAU

Not very long ago only very large consumers of coal purchased their fuel on specifications, but it is now becoming increasingly common for small consumers to do likewise. In many of the specifications drawn up by these small consumers there are usually, in addition to the definite stipulation regarding the heating value, statements concerning the amounts of volatile matter, moisture, ash and sulphur that shall be permitted. While there are very good reasons for specifying definite properties in some cases, some requirements are stated in such a vague way that their value is very questionable. For example, definite statements are made regarding sulphur, without stating in what form the sulphur may be present, or without fully understanding the effect of the presence of sulphur in its various forms. For this reason attention will be called in a brief and general way to the action of sulphur, and why its influence is considered deleterious.

Sulphur may be present in coal in several different forms, the most common of which is iron pyrite (FeS_2). Sometimes the pyrites are divided very finely, the particles being so small as to be barely discernible. At other times large masses are present, which are immediately recognizable. Organic sulphur, which is sulphur combined with carbon or carbon and hydrogen, is also present quite frequently. Sometimes free sulphur is found, but where it occurs it is in such small quantities that is of relatively little importance compared with the other forms. Sulphate of iron, lime and aluminum are often found in weathered coal which has been standing a long time exposed to moisture and air, such as in the outcrop of a coal seam.

The effect of sulphur depends upon the form in which it is present. When coal is consumed sulphur of the unoxidized form is burned to sulphur dioxide, therewith liberating heat. On the other hand, if the sulphur is in the form of ferrous sulphate or calcium sulphate it has no heating value, but instead absorbs heat on combustion of the coal. In weathered coal the amount of oxidized sulphur is ordinarily so small that its effect on the heating value of the coal can be ignored. On the other hand, for coal which has been newly mined the heating value varies from 2250 to 2950 calories, depending upon whether the sulphur is present as organic sulphur or as pyrites. When iron pyrites burn, resulting in the formation of sulphur dioxide (SO_2) and ferric oxide (Fe_2O_3) the heat of combustion is about 700 calories higher than that of sulphur in organic form which burns to sulphur dioxide.

The presence of sulphates is much more detrimental to heating value in weathered coal than in coal which has been newly mined. For example, take the heating value of 1 per cent sulphur existing as pyrite as 29.5 calories. During combustion of the coal the decomposition of ferrous sulphate ($FeSO_4 7H_2O$) corresponding to 1 per cent of the sulphur absorbs about 21.5 calories, being a loss therefore in heat of about 51 calories, or three-fourths of 1 per cent. Considered alone, this would not be such a very serious matter, because usually the amount of sulphur present does not exceed 1 or 2 per cent. But 1 per cent of sulphur existing as pyrites absorbs 2 per cent by weight of oxygen on oxidation, and absorbs and combines with about 4 per cent of water, which is not given off on air-drying. It can thus be seen that air-dry coal is liable to be about 6 per cent heavier on account of the oxidation of 1 per cent of sulphur, and the calorific value per unit of coal 7 per cent lower in heating value instead of only three-fourths of 1 per cent.

Other Reasons Why Sulphur Is Detrimental

In addition to the lower heating value of coal due to the presence of sulphur in its various forms there are other reasons why sulphur is detrimental. One of these is corrosion. When the flue gases pass up the chimney they cool off and condense against the comparatively cold sides of the stack. The sulphur dioxide in the flue gases which have formed during the combustion of the coal unites with the water and forms sulphurous acid which, remaining in that form or changing to sulphuric acid by further oxidation, has a corrosive effect upon the metallic stack and other metallic structures in close proximity.

Furthermore, the greater the percentage of sulphur the greater the chance of clinker forming in the ash although there are exceptions to this statement, of course, depending upon the form in which the sulphur is present, the form when converted to ash, etc. However, sulphur is usually present as pyrites, so that the iron oxide formed during combustion readily unites with the highly silicious constituents of the ash to form clinkers. The higher the temperature the more readily this occurs. Further, iron pyrites give off about one half of their sulphur on being heated, leaving ferrous sulphite. Therefore, in coals rich in pyrites the conditions are very favorable to formation of clinker, especially if the pyrites are present in good-sized lumps. Iron oxide alone will not cause clinker, but in the presence of silicious constituents of the ash it will. Neither will ferrous sulphite clinker by itself. With pyrites in coarse aggregates, and with finely powdered ash of a highly silicious nature, however, ferrous sulphide will cause clinker.

Summarizing, the presence of sulphur is not welcome in coal since it lowers the heating value, causes corrosion of metal and concrete structures, and increases the difficulties of operating the boilers and disposing of the waste products. Which of these objections is the most important to consider depends, of course, upon circumstance, the price of coal, the methods of firing, the form in which the sulphur is present, etc. With the increasing use of specifications for the purchase of coal, and the greater refinements which will come into them, the indications are that sulphur, its various forms and their effects on heating value and operation will receive more attention as time goes on.

Overcoming Difficulties With Aerial Cable

Problem of Supplying Service Where Conditions Do Not Permit the Use of Open-Wire or Underground Circuits Has Been Met by One Operating Company by Installing Aerial Cable

BY E. B. MEYER
Assistant to Chief Engineer, Public Service Electric Company of New Jersey

SINCE the European war began electric service companies have been confronted with numerous operating problems in connection with their transmission systems due to the rapid growth of commercial loads which has resulted from increased industrial activities. The pressure thus brought to bear against central stations has been considerable, since hardly any industrial plants had time to build their own generating stations because of the short time permitted by their foreign contracts to make deliveries. Furthermore, the rates and service offered by utility companies made it hardly worth while to consider building isolated plants.

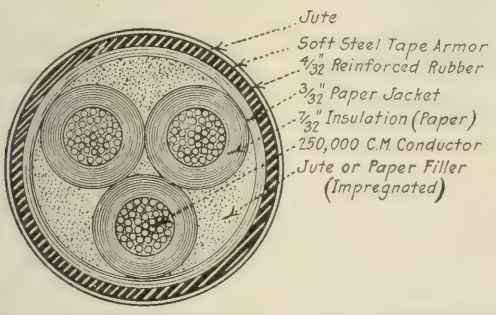


FIG. 1—MODIFIED FORM OF CABLE FOR 13,200-VOLT OVERHEAD SERVICE

This rapid and unexpected growth in business has made it necessary for central station companies to adopt special methods in the solution of their problems, particularly in cases where existing lines had been designed for low-voltage and small-capacity service. One of the special methods of solving these transmission problems has been by the use of aerial cable run on poles and supported by messenger wire, a form of construction similar to that used in telephone work.

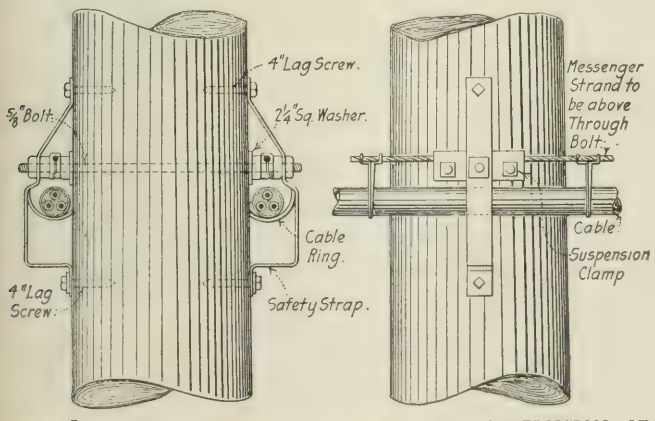


FIG. 2—DOUBLE-ENDED THROUGH-BOLT FOR SUSPENSION OF MESSENGER

Recently a large utility company found it necessary to connect two of its main generating stations with tie feeders. Most of the land between the two stations was soil of a marshy character, through which it would have been impossible to run a duct line without the use of foundation piling. The running of overhead wire was considered, but was found impracticable because the line, in several places would have to cross freight yards, trestles and bridges and the owners of these structures objected to open-wire high-tension lines. It was therefore concluded that the use of aerial cable would furnish the most satisfactory solution of the problem.

In this installation ordinary lead-covered cable of the same type as for underground work was run on a pole line with 50-ft. (15.24-m.) pole spacing. To protect the sheath from mechanical injury a covering was applied consisting of several layers of jute and marlin with an outer armor of soft-steel tape. This type of cable was found undesirable for aerial work, however, because of the excessive weight of the cable and the fact that standard pole-line construction could not be used. To overcome these objections a special cable was developed.



FIG. 3—AERIAL CABLE CROSSING UNDER RAILROAD BRIDGE AND ELECTRIC RAILWAY POWER CIRCUITS

In Fig. 1 is shown the modified form of cable for 13,200-volt operation, which is made up with 7/32-in. (5.55-mm.) paper-conductor insulation, a 3/32-in. (2.38-mm.) paper jacket and a 4/32-in. (3.18-mm.) reinforced-rubber covering over the paper jacket. The construction of the reinforced rubber is similar to that of the ordinary garden hose, several layers of cloth being vulcanized in the rubber. The entire cable is then covered with tape well saturated with rubber compound and a weatherproof braid which is thoroughly impregnated with a waterproofing compound. For mechanical protection the whole core is incased in an armor made of galvanized steel tape. This form of construction reduces the weight of the cable approximately 50 per cent and permits the use of lighter pole-line construction.

The principal advantage of aerial cable for tie-feeder installations is that it makes little difference how many working lines are carried on a single pole line. Additional cable may be run, existing construction changed, transferred or repaired without taking any line out of service except the one on which the actual work is being done. Lightning discharges seem to have little effect because the messenger wire which carries the aerial cable is permanently grounded.

A pole line carrying five 13,200-volt feeders is shown in Fig. 8. This line has been in operation for more than six years without the occurrence of a single failure. Class B chestnut poles, with a normal spacing of 90 ft. to 100 ft. (27.43 to 30.48 m.) are usually required for aerial cable installations. Where conditions make it necessary, sections as long as 150 ft. (45.72 m.) are permissible, but in such cases the adjacent sections should not exceed 130 ft. (39.62 m.). Sections longer than 150 ft. (45.72 m.) should receive special attention, and Class A poles should be used on long sections and at points of special strain.

The location and frequency of guys is largely dependent on local conditions and can in most cases be decided by a competent line superintendent. Attention is called, however, to the fact that the strain at dead ends and corners is very great, frequently being as much as 25,000 lb. (11,339.8 kg.). These points of special strain need to be well guyed. Both the anchors and the guys should be designed with a factor of safety so high that the messenger will fail before the pole will pull over. In all cases it will be necessary to reinforce the guy stubs by an anchor guy.

For the suspension of the messenger a double-ended ⅝-in. (15.88 mm.) through-bolt is recommended, as illustrated in Fig. 2. The use of a safety clamp is also desirable. This clamp serves the double purpose of reinforcing the through-bolt and preventing the cable from falling to the ground in case the rings fail. Careful tests made on this type of suspension show that it will withstand the maximum loads to which it will be subjected.

The clamp used is similar to that employed by the American Telephone & Telegraph Company, the size of clamp depending on the size of the messenger strand adopted. The clamp is designed expressly for construction of this character and is not built like guy clamps, which are designed to grip two strands instead of one. It affords a greater lever arm for the bolts to work upon in grasping the messenger and supports the messenger strand closer to the bolt, thereby decreasing the bending moment on the bolt due to the weight of the cable.

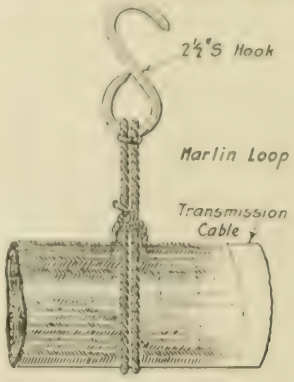


FIG. 5—METHOD OF SUPPORTING CABLE WHILE IT IS BEING INSTALLED

The messenger strand should always be placed above the bolt in order that the weight of the cable shall not be supported by the clamp. Various forms of cable rings may be used in supporting the cable on the messenger wire. Where two or more cables are to be installed on a pole line, they are usually suspended in pairs, two from each through-bolt, in order to save labor of installing. The messenger is extra-strength ⅝-in. (15.88 mm.) seven-strand galvanized wire. The wire composing the strand should be free from scales, inequalities, splints or other imperfections not consistent with the best workmanship. It is usual in purchasing galvanized-steel wire of this character to have it conform to a specification covering the galvanizing. This is necessary as otherwise inferior-grade wire might be supplied.

It is very important that the messenger wire be drawn as tight as possible, in order to prevent excessive sagging when subjected to the weight of the transmission cable. If this is not done an unsightly installation will result. After the messenger wire has been given its final pull and properly dead-ended, the placing of the aerial cable is the next step. In pulling the cable up to the messenger wire it is very important that due precautions be exercised in order that it may not be damaged in any way and not subjected to excessive strains which would tend to weaken or damage the insulation.

The first reel is set up in the usual manner and the cable "run off" to the first pole, at which is placed a sheave of approximately 12 in. (30.48 cm.) diameter,



FIG. 4—TWO AERIAL CABLES ENTERING A POWER SUBSTATION

FIG. 6—CATENARY METHOD OF SUPPORTING CABLE

the top of the sheave being about 5 in. (12.7 cm.) below the messenger wire. On the four or five succeeding poles similar sheaves or cable rollers are placed. In feeding out the cable 2½-in. (63.5 mm.) S hooks, spaced 18 in. (45.7 cm.) apart, are fastened to it with small pieces of marlin tied in loop knots, as illustrated in Fig. 5. A lineman is stationed at each pole to change

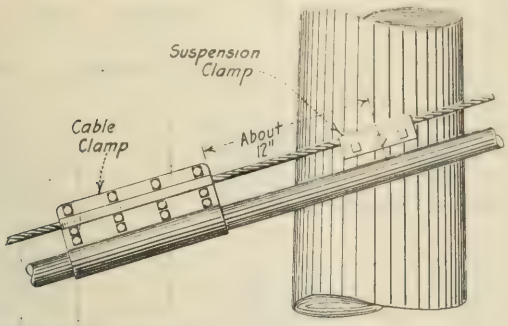


FIG. 7—CLAMP USED WHERE ANGLE BETWEEN CABLE AND THE HORIZONTAL IS MORE THAN 30 DEG.

the S hooks from one side of the pole to the other while the cable is being drawn into place. After the entire length of cable has been installed the S hooks, which were used only as temporary supports, are removed and permanent rings put in place. This operation is performed by a lineman supported on a boatswain's chair, which is moved along the section supported by the messenger wire. In pulling the transmission cable into place either a motor truck, horses, hand or power winch may be used.

No special means are employed in splicing the paper-insulated reinforced-rubber cable, but the usual precautions observed in the installation of underground cable must be taken into consideration. The jointing of any cable is more or less a matter of personal experience and great care must be exercised in all cases to exclude moisture. The work should be done carefully by a reliable and experienced workman and no splicing should be undertaken when weather conditions are unfavorable. Each conductor of the cable is insulated with black bias-cut varnished-cambric tape to a thickness about 30 per cent greater than the machine-applied insulation. Between each layer of tape is applied varnished-cambric insulating compound. After the individual conductors have been insulated a jacket of bias-cut black cambric tape, well painted between layers with an insulating compound, is applied to a thickness of 4/32 in. (3.18 mm.). Over the jacket of cambric tape several layers of the best-grade rubber tape to make a covering 5/32 in. (3.97 mm.) in thickness are applied. In applying the tape it is painted between layers with a good-quality rubber compound. After the joint has thus been made, it is entirely covered with three or four layers of friction tape well painted with rubber compound. The joint is then ready for the application of a soft-steel galvanized tape over which there are finally applied three or four layers of friction tape painted between the layers with a good quality of waterproof compound. To keep the cable in good condition it is necessary to paint it every four or five years with some form of insulating paint. This serves to keep the outside jacket from disintegrating and protects it from the action of the elements.

APPROXIMATE WEIGHTS AND DIAMETERS OF THREE-CONDUCTOR, 13,200-VOLT AERIAL CABLES

Size (B. & S gage or circ. mils)	Weight per Foot (Pounds)	Weight per Meter (Kg.)	Outside Diameter (Inches)	(Cm.)
No. 4	3.50	5.20	2.25	5.72
No. 2	4.05	6.02	2.41	6.14
No. 1	4.45	6.62	2.50	6.35
1/0	4.80	7.13	2.57	6.53
2/0	5.70	8.47	2.66	6.75
4/0	6.70	9.96	2.91	7.40
250,000 circ. mil	7.05	10.45	3.00	7.61
350,000 circ. mil	8.50	12.60	3.22	8.18

In the accompanying table are given the approximate weights and outside diameters of three-conductor cables, insulated for 13,200-volt operation.

Where it is necessary to make connection between an aerial cable and an underground system a standard form of lead-covered cable is used and installed in a lateral pipe. The joint between the underground and aerial cable is made up in the manner just described, and over it is slipped a lead sleeve one end of which is wiped to the lead-covered cable and the other end is well taped to prevent moisture from penetrating the cable.

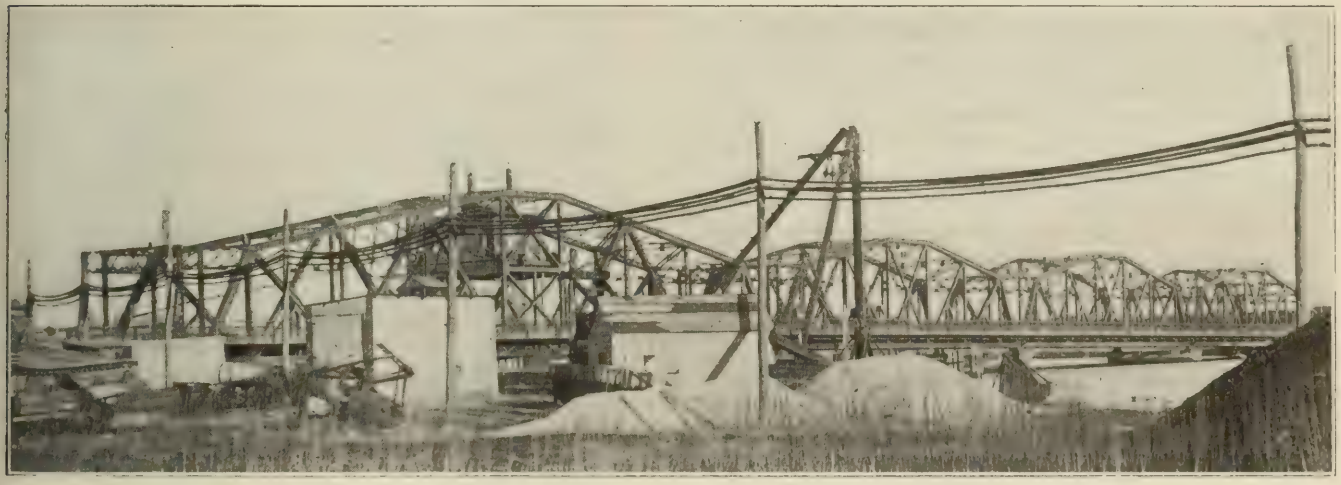


FIG. 8—INSTALLATION OF FIVE AERIAL CABLES WHICH HAVE BEEN IN SERVICE SIX YEARS WITHOUT A SINGLE FAILURE

Two aerial cables entering a power substation are shown in Fig. 4. In this installation iron pipe laterals are run up the pole and underground lead-covered cable is spliced to the aerial cable as just described.

It is customary in aerial installations to ground the messenger strand. Where the soil is dry or soil conditions unfavorable for grounding a ground connection

should be installed at every second pole. Where the earth is damp and soil conditions are favorable a ground should be installed at every fourth pole. In marshy ground and in places where conditions are particularly favorable a ground at every eighth pole will be sufficient. Where possible this ground connection should be well bonded to some metallic sub-surface structure. If this is not possible the standard artificial pipe ground should be installed.

It is also desirable that the steel tape on the cable be bonded to the messenger strand with bonding wire at every cable joint, as proper bonding is necessary in order to furnish the required protection against lightning. Where cable is run through trees and likely to be damaged it should be protected from abrasion by several layers of galvanized tape similar to that used in protecting the joint.

On steep grades where the angle between the cable and the horizontal is greater than 30 deg. the use of a clamp like that shown in Fig. 7 is recommended for securing the cable to the messenger. Clamps of this type can be made up as required and should be used on every fourth pole. The clamp is designed to take the greater portion of the down-hill pull on the cable, which otherwise would be carried by the cable rings.

Advantages of Catenary Method

A catenary method of installing aerial cable is illustrated in Fig. 6. The line represented was built to furnish 3000 kw. to a customer who required service within a few weeks after signing the contract. Within this short length of time it was impossible to obtain the standard aerial cable with reinforced-rubber insulation, so ordinary lead-covered cable was taken out of stock and used instead. Too great a strain would have been produced in the messenger wire and lead cable if the latter had been installed in the same manner as aerial cable usually is on account of the weight and long pole spacing. Consequently it was decided to use the catenary form of construction. As a result the strain is reduced and the transmission cable hangs perfectly level and without sag.

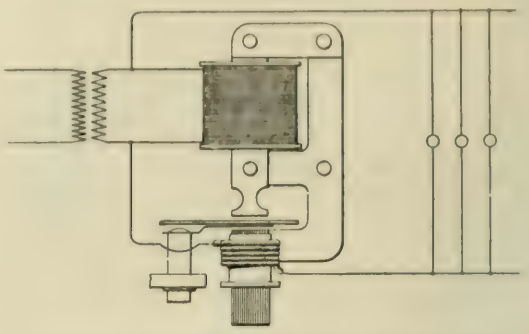
In Fig. 8 is shown an aerial cable crossing under a railroad bridge and electric railway power circuits. Open-air potheads or line terminals are employed to connect the cable and the open-wire transmission conductors. No protection in the form of lightning arresters is provided, as after a number of years of operation without failure from any source the cost of the installation of arresters seemed to be quite unwarranted.

Besides meeting the requirements imposed when a circuit has to be installed quickly, aerial cable also furnishes an ideal form of construction where line extensions have to be made over marshy ground which would require the use of foundation piling for a conduit line, over private property, such as railroad freight yards, trestles or bridges, where very special overhead construction would be necessary, or on important streets where open wires are not permitted and where subway construction would be expensive or impossible. While the installations described are operated at pressures under 15,000 volts such excellent results have been obtained with aerial cable that one large central station company has adopted this type of construction on all special work for operation at 26,400 volts.

FINDING TRANSFORMER LOSSES

Device for Measuring Total Energy Delivered to Transformer from Delivery Side

An exceedingly simple device for measuring the total energy delivered to a distributing transformer from its low-tension secondary side is the subject of patent No. 1,218,538, issued to Evan Evans and assigned to the General Electric Company. A magnetic yoke is provided with potential and series exciting coils tending to send flux across an air gap in which is placed the edge of a rotatable aluminum disk operating the recording wattmeter. By providing a metal vane of copper the magnetic flux of the yoke can be shielded so that the disk will rotate by virtue of the split-phase alternating field set up about the disk. Then, by adjusting the vane so that the disk records the no-load watt losses of the transformer when there is no current through the series coil, the meter can be made to register the aggregate load on the transformer from the delivery or low-tension side of the machine.

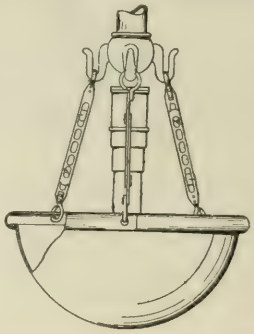


CIRCUITS THROUGH MEASURING INSTRUMENT

ADJUSTABLE ELECTROLIER

Extensible Two-Unit Supports Permit Adapting the Fixture to Any Size of Lamp

An adjustable electrolier for semi-indirect lighting is the subject of patent No. 1,204,044, granted to H. D. McFaddin of East Orange, N. J. Heretofore the supporting rods or spacing members have usually been rigid and of a definite length. With this construction there has been an obvious disadvantage in fitting a globe or shade to a fixture. Extensible rods are employed in the adjustable electrolier in the form of two units, one unit of each rod being attached to the shade-engaging member and the other unit to the lamp-supporting member. The units are adapted to overlap one another, and each unit is provided at its free ends with a hook-shaped tongue to engage with one of several apertures or slots in the other unit. No tools are required in adjusting the connection. Furthermore, if a fixture is installed for a lamp of a given size and it is subsequently desired to use a different form of lamp the change can be permitted by a simple adjustment of the shade-supporting members.



LIGHTING FIXTURE WITH ADJUSTABLE SUPPORTS

Plant to Serve 546-Mile Transmission Line

Methods of Solving Problems Involved in Building a Hydroelectric Plant in Mountains on a Site Fifty Miles from a Railroad

BUILDING a 63-mile (101.4-km.) transmission line from El Centro, Cal., to Yuma, Ariz., increases the total distance from generating plant to furthermost consumer on the interconnected lines known as the Southern Sierras system to 546 miles. The northernmost generating plant in this chain is in a latitude north of San Francisco, while the consumers furthest south are "somewhere in Mexico," as the system supplies energy wholesale to a Mexican company at the border line. Energy is also delivered to subsidiary corporations serving territory in Nevada. Altogether there are 1192 miles (1919 km.) of 55,000-volt lines on the one system.

In order to supply the present and prospective needs of the territory thus served, the Pacific Power Corporation, which is associated with the Nevada-California Power Company and the Southern Sierras Power Company, recently undertook the development of additional power on Rush Creek. The first unit of this plant, which is now in operation, utilizes water stored in Gem and Agnew Lakes and feeds the main transmission line about 30 miles (96.5 km.) north of Bishop, Cal. At present the new plant is supplying 5000 kw., and its capacity will be doubled in the near future by a duplicate unit.

Still another 10,000-kw. plant is projected for a site



FIG. 1—POSITION OF STORAGE PONDS AND COURSE OF PIPE LINE INDICATED IN WHITE

20 miles (32.2 km.) further north on Leevining Creek, where a total of about 1700 ft. (518 meters) of head will be available, utilizing storage developed on Rhinedollar, Tioga and Saddlebags Lakes.

Transportation difficulties constituted one of the chief problems on the Rush Creek development from the very outset. The first task was the building of a wagon road for practically the entire 56 miles (90.1 km.) from the nearest railroad to the power house. This work cost about $40,000. With the completion of the road six caterpillar tractors were put in service. Each tractor drew a three-wagon train, the total capacity of the three trailers being 29 tons (26.3 metric tons). Under normal running conditions these trains made the round trip between railroad and power house in seven days. Altogether about 5000 tons (4540 metric tons) of freight were hauled over this road in 1915 and 1916.

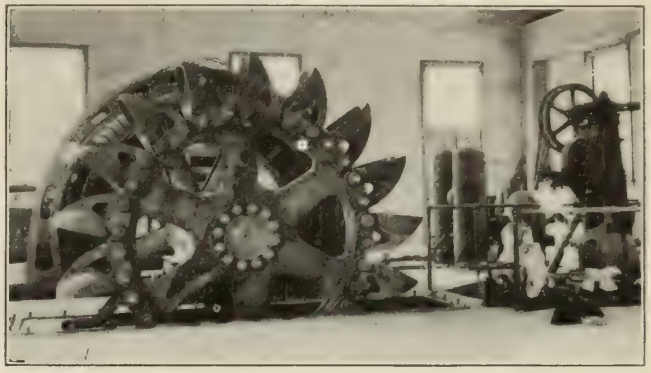


FIG. 2—IMPULSE WATERWHEEL DESIGNED TO OPERATE UNDER TWO DIFFERENT HEADS

After delivery at the power house materials to be used at the upper dam had to be drawn up an incline, shipped across a lake on barges, and then reloaded for conveyance on a second incline. This made cement cost $7.60 per barrel delivered, and the contract price for concrete in place, exclusive of excavation, was $22 per cubic yard ($34.70 per cubic meter).

The upper dam is at an elevation of 1800 ft. (548 meters) above the power house. In building the incline to deliver freight to the dam it was found that, owing to the irregularity of the slope, about 40 per cent of the line would have to be supported on trestle. The trestle bents were built up of logs cut near the site, and rails were laid on stringers made of heavy rough-hewn logs.

The maximum grade on this incline is 67 per cent, and it was necessary to use curves of sharp curvature, the minimum radius being about 75 ft. (22.8 meters). The incline is divided into two sections. The first 4800 ft. (1461 meters) length is operated by a 100-hp. electric hoist near the Agnew dam site. From there cars can be lowered for 500 ft. (152.3 meters) to Agnew Lake. After a half-mile trip across the lake the journey to the upper dam is finished on another incline, 2200 ft. (670 meters) long, also operated by an electric hoist installed at the top.

A feature of the incline which required special study is a 32-deg. curve which it was necessary to install where the intersection of a 60 per cent and a 37 per cent grade left the angle point considerably below relative grade. Special provision was required at this point in order that the hauling cable should maintain its position. A

3½-ft. (1.066-meter) sheave was for this reason mounted on an inclined axle 3 ft. (91.4 cm.) from the inner rail of the curve. While the car is below this point, the cable runs round this sheave, having been automatically seated upon it by converging guides shod with iron.

Two dams have been constructed, one at Gem Lake and one at Agnew Lake. Both dams are of the multiple-arch type, designed by Lars Jorgensen of San Francisco, who also supervised their construction. Gem Lake Dam, impounding 16,000 acre-feet (19.7×10^6 cu. meters), has a drainage area of 22½ square miles (58.3 sq. km.) and is 675 ft. (206 meters) long. The maximum height of the dam is 84 ft. (25.6 meters), exclusive of a 28-ft. (8.5-meter) depth to which it was found necessary by the builders to carry foundations at one point.

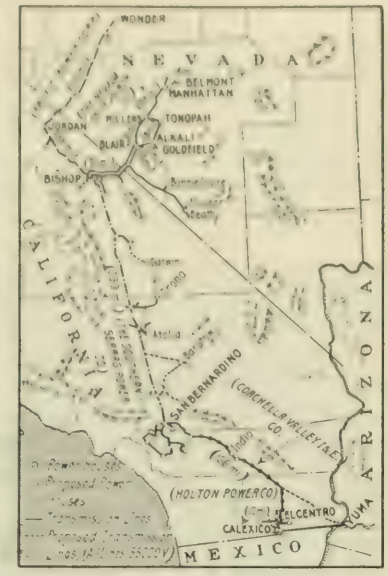


FIG. 3—TERRITORY COVERED BY SOUTHERN SIERRAS SYSTEM

The dam at Agnew Lake will be of practically the same design as the Gem Lake structure, but will be shorter and have a maximum height of 30 ft. (9.2 meters). It is about 550 ft. (167.5 meters) lower in elevation than the upper dam and has a storage capacity of 900 acre-ft. (1.1×10^6 cu. meters). An area of about 1⅝ square miles (4.21 sq. km.) will drain into this lake, and any surplus from Gem Lake is directly tributary, thus utilizing it as an auxiliary for Gem Lake storage.

When the installation is completed there will be two 5000-kw. waterwheel generators. One unit is now installed. It is designed for efficient operation when working under either the 1250-ft. (381-meter) head available from Agnew Dam or the higher head from Gem. The other unit will be designed for operation under the 1800-ft. (548-meter) head. Each unit will be supplied from a separate pipe line running to a Y-piece 500 ft. (152 meters) below Agnew. Through this Y they are connected to a 48-in. (122-cm.) steel pressure pipe line from Gem Lake. One line is also connected with the Agnew outlet by a 30-in. (76.3-cm.) line fitted with valves so that water can be drawn from either source for the variable head machine. The duplicate lines are 30 in. (76.3 cm.) in diameter at the top and 28 in. (71.1 cm.) in diameter at the power house, the thickness varying from ¼ in. (6.35 mm.) to 15/16 in. (23.81 mm.). These pipes, which are of lap-welded steel, were made in 20-ft. (6.1-meter) lengths. The first line has been installed and is now in service. After delivery at the power house the pipe sections were lashed to the incline car and on arriving at the proper level were swung over into position on the pipe line while supported from an anchorage above. The pipe line has a maximum grade of about 60 per cent.

To carry the thrust in the pipe line concrete abutments were built at frequent intervals, usually at changes of grade. At these points clamps encircle the pipe just below a joint, and these clamps in turn bear against vertical iron rails embedded in the concrete abutment. After the pipe has been put in place the concrete abutment is built around the pipe, care being taken to keep the joint free for calking.

Standard Equipment Installed

Because of the remote location of the plant and the cost of special attention in emergencies simplicity of operation was a primary consideration. Consequently standard electrical equipment was used wherever possible. The power house proper, which has already been completed, now contains one unit. The second unit is to be put in while the second pipe line is being built. The first unit consists of a Pelton-Doble impulse wheel driven by a 7¼-in. jet from a needle-regulated nozzle actuated by an oil-pressure governor. The generator already installed is a three-phase, 60-cycle, 2300-volt machine of standard General Electric pattern. Two 60-kw., 125-volt exciters are installed, one being provided with motor drive on one end of the shaft and with an impulse wheel on the other end. The other unit is water-driven only. The switchboard, voltage regulator and 87,000-volt aluminum lightning arrester are also of standard pattern. The three 3000-kva. transformers are of the water-cooled type and are placed outdoors.

The dams have been constructed under a contract with

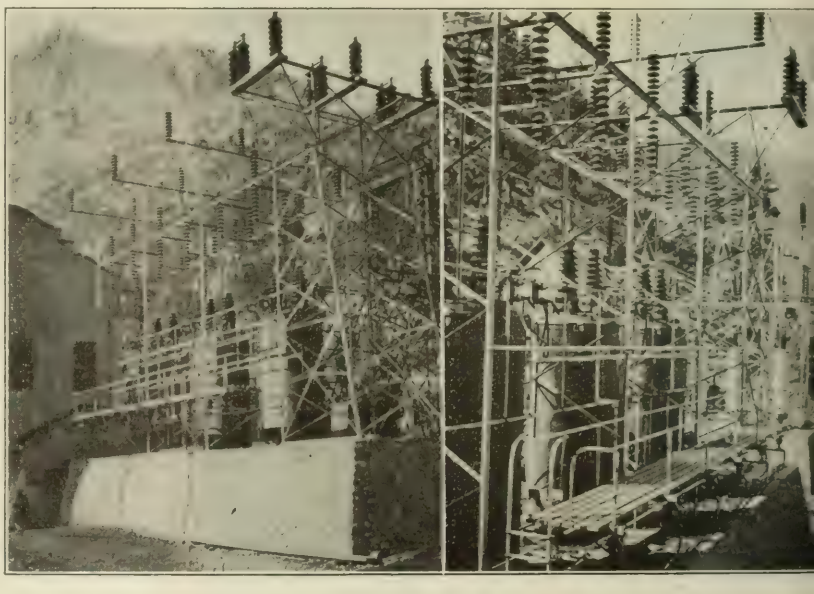


FIG. 4—OUTDOOR WATER-COOLED TRANSFORMER INSTALLATION

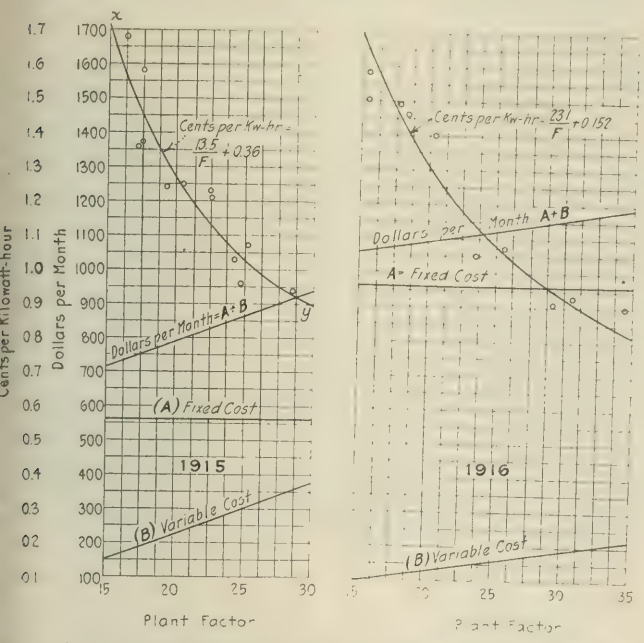
the Duncanson-Harrelson Company of San Francisco. Contracts for the pipe lines were awarded to the M. W. Kellogg Pipe Company of New Jersey and the Llewellyn Iron Works of Los Angeles respectively. C. O. Pool has been in charge of the design and construction throughout the entire development as chief engineer of the Pacific Power Corporation.

ANALYSIS OF OPERATING COSTS

How Total Operating Expenses May Be Separated Into Fixed and Variable Expenses by Graphical Analysis

BY ARTHUR JOBSON
Casper, Wyo.

For a given power plant operating under normal conditions the unit cost of generating electrical energy varies inversely as the kilowatt-hour output. When the total monthly or yearly operating expense is assumed to vary directly as the output, and uniformly there-



FIGS. 1 AND 2—COST OF ENERGY DELIVERED TO THE SWITCHBOARD AT DIFFERENT PLANT FACTORS

with, the expression for the unit cost may be represented by

$$U = a/F + b \qquad (1)$$

in which U is the cost in cents per kilowatt-hour, F the plant factor in per cent (*i.e.*, the ratio of the mean load for any period of time to the aggregate generator rating multiplied by 100), and a and b constants.

If R = aggregate generator rating in kilowatts, h = number of hours operated, and C = operating expense in dollars during the period of h hours, then, substituting in equation (1), $C = [(a/F + b) \times h \times F/100 \times R] \div 100$, or

$$C = hR(a + bF)/10^4 \qquad (2)$$

In this expression $hRa/10^4$ represents the fixed operating expense in dollars for the period considered, and $hRbF/10^4$ represents that part of the operating expense varying with the station output.

From these relations it may be seen that if the actual unit production costs are available and the unit costs are made to conform with equation (1), the total operating expense may be separated into two components, one component being the fixed operating cost and the other that part of the operating cost varying directly with the kilowatt-hour output. The relative proportions of these costs will be characteristic of the particular type of plant and the conditions under which it may have been operating during the period covered by the analysis. This method of analysis is not only applicable to the total operating expense, but any part of such expense, as, for instance, the determination of the relative proportions of the fixed and variable expense required for fuel used in operation.

APPLYING THE METHOD

Applications of this graphical method of analysis to actual data obtained from the operation of a small electric plant are represented in Figs. 1, 2 and 3. The small circles platted in Figs. 1 and 2 indicate average monthly switchboard production costs in cents per kilowatt-hour for the year 1915 and the first ten months of 1916 respectively. Fig. 3 applies similarly to the cost of fuel in the operation of the same plant. The unit cost curve xy in Fig. 1 was determined in the following manner:

The twelve months of the year were divided into two groups, one group consisting of the six months having the lowest unit production costs, and the other group including the six months of highest similar costs. For each group the number of hours, kilowatt-hours generated and operating expense in dollars were totalized. From these the average unit cost and corresponding plant capacity factor in per cent were obtained for each group. These values determined the location of two points on the mean unit cost curve xy, and thus permitted calculation of the constants a and b in equation (1), after which the curve was plotted as shown. The corresponding curves in Figs. 2 and 3 were determined in a similar manner. Equation (2) was then used to determine the average monthly variation in operating expense for corresponding plant factors within the range of the station output in kilowatt-hours. These expenses are represented in the chart by means of straight lines.

Space does not permit a very thorough discussion of these curves. They indicate a relatively larger component of fixed operating expense than would be expected, even for the cost of fuel. It may be pointed out that the total expense in dollars does not include such fixed

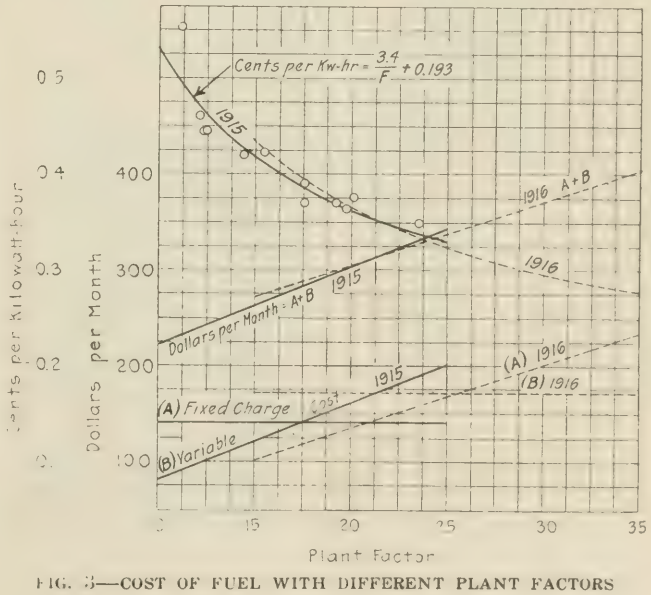


FIG. 3—COST OF FUEL WITH DIFFERENT PLANT FACTORS

charges as interest on the investment, depreciation, insurance, etc. The excessive fixed operating expense during the first ten months of the year 1916 may be attributed partly to the higher wages paid both for operation and maintenance and in part to a larger expenditure than is necessary under ordinary conditions for replacements.

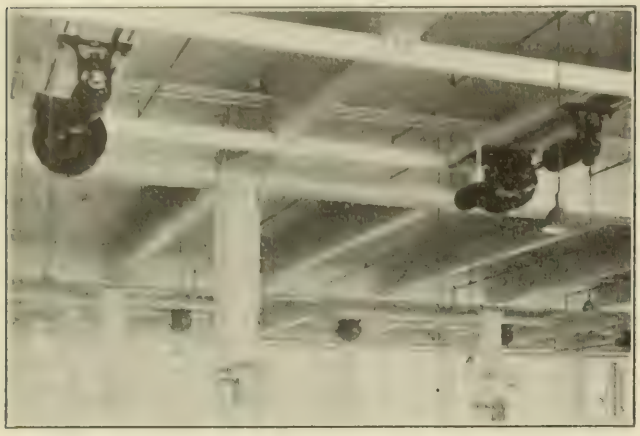
STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

MOUNTING SWITCHES ON POSTS

Bolts Set in Columns Before Concrete Was Poured Prevent Possibility of Switch Rocking

Rugged mountings for motor switches on concrete columns were secured by the method shown in the accompanying illustration in the Naumkeag Steam Cotton Company's mill at Salem, Mass. When the columns



HOW SWITCHES ARE MOUNTED ON CONCRETE POSTS

were poured two 6-in. (15.2 cm.) by ½-in. (12.7 mm.) iron bolts were set horizontally in the columns, one above the other, 3 in. (7.6 cm.) apart, with their heads in the columns and the threaded portion protruding 1 in. (2.54 cm.) beyond the face of the column. By means of these bolts 5-in. (12.7 cm.) by ½-in. (12.7 mm.) wrought-iron plates, to which the oil switches for the motors were bolted, were secured on the columns. The iron plates were made long enough to furnish a proper seat for the switch and then were bent in radially until they touched the column. This construction helps the column bolts in holding the plate firmly and prevents any possibility of the switch rocking when it is operated. This method of mounting is much preferable to using bands around the columns or to a mounting arrangement on expansion bolts. The electrical equipment was installed by Lockwood, Greene & Company, Boston.

Saving Copper Tie Wires

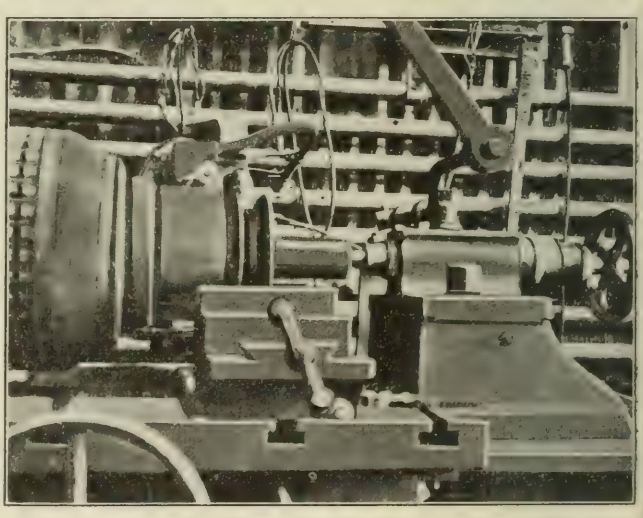
The Lincoln (Neb.) Telephone & Telegraph Company recently estimated how much is wasted on line construction in throwing away copper tie wires. On a thirty-wire pole line are thirty tie wires each 19 in. (48.36 cm.) long, equaling 47.5 ft. (14.5 m.) per pole. Since there are about thirty-four poles per mile, the corresponding aggregate length of the wires would be 1615 ft. (491.2 m.). Since 32 ft. (9.75 m.) of No. 12 N.B.S. gage copper wire weighs 1 lb. (0.45 kg.), 1615 ft. (491.2 m.) or 50 lb. (22.7 kg.) at 31 cents per pound (69 cents per kg.) (junk value) would cost $15.50 per mile of line ($9.63 per km.). The company now sends a man out to follow wiring gangs and pick up the scrap pieces of wire. While fewer tie wires are used per mile of transmission line this example should serve to show how important it is to save scrap wire.

SLOTTING COMMUTATORS RAPIDLY

Motor with Milling Cutter on End of Shaft Mounted on Sliding Frame at the Back of the Lathe

A lathe attachment has been developed in the shops of the Knoxville (Tenn.) Railway & Light Company with which it is possible to turn and slot an average-size motor commutator in about fifteen minutes. It consists of a motor-driven milling cutter mounted over the center line of the lathe in such a manner that the cutter may be used to slot the commutator of a motor held in the lathe. The motor is mounted on a sliding frame which is attached to the lathe carriage at the back of the lathe. The lever shown is also mounted on the carriage, and is so connected to the motor that by moving it the motor is slid 5 in. or 6 in. (12.7 cm. or 15.24 cm.) up or down the lathe.

The cutting wheel which is mounted on the shaft of the motor is brought in line with the center of the lathe by means of the hand wheel on the carriage. It is lowered so as to cut the proper depth by a screw under the motor. The carriage is shifted up or down to get the stroke of the cutting wheel to end at the proper point on



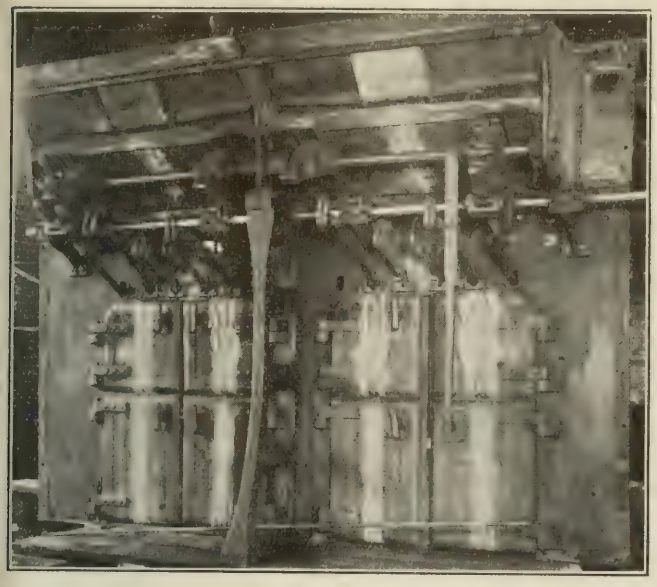
MILLING CUTTER DRIVEN BY MOTOR AT REAR OF LATHE

the commutator. One movement of the lever cuts the entire length of the commutator bar. The lever is returned and the next mica is brought in line with the cutting wheel. For removing copper dust, air is blown through the pipe shown just on the right of the cutting wheel. The armature is turned and slotted and also banded without removing from the chuck.

REDUCING CONSTRUCTION AND MAINTENANCE COST

How an Acetylene Gas Burner Was Used by an Indianapolis Company to Remodel a Stoker and Reduce Expense of Steam Mains

When the Merchants' Heat & Light Company of Indianapolis, Ind., recently needed a 7-ft. 6-in. (2.29 m.) stoker for one of its stations it effected a considerable saving by cutting down and using an 11-ft. (3.35 m.)



FRONT OF 7.5-FT. STOKER MADE FROM 11-FT. STOKER

Westinghouse-Roney stoker that happened to be on hand. The cutting-down process was accomplished by taking two 21-in. (53.3-cm.) sections out of the 11-ft. (3.35-m.) unit. It was necessary to remove the excess width in two sections rather than one, so that the doors and bearing bars would remain symmetrically placed.

The labor and materials required in cutting, welding and reassembling the stoker cost $134.50. The cost of the 7-ft. 6-in. (2.29-m.) unit, installed, including a new grate and dump bars, changes in the ash pit, and relining of the boiler setting, was $750. The purchase price of a similar type of stoker new would have been $2,250, excluding cost of installation. The work was supervised by M. L. Addington, the company's superintendent of power plants.

The application of gas welding has also permitted the company to effect a saving in laying a 2660-ft. (81.1-m.) steam-heating main extension. For this line, which will consist of 12-in. (30.5-cm.), 10-in. (25.4-cm.), and 8-in. (20.3-cm.) pipe laid in wood-log insulation, the pipe has been purchased in 40-ft. (12.2-m.) lengths; that is, pieces twice the usual length. Use of such long sections was practicable since less turning and handling of the pipe is necessary with welded-joint construction than with other types. The ends of these pipes are beveled. To make a butt weld between two 12-in. (30.5-cm.) pipes with square ends requires about one hour. A weld between two beveled pipes of the same size can be made in about one-half hour, effecting a saving both in labor and in gas. The extra time consumed in welding square-end pipes is taken in beveling the abutting edges to form a V-shaped groove, so that the weld will extend entirely through the pipe. This welded steam-line construction, it is said, will effect a reduction in cost and give a better line, since there will be fewer joints and less likelihood of leaks. The contract for this extension, which will amount to $20,000, was awarded to the American District Steam Company, Chicago.

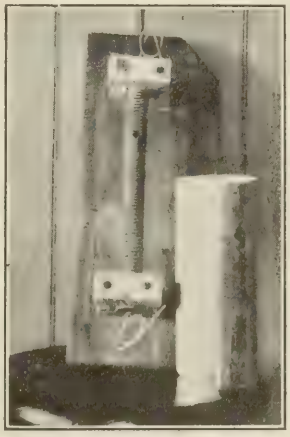
In repairing steam-heating mains, the company has adopted the practice of cutting a 3-ft. to 5-ft. (91.4-cm. to 152.4-cm.) section out of the defective main and welding in a new piece with acetylene gas. Taking into consideration the lesser excavation and material costs, this method is less than one-half as expensive as replacing an entire length of pipe.

Gas is also used in welding service nipples to both steam and hot-water mains. According to the operating company, it is cheaper to weld a nipple to a pipe line and cut a hole in it with acetylene than to cut the main and insert a T. In hot-water systems the welded nipple makes a better job than a nipple inserted in a drilled and tapped hole, since the inner end of the latter obstructs the flow.

ELECTRIC HEATER TO KEEP PIPES FROM FREEZING

Exposed Cooling-Water Pipe Leading to Transformers Is Protected in Winter by the Use of Home-Made Heaters

At one of the hydroelectric plants of the Cumberland County Power & Light Company of Portland, Me., cooling water for the main transformers is piped from the wheel casings in the generating station across the tailrace to a transformer house. The piping is housed in a wooden casing covered with tarred felt, but the outdoor location exposes it to severe weather. To prevent freezing, 32-cp. carbon lamps were installed with the duct about 2 ft. apart, with their axes placed horizontally. When surges occurred on the transmission lines of the system, however, trouble was experienced from burning out of lamps. To secure more reliable service, L. G. Scott, head of the underground-distribution department, designed a simple but effective heating unit of No. 13 gage iron wire, shown herewith.



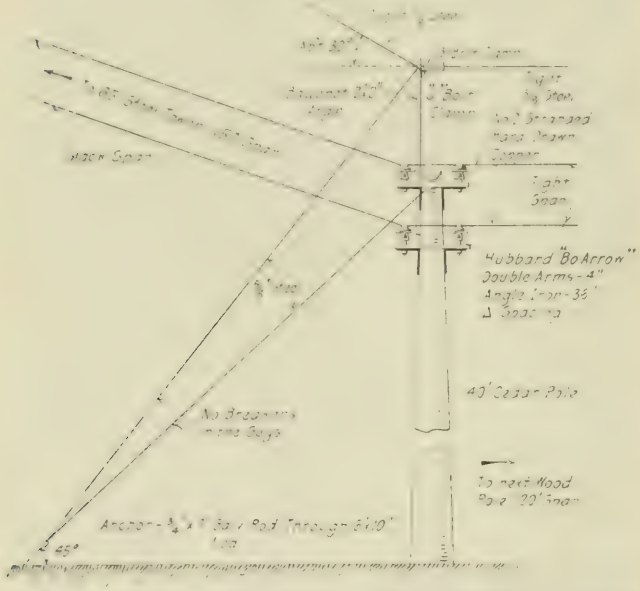
ELECTRIC HEATER FOR PIPE

Each unit was made by winding a wire closely on a ½-in. (12.7-mm.) pipe. The turns were then slightly spread apart and the ends of the helix, which is about 15 in. (38.1 cm.) long, are held in No. 3 B. & D. porcelain cleats. The units are installed 2 ft. to 3 ft. (61 cm. to 91 cm.) apart, each being provided with a semi-cylindrical galvanized-iron reflector which serves to reduce the radiation and by maintaining a higher coil temperature cut down the energy consumption. Twenty-four units are run in series from a 110-volt or 220-volt supply, according to the severity of the weather. At 220 volts the series of resistors draws 20 amp. The diameter of the circulating-water pipe is 2½ in. (6.35 cm.), and the wooden duct is about 12 in. (30.5 cm.) square in cross-section.

CONSTRUCTION FEATURES OF A POLE AND TOWER LINE

How a Cleveland Company Combined to Advantage Cedar Poles and Steel Towers in Building on Railroad Right-of-Way

In building a three-phase, 22,000-volt transmission line between Cleveland and Bedford, Ohio, the Cleveland (Ohio) Electric Illuminating Company has used to advantage a combination of cedar poles and steel towers. For the general run of the line, which is on a railroad right-of-way, 40-ft. (12.2-m.) poles gave sufficient height. At several places, however, cross leads, overhead bridges, etc., required that the line wires have 50-ft. (15.2-m.) clearance above ground. For these high crossings the company used in the line two or more steel towers averaging 65 ft. (19.8-m.) above the foundations. There has been produced, therefore, a line consisting of several stretches of wood poles with intermediate stretches of steel towers. The spacings average 120 ft. (36.6-m.) between poles and 330 ft. (100.6-m.) between towers. The line wire is No. 2 stranded, hard-



CONSTRUCTION USED AT A WOODEN POLE AT THE END OF ONE OF THE SECTIONS OF THE LINE

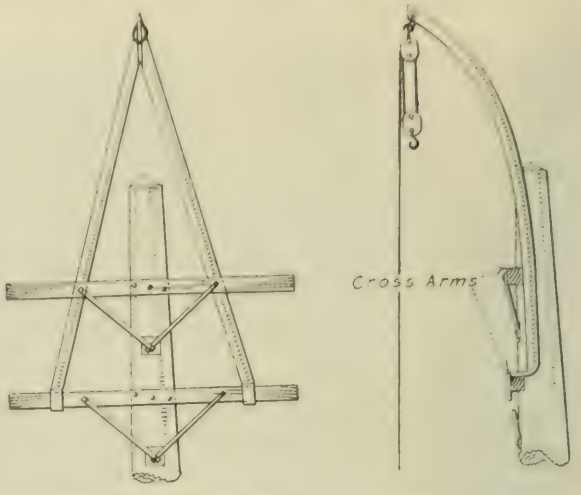
drawn copper, and the ground wire ⅝-in. (15.9-mm.) Siemens-Martin galvanized strand.

Where the line changes from poles to towers or the reverse, the wires make an angle of as much as 30 deg. with the horizontal, on account of the difference in height. To form a rigid construction the company's engineers considered the tower sections of the line and the wood-pole sections as independent units, double-arming the end poles and end towers of each section and connecting between them with a comparatively slack span. For this purpose the end poles were head-guyed to an anchor and a head guy was also brought down from the ground-wire bayonet to the same anchor, which served also as an additional grounding point for the ground wire, as no breakers were used in any guys. This method allowed the line to be built in independent sections, as the towers were placed after the wire was strung on the pole sections, and time was an important factor. Also it eliminates most of the down-strain on towers, due to wire tension, and the up-strain on pole insulators and ground-wire bayonets. With this construction the wires will not pull off insulators.

CRANE TO RAISE TRANSFORMERS

Pole-Top Crane Made of Pipe That Is Designed to Lift 25-Kw. Units

In the accompanying illustration is shown a method by which the Kingsport (Tenn.) Light & Power Company raises its transformers on poles. A 2-in. pipe bent as shown has been used effectively in raising trans-



METHOD OF RAISING TRANSFORMERS ON POLES

formers as large as 25 kw. The diagram shows clearly the shape of the device, and the method of mounting on cross-arms in such a manner as to hold the crane steady while it is in use.

CONVENIENT RACK FOR PIPE

Made of Scrapped Boiler and Condenser Tubes at a Relatively Small Expense

The pipe rack shown in the accompanying illustration, built by James A. Shepard of the Deming (N. M.) Ice & Electric Company, has been found a convenient way to store all plant piping in its various sizes and lengths. The rack is constructed of scrapped boiler tubes and split tubes from an ammonia condenser. The construction is evident from the illustration. The hori-



STRUCTURE DESIGNED BY NEW MEXICO COMPANY FOR HOUSING POWER PLANT PIPING

zontal tubes are simply flattened at the ends and bolted to the uprights, making a structure 9 ft. by 24 ft. (2.74 m. by 7.32 m.). This rack is just at the rear of the plant and was built by the plant repair men in spare time. The total cost for labor was between $15 and $18. The cost for material was $2 for the galvanized iron roof and $3 for bolts.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

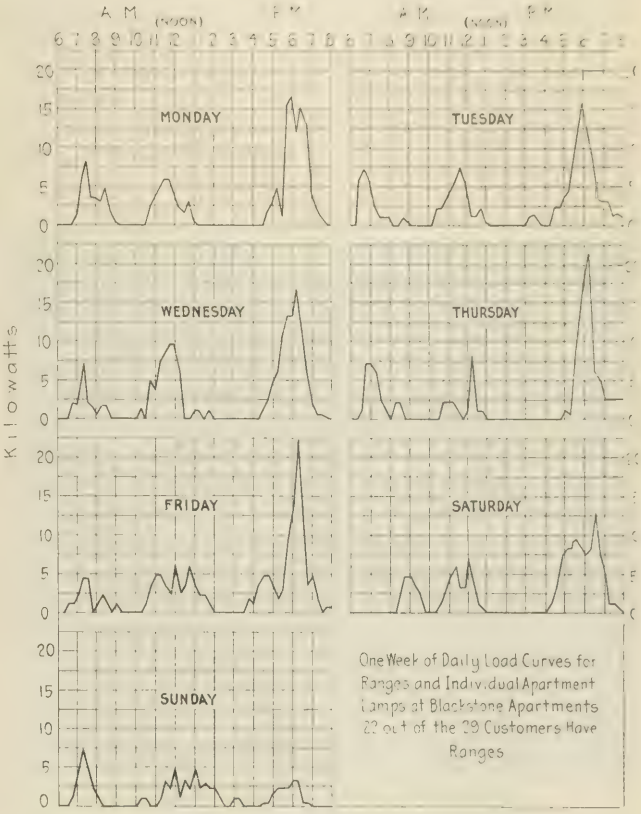
THE CHARACTERISTICS OF APARTMENT RANGE LOAD

Contrary to Conditions Existing in the Average Home, Peak Load Comes on Between 5 and 6.30 P. M.

Speculation regarding the effect of a large electric range load on the central station load curve still exists. There is a definite feeling that the maximum range demand will be a large percentage of the range-connected load and that the peak may come during the station peak. From the standpoint of rates for electric cooking this is, of course, a very important factor.

The conditions that may well be expected from apartment house range loads were touched on by R. B. Snyder, sales manager of the Milwaukee Electric Railway & Light Company, in a paper recently delivered before the Wisconsin Electrical Association. Mr. Snyder showed that while the individual maximum demand of single ranges may average between 40 per cent and 60 per cent of the connected load, the maximum demand for a group of twenty-five ranges will not exceed 15 per cent of the connected load. He stated that when the electric range comes into general use among all classes of customers, if the experience with gas cooking in the average city may be drawn upon, the peak load for cooking will occur between 11.30 a. m. and 1 p. m.

Range installations in apartment buildings, it was



One Week of Daily Load Curves for Ranges and Individual Apartment Lamps at Blackstone Apartments 22 out of the 29 Customers Have Ranges

TEST ON RANGES AND LIGHTS AT BLACKSTONE APARTMENTS, MILWAUKEE. TWENTY-TWO OUT OF TWENTY-NINE CUSTOMERS WITH RANGES

Apartment No.	Number Active Rooms	Connected Load, Watts	February—Daily Kilowatt-Hours Consumption										Total Kw.-hr. per Customer	No. of People	January 1917 Kw.-hr.
			7 Wed.	8 Thursday	9 Friday	10 Saturday	11 Sunday	12 Monday	13 Tuesday	14 Wed.	15 Thursday	16 Friday			
1	3	800	0.3	0.2	0.5	0.1	0.6	0.4	.0	0.8	0	0.8	4.2	2	13
103	1	0.400	1	2	1.6	4.3	2.3	1	1.5	2.5	1	1.2	18.4	2	51
107	2	3.700	1	0.5	1.4	1.2	1.7	0.8	1.7	0.7	0.8	0.5	10.5	2	4[illegible]
108	2	3,400	2.1	2.8	1.2	1.9	2.6	0.7	5.9	2.6	1.8	1.7	23.4	2	62
110	3	5,300	4.4	3.9	1.7	4.2	5.5	2.3	1.3	3.8	3	3	33.1	3	9[illegible]
112	1	5,400	2.7	2	3	1.5	3.5	1.3	8.3	21	5.4	5	34.8	2	16[illegible]
111	3	5,300	6.7	4.2	5.9	6.4	5.3	8.4	0.3	5.5	6.3	9.4	58.4	4	
203	2	300	0.6	0.3	0.6	0.1	0.5	0.3	3	0.7	0.5	0.3	6.9	1	1[illegible]
205	2	4,300	2.9	2.8	3	5.7	2.7	4.9	3	3.7	2	4.2	34.9	3	
206	2	4,800	2.7	2.5	3.8	3.8	4.7	4.3	6.7	2.1	3	2.4	39.0	3	12[illegible]
207	2	3,800	0	0	0	0	0	0.3	0	0	0	0	0.3	1	7[illegible]
208	2	3,700	2.2	3.4	3.7	2	2.3	0.3	1	2.5	3.5	2	18.9	2	7[illegible]
209	2	3,900	3.3	3.4	3.6	6.4	4.3	1.3	2.9	2.6	3.2	2.2	33.2	3	150
301	1	150	0	0	0	0.4	0.3	0.2	1	0.4	0	0.5	1.9	1	14
303	1	100	0.4	0.1	0.1	0.7	0.4	0.2	0.4	0.3	0.4	0.8	3.8	2	[illegible]
212	2	4,800	3.3	3.2	5.1	10	4.2	3.2	0.4	7.9	8	6.9	50.4	4	
306	2	5,100	0	0	0	0	0	0	0	0	0	0	0	2	[illegible]
307	2	3,600	2.5	2.5	5.3	2.4	4.5	1.1	3.7	3	2.3	[illegible]	31.3	2	4[illegible]
308	2	5,100	4.2	4	1.3	2.3	1.4	1.5	1.5	1.5	1	1.8	15.5	2	
309	2	3,400	3.3	4.3	2.7	2	0.6	4.7	0.5	3	3.7	4	18.5	3	
312	2	4,500	2.5	2.8	4	1.7	0.5	2.3	0.3	4.3	3.5	3.2	25.1	2	3[illegible]
401	2	160	0.5	0	0.6	0.5	1	0	0.4	0.6	0.3	0.5	3.4	1	[illegible]
403	1	150	0	0.2	0.2	0.2	0.3	0.5	0	0.1	0	0.2	1.7	1	[illegible]
405	3	4,300	3.2	2.7	3	3.6	2.2	2	2.9	1.3	2.2	4.6	27.7	2	
406	2	5,105	2.5	2.8	6.7	3.7	2.7	1.6	2.9	7.2	6.5	5.3	41.9	3	114
407	2	3,395	2.1	0.8	0.5	1	2.3	0.8	0.4	1.3	1.3	1.2	11.7	2	10[illegible]
408	2	3,590	0	1.3	1.1	0.9	1	0	0	0	3.2	2.5	10.0	1	2[illegible]
409	2	5,590	2.7	2.3	3.5	2.1	5.2	4	5	4	4.2	2.2	35.2	3	15[illegible]
412	2	4,500	0	0	0.1	0.2	2.3	3.1	4.7	7.2	6.5	5.3	29.4	2	182
Total	..	97,140	52.8	49.3	60.5	64.2	68.4	54.5	64.9	73.7	73.6	76.7	733.6		
Maximum demands			16.8	21.4	22.8	13.2	7.2	16.8	15.6	18.7	17.9	19.2			
Load factor per cent			13	9.6	12	20.3	39.5	17	13.5	16	17.1	16.7			

Average kw.-hr. per customer per day, 2.5. Average kw.-hr. per person per day, 1.18

pointed out, cause entirely different load conditions from those in the average home. A large diversity factor is obtained with apartment installations, but the peak load occurs between 5 p. m. and 6.30 p. m. This seems to be the experience quite generally. As the apartment building falls easiest prey to the many charms of electric cooking, Mr. Snyder felt it to be likely that the initial loads caused by such installations in large cities will not represent, on the average, conditions which will prevail when all classes are using the service for cooking.

The seven curves show the day load curves of an installation of twenty-two ranges and necessary lighting at the Blackstone Apartments in Milwaukee. It was impossible to separate the lighting from the total demand. Considerable variation is noted from day to day in the maximum demand, which occurs between 5 p. m. and 6.50 p. m., except on Sunday. The average demand for the week was 16.3 kw., caused by a connected load of 97.14 kw. The greatest demand was 22.8 kw. and the smallest was 9.2 kw. on Sunday. The average diversity factor for the week was 6.7. The average load factor of the twenty-two installations for one week was 17.8 per cent.

A ten-day record of individual operation of these ranges is contained in the accompanying table, showing the daily variation in kilowatt-hours and demand for each customer, together with a record of the number of active rooms and persons in the family. The daily use per person of 1.18 kw.-hr., including lamps, shows the average consumption for cooking purposes to be well below 1 kw.-hr. per person per day.

COLLECTING $50,000 AFTER RECORDS WERE DESTROYED

Placing Absolute Reliance in Honesty of Customers Results in Loss of Only 10 Per Cent of Amount Due for Both Service and Merchandise

BY C. ERWIN

Auditor Decatur (Ill.) Railway & Light Company

Fire completely destroyed the office of the Decatur (Ill.) Railway & Light Company some time ago, and the conflagration spread so rapidly that it was possible to save only the cash, the general ledger and some less important books. All records of accounts against customers and records of meters installed were lost owing to the fact that the fireproof safe containing them fell into a pile of burning coal in the basement and in that position was hit by another safe that fell from the floor above it. The general ledger, to which accounts are posted once a month, showed that customers owed the company $50,000, but there were absolutely no details to assist in accounting for that amount.

To re-establish the company's records a conference of all employees who knew anything about meter reading was called. From these men a crew of twelve was picked to make a house-to-house and building-to-building canvass. A card index covering every house in the territory of the company was first made, regardless of whether the house was served or not. These cards were kept in a temporary file until it was established whether or not the house contained a meter. Then the cards, signed by an inspector, were transferred to a permanent file and were arranged alphabetically by street and by house numbers. This helped locate accounts quickly. From these permanent cards new meter ledgers were made up.

Frank Appeal for Assistance in Time of Trouble

While the house-to-house canvass was in progress the company conducted a newspaper advertising campaign, acquainting the people with conditions at its office and appealing to them to give canvassers all information sought. A regular bill, paid or unpaid, for March, the month before the fire, was what was wanted. From this it was possible to get the last meter reading and to establish a basis for future billing. The canvassers asked for these bills and gave customers receipts for them to hold until the bill was returned. The canvassers also asked if customers had merchandise accounts and secured the last statement delivered on these if possible. The whole thing was put squarely up to the honesty of the people. If a customer said his March bill was paid, the company took his word for it, even though he had no receipt. The only exceptions to this were with accounts where some employee of the company knew positively from memory that some bill was unpaid.

In assigning canvassers to this work the company put two men on a street, one on each side. To avoid complications at corner houses the canvasser was instructed to be guided by the street on which the house faced or was numbered. About the only places in which difficulty was experienced were in flat buildings with several meters and in downtown districts where each building had several meters. Two of the company's oldest employees were assigned this work, because they knew where to look for meters. After the canvass, linemen made a general tour of the system, tracing services to ascertain if meter records were properly established. They found four houses where electricity was being stolen.

Majority of Customers Respond Willingly to Appeal

The upshot of the whole affair was that the great majority of the customers were able to give the exact information necessary to re-establish accounts. All but a small percentage did this willingly. Against those who could or would not give information estimated March and April bills were rendered. When customers called to settle an adjustment was made based on their consumption between the time of the canvasser's first reading and the next reading made after the record was established. At the end of six months of this work records were pretty well established. The bulk of them were obtained in the first sixty days, but accounts came straggling in for the next four months. After that it was only occasionally that some one discovered a "lost" meter. So at the close of the year the company was able to charge off the accounts uncollectible, which amounted to approximately $5000, or 10 per cent of the amount due after the fire.

How the Company Handled Obstinate Patrons

Many odd and interesting incidents which show how human nature works in such cases came to light while collecting was in progress. Customers who had quarrels with their neighbors brought in information about unpaid merchandise accounts, enabling the company to establish some records. Then there were other persons

who proffered information regarding unrecorded use of service with the proviso that the company pay them liberally for the information. Such offers were flatly refused.

The merchandise accounts seemed to give more trouble than service accounts. One of these cases, involving a sign sold to the leading dry goods store, was of particular interest. The sale was made and the sign was installed about three weeks before the fire. The terms on this bill were to have been cash on installation. The consumer entirely failed to mention the sign transaction to our canvasser, and we would have lost the account had we not just happened to think of it about six months after the fire. The writer immediately remembered that, instead of paying cash as he agreed, the merchant only paid $50. We called on him and asked him about the sign. He immediately said it was paid for long ago, and when asked for his receipt or his copy of the contract he said that he did not have them. We knew that a store of this size kept a careful record of transactions and were positive that he had all the information we wanted. We therefore made out a bill which we knew was about $50 more than the sign amounted to and sent it to him without any comment. The second day after this the merchant was in our office early in the morning with his copy of the contract and his receipt for the $50 paid, making vigorous complaint on the amount we were charging him. As soon as we got the information we wanted in our hands the writer told him face to face what we had done and why we did it, and the look that he gave will long be remembered. His actual balance was $175, and we insisted on having a check for it, which he gave.

Purchase of Office Equipment Also Handled on Appeal-to-Honesty Basis

But, despite such incidents as this, our experience proved conclusively that the people in general are honest. On presenting the situation frankly we found them willing to treat us in the way they would expect to be treated had they been the sufferers. This spirit was evidenced not only by our customers but by firms from whom we bought. Of course we had to re-equip our office from pencils to scrap paper. We knew what the situation was by 6.30 on the morning of the fire. By 9.30 we had rented a vacant room, had desks and chairs installed and were ready to start business. Our printed matter was all destroyed, and our first effort was to notify every printer in the city who had ever done any work for us at all to go through his files and get a copy for all forms that he had printed for us. These all came in before the day was over, and by night we practically had ordered every form that was necessary to carry on our business. We wired for adding machines, typewriters, an addressograph and other appliances which could not be purchased locally. By the close of the next day we had most of this equipment in the office. Most of it was loaned to us until such time as we could place a definite order for the exact kind wanted. We bought everything without discussing prices, leaving the matter to the honesty of the seller, just as we had put our accounts that were due us up to the honesty of the consumer. In checking over these bills a year later we found that the printers were very fair with us, and one house in particular actually gave us everything at a lower price than we have been able to buy it since.

THE METER DEPARTMENT IN UNIFORM AND CAP

It Is Found that by Improving the Appearance of Meter Readers a Better Impression Is Made Upon Customers

In a very considerable number of towns in the United States the men who read the electric meters certainly look like a lot of cut-throats or desperadoes. There is a feeling that since they must go into cellars and out-of-the-way places where dirt and dust prevail they cannot be expected to keep clean or present a very tidy appearance.

On the other hand, the effect that the unkempt appearance of such men has on consumers has probably never entered the mind of the employers of these men.



STANDARD OF DRESS AND NEATNESS OF APPEARANCE SPEAK WELL FOR THE COMPANY

It is not strange, however, that consumers should question their bills when the meter has been read by a man whose personal appearance is not prepossessing. Many customers undoubtedly distrust the meter readers on this account.

It has been with this conviction that some central stations have taken steps to improve the appearance of their meter readers. The Rockford (Ill.) Electric Company, one of the American Gas & Electric properties, has put the members of its meter department in uniform. As can be seen from the accompanying illustration, the men present a neat and dignified appearance well in keeping with the responsibility they have. They are the greatest source of personal contact that the company has with its customers, and in uniform they help to promote a friendly feeling on the part of customers toward the company.

The uniform is of dark tan-colored woolen cloth with a standard conductor's cap to match. The letters "R. E. Co." are sewed across the front of the cap and also on the edge of the upper pocket of the coat, forming a distinguishing feature.

Arrangements have been made with one of the local clothiers to supply the uniforms at a low cost. The men pay for them, but by a slight raise in pay when the plan was put in effect the company actually meets one-half the cost. The cap is the property of the company and has to be returned when a meter reader drops out.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

RUBBER INSULATION

Specification and Tests Proposed in Report of Joint Rubber Insulation Committee

RUBBER insulation is of vast practical importance to electrical engineers. In recent years there has been no difficulty in securing insulation having the dielectric strength, specific resistance, elasticity and mechanical strength required in practice. Indeed, with the possible exception of dielectric strength, these qualities are usually in excess of actual service requirements. However, there is another quality, namely, permanence, which, although equally essential, has not been so easy to obtain. It is an important problem to devise some tests which will indicate the permanence of rubber for insulation. The problem is evidently to establish some relation between permanence and one or more of the properties which are susceptible to tests.

Two types of specification have been devised—first, a purely physical specification, but specifications based exclusively on physical tests have fallen into disrepute, though such tests now serve in modified form as adjuncts to other types of specifications.

The second type of specification is that in which a more or less rigid formula for the compound is specified and compliance with it exacted either by inspection during manufacture or by chemical analysis supplemented by other tests of the finished product.

The Specification Adopted

The specification worked out by the Joint Rubber Insulation Committee is of the second type. This joint committee, which has been at work since 1911, consists of representatives of government departments, national societies, manufacturing electrical companies, operating electrical companies, etc. The report of this committee is printed in full in the April, 1917, issue of the *Proceedings* of the American Institute of Electrical Engineers. The committee's specification for a rubber insulating compound has been adopted by the principal engineering societies which issue standards of this kind. Among these are the American Electric Railway (Engineering) Association, the Association of Railway Electrical Engineers, and the American Society for Testing Materials. The specification has also been adopted by a large number of important purchasers of insulated wire, including the United States Signal Corps, the Panama Canal, the New York Central Railroad Company, the Interborough Rapid Transit Company, the Public Service Corporation of New Jersey, etc.

We herewith give the specification for 30 per cent Hevea rubber compound (chemical clauses) in full from the report:

> A 30 per cent fine Para or best quality plantation Hevea rubber compound with mineral fillers shall be furnished. It shall contain only the following ingredients: Rubber, sulphur, inorganic mineral matter, refined solid paraffine or ceresine.
>
> The vulcanized compound shall conform to the following requirements, when tested by the procedure of the Joint Rubber Insulation Committee, results being expressed as percentages by weight of the whole sample:

REQUIREMENTS INDEPENDENT OF THE AMOUNT OF RUBBER FOUND

	Maximum	Minimum
Rubber	33	30
Waxy hydrocarbons	4	..
Free sulphur	0.7	..

Red lead, carbon, or organic fillers shall not be present.

REQUIREMENTS DEPENDENT UPON AMOUNT OF RUBBER FOUND

(Requirements for intermediate percentages shall be in proportion to the percentage of rubber found.)

Limits Allowed for 30 Per Cent Rubber Compound:	Maximum	Minimum
Saponifiable acetone extract	1.35	0.55
Unsaponifiable resins	0.45	...
Chloroform extract	0.90	..
Alcoholic potash extract	0.55	...
Total sulphur	2.10	...
Specific gravity	...	1.25
Limits Allowed for 33 Per Cent Rubber Compound:		
Saponifiable acetone extract	1.50	0.60
Unsaponifiable resins	0.50	..
Chloroform extract	1.00	..
Alcoholic potash extract	0.60	..
Total sulphur	2.30	..
Specific gravity	...	1.67

> The acetone solution shall not fluoresce.
>
> The acetone extract (60 cu. cm.) shall be not darker than a light straw color.
>
> Hydrocarbons shall be solid, waxy and not darker than a light brown.
>
> Chloroform extract (60 cu. cm.) shall be not darker than a straw color.
>
> Failure to meet any requirement of this specification will be considered sufficient cause for rejection.
>
> Contamination of the compound, such as by the use of impregnated tapes, will not excuse the manufacturer from conforming to this specification.

In the full report of the committee this specification is followed by a greatly detailed outline of analytic procedure and by notes which explain certain parts of the specification. It is stated, for instance, that experience has shown that compounds of the grade which contains only good Hevea rubber may be relied upon to be more permanent than those made of rubber of other grades. It is not affirmed by the committee that a compound which conforms with this specification is necessarily permanent, or that a better compound cannot be made, but it is believed that enforcement of the specification will limit the use of inferior materials and that it will put the manufacturers more nearly upon an equality of endeavor, where they can use their experience to obtain the best results. Used in connection with the analytical procedure, the specification will enable purchasers to order a good compound and to ascertain with a greater certainty than heretofore whether the material received represents the compound specified.

It is also emphasized that this specification should be supplemented by appropriate elasticity and tensile strength tests, in order to add to the assurance that good rubber has been used and that the vulcanization process has been properly carried out; also, by appropri-

ate electric stress and resistance tests, to assure proper insulating qualities and homogeneity of structure. The exact value of the limits for these tests will depend upon the use to which the material is to be put.

Generators, Motors and Transformers

Voltage Regulation of Rotary Converters.—G. A. JUHLIN.—The conclusion of his paper read before the (British) Institution of Electrical Engineers. After having discussed the systems of the reactance control and booster control for regulation of rotary converters, the author discusses the relative advantages of the two systems in cases where two ranges of voltages are required, namely, 400 to 440 volts for lighting and power and 500 to 550 volts for traction. From the point of view of first cost, the advantage would be with the reactance control. The size of the booster would be materially reduced by arranging the transformers with tappings giving 420 and 525 volts respectively on the continuous-current side and providing a change-over switch, as in the case of the reactance control. The advantage of this arrangement would be not only reduced cost but also improved conditions from a point of view of commutation on account of the reduced boost. This advantage is more marked in large units than in smaller ones, owing to the increasing difficulties in commutation. As regards the power factor, the booster type of converter has the advantage, as its power factor can be varied at will under all conditions of load and voltage, and, in cases where wattless currents are required for power-factor improvement independent of the voltage conditions, it is the only type suitable. When no leading currents are desired, however, there appears little or no reason why the reactance type should not be used, and it is doubtful whether better results would be obtained with the booster type. With the reactance type of control it is only necessary to operate the field rheostat in changing the voltage, and the fact that the power factor is fixed definitely for each voltage is not altogether a disadvantage. With respect to the commutation the reactance control has the advantage. Satisfactory commutation is obtained with the booster type of machine, but much finer adjustments as regards interpoles and brush gear are necessary with this type of machine. As to the range of voltage the reactance type is somewhat limited and $\pm 7\frac{1}{2}$ per cent may be considered as the limit, while with the booster type a great range may be obtained, 15 per cent or even more. The efficiency is slightly higher for the reactance type. With respect to starting there is no difference between the reactance type and the booster type. Less space is required for the reactance type, while with respect to maintenance the booster type requires more parts to keep in order. An account of the discussion which followed is also given.—London *Electrician*, March 16, 1917.

Generation, Transmission and Distribution

Gas Power Versus Water Power.—H. G. H. TARR.—The author gives comparative figures to show that gas power may be cheaper than water power if the by-products gas producer is used, not in connection with gas engines but in connection with gas-fired steam boilers and steam turbines. Not all American coals are suitable, but there are enough available which can be used. The author first gives figures for the cost of a 20,000-hp. water-power plant, for which an investment of $5,333,000 is assumed, finding a total operating cost of $656,000 a year, with an income of $1,111,000 (from electric power, assuming an 85 per cent load factor), so that there is a profit of $455,000 or 8.5 per cent on the investment. He then gives the figures for a 20,000-hp. steam power plant with Mond by-products recovery. The total investment is $2,860,000, the operating cost $760,000. The income from the electrical power is as before $1,111,000, while from ammonium sulphate (70 lb. per ton—31.8 kg. per metric ton—of coal), at 3 cents per pound, the income is $312,900, so that there is a total income of $1,433,900, or a profit of $673,900 or 23 per cent on the investment. The American coals best suitable for the process have been found to be those from Kentucky, high in nitrogen while they burn freely and do not cake or coke in the producer. Aside from this any coal that has sufficient nitrogen content is suitable, and it is believed that present studies will develop a producer that will overcome this obstacle.—*Met. and Chem. Engineering*, April 1, 1917.

Installations, Systems and Appliances

Auto-Transformers.—An illustrated discussion of a case of improper use of auto-transformers for interconnecting different systems, which resulted in serious troubles being transferred from one system to the other. The conclusion is drawn that the neutral point of all auto-transformers should be earthed. It should be remembered, however, that earthing an existing insulated distribution system requires the substitution of three-pole for two-pole relays on automatic circuit breakers. The presence of several earths on a distributing system favors the development of harmonic currents, which may produce serious telephonic disturbances and even attain values high enough to cause material damage. It is not advisable in any case to connect two important systems of distribution by auto-transformers, since all disturbances, of whatever origin (atmospheric disturbances, earth faults, etc.), are then transferred freely from one system to the other. The magnetic circuit of a double-wound transformer forms an elastic link, eliminating all risks of such a nature.—London *Elec. Review*, Jan. 5, 1917.

Electrophysics and Magnetism

Mathematics of Oscillating-Current Circuits.—V. BUSH.—A paper read at the recent New York Meeting of the American Institute of Electrical Engineers in which the author shows how oscillating-current circuit problems can be treated by a new method involving a generalized angular velocity and a generalized impedance which are complex quantities. Kirchhoff's law may be thus generalized and yields a simple method of determining the generalized angular velocities, and thus the frequencies and decrements, of free oscillation. The method is illustrated by three examples.—*Proceedings* American Institute of Electrical Engineers, February, 1917.

Units, Measurements and Instruments

French National Laboratory.—P. JANET.—A review of the work done by the Central Laboratory of Electricity in Paris and its international scientific importance, with a chronological list of the papers which have emanated from that institution.—*Rev. Gen. d'Elec.*, Feb. 17, 1917.

Telegraphy, Telephony and Signals

Wireless Telegraphy Receivers for Use in Cable Telegraphy.—Louis W. Austin and Louis Cohen.—The receiving instruments in radio-telegraphy, particularly the audion and ticker types, are of a far higher order of sensitiveness than those used in cabling. The present authors think that they may be used to great advantage

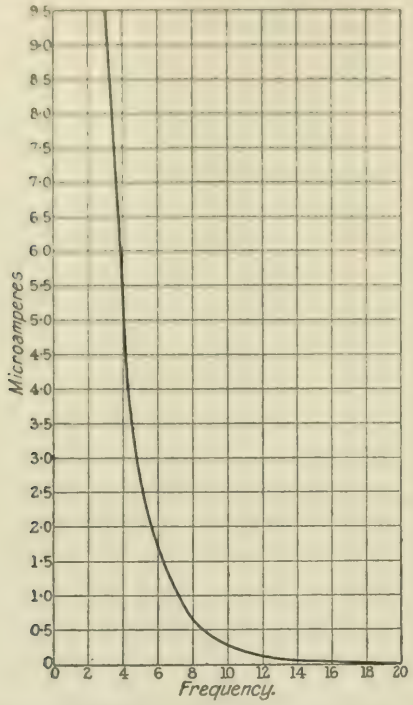


FIG. 1—RATIO OF DECREASED CURRENT TO INCREASED FREQUENCY

also in cable work both for audible reception and for recording. The audion operates as an oscillator for any frequency even below the range of audibility, and by associating with it an oscillating circuit of suitable electrical constants it can be made to oscillate with an audible frequency, the note of which is heard in telephones connected to it in the usual way. The received signal modifies the oscillatory current and the variation thus produced is heard in the telephones. Or the audion may be adjusted for the critical point just short of oscillations, and the effect of the received signal is to start momentary oscillations in the audion. In such an arrangement a current of 1 microampere is more than ample to give a readable signal, and even less than 1 microampere will suffice. In case of the ticker method the operation is somewhat different. The function of the ticker is merely to interrupt the incoming current, rendering it audible, and thus make it possible to use telephones for the reception of signals. For recording purposes the recording device is preferably connected through a transformer to the detecting instrument. Higher sensitiveness of the receiver is particularly desirable for the Squier system, in which the speed of signaling is directly proportional to the frequency of the current employed; but for the same transmitting voltage the current at the receiving end decreases very rapidly as the frequency is increased. In Fig. 1 a curve is given showing the decrease in received current for a transatlantic cable for increasing frequency. For a frequency of 20 the current at the receiving end is about 0.3 microampere for 100 volts at the transmitting end, and therefore it is only with highly sensitive detectors that any such frequency could be employed for cable work. The combination of the use of alternating currents and highly sensitive detectors offers the additional great advantage that the solution to the problem of multiplexing can be realized. In direct-current cabling all improvements in regard to increase in sensitiveness and speed are controlled by the accuracy with which the duplex bridge may be balanced. The opening and closing of the circuit in signaling introduces transient effects which are difficult to balance accurately. This was recognized by Squier. The use of an unbroken alternating current eliminates many of the difficulties in balancing which were considered heretofore as inherent in duplex cabling, and also simplifies the problem of multiplexing. In conjunction with G. O. Squier, the writers developed a method in which an extra simplex system is superimposed on a Squier duplex cable. The arrangement of circuits used is shown in Fig. 2. At the two ends of the cable there are stations *A* and *B* equipped for duplexing, and in addition there are stations *D* and *C*, where one acts solely as the transmitter and the other as the receiver, constituting the superimposed simplex system. In the simplex system, which may be designated by *DC*, audible reception is used. The frequency of the current may be either within the range of audition or below audition and rendered audible at the receiving end by a ticker or an audion, the frequency of the current being comparatively high, say, 15 or more. The current used in the duplex system is of low frequency. The two receiving circuits at *B* and *C* are tuned for the corresponding frequencies of the signals which are to be received at the respective stations, and since the frequencies used in the two cases are quite different, the tuning of the circuit will insure responsiveness of each receiver only to the current of the signal which is to be received at each station. To eliminate the effect of transmitter *B* in receiver *C*, the receiving circuit is coupled to the bridge arm of the artificial cable as well as to cable, and the secondaries so connected as to induce equal and opposite emf.'s in the receiving circuits, thus neutralizing the effect of transmitter *B* on receiver *C*. A little different arrangement is employed to eliminate effect of transmitter *D* on receiver of station *A*. In addition to double transformers, which neutralize each other's effects, a loop circuit tuned to the frequency of transmitter *D* is also introduced in receiving circuit of station *A*, thus rendering it opaque to currents of frequency produced by

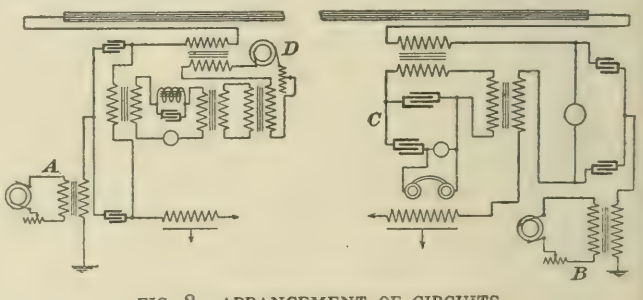


FIG. 2—ARRANGEMENT OF CIRCUITS

station *A*. In this way it becomes perfectly feasible to superimpose an extra simplex circuit on a duplex cable. By suitable modifications of transformers and tuned circuits, and also making use of different frequencies, it is possible to develop a system in which a number of simplex systems are superimposed on a duplex cable.—London *Electrician*, March 16, 1917.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

JOBBERS AND THE N. E. L. A. COMMITTEE MEET TO CO-OPERATE

Representatives of the Two Associations Consider Basis of Practicable Co-operation and Will Have Further Negotiations

A meeting of a committee representing the Electrical Supply Jobbers' Association and the Commercial Section of the National Electric Light Association was held at the N. E. L. A. headquarters in New York on April 6. The purpose of the meeting was to discuss co-operation between the two bodies in accordance with the general idea expressed at the meeting of the N. E. L. A. executive committee on March 9.

The following were present at the meeting on April 6: Chairman E. A. Edkins, M. S. Seelman, R. R. Young and J. F. Becker, representing the N. E. L. A., and W. E. Robertson, F. S. Price, N. G. Harvey, W. A. Pixley, T. M. Debevoise and Franklin Overbagh, representing the jobbers.

After extended discussion lasting through luncheon and into an afternoon session, the jobbers suggested that with the general discussion as a basis they would prepare, probably through Mr. Overbagh, in letter form a basic outline of co-operation which could be practiced to the mutual interest of all concerned. This brief will be given consideration by Chairman Edkins' committee, after which further action will be determined.

FIXED PRICES DENIED BY SUPREME COURT DECISION

Limited-License Plan of Distribution Followed by Victor Talking Machine Company Held Illegal by Highest Tribunal

Decisions rendered by the United States Supreme Court on April 9 declared that price-fixing restrictions for public use of patented articles of the Victor Talking Machine Company and others were illegal and void. The ruling in the Victor case, written by Justice Clarke, was adopted by a vote of six to three, Justices McKenna, Holmes and Van Devanter dissenting. R. H. Macy & Company, New York, were in the case. The higher court reversed the decision of the lower court in the suit brought to prevent that company from selling machines at "cut prices." Machines were sold by the manufacturer under a license agreement to avoid an outright sale by the Victor company. The bill was dismissed by the court for the Southern District of New York and that decision was reversed by the Circuit Court of Appeals on the ground that the patentee may dispose temporarily of the use and ultimately of the title of a machine made by him under a patent right.

A second decision upon patent rights, following the same lines, was in the case of the Motion Picture Patents Company against the Universal Film Manufacturing Company.

TUNGSTEN LAMP PATENT DECISION UPHELD IN ENGLAND

Higher Court Denies Patents for Treatment of Tungsten for Lamp Filaments and Improved Wire-Drawing Methods

Information has been received that the court of appeal in England has rendered a decision in the appeal of the British Thomson-Houston Company against the decision of Justice Astbury in the case of British Thomson-Houston Company, Ltd., vs. Duram, Ltd.

In the first action the plaintiffs asked for an injunction against the defendants for infringements of two patents. The first of these, dated 1906, was for an invention of a process and apparatus for the treatment of metallic tungsten for the manufacture of electric lamp filaments therefrom. The second, dated 1911, was for an improved method of drawing wire by the use of graphite as a lubricant. Justice Astbury held that the first patent was bad for want of subject matter and that the second was bad, as a complete user of the invention for the purpose of commercially drawing wire had been proved to have existed in 1905.

The court of appeal upheld the rulings of Justice Astbury and dismissed the appeal. Details of the suit in the lower court were published in the ELECTRICAL WORLD of Jan. 13, 1917, page 71.

SUCCESS OF N. E. L. A. PLAN FOR CONVENTION EXHIBITS

Assignments Made, All Space Taken and More Wanted—Exhibitors Urged to Have Educational Features

The assignment committee of the National Electric Light Association, meeting at the offices in New York on April 5, made assignments for the exhibits for the Atlantic City convention, which is to begin on May 29.

The exhibition committee arranged for more than double the amount of space that has been used by the association in the past. For the first time in the history of the association all the space was applied for previous to the assignment. Present conditions make this a remarkable showing. Additional applications are coming in almost daily, and it will be necessary for the exhibition committee to plan additional space, if possible, to care for the Class "D" members that have not formally applied but wish to make an exhibit.

The executive committee of the National Electric Light Association is particularly repeating its request that each exhibitor have one or more features of a working or educational nature.

Exhibitors shipping by freight should take up the matter with their transportation departments and arrange to have the shipments reach Atlantic City by May 20 at the latest. Arrangements are being made by the exhibition committee to care for such shipments.

Electrical Industry in War Time

While Central Stations Consider Ways and Means of Serving, Great Industries Turn to Manufacturers for Flood-Lighting Accessories

OUTSIDE of the patriotic spirit in which international developments are awaited the great feature of the present situation in the electrical industry is the intensely practical nature of the activities which are engaging men and industries. Individuals and plants are giving necessary services.

In the larger councils at Washington, in the questions of policy and production as well as of protection, the electrical industry, by reason of its great power and resources, is taking a leading part. There is a general sentiment that "business as usual" will be the dominating note in future operations.

As an indication of the attitude of the central station industry Herbert A. Wagner, president of the National Electric Light Association, has offered his services to effect the most efficient use of the members of that organization. The letter addressed by Mr. Wagner to the Secretary of War on April 4 says:

MR. WAGNER'S OFFER

"My attention has been called to letters written to you under dates of Feb. 28 and March 7, by Dr. Dugald C. Jackson of the Massachusetts Institute of Technology in reference to the organization of the engineers in the electrical industry for special service to the government. In these suggestions I heartily concur with Dr. Jackson.

"Electricity and electric power will play a very important part in the preparations for and conduct of the war in which we are about to enter. It is safe to say that the most highly trained and best disciplined electrical engineers in the country are those in the employ of electric central stations and electric manufacturers in the cities throughout the states. In many of these cities, as in my own city of Baltimore, the central station electric companies are furnishing large amounts of power for the operation of industries, including munition plants, upon which the government will be largely dependent for supplies, and to steam railroad companies for an important part of their transportation requirements.

"It is necessary that these power sources be conserved and operated for the benefit of the government, and that locally the government should have recourse to the services of the trained engineers in the employ of the power companies. The large electric central stations and the electrical manufacturers throughout the country are already organized, in a sense, for the interchange and dissemination of engineering information and for general educational purposes, through the National Electric Light Association, which has an enrollment of some 15,000 members in the electrical industry.

"This association is organized for effective work, through a large number of committees, including in the neighborhood of 1000 active men. Should the government find it advisable to take steps toward the organization of the men in these industries, to bring about their most efficient use for preparedness and defense, as president of the National Electric Light Association, and individually as an engineer of experience, I should be most glad to offer my services to the War Department in any way that you may see fit to utilize them.

"Many of the electric central station companies have already made special provision for such of their employees as may volunteer or be called for military service. It is highly probable, however, that a large number of the employees of these companies can be used to better advantage, in view of their special training, for local work in connection with the supply of power, and in engineering and organizing work in promoting efficiency in the production of supplies and munitions, and in perfecting local defense.

"It is to suggest your consideration of this phase of the situation both as Secretary of War and as chairman of the Council of National Defense, before numbers of specially trained men enlist for ordinary service, that I am encroaching on your time in these more than busy hours."

General attention is being directed to the value of flood-lighting as a means of protection for industrial

EFFECT ON THE INDUSTRY

As Expressed by Central Station Executives

FROM W. W. FREEMAN, PRESIDENT UNION GAS & ELECTRIC COMPANY, CINCINNATI

To the ELECTRICAL WORLD:

It seems too soon to note any decided effect of the war situation on the industry. Naturally, the probability of largely increased taxation will tend to promote caution as to expenditures by business people, and this may affect the gross revenues of utility properties. Such increased taxation may also add to our expenses and make economies very necessary wherever practicable in our operations. If the demand for metals should be still further increased and the prices rise correspondingly, it will be increasingly difficult to finance extensions at the almost prohibitive cost of same. These are conditions which are quite likely to arise, but thus far conditions have not materially changed.

W. W. FREEMAN.

Cincinnati, Ohio, April 9, 1917.

FROM DUDLEY FARRAND, ASSISTANT TO PRESIDENT PUBLIC SERVICE CORPORATION OF NEW JERSEY

To the ELECTRICAL WORLD:

Central stations can be most useful in the service of their country if they continue in operation with undiminished energy. Their output is essential to public safety and comfort. The loyalty of both officials and employees is beyond question, but the military needs of the country require that the first service of these men shall be given to the protection and uninterrupted operation of the great generating plants upon which such momentous results depend. The experience brought out in the present war has so thoroughly demonstrated the soundness of this position that it is not open to debate.

DUDLEY FARRAND.

Newark, N. J., April 11, 1917.



A LARGE ROOF SIGN ON THE SUPERIOR (WIS.) WATER, LIGHT & POWER COMPANY PLANT MAKES A FINE APPEARANCE



FLOOD LIGHTING IS OF DEMONSTRATED VALUE IN MINING OPERATIONS

plants of every character. As a result of a keener realization of the importance of this resource the manufacturers of flood lamps are receiving heavy orders. The use of such lighting reduces the number of men required to patrol or watch an area and is an excellent safeguard against prowlers. In the application of such lighting much skill is being employed.

Such systems of lighting have been in use on a large scale in many sections of the country, and their flexibility and the speed with which they can be set up are leading to a vast extension of their application in the serious problem of assuring protection for industrial property.

In cases where patrols are used, one of the principal methods of protective lighting is to mount the projectors about 300 ft. apart, all pointing in the same direction and making a ring of light around the plant. In other places, where an open space is to be lighted, a bank of flood-lighting units is placed on a building with successful results.

Electric Flags

Electric flags and electric illumination for flags are being used in all parts of the country to a greater extent than ever before. Many ideas of this nature are being advanced. For instance, Senator James A. Emerson of Warrensburg, N. Y., has amended the act relating to the public buildings of New York State so as to cause the flag to be displayed at all times on the Capitol building and to be electrically illuminated between sundown and sunrise. Senator Emerson's amendment has been passed by the Senate and the Assembly and is assured of the Governor's signature.

In other communities public utility companies are taking an active part in patriotic displays of the flag and in picturesque lighting effects which throw that emblem of the nation into prominence at night.

Telephone Engineers Ready

The American Telephone & Telegraph Company has offered about 500 engineers to work with the Signal Corps of the army and navy.

Of restrictive measures some touch allied industries in a slight way. In Greater New York the police authorities dismantled in one day 800 private wireless stations. This precaution has been taken in many other districts in accordance with the order of the President directing the Secretary of the Navy to take necessary action in the matter. This order provides "that such radio stations within the jurisdiction of the United States as are required for naval communications shall be taken over by the government of the United States and used and controlled by it, to the exclusion of any other control or use, and, furthermore, that all radio stations not necessary to the government of the United States for naval communications may be closed for radio communication."



IN STORAGE YARDS POWERFUL FLOOD LIGHTING IS A WISE PROTECTIVE MEASURE



ADEQUATE LIGHTING GREATLY SIMPLIFIES THE PROTECTION OF INDUSTRIAL PROPERTY

MANY POWER PROBLEM TOPICS AT BOSTON MEETING

Relative Merits of Isolated Plant and Central Station Service, Mechanical Stokers and Steam Turbine Developments Included

An assault by advocates of isolated plant service upon the central station was a striking feature of the power plant symposium at Boston, Mass., on April 4 and 5, under the joint auspices of the Boston sections of the American Institute of Electrical Engineers and the American Society of Mechanical Engineers. The meetings were tempered, however, by the recognition by some that ex cathedra declarations of economic superiority on the part of either device for supplying energy (sometimes plus heat) to modern business and industry should give way to investigation of each particular problem.

At the opening session on the evening of April 4, Frederick Ewing, mechanical engineer of the Mexican Petroleum Company, New York, emphasized the great importance of fuel oil, even to Eastern plants, in these times of high coal cost.

Value of Mechanical Stokers

R. Sanford Riley, president of the Sanford Riley Stoker Company, Worcester, Mass., described the evolution of the mechanical stoker and exhibited lantern slides of interesting installations, calling particular attention to the manner in which power-driven stokers have kept pace with increasing boiler and furnace sizes, providing at the same time for remarkably close control of fires through draft adjustment, automatic and otherwise, and variation of stoker speed. The value of mechanical stokers in stand-by stations associated with hydroelectric power plants was pointed out, full operating conditions being attained often in fifteen or twenty minutes from a "dead start."

High Temperature Insulation of Boiler Settings

The latest practice in high temperature insulation of boiler settings was described by P. A. Boeck, chemical engineer, Celite Products Company, New York. The author reviewed tests showing the reduction in heat transmission by the use of insulating brick and other refractory material incorporated into settings. Tests by the Bureau of Mines show that air spaces between brick walls are of little value in preventing the flow of heat through the walls. Insulation increases the thermal capacity of the boiler, minimizes local overheating and improves the general condition of the boiler room. The conductivity of the average firebrick between 400 deg. and 2500 deg. Fahr. varies from about 0.5 to 1.2 B.t.u. per square foot per 1 in. per hour for 1 deg. Fahr., giving an insulating ratio of more than ten to one in favor of the insulating material. Hollow wall spaces filled with powdered insulation are giving way to the use of insulating brick, which is sometimes also used over the drums. Numerous installations of "Celite" were shown in lantern slides.

The author said that an application of 2.5-in. insulating bricks in a plant at San Francisco, Cal., paid for itself in three months.

Factors Affecting Isolated Plants

Walter N. Polakov, consulting engineer, New York, reviewed the factors to be considered in deciding whether to purchase or to generate energy in a local plant. The author said that the high cost of isolated plant service is due often to obsolete methods or equipment. He intimated that through efficiency engineering the isolated plant can institute improvements which often obviate the need of purchasing energy.

Mr. Polakov attacked the central station interests of this country, contending that their rates are unduly high and criticising the policy of centralization in the generation and distribution of electricity.

A. R. Meek, Eastern manager of the Ridgway Dynamo & Engine Company, Boston, pointed out that central station and isolated plant service each have their sphere, to be determined by careful analysis.

The author challenged the alleged general economic benefits of centralization, and reviewed the heating and power requirements of a representative ten-story office building of 45,000 sq. ft. ground area. With coal at $7 per ton, Mr. Meek concluded after a protracted analysis that isolated plant operation would cost $4,745 less than central station service per year, the latter supplying electricity at 1.7 cents per kilowatt-hour. The estimated cost of the isolated plant was $44,800 or $112 per kilowatt, and the gross cost of isolated plant electricity per kilowatt-hour was 3.27 cents, the day and night consumption being respectively 74,400 kw.-hr. and 16,800 kw.-hr per month.

Operation of Holyoke Municipal Plant

The last two papers of the session discussed the results of operation at the Holyoke (Mass.) municipal lighting plant and outlined possible co-operation between central station and isolated plant.

John J. Kirkpatrick claimed that the Holyoke plant is meeting its full requirements on a maximum rate of 6 cents per kilowatt-hour for domestic lighting. He said that barely 20 per cent of the Holyoke output is generated by water-power.

A paper, presented by an associate of P. R. Moses of New York in the absence of the latter, discussed the possibility of co-operation in the handling of diversified and peak loads.

At a get-together dinner before the final session, C. F. Weed, vice-president of the Massachusetts committee on public safety, talked upon preparedness.

Economy in Production

John A. Stevens, consulting engineer, Lowell, Mass., gave an informal talk upon power generation at the evening meeting on April 5 urging the struggle for greater economy in production. R. A. Langworthy of Stone & Webster, Boston, discussed the relation of the heating problem to economical plant operation.

Developments in Steam Turbines

At the final session, Dr. L. C. Loewenstein, General Electric Company, Lynn, Mass., talked informally, in the absence of Richard H. Rice, on recent steam turbine developments. He pointed out that the advance in turbine design warrants scrapping the machines of five years ago.

To-day a 45,000-kw. unit is being built which is of the horizontal type, running at 1200 r.p.m., and on 200 lb. steam pressure, with 200 deg. superheat and a 29-in. vacuum, producing a kilowatt-hour on a guarantee of 10.4 lb. of steam. A single generator is all that is required in the later designs of high-powered units. Improvements in condensers and boilers have been caused

by the advance in turbine design, and whereas vacua of 26 in. to 27 in. were formerly regarded as satisfactory under the reciprocating engine régime, the industry today is getting 29 in. and even 29.5 in. with a 30-in. barometer.

The last speaker was C. H. Bromley, associate editor of *Power*, New York, who reviewed recent progress in condenser practice.

VARIED ACTIVITIES OF THE ASSOCIATED MANUFACTURERS

General Offices to Be Removed to Grand Central Terminal District—Meetings of Sections and Board of Governors

The headquarters of the Associated Manufacturers of Electrical Supplies will be moved from 62 Cedar Street, New York, to the Forty-second Street Building, 30 East Forty-second Street. This change has been urged for some time to meet the convenience of members. It will provide more space for the general offices, the governors and for meetings. Charles E. Dustin, the general secretary, says that it is expected to move on April 28.

MEETINGS CALLED

A meeting of the outlet box section will be held on Tuesday, April 24, at 10.30 a. m. at the present offices, 62 Cedar Street, New York.

A meeting of the board of governors will be held on April 18 at 2.30 p. m. at the offices, 62 Cedar Street.

The wire and cable section will meet on Tuesday, April 17, at the Yale Club, New York City.

A meeting of the magnet wire committee of the wire and cable section will be held on Wednesday, April 18, at 10.30 a. m. at the offices, 62 Cedar Street.

WORK OF THE JOVIAN COMMISSION AT CLEVELAND

Large Meeting with Representatives of Local Electrical Leagues Results in a Definite Plan for the Future

A meeting called by Jupiter Henry L. Doherty of the special commission authorized at the last Jovian annual convention was held in the rooms of the Cleveland Electrical League, Cleveland, on April 3 and 4.

The following conclusions were reached, and they will be placed before an early meeting of the entire Jovian Congress and Past Jupiters, followed, if practicable, by a special meeting of the Jovian Order to enact necessary legislation:

First—The chief function of the Jovian Order shall be as an international association of Jovian leagues.

Second—The order shall retain its present status as an international semi-fraternal constructive development body with a large membership representative of the entire electrical industry.

Third—Appointment by Congress of an executive committee, each committeeman having charge of a department to which some specific activity is assigned, for example, insurance, membership employment, publication, educational and development. The reigning Jupiter would be chairman and the Mercury secretary.

Fourth—Jovian membership should be through membership in local league, with provision for individuals not wishing to join leagues and for others not wishing to become Jovians.

Fifth—In the future, as soon as is practicable, candidates will be accepted to membership in the order only through local leagues. All men who join a local league automatically become Jovians.

Sixth—Congressmen and statesmen to be elected by Jovians in their respective districts instead of by membership at large.

Seventh—Present method of voting to be changed whereby a quorum consists of members present either in person or by proxy following a call for a special or annual meeting, provided that no one delegate is permitted to vote more than nine proxies.

Eighth—Certain changes in constitution of the Past-Jupiters' Association to be decided by it.

BOUNDARIES FOR ILLUMINATING ENGINEERING SOCIETY SECTIONS

Geographical Limits for the Various Sections Fixed by a Special Committee and Adopted by the Council

A special committee on section boundaries has reported a plan for geographical boundaries of the various sections of the Illuminating Engineering Society. The committee considered it advisable to establish boundaries along state lines except in Pennsylvania and New Jersey, where division within the states seemed necessary.

The report of the special committee has been adopted



BOUNDARIES OF ILLUMINATING ENGINEERING SOCIETY SECTIONS

by the council of the society. It divides the territory as follows:

New England Section.—Maine, New Hampshire, Vermont, Massachusetts and Rhode Island.

New York Section.—New York, Connecticut, and that part of New Jersey north of 40 deg. 20 min. north latitude (*i.e.*, a little north of Trenton).

Philadelphia Section.—That part of New Jersey south of 40 deg. 20 min. north latitude, that part of Pennsylvania east of 78 deg. west of Greenwich (*i.e.*, just east of Altoona), all of Delaware, Maryland and District of Columbia.

Pittsburgh Section —That part of Pennsylvania west of 78 deg. west of Greenwich, all of West Virginia and Ohio.

Chicago Section —Illinois, Indiana, Wisconsin and Michigan.

PACIFIC COAST SECTION: IDEALS AND NEEDED WORK

President R. H. Ballard Tells Through the Electrical World of the Urgent Necessity of a Close-Knit Organization

A statement of the purposeful ideals and successful work of the Pacific Coast Section of the National Electric Light Association has been prepared for the ELECTRICAL WORLD by R. H. Ballard, Los Angeles, Cal., the president of the section. It is as follows:

"Meeting an insistent demand for an organization on the Pacific Coast which, while embracing the ideals and underlying principles of the National Electric Light Association, will provide means for the proper application of these principles to our special conditions, the Pacific Coast Section was organized on Jan. 6, 1917. The enthusiastic welcome accorded to it since then in all fields of its activities is the best evidence of its need.

MEMBERSHIP OF 1500

"In the three months of existence a very active campaign by its membership committee has resulted in cementing together into one organization practically all of the light and power companies in the vast area included in its geographic boundaries in California, Arizona, Nevada and New Mexico. The total membership at this writing exceeds 1250, and it is confidently expected that at the first convention of the section, to be held at Riverside, Cal., on April 19, 20 and 21, 1917, a total of 1500 members from all classes will be reported.

"In true Western spirit, manufacturers, jobbers and contractors have been invited to affiliate with the section, take an active part in its work and be represented on committees, including representation on the executive committee. The response from these interests and the spirit of co-operation shown have been most gratifying.

"Instead of dividing the association into separate sections, the general plan of segregation by committees has been adopted and the responsibility for all matters connected with the several divisions of activity rests with these committees, authority being given for the formation of as many sub-committees as may be necessary and the preparation of papers by individuals, but always subject to the control of the committee itself. These committees are: public policy, engineering, commercial, accounting, membership.

"At the forthcoming convention committee chairmen will preside while their reports and papers are under discussion. All reports and papers, excepting the report of the public policy committee, will be printed in advance and copies distributed to each member of the section some days before the convention. Brief abstracts of the papers and reports and discussion thereon will constitute the procedure at the convention. The report of the public policy committee will be presented at a banquet on the evening of the second day, which will be tendered to members, ladies and invited guests.

EDUCATION AND CO-OPERATION

"Education and co-operation may be said to be the broad plan of the Pacific Coast Section—education not only of the men connected with the industry as employees but of the officers of the companies as well. Adopting a common ground, the aims, policies and duties of the industry may be placed concretely before the public in such a way as to encourage a broader and more comprehensive knowledge of the value of the industry to the public and the public to the industry, thus promoting co-operation, not only in methods of construction, commercializing, standardizing and efficiency, but in public relations, regulation and employees' welfare work.

LIGHTING DEMONSTRATION ON ELEVATED BLOCK IN NEW YORK

Experiment by New York Edison Company and Sixth Avenue Association in the Successful Distribution of Light

A lighting demonstration of the Sixth Avenue Association on a "model block," between Forty-eighth and Forty-ninth Streets, on both sides of the avenue, has attracted much comment in New York.

When the organization committee called a meeting Arthur Williams of the New York Edison Company presented the scheme of picking out a "model block" and lighting it as it should be lighted, as a demonstration of what could be done.

After the block had been selected the bureau of illuminating engineering of the company designed lighting schemes for all show windows and installed the wiring, fixtures and lamps with signs and 500-watt lighting units outside to assist in lighting the street beyond the curb line. The block has seventeen stores and the show window of each store is lighted differently, particular attention being paid to the color. Some stores are lighted by daylight lamps, some by amber lamps, some by red-tinted lamps and others by a combination of different colors.



BEFORE—DISMAL STREET AND UNATTRACTIVE WINDOWS



AFTER—THE BRIGHT ILLUMINATION INVITES INSPECTION

STREET-LIGHTING EXTENSION CONTRACTS LET IN CHICAGO

Details of Awards for Bulk of the Improvements Authorized by Voters at the Recent Election in That City

The bulk of the work to be done in improving and extending Chicago's street-lighting system, in accordance with the vote at a bond election at which the necessary funds were authorized, has been let to contracting firms in the city.

This procedure, it has been determined after calling for bids on labor and material several times and after installing trial circuits under the direct jurisdiction of the city, is the least expensive plan of handling the improvement.

The contract for installing the posts and the cable, amounting to about $1,500,000, was awarded to W. F. Cummings of Chicago. A large number of posts have already been purchased by the city, but during 1917 it is expected that this contractor will buy 2,140,000 ft. (652.27 km.) of No. 8 600-volt armored cable, 275,000 ft. (83.82 km.) of 5000-volt No. 8 armored cable and 6000 cast-iron posts.

The Contracting & Material Company, Chicago, secured the contract for furnishing and laying the conduit. This contract amounts to about $150,000.

The contract for substations, amounting to $38,000, was awarded to the Pierce Electric Company of Chicago.

WAR CONDITIONS AFFECT MARCONI WIRELESS OPERATIONS

Organization and Personnel, Including High Power and Coastal Stations and Manufactories, Are Offered to Our Government

Information in regard to the effect of war conditions is given in the report of directors of the Marconi Wireless Telegraph Company of America for the year 1916. These conditions, preventing the operation of the transatlantic stations at New Brunswick and Belmar, N. J., and Marion and Chatham, Mass., remain unchanged.

"The British Admiralty still holds, for military purposes, the English plants constructed for exchange of traffic with this country," says the report. "The continuance of the war has likewise rendered it impossible to inaugurate our direct service with Scandinavia.

"Service with Japan was successfully inaugurated on Nov. 15 last, and an increasing volume of traffic is being handled, under government censorship, at a tariff one-third lower than that of the submarine cable. On the Pacific, as on the Atlantic, operations are restricted by war conditions, the Japanese stations being controlled by that government. For the present, therefore, the new service is limited to traffic between San Francisco, Hawaii and Japan.

"Your company continues to manufacture apparatus for use by the United States army and navy, and recently has been awarded contracts for a large number of wireless sets of various types."

When diplomatic relations with Germany were severed the organization and personnel, including the high-power and coastal stations wherever situated, the manufactories, workshops and trained staff, were offered to the government. This offer was acknowledged by the President and the Secretaries of War and the Navy. The officials of the company are co-operating closely with the government.

Gross earnings from operations of the company in 1916 were $862,502, as compared with $748,238 in 1915. Receipts from message traffic with ships show an increase of 9 per cent over 1915.

HIGHER ELECTRIC RATES TO OFFSET HIGHER COSTS

Penn Central Light & Power Company Asks Pennsylvania Commission to Help by Allowing 12 Per Cent Advance

An increase of about 12 per cent in rates is asked by the Penn Central Light & Power Company, Altoona, Pa., in a schedule filed with the Pennsylvania Public Service Commission.

J. H. Shearer, general superintendent of the company, says in a public statement that the operating expenses have increased 61.4 per cent, while earnings have increased but 27.8 per cent. Expenses in February were 93.1 per cent higher than in February, 1916. Taxes were 10 per cent higher.

About 70,000 tons of coal are used in the year. In 1914 coal cost $1.90 per ton, while for the first three months of 1917 the price was $5.39, an increase of 183 per cent. Copper has trebled and all other materials used in the service have also advanced. Mr. Shearer says that the higher rates will be far from sufficient to cover the difference caused by higher expenses.

The increase for each individual, Mr. Shearer points out, will be insignificant.

MANUFACTURERS OF ELECTRIC VEHICLES TO HOLD CONFERENCE

Meeting Called for April 19 Is to Supplement the February Gathering of Central Station Representatives

A conference of electric vehicle manufacturers is to be held on Thursday, April 19, at 1.30 p. m., at the headquarters of the National Electric Light Association, New York.

Chairman E. S. Mansfield of the Electric Vehicle Section of the association says that definite plans are being formulated to promote wider use of electric vehicles in co-operation with the central station industry. The importance of the meeting is being urged upon manufacturers of electric passenger and commercial vehicles, electric industrial trucks, batteries, tires and accessories. Following is the tentative program:

"Analysis of the Present Electric Vehicle Situation and the Purposes of This Conference," by Chairman E. S. Mansfield; a paper by C. D. Fairgreave, Anderson Electric Car Company, on "Advertising and Publicity"; a paper on getting local distribution, by P. D. Wagoner, General Vehicle Company; "The Charging Problem in Vehicle Selling," by C. A. Street, Walker Vehicle Company; "The Electric Industrial Truck," author not yet determined; paper by E. P. Chalfant, Anderson Electric Car Company, on "Co-operation."

After discussion on these addresses a plan for action will be proposed.

This conference of manufacturers follows a similar conference of central station representatives on Feb. 14.

POWER FOR PHILADELPHIA IN DAYLIGHT DARKNESS

Electricity the Accepted Defense Against Heavy Fog Bank Which Oppressed the City for Several Hours at Midday

Philadelphia had an experience with midday darkness one day in March. The unusual darkness became acute about 10.30 in the morning and continued until nearly 3 p. m. It was caused by a fog bank which, according to the director of the Philadelphia weather



ELECTRICITY IS THE ACCEPTED DEFENCE AGAINST DARKNESS

bureau, covered approximately 25 square miles and weighed 550,000 tons.

The demand upon the Philadelphia Electric Company for energy above the normal amount used in the central district in the daytime was approximately 8000 hp.

An interesting letter describing the organization through which the Philadelphia Electric Company prepares for a demand of this character appeared in the Philadelphia *Public Ledger*. It was written by Charles Meigs Ripley of the Philadelphia office of the General Electric Company.

Mr. Ripley showed that in this case the cloud "stormed" Philadelphia unannounced, coming "in the only manner possible to escape detection, *i.e.*, straight down from above." He added:

"There is within the walls of the modern power plant a field for romantic and fascinating stories more interesting than most of the tales of Homer or Dumas. The electrical industry needs a Kipling or a Jack London adequately to describe the electrical developments of the twentieth century.

"Marvelous as was the achievement, it should be understood that a total reserve capacity of 42,000 hp. was available and ready to meet an even greater emergency. It is true alike of electrical generating machinery and armies that 'they also serve who only stand and wait.'"

PLANS OF THE SOCIETY FOR ELECTRICAL DEVELOPMENT

Annual Meeting Is to Be Held on May 8 and Comprehensive Sales Plans Are to Be Presented for Consideration

The annual meeting of the Society for Electrical Development, Inc., will be held on May 8, at its offices in the United Engineering Societies Building, New York City.

Directors for the ensuing year will be elected, and the report of J. M. Wakeman, the general manager, will be presented. Plans for 1917 and early 1918 will be discussed.

The society has comprehensive sales plans to present for the periods following "America's Electrical Week" and "Wire-Your-Home Time."

After the annual meeting the directors will elect officers. The directors are expected to decide whether there should be another electrical week this year or next spring, and to appoint a committee to take charge of such a campaign.

COAL SUPPLY A COSTLY BURDEN IN NEW JERSEY

President Thomas N. McCarter Discusses the Expense, Which, Under Rigorous Regulation, Cannot Be Passed to Consumers

"The great difficulty of operating this company for the year has centered around the coal supply," said President Thomas N. McCarter in the annual report of the Public Service Corporation of New Jersey in referring to the subsidiary Public Service Electric Company.

"The coal for the year," Mr. McCarter adds, "was contracted for with responsible contractors, who, however, owing to conditions which for the most part they could not control, were able to make deliveries of only a small portion of the amounts called for by their contracts. It, therefore, became necessary to buy coal in the open market at going prices. Enormous quantities of coal were purchased by the company at prices running from $6 to $7 per ton, as against its contract price of $3.25 per ton.

"It can be readily imagined how vital this matter is. Unlike the ordinary manufacturer, this emergency cost cannot be passed on to the consumer by the company. This situation affords a melancholy illustration of the results from and dangers of rigorous rate regulation."

The increase in kilowatt-hours commercially sold by the company was 83,792,262, or 42.52 per cent. The revenue from electric sales increased 23.02 per cent. The revenue from electric sales averaged 4.45 cents per kilowatt-hour sold, as against 5.16 cents per kilowatt-hour in the previous year. The ratio of operating revenue deductions to operating revenue was 58.4 per cent, as against 54.3 per cent for the corresponding period in 1915.

Mr. McCarter shows that taxes for the year amounted to $2,713,059, an increase of $396,093 over the previous year.

"The corporation will always be ready to bear its share of the public burden," Mr. McCarter continues, "but there is a limit to the increase in taxation it can bear, unless the burden is to be passed on to the consumer by a raise in rates.

"There is pending in the Legislature a bill, which has received the support of the dominant political party, which seeks to raise the franchise taxes paid by the gas and electric companies from 2 per cent of their gross receipts to 5 per cent in increasing installments of 1 per cent a year, reaching the maximum after three years. If enacted into law this statute would, when fully consummated, increase the taxes of these two companies annually by about $900,000 or $1,000,000 a year.

"Thus the sovereign power of the State is constantly being exercised to increase the operating expenses of these companies through taxes with one hand, and to reduce their revenue by rate reductions with the other. How long can this continue, especially in times of economic inflation like the present when all operating costs are abnormally swollen?"

A "graphic illustration of the advantages of government by commission," cited by Mr. McCarter, is the expense of collecting data and preparing the electric rate case for submission to the commission. Exclusive of the salaries of its own employees who are concerned with this case the company has already expended in and about this matter $362,752. The estimated total cost, after completion of the investigation, is $500,000.

HYDROELECTRIC POWER HELPS NORTHERN STATES COMPANY

Increased Cost of Fuel, Bought Necessarily in Part at Retail Prices, Contrasted with Water Power Generated and Purchased

At the date on which the annual report of the Northern States Power Company was prepared (March 19, 1917) the sales of stock to residents of the territory served amounted to approximately $1,436,300 par value, distributed among 2774 holders.

The business of the company increased rapidly in 1916, gross earnings amounting to $6,087,153 as compared with $5,121,827 in 1915. Large extensions and additions have been made and are being made.

President H. M. Byllesby refers to the circumstance that the company will secure an increasing proportion of power from hydroelectric plants, as follows:

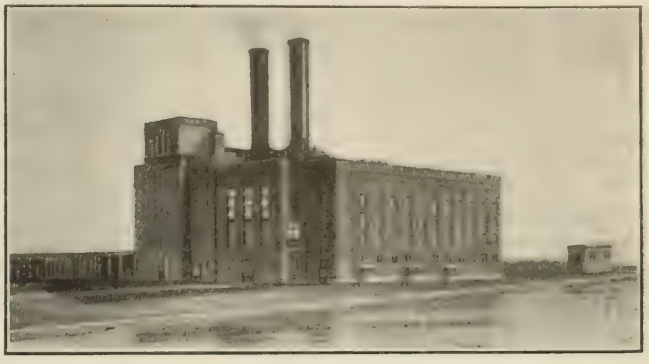
"During the past eighteen months your company, in common with all others, has been confronted with a necessary increase in labor cost and a marked increase in the cost of all materials entering into its operation and construction. Also, notably during the past four months, it has suffered greatly from increased cost of fuel required for that part of the power generated by steam. This has been due not only to the increased cost of coal, but has followed the great congestion in the railroad service, which frequently has forced your company to go into the open market and purchase practically at retail, and at retail prices, the fuel which could not be delivered under its coal contracts and which was necessary in order to preserve the continuity of service.

"How far this increase in labor, material and fuel may go, of course, cannot be predicted, but with the increasing proportion of power produced by its own hydroelectric plants and the power which it will purchase from the Wisconsin-Minnesota Light & Power Company under a fixed contract, as well as the assured growth of your company, it is confidently expected that net earnings will continue to increase satisfactorily."

EXTENSION OF THE NIAGARA RIVER STEAM POWER STATION

Actual Construction for the New 35,000-Kw. Addition Will Be Begun as Soon as Weather Permits

The engineers on the design and construction of the new power station of the Buffalo General Electric Company are at work on the details for the new 35,000-kw. extension. Actual construction will be commenced as soon as weather conditions permit.



WORK UNDER WAY ON EXTENSION TO THE BUFFALO PLANT

The present turbine room is large enough to contain the new 35,000-kw. Curtis turbine-generator, but the boiler room will have to be extended to contain the entire new equipment of five 1140-hp. boilers which has been ordered. Three of these boilers can be accommodated in the present boiler room, and it is expected that they will be in operation early in the fall. Until the new generator is installed these boilers will serve principally as relays for the present five boilers supplying steam for the initial installation of 60,000 kw. The two additional boilers will be placed in an extension of the present boiler room.

The new boilers are similar in type and arrangement to those at present installed, being of the Babcock & Wilcox type fired from both ends by means of two Riley stokers, each having fifteen retorts. The boiler settings are the largest of the type yet installed and are approximately 25 ft. wide by 18 ft. deep. The present stokers are engine-driven through countershafts, but the new boilers will be turbine-driven and will be direct-connected by chain drives. The chain drive for both the present and the additional installations consists of Link Belt chains.

The new boilers will be equipped with Green's economizers similar to the initial set, and the forced draft fans will also be supplied by the Green Fuel Economizer Company. A fourth Cochrane feed-water heater is to be installed similar to the three Cochrane heaters in the present equipment. The present boiler feed consists of four-stage centrifugal pumps, which are turbine-driven, but in the new installation there will be added a spare centrifugal motor-driven boiler-feed pump. The main high-pressure steam valves, which have a working pressure of 275 lb. with 275 deg. superheat, as in the present installation, will be supplied by the Nelson Valve Company. Coal larries are to replace coal spouts for the entire boiler room.

This addition to the Niagara River power station is being carried out by the Stone & Webster organization, which designed and built the first installation.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Power of City to Make Contract.—An exclusive contract with a waterworks company to supply a city's needs to endure for forty years, subject only to adjustment of rates at the end of twenty years, is not within the power of a city to make, it was held by the Supreme Court of the State of Montana (162 P. 381).

The Constitution of Entry for Survey of Eminent Domain.—The rights given by law to corporations, including power companies, to enter on land to make examinations and surveys, etc., are based on the sovereign power to take, injure or destroy the property of others through its appropriation and devotion to a public use, it was held by the Supreme Court of Alabama in the case of Dancy vs. Alabama Power Company (73 S. 901).

Right of Commission to Enforce Duties.—The right of the Public Service Commission to enforce legal duties and to prevent violations of law by mandamus under Public Service Commission law is established, and cannot be defeated because the Attorney General may have the right to institute forfeiture proceedings against the offending public utility, it was held by the Supreme Court of New York in Public Service Commission for First District vs. Richmond Light & Railroad Company (163 N. Y. S. 64).

Action for Loss by Fire Occasioned by Electricity.—Where plaintiff suffered loss by fire which evidence shows started at a point on electric wires owned by defendant, the Northern California Power Company, and which in the ordinary course of events would not have happened if the power company had used proper care, under the doctrine of *res ipsa loquitur* a prima facie case of negligence by defendant was shown, and the burden of excusing such negligence was upon the defendant, it was held by the District Court of Appeal, Third District of California, and a rehearing was denied by the Supreme Court (162 P. 412). Evidence showing that the electric wires produced in court by the power company were not the ones in use at time of plaintiff's loss by fire was admissible not as *res gestae*, but in the nature of an admission that defendant had no defense except by fabricating evidence. Defendant's requested instruction that "the defendant cannot be held liable for any defective wiring in the tank-house" was properly refused where there was no evidence to show that such wiring was defective, the claim being that plaintiff's loss by fire was caused from defects outside the house and not from faulty interior wiring.

Reasonableness of Order Regulating Rates.—In a city's proceeding before the Public Service Commission against a manufacturer and distributor of gas the evidence tended to show an exorbitant rate for gas in the city and that a reduction in rates would increase the sales or consumption. The Supreme Court of Missouri held (191 S. W. 412) that an order of the commission fixing lower rates for the gas company temporarily, merely to make a test, that the real question of a reasonable rate might be ultimately determined, the order leaving the latter point open, was not unreasonable. In such a proceeding the fact that other cities of similar population were procuring gas at a much less rate than defendant company charged was evidence of the fact that its rate was unreasonable as charged by the city concerned.

Damages for Diversion of Water.—Where the York Haven Water & Power Company wrongfully diverted the waters of a stream so that they no longer flow past the plaintiff's farm, the measure of plaintiff's damages is the difference in value of the farm before and after diversion, it was held by the Supreme Court of Pennsylvania (99 A. 798). Residents of the locality familiar with the farm and other real estate who had knowledge of the value of land in the vicinity may give their opinion as to the amount of damages. The plaintiff may recover damages for loss of moisture which formerly rose from the water and was precipitated as dew upon his land. After the affirmation of a decree directing the removal of a dam, defendants neglected for some months to carry it out. The court held that in this case there was such a wanton disregard of plaintiff's rights that he might recover punitive damages, and that an award of $500 for punitive damages was not excessive where the actual damages amounted to over $4,000.

Responsibility of Employer for Negligence.—The foreman of a telephone and telegraph company directing the work of attaching a cable to a messenger wire along the company's poles was a vice principal, rendering the company responsible for his negligent default in failing properly to warn an employee of the defects in the transformer on the adjacent poles of a power company and of the dangers incident to existing conditions, it was held by the Supreme Court of North Carolina (91 S. E. 354). Where the telephone employee went on a power company's pole in the absence of any contract or agreement giving either the employee or the telephone company the right to be upon the power company's poles, both the telephone company and its employee were trespassers, and the power company was not liable to the employee for an electric shock received by him through defect in a transformer, since the established principle in the law of negligence that there is no liability to trespassers, except for injuries willfully or wantonly inflicted, is applicable to electric companies and electric appliances.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Income from All Telephone Lines the Basis of Rates.—An order of the Pennsylvania Public Service Commission, directing the Bell Telephone Company of Pennsylvania to reduce its rates about $1,000,000, holds that the income from all lines in the State rather than the income from any particular community must be made the basis of the charges. The company is directed to install measured service instead of unlimited service in Philadelphia and Pittsburgh.

Supplemental Order by California Commission in Oro Case.—The Railroad Commission of California has issued a supplemental order to the decision authorizing the Pacific Gas & Electric Company to buy certain of the properties of the Oro Electric Corporation. The company has filed stipulations that it will not claim before any public body values for franchises obtained in this deal greater than original cost, that it will pursue a liberal policy of extension of electric development in the territory, etc.

Massachusetts Board Alters Order When Company Changes Plans.—By an order of Nov. 21, 1913, the Massachusetts Board of Gas and Electric Light Commissioners approved the issue by the Amesbury Electric Light Company of 1500 shares of additional capital stock at 100, of which the proceeds of 600 shares were to be applied to the payment of an equal amount of the cost of additions to the generating equipment made subsequent to June 30, 1913. After the issue of the 600 shares, but before the devotion of the proceeds to the purpose specified in the order, the company entered into an arrangement for the purchase rather than generation of the electricity supplied to its customers, and abandoned its contemplated additions to its generating equipment. Subsequent to June 30 and prior to Jan. 1, 1917, the company expended more than $60,000 upon extensions of its distribution system, which expenditures were represented in its floating debt outstanding on a later date. The company requested the board to amend the order of Nov. 21, 1913, so as to permit it to apply the proceeds of the 600 shares to its floating debt. The board has ordered that so much of the order of Nov. 21, 1913, as requires the application of the proceeds of 600 shares to the payment of an equal amount of the cost of additions to its generating equipment made subsequent to June 30, 1913, shall be rescinded and that the company shall apply the proceeds to the payment and cancellation of an equal amount of notes outstanding on Jan. 1, 1917, and to no other purpose.

Dr. Maltbie in Toledo Rate Case.—A meeting of the committee on gas and light of the Toledo (Ohio) City Council was held on April 1 to consider the electric rates of the Toledo Railways & Light Company. Dr. Milo R. Maltbie, representing the city of Toledo, was present.

National Board of Water Conservation Urged.—Charles N. Chadwick, chairman of the special committee on conservation of state waters, lands and forests of the New York Chamber of Commerce, has made a report recommending the appointment of a National Board of Water Conservation.

Western Electric Company Preferred Stock Increase.—Western Electric Company stockholders have voted to increase the preferred stock from $15,000,000 to $30,000,000. The stock is offered to common shareholders at par, payable in two installments of $50 each, on April 16 or June 30, or in full on or before April 16 if the subscriber prefers.

Kansas City Rate Reduction Accepted.—President John H. Lucas of the Kansas City Light & Power Company has notified the Missouri Public Service Commission that that company will accept the order reducing rates. The new maximum rates, effective on April 17, will be 8 cents per kilowatt-hour for the first 3 kw.-hr., and 5 cents thereafter.

New York City Asks Reduction in Flatbush Rates.—At a hearing before the New York Public Service Commission, First District, on April 6, Dr. Milo R. Maltbie, City Chamberlain of New York, appearing for Mayor Mitchel, announced that he would ask for a reduction in the maximum electric rate of the Flatbush Gas Company from 12 cents per kilowatt-hour to 8 cents plus 0.5 cent for lamp renewals.

Connecticut Companies Consolidated.—The East Haddam Electric Light Company and the Colchester Electric Light Company have been consolidated as the Central Connecticut Power & Light Company, with headquarters at East Hampton, Conn. The new company will continue to serve the same towns. In three years the property has increased its customers and receipts fifteen times. Arthur B. Lisle is president of the new company and L. P. Perry general manager.

Washington - Idaho Company Improvement Plans.—Deeds have been recorded in Idaho covering the sale by the Lewiston-Clarkston Improvement Company of its electric power plants and irrigation system to the Washington-Idaho Water, Light & Power Company. The latter company was organized recently by Liggett, Hichborn & Company of New York and Boston. The consideration was $800,000. A mortgage in favor of the Equitable Trust Company of New York was also recorded. This authorizes a present bond issue of $600,000 and $400,000 to meet future developments. The plans of the purchasers contemplate construction of a dam in the Snake River three miles below Lewiston, which will develop 50,000 hp.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Municipal Ownership Plan Defeated at Faribault, Minn.—At the election on April 4 in Faribault, Minn., the question of whether the city should distribute and sell electricity was decided negatively by a vote of approximately 1100 to 400.

New Directors of Cities Service Company.—At the annual meeting of stockholders of the Cities Service Company, held in Dover, Del., on April 3, J. C. McDowell, in general charge of the natural gas and oil operations, and M. R. Bump, chief engineer of the Doherty organization, were elected new directors. The stockholders voted an increase in the authorized amount of preferred stock from $60,000,000 to $100,000,000, and in the authorized amount of common from $40,000,000 to $50,000,000.

Large Central Station Flashing Sign at Portland, Me.—Although the Cumberland County Power & Light Company of Portland, Me., occupies offices in a comparatively old building in Monument Square, the business center of the city, the company has contributed in a striking manner to the electrical advertising illumination facilities of the place by a flashing sign. The sign extends across a front of about 60 ft., above and below the third-story windows, and emphasizes the triple service rendered by the company. It contains 704 white lamps and 302 red lamps, all of the 10-watt size, the different designations being operated on a flasher with arrow "service" signs. The company's installation also includes a rectangle of 10-watt red lamps carried along the cornice and dropping vertically to a horizontal run of lamps just above the first story.

Opposition to Metric System.—The American Institute of Weights has been formed, with offices at 20 Vesey Street, New York, to oppose "a propaganda for the adoption" of the metric system. The officers are: W. R. Ingalls, president; Henry D. Sharpe and D. H. Kelly, vice-presidents; Walter M. McFarland, treasurer; Frederick A. Halsey, commissioner and secretary. The council is composed of John F. Farrell, Frederick A. Geier, E. M. Herr, A. C. Humphreys, W. R. Ingalls, D. H. Kelly, Henry M. Leland, William Lodge, Walter M. McFarland, Henry D. Sharpe, Stevenson Taylor, Charles N. Thorn, Henry R. Towne, W. R. Warner and W. H. Van Dervoort. Six others are to be elected. Two bulletins have been issued to further the purpose of the organization, "The Six Metric Myths" and "Indorsements That Count." Copies will be sent free to any address on request.

British Engineering Profession Relief Fund.—Contributions to the fund of the Professional Classes War Relief Council, Inc., which were urged in a notice published in the Electrical World on March 24, 1917, have not reached the amount desired. From 1072 contributors there has been received $10,711. It is felt by those who are interested in the fund that electrical engineers have not contributed as generously as could be desired. The movement is intended to relieve families of professional men in Great Britain, many of whom are experiencing privation. Contributions may be sent to Lewis B. Stillwell, treasurer, care the Farmers' Loan & Trust Company, 475 Fifth Avenue, New York.

Inclined Coal Mine to Be Electrically Operated.—The Canton (Ill.) Gas & Electric Company has closed a contract to supply electrical energy to a coal mine of the Big Creek Coal Company of Chicago, at St. David, Ill., five miles southeast of Canton. This installation will be unusual in that it will serve a mine which is not of the ordinary hoist and shaft type, but is known as an inclined mine. The mine is constructed so that the coal is delivered directly from a side hill to the ground level and is then carried to the tipple on an endless chain incline. The capacity of this mine is about 1500 tons per day. The electrical installation will include about 500 hp. in motors of various sizes, which will be installed to operate all the machinery used in and at the mouth of the mine. The power will be delivered over the central station company's 13,000-volt transmission line, which now extends through St. David. It is planned that an installation of 450 kva. of step-down transformers will be used to displace the coal company's old steam equipment.

Cleveland's New Electrical Inspection Ordinance.—The amended ordinance under which the electrical inspection department of the city of Cleveland operates was amended recently. One section provides that for each extra inspection made necessary by faulty construction or inaccurate information on permit an extra charge of $1 shall be made. Another section says: "If upon inspection the city electrician shall find that an electric meter registers more watt-hours than it should, he will then order the same to be replaced by another meter reading correctly, at the expense of the company owning such a meter, and the inspection fee of $1 shall be returned to the person making the application." There is nothing about the usual 3 per cent leeway in the correctness of the meter reading. Another section prohibits the use of wood molding after Jan. 1, 1917. The same section also prohibits concentric wiring. In assembly halls and similar buildings, except theaters, no provision is made for the proper control of lights at some point near the main entrance. The ordinance also allows 750 watts for branch circuits with a maximum of twelve sockets. In other respects than those mentioned the ordinance follows closely Code requirements.

Cleveland Electrical League.—Charles F. Kettering of the Domestic Engineering Company of Dayton addressed the Electrical League of Cleveland on April 5.

Electric Hoisting in Mines.—H. L. Hall will address the Denver Section of the American Institute of Electrical Engineers on April 21 on the subject of "Electric Hoisting in Mines."

Chicago Section, A. I. E. E.—"Economic Industrial Applications of Electricity" is the subject of the meeting of the Chicago Section of the American Institute of Electrical Engineers that will be held April 23.

Central Station Construction Discussed Before Pratt Institute Engineers.—On April 10 E. B. Meyer, assistant to the chief engineer of the Public Service Electric Company of New Jersey, delivered an illustrated lecture before the electrical engineers of Pratt Institute, Brooklyn. The subject was "Description and Construction of a Modern Electric Generating Station."

New York Section, I. E. S.—"Evolution of Light Projection" was the title of the paper presented by C. A. B. Halvorson and R. B. Hussey of the General Electric Company, Lynn, Mass., before the Illuminating Engineering Society of New York. R. B. Thompson, Central Hudson Gas & Electric Company, Newburgh, N. Y., presented a paper on "Development of a Permanent Street Lighting Plant for a Small City or Village."

Transmission and Distribution Committee Meeting of the O. E. L. A.—The transmission and distribution committee of the Ohio Electric Light Association will hold its next meeting at Canton, Ohio, on April 18. F. H. Golding, manager of the Central Power Company, Canton, will deliver the address of welcome. R. L. Allen, engineer, with the Archbold-Brady Company, Syracuse, N. Y., will read a paper on "Design and Structural Advantages of the A-Frame Steel Tower," and A. O. Austin, chief engineer of the Ohio Insulator Company, Barberton, will deliver a paper on "Insulator Developments for 1916." After luncheon there will be a trip of inspection through a number of factories at Canton.

Detroit-Ann Arbor Section of A. I. E. E.—Paul M. Lincoln, past-president of the American Institute of Electrical Engineers and electrical engineer of the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., addressed the Detroit-Ann Arbor Section of the A. I. E. E. at a banquet given March 31 in Detroit. Among others who spoke were Peter Junkersfeld, vice-president of the society and assistant to the vice-president of the Commonwealth Edison Company, Chicago; C. F. Hirschfield, chief of the research department of the Detroit Edison Company, and Prof. J. C. Parker, head of the electrical engineering department of the University of Michigan. The chairman of the evening was A. A. Meyer of the Detroit Edison Company.

Associations and Societies

A complete Directory of Electrical Associations is regularly printed in the first issue of each month on the next to last text page.

Electrical Machinery and Supplies.—Earl Buckingham, associate member of the American Society of Mechanical Engineers, recently addressed that body in New York, presenting an illustrated talk on "Standards of Business Success." He showed the results of his investigation along eight different lines of business, one of them being electrical machinery and supplies.

Kansas Branches of A. I. E. E. Meet.—C. H. Taylor, representative of the Westinghouse Electric & Manufacturing Company, F. B. Uhrig of the Western Electric Company, J. T. Skinner of Lawrence and H. P. Cady of the Kansas State University faculty were the speakers at the ninth annual electrical engineers' day at the University of Kansas, Lawrence, Kan., March 28. The meeting was a joint session of the university and the Kansas branches of the American Institute of Electrical Engineers.

Annual Convention of the Southwestern Electrical and Gas Association.—The thirteenth annual convention of the Southwestern Electrical & Gas Association will be held in the Adolphus Hotel, Dallas, Tex., on April 26, 27 and 28. The morning of the first day of the convention will be devoted to an address of welcome, the president's address, election of new members, the appointment of the convention committee and similar business. The street and interurban railway sessions will be held on the afternoon of the same day and the morning of the next day. The gas sessions will be held at the same time as the street and interurban railway sessions, but in separate rooms. The electric light and power sessions will be held on the afternoon of April 26 and the morning of the following day. The general session will be held early in the afternoon of April 27, followed by the business session, at which the reports of the treasurer and all committees will be presented and officers and standing committees for the coming year will be elected. It was thought best by all three of the committees to devote one of the sessions to practical operating subjects and the other session to executive and administrative matters and to matters of public policy. Class B members, who are to be the principal hosts of the convention this year, have laid out a liberal plan of entertainment for the attending members, visitors and guests. The Dallas Electric Club has also arranged to entertain the visiting ladies. A rejuvenation will be held on the evening of April 27, a special entertainment having been arranged to take place on that evening.

Spokane Section, A. I. E. E.—"High-Tension Transformers" and "Electrolysis" are the subjects to be discussed before the Spokane Section of the A. I. E. E. on April 20.

Electrical Supply Jobbers' Association.—The ninth annual meeting of the Electrical Supply Jobbers' Association will be held May 22 to 24, at the Homestead Hotel, Hot Springs, Va.

Empire Gas and Electric Association.—Methods of installing and testing large-capacity watt-hour meters will be discussed by the electric meter committee of the Empire Gas and Electric Association in the United Engineering Societies Building, New York, April 13.

Ithaca Section, A. I. E. E.—The Ithaca Section of the American Institute of Electrical Engineers recently held a meeting at which J. D. Stahl spoke on "The Electrical Features of the Panama Canal." T. G. Spates addressed the club on "The Problems and Possibilities of the Central-Station Industry."

May Meeting of the A. I. E. E.—The annual business meeting of the American Institute of Electrical Engineers will be held in New York at the Engineering Societies Building on May 18. At this meeting the report of the Board of Directors is to be presented and announcement made of the election of officers for the ensuing year.

Insulating Materials.—L. E. Barringer, engineer in charge of insulations for the General Electric Company, addressed the Pittsfield (Mass.) Section of the American Institute of Electrical Engineers on the subject of "Insulating Materials," at a recent meeting. After commenting on the great difficulties in the way of forming a working theory upon which to base the design of insulations, Mr. Barringer took up the characteristics required for various classes of service and explained how the materials available met these requirements. Some must be capable of withstanding high temperatures, some must be good heat conductors and others good heat insulators, while still others must have great mechanical strength.

Twenty-third Annual Convention of the O. E. L. A.—The Ohio Electric Light Association will hold its twenty-third annual convention, July 16-20, 1917, at the Breakers Hotel, Cedar Point, Ohio. The tentative program is as follows: The first session will include the president's address, reports of the secretary-treasurer and executive committee, election of new members and similar business. On Tuesday the meter committee will report, and W. S. Barstow, New York City, and one of the electrical engineers of the Bureau of Standards will give addresses. Wednesday morning's session will be devoted to new-business subjects. Addresses will be delivered on Wednesday afternoon by H. C. Eddy, H. O. Loebell, C. I. Crippen, J. C. Matthieu and C. E. Torrey. Station-operating subjects will be discussed on Thursday morning, and transmission and distribution problems on Thursday afternoon.



WASHINGTON DEVEREUX

Washington Devereux, chief of the electrical department of the Philadelphia Fire Underwriters' Association, has been elected president of the National Association of Electrical Inspectors. Since 1880, when he became connected with the Bell Telephone Company of Pennsylvania, Mr. Devereux has been constantly engaged in the electrical industry in the United States and the West Indies. His society affiliations include most of the great national electrical associations. He is author of "Electrical Key," the standard work for use of the Electrical Inspection Bureau, and is the originator of the electrical conference which consists of inspectors and district managers of the Philadelphia Electric Company, municipal inspectors, electrical contractors and mechanics, and inspectors of the Philadelphia Fire Underwriters' Association. This conference meets once a month to discuss code regulations, the best methods of co-operation between the various branches of the electrical industry and other electrical subjects. Besides Mr. Devereux has been prominent in Jovian activity in Philadelphia. From 1910 to 1912 he was statesman of the Jovian Order from the Eastern District of Pennsylvania.

A. C. Hathaway has resigned his position as assistant general manager of the Virginia Railway & Power Company at Norfolk, Va. Mr. Hathaway is succeeded by T. Norman Jones, Jr.

Arthur Kempston, now in charge of overhead construction for the city of San Francisco, has been appointed chief of the city's department of electricity, succeeding James M. Barry, who resigned to become engineer of distribution with the Great Western Power Company. Ralph W. Wiley succeeds Mr. Kempston.

M. C. Whiting, assistant general superintendent of the Cairo Railway & Light System, has resigned to accept the position of general manager of the International Silica Company of Cairo, Ill. Mr. Whiting was with the Cairo lighting system for six years. Previous to that time, after his graduation from the University of Illinois in 1908, he was with the Galesburg Railway, Light & Power Company.

Men of the Industry

Changes in Personnel and Position— Biographical Notes

C. W. Sanders has been appointed operator at the Tacoma municipal power plant at La Grande, Wash.

F. S. Morrison has been appointed assistant operator at the Tacoma municipal power plant at La Grande, Wash.

H. H. Barnes, Jr., engineer for the General Electric Company, after an illness of three months is again taking up his duties in New York.

H. R. Lanning has been appointed chief operator of the Tacoma municipal power plant at La Grande, Wash., succeeding Henry Abbott, who recently resigned.

Ralph W. Wiley succeeds Arthur Kempston, who has been appointed chief of the department of electricity of San Francisco, in charge of overhead distribution for the city.

W. W. Scherer, who was formerly associated with the testing laboratory of the Pacific Gas & Electric Company, has become identified with the Western Electro-Mechanical Company of Oakland, Cal., manufacturer of electrical testing instruments.

Harry H. Lyons, for the last five years connected with the Arkansas Valley Railway, Light & Power Company at Pueblo, Col., has been appointed district superintendent of the new division of the company which includes Ordway, Sugar City, Crowley and Olney Springs.

H. C. Hoagland has been transferred from Muskogee, Okla., to Oklahoma City, where he will take up the duties of vice-president and general manager of the Central Oklahoma Light & Power Company. Mr. Hoagland goes to Oklahoma City after a service of about half a year in Muskogee, where he had charge of the H. M. Byllesby & Co. plants in Muskogee, El Reno and Oklahoma City. Prior to that he was general manager of the Fort Smith (Ark.) Light & Traction Company.

Henry F. Holland, who was appointed manager of the electric range department of the Great Western Power Company, San Francisco, Cal., only a few months ago, has severed his connections with that company and returned to Los Angeles, following the action of the company on March 1 in the abandonment by it of its range department with all its activities. For the present Mr. Holland's address is 1928 Highland Avenue, Hollywood, Cal. Mr. Holland has been closely identified with electric heating for the past ten years or so and has been very active in Jovian circles on the Pacific Coast. Before going with the Great Western he was Pacific Coast representative of the Simplex Electric Heating Company.



DUDLEY FARRAND

Dudley Farrand, for many years general manager of the Public Service Electric Company of New Jersey, has been promoted to be assistant to Thomas N. McCarter, president of the parent company, the Public Service Corporation of New Jersey. Mr. Farrand was born in Bloomfield, N. J., in 1869. He entered Princeton College with the class of 1891, but left before the completion of his course to become connected with the Newark (N. J.) Electric Light & Power Company, of which he became a director in 1891. Five years later he was made assistant general manager of the People's Light & Power Company, becoming general manager in the following year. The United Electric Company of New Jersey was formed in the spring of 1899 with Mr. Farrand as general manager. This company, the forerunner of the Public Service Electric Company, served a large portion of the State. Later when the electric interests were consolidated with large railway interests under the Public Service Corporation of New Jersey Mr. Farrand continued in charge of the electric department. Mr. Farrand has been closely associated with national electrical associations, having been elected secretary of the National Electric Light Association in 1904 and president of the association in 1907.

Daniel L. Turner, who has been acting chief engineer of the Public Service Commission for the Second District of New York since the appointment in November last of Alfred Craven as consulting engineer of the commission, has been appointed chief engineer of the commission.

Obituary

Joseph Phineas Davis, chief engineer for the American Telephone & Telegraph Company from 1880 to 1905, died at his home in Yonkers, N. Y., on March 31. Mr. Davis was born at Northboro, Mass., in 1837 and received his engineering education at the Rensselaer Polytechnic Institute, from which he was graduated in 1856. After serving for twenty-five years as chief engineer of the telephone company Mr. Davis retired in 1905.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

BRISK DEMAND FELT FOR ELECTRICAL WAR EQUIPMENT

New England Manufacturers Feel Activity in Market for Flood-Lighting Outfits—Increased Use of Industrial Trucks Expected

The declaration of hostilities against Germany has greatly stimulated the demand for electrical war material produced in New England. One large manufacturer of flood-lights is almost overwhelmed with orders following the completion of plans for guarding bridges and other strategic points. In one day last week orders for 1400 such units were received. So great is the urgency that the cast-iron parts, which are the most difficult portions of the equipment to procure, are being shipped to the factory by express. Several types of reflectors are used.

It is predicted that shortage of industrial labor resulting from the mobilization of land and sea forces can be met in part, so far as factory transportation is concerned, by the use of industrial electric trucks. A widespread demand for this equipment is likely to be seen in the early future, together with a demand for small motors of a wide range of sizes. Turbo-lighting sets, also, for marine work are certain to be sold in increasing numbers.

Some uncertainty exists as to the future course of material prices, in view of the action of certain producers of bulk metal in offering to supply material far below the present market level for governmental use. Readjustments in the interests of patriotism should be possible without serious difficulty so far as war material supply goes, and the ultimate destination of material should be taken into account in mobilizing the industrial resources of the country for the most efficient prosecution of the war.

INCREASE OF 500 PER CENT IN THE PROJECTOR MARKET

Big Demand for Protective Purposes from Industrial Plants, Central Stations and Railroads Is Now Felt

During the last month the demand for flood-lighting projectors has increased 500 per cent. Manufacturers are now trying to turn out in one day the quantity that they have been accustomed to turn out in a week. The bulk of the increase came during the first week after President Wilson's memorable speech to Congress, two weeks ago.

Industrial plants, the government, light and power companies, railroads—these have been the largest purchasers of projectors. In most cases the units have been purchased as protection against enemies of the country. Power plants are using them to bathe dams and stations in a flood of light, railroads to light up points of strategic value on their lines, and industrial plants to light up all of the immediately surrounding territory. Flood lighting, it has been found, offers a better protection at night than is gained by any other means, besides enabling the companies to get along with fewer guards. Thus, from a labor standpoint alone, there is an argument for flood lighting.

In addition to the demand for protective purposes there is a very noticeable demand for projectors for increasing production. The government has removed the eight-hour handicap from both shipbuilding plants and munition works on government contracts. As a result, these plants are working on twenty-four-hour schedules, and flood lighting is finding a large use for night work. Most of the projectors are sold for outside use, although there have been many sold for inside work.

This increased demand started a few weeks prior to the actual declaration of war. A number of industrial plants, anticipating the government's action, purchased projectors. The market, however, was flooded with orders immediately after the President's speech. So great has this demand been, and so unexpected was it, that manufacturers are now weeks behind in deliveries, and as the orders pour in the situation becomes worse.

Coupled with this demand is a very embarrassing raw-materials situation. Premiums have to be paid on almost all items entering the construction of projectors. Steel and iron castings, screws, bolts and glass are very difficult to obtain, particularly glass.

The government, it is understood, is in the market for quantities of projectors for use in various field and marine operations. It is expected that the mosquito fleet will be equipped with individual projectors for each submarine chaser. In case orders develop from this direction they will take precedence over all other orders, and deliveries will be delayed by just so much.

JANUARY ELECTRIC EXPORTS COME TO ALMOST $5,000,000

Foreign Trade During First Month of Current Year Totals More Than Double the Sum That Was Reached During January, 1916

The year 1917 opened auspiciously for electrical exports, the total for January being $4,912,924. In comparison with January, 1916, this represents an increase of $2,600,000, or over 100 per cent.

Exports of batteries, insulated wire, tungsten filament lamps and motors were the largest in that month that they have been since the beginning of the war. Insulated wire, which was the largest single item in the month's exports, amounted to over $800,000.

Conspicuous figures are those for insulated wire and cable and for motors. During the last year and a half the exports of these articles have been increasing almost constantly. To a certain extent, of course, these increases can be accounted for by the increase in price. In the last eighteen months insulated wire and cable has practically doubled in price. Even on this basis, though, there has been an actual gain in volume of wire exported. The prices of motors, of course, have increased to a considerable extent, but it is doubtful if the prices have increased to such an extent as to offset the apparent gain in exports.

For the seven months ended Jan. 31, 1917, the electrical exports of American manufacturers amounted to $28,217,968, compared with $15,638,569 for the corresponding seven months of the year previous. As just pointed out, the increase here, which is almost 100 per cent, can be accounted for to a considerable degree by increase in prices. There has been, however, a marked increase in the demand of foreign markets for American goods. Many markets which at the beginning of the war were stocked with goods manufactured by other nations hesitated for a long while before buying goods of American manufacture in the expectation that the war would be of short duration and that it would again be possible to stock up on regular lines. Stocks, however, have become depleted, and peace still seems far away; consequently it has become necessary to purchase elsewhere. As a result American goods have entered markets in which formerly they were never represented.

In the accompanying tables are shown in detail the exports of electrical merchandise as compiled by the Bureau of Foreign and Domestic Commerce:

Articles	January 1916	January 1917	Seven Months Ended January 1916	Seven Months Ended January 1917
Batteries	$115,354	$379,781	$822,212	$1,542,053
Dynamos or generators	56,983	271,742	852,748	1,466,111
Fans	16,010	43,660	203,829	188,522
Insulated wire and cable	265,622	808,579	1,701,393	4,030,688
Interior wiring supplies, etc., including fixtures	87,611	133,140	495,471	623,672
Arc lamps	1,203	973	10,407	6,951
Carbon-filament lamps	14,667	15,470	102,995	83,702
Metal-filament lamps	109,720	181,785	684,364	894,699
Meters and other measuring instruments	75,352	94,575	448,951	576,034
Motors	389,380	659,620	2,283,042	3,267,139
Telegraph instruments (including wireless apparatus)	5,802	24,808	93,575	173,388
Telephones	69,050	132,807	448,932	997,312
Transformers	55,708	133,539	520,535	656,341
All other	1,058,360	2,032,445	6,970,115	13,711,357
	$2,320,822	$4,912,924	$15,638,569	$28,217,968

CONDITION OF MARKET FOR CODE RUBBER-COVERED WIRE

Stocks Below Normal with Little Improvement in Deliveries—Favorable Opportunity for Jobbers in Securing Better Profits

Conditions as they now obtain in the market for National Code rubber-covered wire are discussed by M. A. Oberlander, Western Electric Company, as follows in the current issue of *The Reminder*, published by the Electrical Supply Jobbers' Association:

"From what I can learn the manufacturers' and jobbers' stocks are low—in other words, practically below normal—especially so on stranded sizes.

"There does not seem to be much improvement in the way of deliveries. Where manufacturers do not have in stock the size of wire required, it takes at least four to six weeks to make shipment. The prospects for an improvement are very slim, especially on account of the difficulty the manufacturers are having in securing raw materials.

"The demand for wire seems to continue to grow and there does not seem to be any sign of a let-up; in fact, if anything, conditions are likely to grow worse, for the government, as you are aware, is beginning to place large orders.

"Price conditions are very much better than they have been, and there is no reason why they should not continue to improve, as from what I can learn from the majority of purchasers, it is principally a question of delivery at this time, and price is a secondary consideration. In other words, we are still on a seller's market, and there is no reason why we cannot obtain a favorable profit, especially on material that we have in stock.

"I would caution all to be careful in taking any contracts on wire, for the reason that should there be any decline in price you will find your customers canceling their orders, and as a rule the jobber is always made the 'goat' in such instances.

"From my observation there are no signs of lower market prices for some time to come. For example:

"Rubber-covered wire, 1916 over 1915, increased 41 per cent.

"Copper—1916, 0.34; 1915, 0.19; increased 81 per cent.

"Rubber—1916, 0.75; 1915, 0.59; increased 27 per cent.

"Cotton—1916, 0.32; 1915, 0.21; increased 54 per cent.

"In the event of there being war, there is no question that there will be an enormous increase in the purchase of copper; on the other hand, should there be peace, we must realize that the Central powers have not been buying any copper for the past two years, and their requirements, in my opinion, will easily offset the purchases that are now being made in excess by the Allied powers. I cannot therefore help but foresee a high price for copper wire for at least a year or more.

"In summing up the situation, the jobbers now have a favorable opportunity for securing better profits than they ever had in the past, and there is no reason whatever why we should not all be able to sell rubber-covered wire on the basis of market prices and yet make a satisfactory profit."

MARKET CONDITIONS OF THE WEEK UNCERTAIN

Some Manufacturers Report Diminution of Incoming Orders and Others Have Had Unusually Large Business

During the past week the market for electric goods has been very uncertain. Some manufacturers have seen a decided falling off in orders, while others equally large and important have not only felt no diminution in orders but actually experienced unusually large business.

There are predictions of every kind for the immediate future, but it is doubtful if any are more than personal opinions or guesses. Undoubtedly there will be a big demand for electrical material for war purposes, but the demand for regular uses is highly uncertain.

Certainly there has already been a large demand for certain kinds of electrical equipment, not for war purposes, but occasioned by the war. One instance of this is to be found in the market for flood lamps discussed on the preceding page, and this is typical of others.

COPPER MARKET CONDITIONS ARE BROUGHT TO STANDSTILL

Both Buyers and Sellers Await Developments, with General Expectations of Price Concessions in Near Future

Since the entrance of the United States into a state of war the copper market has come practically to a standstill. Buyers and sellers are both awaiting developments. There is a rather widespread feeling that prices will be lower owing largely to the fact that a considerable portion of the production for the second half of the year remains unsold.

Copper for export to the Allies must surely be sold at a lower price because the United States is now at war with the common enemy. There are many other reasons offered by buyers for expecting price concessions, although there is great uncertainty regarding the probable effect of active war on construction in the United States.

Quotations, which, of course, are nominal, were considered lower on Tuesday of this week than a week previous. Electrolytic sold at 33.5 cents for April shipment, 32.75 cents for May, 32.5 cents for second quarter, 30.25 cents for third quarter, and 29.25 cents for fourth quarter.

NEW YORK METAL MARKET PRICES

	April 3 Selling Prices Bid	April 3 Selling Prices Asked	April 10 Selling Prices Bid	April 10 Selling Prices Asked
Copper:	£ s d		£ s d	
London, standard spot	136 0 0		136 0 0	
Prime Lake	34.00 to 34.50†		33.50 to 34.00†	
Electrolytic	33.75 to 34.25†		33.25 to 33.75†	
Casting	30.75 to 31.25†		30.75 to 31.00†	
Copper wire base	39.00 to 41.00†		39.00 to 41.00†	
Lead	9.00		9.00	
Nickel	50.00		50.00	
Sheet zinc, f.o.b. smelter	21.00		21.00	
Spelter, spot	10.55 to 10.67½		9.92½ to 10.17½	
Tin, straits	54.37½		54.70	
Aluminum, 98 to 99 per cent.	55.00 to 57.00		55.00 to 57.00	

OLD METALS

Heavy copper and wire	28.00 to 29.00	27.50 to 28.50
Brass, heavy	17.50 to 18.00	16.50 to 17.00
Brass, light	13.00 to 13.50	12.50 to 13.00
Lead, heavy	7.50 to 7.75	7.50 to 7.75
Zinc, scrap	7.75 to 8.00	7.50 to 7.75

†Nominal.

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Heating Unit for Electric Range

The Rutenber Electric Company of Marion, Ind., has developed a heating unit of the open-coil type for its ranges. The resistance elements are arranged in two double clover-leaf patterns, one

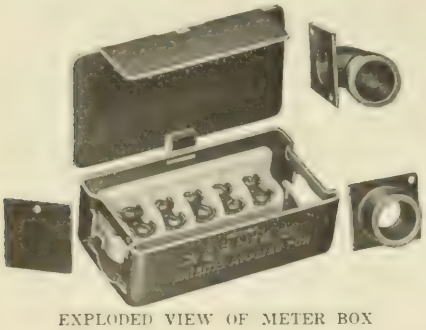


CLOVER-LEAF TYPE OF HEATING UNIT FOR ELECTRIC RANGE

larger than the other, nichrome wire being used and laid in deep wide grooves in a firite plate 1 in. (2.54 cm.) thick and 8 in. (20.3 cm.) in diameter. With this arrangement excellent radiation is permitted and the centers of the coils are prevented from being the hottest points. No long coils are exposed; each coil is pinned down at each turn, so that it is impossible for a coil to get out of its groove or expand and possibly become short-circuited by a metal vessel making contact with two coils.

Universal Watt-Hour Meter Box

The James E. Gleason Company, 106 South Clinton Street, Chicago, Ill., is marketing a type of watt-hour meter box which, with a few terminal fittings, is said by the manufacturer to take the place of thirty-five different styles of



EXPLODED VIEW OF METER BOX

similar boxes. The fittings and the ends of the box are arranged so that the parts are interchangeable, thereby making it possible to change the direction of energy transfer through the box by changing the relative positions of the terminal fittings. The box has the additional advantage that it can be sealed to protect the service against unauthorized connection. The interchangeable terminal fittings are shown in the accompanying illustration. The meter box is being manufactured by the P. & B. Manufacturing Company.

Outdoor Conduit Fitting

An improved galvanized weatherproof fitting for outside conduit construction has been developed by the Utility Fittings Company, 812 Walnut Street, Philadelphia, Pa. This device is for use where a neat, short right-angle turn is necessary and can also be used for a pull box. It has a smooth interior and well-rounded corners, which facilitate drawing of the wires and minimize chance of injury to the conductor insulation. The threads for the closure cap are on the exterior of the fitting. The closure cap has a

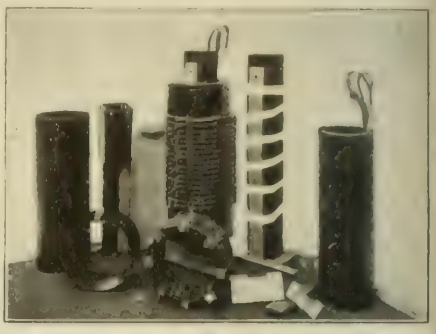


Y TYPE OF CONDUIT FITTING FOR OUTSIDE CONSTRUCTION

smooth interior flange, thus when securely seated on the fitting, which is also turned smooth, a waterproof outlet box is obtained, it is asserted. In the accompanying illustration is shown a type of Y fitting which is particularly adapted for conduit-service entrance to buildings.

Core-Type Transformers

Core-type construction is used for small and moderate-size high-voltage transformers by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa. The high-tension conductors have small cross sections and in most designs consist of a number of turns and layers of small round wires. By taping and impregnating the coils thus formed, mechanically strong and rugged transformers result. Concentrically arranged coils are employed, the low-tension winding being on the outside separated from the high-tension winding by a heavy insulating barrier of bakelite-micarta in the form of tubes. The tubes are strong mechanically, have a high dielectric strength, and are unaffected by oil. Ample ventilation is secured in both high-tension and low-tension windings

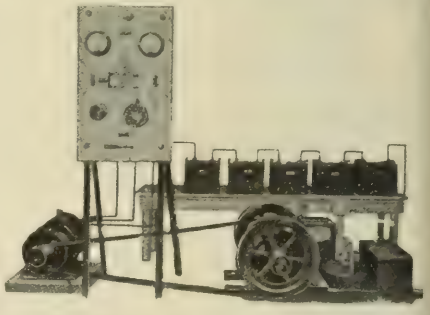


AN UNASSEMBLED VIEW OF A CORE-TYPE TRANSFORMER

by means of liberal-size ventilating ducts. The coils are protected from distortion which may result from heavy overload or short circuit by rings of wood and micarta bearing against the end of the frame. This construction does not interfere with the flow of the cooling oil, the manufacturer points out.

Domestic Electric-Service Plant

A domestic electric-service plant which includes a flywheel-type dynamo with a sliding base and oil-ring bearings, a battery and switchboard has been developed by the Main Electric Manufacturing Company of Pittsburgh, Pa. The generator is rated at 40 volt, 15 amp., and the battery, which is the thick-plate type with hard-rubber jars, at 40 amp.-hr. The switchboard is of

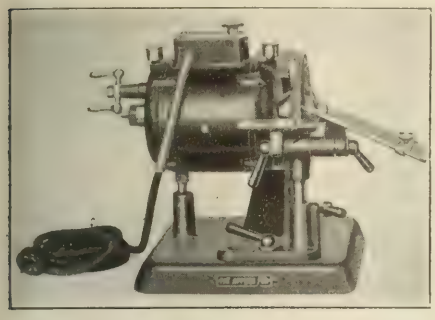


ELECTRIC-LIGHT PLANT WITH FLYWHEEL-TYPE GENERATOR

blue Vermont marble and carries a voltmeter, ammeter, automatic cutout, polished copper knife switches, field regulating rheostat, pilot lamp, etc. It is mounted on angle irons 60 in. (1.52 m.) high.

Motor-Driven Grinders

The Universal Electric Company of Newark, N. J., is marketing a line of motor-driven grinders with motors wound for all commercial voltages and frequencies in the universal type and for direct or alternating current. Attention is called to the improved type of starting switch which consists of three contact brushes, arranged with all working parts covered. The rotor can be removed or reassembled without



COMBINATION DRILL, TOOL, AND TOOL POST GRINDER

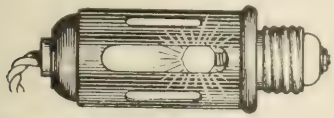
any of the difficulties encountered in rotors with lever-type switches, it is claimed. In the accompanying illustration is shown a combination of drill, tool, and tool post grinder. The motor is rated at ¼-hp., 3575 to 3550 r.p.m., and the size of the grinding wheel is 6 in. by ½ in. (15.2 cm. by 1.27 cm.).

Time-Limit Protective Plugs

Time-limit protective plugs in sheet-metal cases have been developed by the General Electric Company of Schenectady, N. Y., to be used in connection with drum-type and other small-motor starting switches. The case has a hinged cover and is provided with a hasp so that it can be locked closed. One-inch (2.54-cm.) knockout holes for conduit wiring have been provided. The line from the starting switch to the motor can be broken at any point and protective plugs inserted. The plugs can be furnished for use with any alternating-current motor rated at any value up to and including 3 hp., 110, 440 and 550 volts, and 5 hp. on 220 volts.

Pilot Lamp for Electrical Appliances

A device that shows at all times whether or not an appliance is consuming energy is being manufactured by



SIGNAL FOR USE WITH ELECTRICAL APPLIANCES

the Electric Signal Company, 1307 Sutter Street, San Francisco, Cal. The signal is in the form of a pilot lamp mounted in a brass case 4 in. (10.2 cm.) in length. The lamp is rated at 2 cp. and is connected in parallel with the appliance and glows the instant the latter is energized.

Color-Matching Unit

The St. Louis Brass Manufacturing Company of St. Louis, Mo., is producing a color-matching unit which it calls the "Spectrolite." The color-matching light is derived from a standard 60-watt "Mazda" lamp, a correction being accomplished by means of strips of glass, the color of which is so adjusted by selective absorption of the rays of light from the lamp that there is emitted only the part of the light which does not distort even the most delicate shades. The selective absorption of light is accomplished by contact of the light rays with the glass, rather than by penetration, thus providing a more efficient unit. The glass strips are disposed at a fixed angle to a line passing through the axis of the lamp and at a uniform radial distance in such manner that the emitted light must in all cases come in contact with one strip of glass from which it is reflected to the working



PORTABLE TYPE OF COLOR-MATCHING UNIT

plane. A particularly interesting feature of the unit is that with its light it is possible to see at a glance the basic hue of any color.

Reel for Lamps

A reel that consists of a ball casing containing a winding mechanism and a drum capable of winding 10 ft. (3 m.) of insulated lamp cord has been developed by the Anderson Electric Specialty Company of Chicago, Ill. The lamp does not revolve, nor does the cord twist during the winding operation. This device can be adapted for use with drop-lamps, portable lamps and the like, as well as to provide an extension lamp.

Straight-Through Switch

The straight-through or feed-through switch manufactured by the Bryant Electric Company of Bridgeport, Conn., has recently been redesigned with a resultant improvement, it is said, in mechanical and electrical efficiency. Although the over-all measurements of the switch have been reduced, the current-carrying and breaking ratings are greater. The mechanism proper is securely mounted between two substantial porcelain blocks, the make-and-break mechanism of the knife-switch character being well protected in the center thereof. The shell of the switch is provided with an interchangeable cap, so that, if desirable, the shell and body will fit into a cap which has been threaded onto and rigidly fastened to metal tubing.

Industrial Truck

Samuel L. Moore & Sons, Inc., Elizabeth, N. J., has developed a four-wheel-steel industrial truck for which several advantages are claimed over the two-



FOUR-WHEEL-STEER INDUSTRIAL TRUCK

wheel-steer type. For instance, it is possible to operate the truck in very narrow aisles and in limited turning quarters, something impossible, it is said, with a two-wheel-steer truck. In addition, the truck can enter the side doors of a standard box-type freight car and run toward either end of the car. The ability to turn in a short radius is absolutely necessary in machine shops, warehouses and railroad terminals, where all vacant space has a big value.

Lead-Burning Apparatus

Oxy-illuminating-gas apparatus especially designed for lead-burning purposes, such as is employed in storage-battery work, has been developed by Ashton, Laird & Company and is sold exclusively by the Bradford-Ackerman Corporation of New York City. The process employs either artificial or natural illuminating gas, drawn directly from city gas mains, in connection with "tanked" oxygen. Attention is called to the oxygen pressure-reducing regulator, by means of which accurate adjustment of the desired working pres-



PORTABLE LEAD-BURNING APPARATUS

sure is obtained and maintained constant at the torch until the exhaustion of the oxygen tank is complete. Two models of this system are furnished, one stationary and the other portable.

Trade Notes

THE WESTERN ELECTRIC COMPANY, INC., announces the opening of a branch house at New Haven, Conn., with complete stocks of electrical supplies.

P. C. THOMAS has resigned as superintendent of the Canadian Tungsten Lamp Company to be associated with the Westinghouse Lamp Company at Bloomfield, N. J.

A. MAJOR, who has traveled out of Kansas City the past fourteen years for electrical jobbing houses, has been appointed sales manager of the Missouri Valley Electric Company at Kansas City. Mr. Major was for the last eight years with the Funston Electric Company.

PAUL D. FUQUA, who has been employed in the last two years as engineer in charge of the design and construction of the reinforced concrete bridge for the city of Dayton, Ohio, has resigned to accept the Chattanooga (Tenn.) agency for the sale of "Delco-Light" products, taking up his new work about April 20.

THE CONTINENTAL SALES DISPLAY CORPORATION has acquired the property of the Mott-Le Gaige Animated Advertising Corporation and the Ad-Display Machine Corporation. At a meeting of the directors of the Continental Sales Display Corporation held Jan. 31, the following officers were elected: James Duane Livingston, president and treasurer; George B. Hutchings, vice-president, and James F. Tilley, vice-president and secretary.

THE DE VEAU TELEPHONE MANUFACTURING COMPANY of Brooklyn, manufacturer of interior telephones, has been merged with the business of Stanley & Patterson of New York. Al De Veau becomes secretary of Stanley & Patterson and director of factory sales in charge of the sale of the following products: Faraday signal gongs, P-R bells, Patterson battery sets, De Veau telephones and De Veau electrical specialties. Mr. De Veau's headquarters will be at 23 Murray Street, New York, the main office of the company.

GEORGE H. WAHN COMPANY, Boston, Mass., has moved to 69-71 High Street. In making the announcement Mr. Wahn writes: "Less than two years ago (May 15, 1915), we started in business, taking very small rooms at No. 54 High Street, where we stayed for three months, when we moved to our present location at 99 Bedford Street. Through what we are pleased to term 'Wahnco service,' our business has developed to such an extent that we find it absolutely impossible to continue at our present address, although our lease here does not expire for several months."

New Incorporations

THE ATHENS POWER COMPANY of Princeton, W. Va., has been incorporated by J. N. Hoylman, F. A. Bohn, R. A. Dangerfield and S. A. Shumate. The company is capitalized at $10,000.

THE ASHLEY (Ohio) ELECTRIC LIGHT & POWER COMPANY has been incorporated with a capital stock of $10,000 by C. F. Sperry, J. B. Johnston, C. R. Wing, E. R. Sperry and C. S. Aldrich.

THE HEALDTON (Okla.) ICE, LIGHT, POWER & SUPPLY COMPANY has been chartered with a capital stock of $15,000 by C. V. Miller, N. A. Jennings of Healdton and R. E. Martin of Wirt, Okla.

THE BUCKEYE POWER COMPANY of Steubenville, Ohio, has been incorporated with a capital stock of $9,000 by Frederick A. Boutelle, J. B. McCullough, Albert G. Lee, Clyde E. Linduff and Paul R. Bowles.

THE NAPPANEE (Ind.) UTILITIES COMPANY has been incorporated with a capital stock of $75,000 by John Hartman, Willard A. Price and Burton A. Uline. The company proposes to supply water, light, heat and power.

THE PROSPECT ELECTRIC COMPANY of Niagara Falls, N. Y., has been chartered by William A. Rix, Alfred Rix, and Herbert J. Wills. The company is capitalized at $10,000 and proposes to do a general contracting business.

THE INDEPENDENT ELECTRIC LIGHT & POWER COMPANY of San Antonio, Tex., has been chartered with a capital stock of $30,000 to construct and operate an electric-light and power plant. W. L. Cunningham is among the incorporators.

THE DURYEA ILLUMINATORS of Rochester, N. Y., has filed articles of incorporation with a capital stock of $10,000 to manufacture advertising signs and devices. The incorporators are Harry R. Duryea, Meeting A. Duryea and Thomas A. Duryea.

THE ECONOMIC ELECTRIC COMPANY of Wilmington, Del., has been chartered with a capital stock of $400,000 to manufacture electric machines, storage batteries, etc. The incorporators are K. M. Dougherty, C. Beaton and E. Lanch, all of Wilmington, Del.

THE VIKING SIGN COMPANY of New York, N. Y., has been incorporated by J. Acker, P. S. Van Bloom and L. T. Strauss, 11 West 125th Street, New York, N. Y. The company is capitalized at $7,500 and proposes to deal in signs, posters, lighting fixtures, etc.

THE MUTUAL COAL, LIGHT & POWER COMPANY of Gallup, N. M., has been incorporated with a capital stock of $2,500,000 to generate and transmit electricity for lamps, heaters and motors. The incorporators are: George A. Keeper, James A. Sneggon and C. C. Manning, all of Gallup.

THE MASSAM COMPANY of Springfield, Mass., has been incorporated with a capital stock of $500,000 to manufacture mechanical and electrical equipment. The officers are: Charles F. Munder, president; George H. Morgenstern, vice-president, and Frank W. Arthur, treasurer, all of Springfield, Mass.

THE AUTO ELECTRIC SERVICE COMPANY of Huntington, W. Va., has been incorporated by C. H. Doebler, Sr.; F. W. Irvin, S. W. Lallance, Frank N. Eppinling and G. L. Irvin, all of Huntington. The company is capitalized at $5,000 and proposes to manufacture and deal in electrical appliances.

FOOTE, PIERSON & COMPANY of New York, N. Y., have filed articles of incorporation with a capital stock of $100,000 for the purpose of manufacturing all kinds of electrical machinery and doing a general contracting business. The incorporators are: Henry G. Pierson, M. N. Liesman and William R. Stout.

THE ARMSTRONG CONSTRUCTION COMPANY, Frudden Building, Lansing, Mich., has been incorporated for the purpose of doing a general electrical contracting business. The officers are: E. A. Armstrong, president; Arthur R. Sawyer, vice-president, and Charles M. Armstrong, secretary and treasurer.

THE PRESTON COUNTY POWER COMPANY of Kingwood, W. Va., has been chartered by B. P. Hessler, R. L. Weide of Washington, D. C.; John F. Pierce of Rowlesburg, W. A. Schaeffer and Carleton C. Pierce of Kingwood, W. Va. The company is capitalized at $5,000 and proposes to develop coal lands.

THE INSULATION DEVELOPMENT CORPORATION of New York, N. Y., has been incorporated by M. Dillon, E. Lawler and E. Rose, 12 Broadway, New York, N. Y. The company is capitalized at $5,000 and proposes to operate wire drawing, wire insulating plants and to do a general mechanical engineering business.

THE SCHUESTER ENGINEERING COMPANY of New York, N. Y., has been incorporated by H. A. Bellows, C. G. Grossman and K. R. Schuster, 21 Park Row, New York, N. Y. The company is capitalized at $100,000 and proposes to do a general construction, engineering and contracting business, and install electric systems.

THE SOUTH GEORGIA POWER COMPANY of Valdosta, Ga., has been chartered with a capital stock of $25,000 to supply electricity and to operate electric railways in Georgia. The incorporators are: Alma Roberts, Frank Roberts, William Roberts and others of Lowndes County, Ga., and B. P. Rucker of Schenectady, N. Y.

THE SOUTHERN ARIZONA UTILITIES COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $200,000 for the purpose of generating electricity for lamps, heaters and motors. The incorporators are: S. B. Howard, Harry B. Davis and A. W. Britton, all of New York, N. Y.

THE SUCCESS ELECTRICAL CORPORATION of Brooklyn, N. Y., has been incorporated with a capital stock of $10,000 by H. Bierer, G. A. Page and W. Schweikert, 1238 Rogers Avenue, Brooklyn, N. Y. The company proposes to do a general electrical and mechanical engineering business and deal in electrical supplies, etc.

THE HUDSON POWER CORPORATION has filed articles of incorporation with the Secretary of State with a capital stock of $3,000,000 for the purpose of furnishing gas and electricity to cities, towns and villages in the Hudson River counties. The incorporators are: J. C. Grier, S. P. Curtis and I. W. Day, 400 Park Avenue, New York City.

THE INTERNATIONAL PORT O-PHONE SALES CORPORATION of New York, N. Y., has been incorporated by D. Wood, E. W. Seymour and C. C. Kelley, 115 Broadway, New York City. The company is capitalized at $100,000 and proposes to manufacture and deal in electric motors, machinery and appliances for defective hearing.

THE GARY & HOBART TRACTION COMPANY of Gary, Ind., has been incorporated by William Earle, Ora L. Wildermuth, Harlan Stratton, Grant Crumpacker and Adlai T. Ewing. The company is capitalized at $60,000 and proposes to construct and operate an electric railway between Gary, East Gary, New Chicago and Hobart, and also to supply electricity for lamps, heaters and motors in the cities just named.

THE LAMOKA ELECTRIC WATER POWER CORPORATION of Corning, N. Y., has been incorporated by J. Towner Hayt, Harry A. Erwin, George F. Showers and others, all of Corning. The company is capitalized at $100,000 and proposes to construct a dam near Savona, and a canal and pipe line from Wayne to Lake Keuka, on the west shore of which a power house will be erected between Grove Springs and Keuka, in New York State.

Trade Publications

ANCHORS.—W. N. Matthews & Brother, St. Louis, Mo., has issued an illustrated folder descriptive of its Scrulix Anchors.

CLIPS.—R. S. Mueller & Company, Cleveland, Ohio, has prepared an illustrated folder descriptive of its "Universal" test clip.

PLUGS AND RECEPTACLES.—"The Story of the Slots" is the title of a descriptive folder that Harvey Hubbell, Inc., of Bridgeport, Conn., is distributing.

ELECTRICAL SUPPLIES.—Charles G. Robin, Inc., 48 Warren Street, New York City, has recently prepared and is distributing its 1917 catalog on electrical supplies.

REFLECTORS. — "Imperial" flood-light projectors and "Imperial" reflectors are described in bulletin No. 302, issued by the Crouse-Hinds Company of Syracuse, N. Y.

RAILWAY ACCESSORIES.—The Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., is distributing catalog 5-B, descriptive of its railway accessories.

LIGHTNING ARRESTERS. — Catalog 1-A, descriptive of lightning arresters, has been prepared by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa.

MOTORS.—The Eck Dynamo & Motor Company, Belleville, N. J., has issued bulletin No. 1000, descriptive of its Type D commutating-pole, constant-speed direct-current motors.

METERS. — Alternating-current watt-hour meters, single-phase and polyphase, are described in bulletin No. 46, recently prepared by the Sangamo Electric Company of Springfield, Ill.

REFLECTORS.—The Holophane Glass Company, Inc., of New York City is mailing a folder descriptive of its store-lighting campaign on the use of the new Holophane reflector-refractor units.

SWITCHBOARD ACCESSORIES.—The Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., is distributing catalog 2-B, descriptive of its switchboard accessories.

HIGH-TENSION SWITCHES. — The K-P-F Electric Company, 37 Stevenson Street, San Francisco, Cal., has prepared an illustrated catalog descriptive of its high-tension pole-top switches.

ELECTRICAL SUPPLIES.—Clarence E. Edson of Cleveland, Ohio, is distributing a booklet descriptive of his line of electrical specialties, including heating pads, water heaters, ozone vaporizers, etc.

SWITCH PLATES. — Notwithstanding the complete information which is given in the catalog of the Bryant Electric Company of Bridgeport, Conn., it has been found that a great many architects do not find it convenient to make use of some of the information, particularly with reference to the over-all dimensions of flush switch plates. To facilitate the use of this information when necessary, the Bryant Electric Company has issued a special dimension sheet, which will enable any architect or architectural draftsman to readily place the switches on his plans.

New England States

CARIBOU, ME.—A bill has been passed by the State Legislature authorizing the town of Caribou to acquire the property of the Caribou Water, Light & Power Company.

ASHLAND, N. H.—At a special election held recently the proposal to purchase the property of the Ashland Electric Light Company was carried. The sum of $50,000 was appropriated. Of this $25,000 will be used for the purchase of the plant; $9,500 for an option on the property and water rights of the Asquam Lake Lumber Company, and the remainder for improvements to the electric-lighting plant.

SWANTON, VT.—The village of Swanton is building a new municipal power station to be equipped for an ultimate capacity of 4000 hp., the first unit to consist of an S. Morgan Smith 1250-hp. vertical water wheel directly connected to a 1125-kva. Electric Machinery three-phase, 60-cycle, 6600-volt generator. C. J. Parker is manager.

ASHBURNHAM, MASS.—Some extensions will be made to the municipal electric distribution system. A. F. Roy is manager.

HULL, MASS.—At a special election held recently the proposal to sell the equipment in the municipal electric plant at Nantasket Beach was carried.

WORCESTER, MASS.—The city of Worcester has appropriated $184,000 for street-lighting this year.

WORCESTER, MASS.—The Worcester Consolidated Street Railway Company is planning the reconstruction of its tracks and the installation of new feed wires on Front Street from Main to Harding Street, at a cost of about $30,000.

PROVIDENCE, R. I.—The State Legislature has passed the bill giving the Rhode Island Power Transportation Company State-wide domain for a period of ten years and the power to convey all its rights and property to any other concern.

PROVIDENCE, R. I.—The Board of Aldermen has passed an ordinance granting the Narragansett Electric Lighting Company permission to erect electric transmission lines along India Street and to string high-tension wires across certain other streets.

NEW HAVEN, CONN.—Plans for extension of the ornamental lighting system on several streets have been adopted by the lighting committee of the Board of Aldermen. About 50 new lamps will be erected.

Middle Atlantic States

AMSTERDAM, N. Y.—The City Council has granted the Adirondack Electric Power Corporation and the Edison Electric Light & Power Company an extension of time in which to place their wires underground.

ARGYLE, N. Y.—At an election held recently the proposal to install an electric-lighting system in Argyle was carried.

FREDONIA, N. Y.—The Niagara & Lake Erie Power Company has submitted a proposal to the Village Trustees for furnishing energy to operate the municipal street-lighting system.

GLOVERSVILLE, N. Y.—A new power plant will be erected at the mill owned by J. C. Bleyl, on West Center Street. The equipment will include a water-tube boiler, electric generator and steam turbine. Contracts, it is understood, have been placed for the machinery.

ITHACA, N. Y.—The Cayuga Power Corporation has been granted a franchise to supply electricity for lamps and motors in Freeville, and was also awarded a contract for street lighting.

LITTLE FALLS, N. Y.—The installation of a new street-lighting system in Little Falls is under consideration. It is proposed to substitute Mazda lamps for the arc lamps now in use. The Utica Gas & Electric Company furnishes electrical service here.

LONG ISLAND CITY, N. Y.—Bids will be received by the president of the borough of Queens, Queens Subway Building, Hunter's Point and Van Alst Avenues, Long Island City, until April 18 for construction of a temporary automatic electric pumping station at Thrall Avenue and Beaufort Avenue to Hatch Avenue. Plans, etc., may be seen at the above office. Maurice E. Connolly is president.

NIAGARA FALLS, N. Y.—Extensive improvements, involving an expenditure of $2,023,000, are contemplated by the International Railway Company during the present year. The work will include the construction of new roadways, reconstruction of others, new electric line or overhead system, new buildings and structures and power plant equipment.

PARISHVILLE, N. Y.—The local electric-light plant and water power sites, owned by the A. Sherman Lumber Company, has been purchased by Myron Roberts of Parishville. The new owner, it is reported, contemplates further development of the water power.

POTSDAM, N. Y.—It is reported that interests connected with the Aluminum Company of America, which took over the Hannawa Falls Power Company and the Northern Power Company, are considering the development of the water power on the Raquette River at Colton. The proposed project will include a dam, pipe line and power house, to cost about $375,000.

ROCKVILLE CENTRE, N. Y.—New equipment, including a 500-kw. General Electric turbo-generator and a barometric condenser is being installed in the municipal electric plant. H. C. Major is chief engineer.

SALAMANCA, N. Y.—The Water and Light Department is installing a 150-hp. engine and a 120-kw. generator in the municipal electric-light plant. H. E. Heller is superintendent.

SALAMANCA, N. Y.—Work will soon begin on the erection of new shops, power plant and storehouse of the Buffalo, Rochester & Pittsburgh Railway Company in Salamanca, involving an expenditure of about $300,000. The power plant will cost $90,000. A new coaling plant and transfer platforms may also be installed.

SYRACUSE, N. Y.—The Board of Supervisors is considering plans for the installation of new boilers, furnaces, water purifying apparatus and other new equipment at the penitentiary. C. H. Livingston is superintendent.

SYRACUSE, N. Y.—Extensions and improvements to its local system, involving an expenditure of about $500,000 are contemplated by the New York State Railways Company. The work will include extensions to its lines in different sections, new track work, new rolling stock, new electric equipment at the various power houses and substations.

ELIZABETH, N. J.—The Board of Works has awarded the Elizabethtown Gas Light Company a contract for street-lighting for a period of one year. The city expects to have perfected arrangements for the erection of a municipal electric plant at expiration of the contract.

NEWARK, N. J.—Plans are being considered by the Board of Freeholders of Essex, Hudson and Bergen Counties for the installation of flood light projectors on eight bridges over the Passaic and Hackensack Rivers.

NEWARK, N. J.—New boilers and accessory equipment will be installed at the Overbrook Hospital, at a cost of $59,928. The work will be in charge of the United Construction & Supply Company, 61 Broadway, New York, N. Y.

NEW BRUNSWICK, N. J.—The New Brunswick Power Company is constructing a tunnel, at a cost of about $50,000, from its power house at Union Street to the water's edge for the purpose of securing a larger supply of water for condensing purposes.

PATERSON, N. J.—The property owners on Market Street, from Main to Cross Street, have petitioned the Board of Works for the installation of an improved street-lighting system on that thoroughfare.

PERTH AMBOY, N. J.—The Citizens' Electric Light, Heat & Power Company, operated by the Public Service Electric Company, has commenced work on the installation of a new steam turbine at its Buckingham Avenue power station. Notice has been filed by the company of its intention of installing an underground conduit on High Street.

TRENTON, N. J.—A new power plant, to cost about $10,000, will be erected by the John A. Roebling's Sons Company on Canal Street to operate its wire plants.

TRENTON, N. J.—The Trenton Gas & Electric Company will erect two one-story additions at its plant on New York Avenue. A filtration plant, two stories high, will also be built by the company.

TRENTON, N. J.—Application has been made by the Eureka Power Company, a subsidiary of the New Jersey & Pennsylvania Traction Corporation of Trenton, for permission to erect a new pole transmission line and distributing system on the River Road to furnish electrical service in Titusville and Washington's Crossing.

WEEHAWKEN, N. J.—The Public Service Company has been awarded a contract for lighting the streets of Bergen Township for a period of five years.

ALLENTOWN, PA. — Application has been made to the Public Service Commission by the Lehigh Valley Transit Company for permission to issue $135,000 in bonds, the proceeds to be used for extensions and improvements to its system.

ALTOONA, PA.—The Pennsylvania Railroad Company is contemplating equipping its railroad for electrical operation from Altoona to Conemaugh, a distance of 25 miles.

ALTOONA, PA.—The Pennsylvania Hydro-Electric Company of Altoona has petitioned the Public Service Commission for permission to issue $36,000 in bonds for improvements and extensions to its plant.

EASTON, PA.—The Pennsylvania Utilities has petitioned the Public Service Commission for permission to issue $46,000 in bonds, the proceeds to be used for extensions and betterments.

EASTON, PA.—Bids will be received at the office of the county controller, Easton, until April 20 for construction of house of detention for the county of Northampton. Separate bids to be submitted on the building, heating, plumbing, and electric wiring and electric fixtures. George F. P. Young is county controller.

ERIE, PA.—Plans have been approved for the rebuilding of the State Street conduit for high-tension wires. William Crane is city electrician.

GILBERTON, PA.—The Philadelphia & Reading Coal & Iron Company is planning to install new electrically-operated pumping machinery for water and sewerage service.

HARRISBURG, PA.—Further improvements are contemplated by the Harrisburg Light & Power Company, including the installation of mechanical stokers, to cost about $100,000, and line extensions.

HAZLETON, PA.—The Cranberry Mines, operated by the Lehigh Coal & Navigation Company, will be equipped for electrical operation, at a cost of about $300,000. Electrically operated pumping machinery is now being installed.

MOUNT CARMEL, PA.—The Shamokin & Mount Carmel Transit Company is reported to be contemplating extending its railway from Centralia to Ringtown and thence to Shenandoah, a distance of about 14 miles.

NEW CASTLE, PA.—The New Castle Electric Company has petitioned the Public Service Commission for authority to issue $9,000 in bonds for improvements to its plant.

PHILADELPHIA, PA.—A new boiler bplant, one story high, and pumping station will be erected by the S. S. E. Company, 2300 Chestnut Street, at its factory at Erie Avenue and B Street.

PHILADELPHIA, PA.—The contract for electrical equipment for the new public library on the Parkway has been awarded to the Thompson-Starrett Company, 49 Wall Street, New York, N. Y., at $79,000. The heating and ventilating system will be installed by William M. Anderson of Philadelphia, at a cost of about $318,750.

PHILADELPHIA, PA. — Local extensions and improvements, to cost about $134,300, are contemplated by the Bell Telephone Company. It is planning to erect over 5000 ft. of new aerial lines and about 12,000 ft. of underground cables, to cost about $80,000. Extensions will also be made to its conduit system. Work has also begun on the erection of a two-story plant for the repair and operating departments on South Cameron Street, to cost $22,000.

PITTSBURGH, PA.—Application has been made to the Public Service Commission by the West Penn Railways Company for authority to issue $45,000 in bonds for extensions and improvements to its system.

POTTSVILLE, PA.—The installation of electrically operating loading machinery at its coal mines in northern Schuylkill County is under consideration by the Philadelphia & Reading Railroad Company.

READING, PA.—The City Council is considering the installation of a new fire-alarm signal to cost about $10,000.

READING, PA.—The Metropolitan Electric Company is contemplating the erection of a new electric transmission line from its local power station to Wernersville and vicinity to supply electricity for industrial purposes.

RUTHERFORD, PA.—Contract has been awarded by the Philadelphia & Reading Railroad Company to A. L. Carhart of Philadelphia, contractor, for construction of new

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

engine and power house at its local repair shops to cost about $40,000.

BUFFINGTON, PA.—Bids are being asked by the Philadelphia & Reading Railroad Company for the construction of a new engine house and addition to power house at its repair shops in Rutherford. Samuel T. Wagner, Reading Terminal, Philadelphia, is engineer.

SHARON, PA.—The Harmony Electric Company, it is reported, is planning to supply electricity in the Shenango Valley. Application will be made by the Harmony Electric Company for six charters on April 16 to extend its lines into Sharon, Sharpsville, Farrell, Middlesex, Shenango and Hickory Townships.

STEELTON, PA.—Plans are being considered by the City Council for the installation of an underground conduit system on Front Street for placing all overhead wires underground. The Municipal League is interested in the project.

SUNBURY, PA.—The installation of an ornamental street lighting system, using concrete or other standards is under consideration by the Northumberland County Gas & Electric Company.

WARREN, PA.—Plans are being considered for the erection of a factory building, 70 ft. by 150 ft., and boiler house for the Warren Mirror Works, to cost about $50,000. Bids, it is understood, will soon be asked by F. Grunniger, Wetmore Building.

WILMINGTON, DEL.—The Northern Central Power Company, operating electric and gas properties, has been taken over by the Electric Bond & Share Company of New York, N. Y., which contemplates extensions and improvements to the system.

FREDERICK, MD.—The Board of Aldermen has decided to purchase a new three-phase Westinghouse generator, to cost about $1,440, for the municipal electric-light plant.

SOLLERS POINT, MD.—The Aluminum Ore Company of East St. Louis, Ill., controlled by the Aluminum Company of America of Pittsburgh, Pa., it is reported, is building a branch plant at Sollers Point for the manufacture of anhydrate of aluminum from bauxite ore. The equipment of the power house will include four 1000-kw. generators and steam engines; boiler plant will be equipped with cross drum and marine type boilers, automatic stokers, mechanical boilers and overhead coal bunkers. The plans provide for the erection of one four-story, two three-story, two two-story and seven one-story buildings and open wood pier 400 ft. by 75 ft.

BLUEFIELD, W. VA.—The Appalachian Power Company is contemplating the erection of electric transmission lines between Norton and Esserville, Wise and several other towns.

WHEELING, W. VA.—Bids will be received at the office of the United States Engineer Office, Wheeling, until April 30 for construction of a fireproof power house at Dam No. 24, Ohio River. Further information may be obtained upon application to the above office.

DANVILLE, VA.—The Chesapeake & Potomac Telephone Company contemplates the erection of a telephone exchange in Danville, to cost about $150,000.

FARMVILLE, VA.—At an election to be held April 24 the proposal to issue $50,000 in bonds for improvements to the municipal electric-light plant, water-works system and street repairs will be submitted to the voters.

NORFOLK, VA.—The installation of a new street-lighting system is reported to be under consideration in Norfolk.

OCCOQUAN, VA.—Bids will be received at the office of the secretary of the Commissioners of the District of Columbia, Room 509, District Building, Washington, D. C., until April 16, for construction of a radial brick stack, furnishing and installing water-tube boilers and breaching, boiler feed pumps and feed-water heater at the District of Columbia workhouse and reformatory at Occoquan. Plans and specifications may be obtained at the office of the chief clerk, Engineer Department, District Building, Washington, D. C., upon deposit of $5.

RICHMOND, VA.—Plans are being prepared by the James River & Kanawha Power Company for the erection of a power plant at the falls of the James River, to cost about $250,000. As yet definite plans have not been decided upon. A. J. Bradley, P. O. Box 421, is president.

WASHINGTON, D. C.—The District of Columbia Paper Manufacturing Company, K and Potomac Streets, is planning to erect a power plant, to cost about $10,000, at 1037 Potomac Street.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until April 23 for two motor-driven hydraulic pumps and two accumulators at the navy yard, Norfolk, Va., and one motor-driven hydraulic pump and one accumulator at the navy yard at Philadelphia, Pa. Specifications (No. 7349) can be obtained on application to the above bureau or to the commandants of the navy yards named.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Various, Schedule 931—miscellaneous interior communication cable, miscellaneous telephone cable, miscellaneous portable telephone cord, miscellaneous antenna wire, bell wire, ignition wire, lighting and power wire, and miscellaneous single and double conductor wire. Brooklyn, N. Y., and Charleston, S. C. Schedule 931—miscellaneous lighting cable, Brooklyn, N. Y., and Mare Island, Cal. Schedule 927—furnishing and installing cork insulation on vessels. Brooklyn, N. Y., Schedule 930—60,000 ft. lead-sheathed cable, 180,000 ft. portable ship-lighting cable, 300,000 ft. incandescent lamp cord, 365,000 rubber-covered duplex wire, 175,000 ft. rubber-covered single wire, 60,000 ft. telephone wire. Washington, D. C. Schedule 911—two induction motors. Mare Island, Cal., and Puget Sound, Wash. Schedule 931—miscellaneous magnet wire. Boston, Mass., Schedule 916—one metal stock cutter, with automatic power feed. Charleston, S. C., Schedule 921—one upright drill. Portsmouth, N. H., and Puget Sound, Wash., and Brooklyn, N. Y., Schedules 928-914—19 motor-driven, bench type, 12 in. by 1¼ in. emery grinders. Portsmouth, N. H., Schedule 928—two motor-driven 12-in. saw tables. Applications for proposal blanks should designate the schedule desired by number.

North Central States

DETROIT, MICH.—Bids will be received at the United States Engineer Office, Detroit, until May 1 for furnishing electric cables and wire at Sault Ste. Marie.

DETROIT, MICH.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until April 27, for the installation of two new electric passenger elevators, etc., in the United States post office and court house, Detroit. Plans and specifications may be obtained at the above office.

IRONWOOD, MICH.—The installation of an ornamental lighting system in Ironwood is under consideration.

CANTON, OHIO.—Plans are being prepared by the Republic Stamping & Enameling Company for additions to its west side plant, involving an expenditure of about $500,000. Improvements contemplated will include a power plant and additions to stamping and other departments.

CINCINNATI, OHIO.—Plans have been prepared for an addition to the plant of the Fosdick Machine Tool Company, 50 ft. by 250 ft., one and two stories high. The company, it is reported, will install additional power plant equipment in the near future.

DAYTON, OHIO.—Bids will be received by Charles F. Brenner, president of Montgomery County Commissioners, until April 25 for lighting and power plant equipment for the Montgomery County Children's Home, Dayton.

EAST PALESTINE, OHIO.—The Youngstown & Sharon Street Railway Company of Youngstown is planning to extend its electric transmission line to East Palestine at once. The company has closed a contract with the East Palestine Rubber Company to supply energy to operate its new plant now under construction. The street railway line will be extended later.

HOLLOWAY, OHIO.—The construction of an electric railway in Harrison County from a point below Holloway to Jockey Hollow Field near Moorefield is under consideration. J. A. Bell, Oliver Building, Pittsburgh, Pa., is reported interested.

MILFORD, OHIO.—Plans have been submitted by the Cincinnati, Milford & Lockland Traction Company to the Commercial Club of Wilmington for extension of its system to that city.

OSGOOD, OHIO.—Plans are being prepared by the Lippincott Company of Cincinnati for the erection of a plant at Osgood. Equipment for power plant includes two 225-hp. boilers. The company manufactures catsup.

PIQUA, OHIO.—The Meteor Motor Car Company is considering increasing the output of its plant. Among the improvements contemplated is an addition to the power plant.

SALEM, OHIO.—The Water Works Department is contemplating the installation of electrically driven deep well pumps to replace the present compressed air-lift system.

TOLEDO, OHIO.—Arrangements have been made whereby the Toledo Railway & Light Company will extend its lines to all the additions in West Toledo to supply electricity for domestic use.

ADAIRVILLE, KY.—The installation of an electric-light plant in Adairville is reported to be under consideration. The Electric Equipment Company of Nashville, Tenn., is reported interested.

ASHLAND, KY.—Local citizens have pledged $50,000 in cash to aid the Vaughn Construction Company of Shawsville, Va., to construct an electric railway between Ashland and Russell.

BARBOURVILLE, KY.—The Barbourville Electric Light, Heat & Power Company is considering extending its transmission lines to Artemus.

GREENVILLE, KY.—Extensive improvements will be made to the local plant of the Kentucky Utilities Company, which will include overhauling the distribution system and the installation of electrically operated pumps at the water-works and ice plant.

SCOTTSVILLE, KY.—The name of the Scottsville Electric Light Company has been changed to the Scottsville Light & Power Company and the capital stock increased from $15,000 to $20,000. Improvements will be made to the plant.

DECATUR, IND.—The power plant of the Fort Wayne & Decatur Traction Company was recently destroyed by fire, causing a loss of about $50,000.

LAFAYETTE, IND.—The City Council is considering submitting to the voters at the coming municipal election the proposal to establish a municipal electric-light plant in Lafayette.

MUNCIE, IND.—A 12,500-kva., three-phase, 60-cycle, 2300-volt General Electric turbine is being installed in the municipal electric-light plant. W. O. Haymond is superintendent.

ONTARIO, IND.—The Cain Water Power & Light Company, recently organized with a capital stock of $75,000, to supply electricity for lamps and motors in Lagrange, Rome City, Wolcottville and Ontario, will develop a water power on the Pigeon River and erect a plant at Ontario and also another plant several miles out of the town. A. B. Cain of Ontario, William H. Cain of Butler, H. F. Cain of Mongo, and C. J. Cain of Buffalo, N. Y., are the incorporators.

WARSAW, IND.—A committee has been appointed by the City Council to secure estimates of the cost of the installation of a new lighting system.

CHICAGO, ILL.—Bids, it is reported, will soon be asked by the Commonwealth Edison Company, 72 West Adams Street, for alterations to substation. Von Holst & Fyfe, 72 West Randolph Street, are architects.

EVANSTON, ILL.—Bids will be received at the office of the commissioner of public works, City Hall, Evanston, until April 30 for furnishing and installing one 250-hp. water-tube, high-pressure boiler, including down-draft furnace of the Hawley type, boiler foundations, breeching, steam piping, etc., including the removal of the present water-tube boiler and also the resetting of one of the present boilers in a location to be designated by the city of Evanston. Plans and specifications are on file in the office of I. C. Brower, commissioner of public works.

LA SALLE, ILL.—The Chicago, Ottawa & Peoria Railway Company of Ottawa is remodeling and installing new equipment at its plant in La Salle, at a cost of about $200,000. This plant will be used as an auxiliary.

MILLEDGEVILLE, ILL.—Steps have been taken by local business men for the installation of an electric street-lighting system.

KNAPP, WIS.—The Wisconsin-Minnesota Power Company of Eau Claire is considering the extension of its electric transmission lines into Knapp.

LITTLE FALLS, WIS.—The Little Falls Water Power Company is reported to be contemplating extensions of its distributing lines into rural communities in this district.

MAIDEN ROCK, WIS.—Plans are being considered by the Wisconsin-Minnesota Light & Power Company of Eau Claire for the erection of an electric transmission line to Plum City and Maiden Rock.

FARWELL, MINN.—The Glenwood (Minn.) Electric Light, Heat & Power Company has been granted a franchise to install and operate an electric-light and power plant in Farwell.

ST. PAUL, MINN.—The St. Paul Gas Light Company contemplates the construc-

tion of a power station, 80 ft. by 140 ft., two stories high.

ST. PAUL, MINN.—Plans are being considered for the installation of an ornamental lighting system on Eighth Street, between Wabasha and Roberts, to cost about $4,132.

CENTERVILLE, IOWA.—The Iowa holdings of David G. Fisher & Company of Davenport have been consolidated with the Iowa Southern Utilities Company, with headquarters in Centerville. The Fisher properties taken over by the consolidation are the Leon Electric Company, Clearfield Electric Company, Blockton Light & Power Company and the Mount Ayr Light & Power Company. The Fisher companies now have about 25 miles of transmission lines under construction and an additional 75 miles was proposed in this year's budget. The entire development work contemplated this year by the merged companies will involve an expenditure of about $250,000.

MUSCATINE, IOWA.—Improvements to the ornamental street-lighting system are reported to be under consideration.

BUTLER, MO.—Plans are being considered for changing the system of the municipal electric-light plant from direct to alternating current.

EDITH, MO.—Plans are being prepared, it is reported, for the construction of a power plant on the Niangua River, near Edith, to cost about $4,000,000. C. F. Robertson and associates are interested.

SMITHVILLE, MO.—The local electric-light plant, owned by C. Morton and H. Gordon, was destroyed by fire on March 25, causing a loss of about $7,500. Electrical service is now supplied from the McComas water power plant at Edgerton. The local plant may be rebuilt.

ALEXANDRIA, S. D.—At an election to be held April 17 the proposal to issue $12,000 in bonds for extensions and improvements to municipal electric-light power plant will be submitted to the voters.

FULLERTON, NEB.—The Fullerton Electric Light & Power Company is contemplating the installation of a new gas engine and new generator. Additional equipment will also be installed in the water-works plant.

HUMPHREY, NEB.—The installation of a new oil engine and generator is contemplated by F. J. Huthmacher, owner of the local electric-light plant. The size of the units has not yet been decided upon.

MARQUETTE, NEB.—At an election held recently the proposal to sell the municipal electric light plant to the Public Service Company of York was carried.

WEST POINT, NEB.—The Nebraska Gas & Electric Company, which recently took over the property of the West Point Electric Light & Power Company, is contemplating changing the system from direct to alternating current.

YORK, NEB.—The Public Service Company is erecting an electric transmission line (33,000 volts) from York to Stromberg.

ABILENE, KAN.—The Riverside Light, Power & Gas Company is contemplating extending its transmission lines to Bennington.

PLEASANTON, KAN.—The installation of an electric-lighting system in Pleasanton is under consideration.

Southern States

MOREHEAD CITY, N. C.—The city of Morehead is installing a new municipal electric-light plant. C. Smith is superintendent.

RALEIGH, N. C.—The installation of an ornamental lighting system on Wilmington Street is under consideration.

CONWAY, S. C.—The Quattlebaum Light & Ice Company will soon install a new engine and generator in its plant. Orders, it is understood, have been placed for the new equipment. Paul Quattlebaum is president and manager.

BANNING, GA.—The Hutcheson Manufacturing Company is planning to add 2500 spindles to its mill and to build a dam to develop water power, and will also connect with the electric transmission system of the Georgia Power Company to furnish power during low-water periods or emergencies.

THOMASVILLE, GA.—At an election to be held April 27 the proposal to issue $160,000 in bonds for the installation of a fire alarm system, road work, etc., will be submitted to the voters.

ST. CLOUD, FLA.—The City Council is considering the question of establishing a municipal electric-light plant in St. Cloud.

WINTER HAVEN, FLA.—Contracts have been placed by the Winter Haven Water, Ice & Light Company for an additional 300-hp. Diesel engine and generator, to be installed by July, 1918, or before. W. A. Lyon is secretary and treasurer.

ALEXANDRIA, TENN.—Arrangements have been completed for the installation of an electric-lighting system in Alexandria.

TREZEVANT, TENN.—The City Council is considering calling an election to submit the proposal to issue $7,500 in bonds for the installation of an electric-light plant to the voters.

COLUMBIA, ALA.—The Columbia Power Company of Lexington, N. C., recently organized, is planning to construct a hydroelectric power plant on Omersee Creek, near Columbia, to develop about 700 hp., to supply electricity in Columbia, Ashford, Headland and Midland. J. Ed. Foy and Dermott Shemwell of Lexington, N. C., are interested.

GREENSBORO, ALA.—The electric plant and ice factory of the Greensboro Water & Light Company have been purchased by H. C. Armstrong, R. L. Ellis, Hugh Mallory and others. The new owners contemplate extensions and improvements to the property.

COLFAX, LA.—An agreement has been reached whereby the town of Colfax will take over the property of the Colfax Light & Power Company. The town is planning to double the output of the plant and install an elaborate street-lighting system. The proposal to issue bonds for the installation of a water-works system will be submitted to the voters. Xavier A. Kramer of Magnolia, Miss., is consulting engineer.

RAYNE, LA.—Bids will be received by the city of Rayne until April 23 for furnishing and installing machinery and equipment in connection with improvements to the municipal water and light plant. Copies of plans and specifications may be obtained at the office of Harold Raymond, Interstate Bank Building, New Orleans, or at the office of O. P. Bonn, Mayor, Rayne.

BUTLER, OKLA.—At an election held recently the proposal to issue $6,000 in bonds for the installation of an electric-light plant was carried.

CAPRON, OKLA.—The installation of an electric-lighting system is reported under consideration.

MARLOW, OKLA.—New equipment, including two Bruce-McBeth gas engines, one 100 hp. and one 150 hp., and a 187-kva., 2300-volt generator, is being installed in the municipal electric-light plant. L. A. Pritchett is superintendent.

RED ROCK, OKLA.—The city of Red Rock is contemplating the purchase of equipment for water-works system, including two triplex pumps, oil engines, etc. Plans and specifications are on file in the office of the Benham Engineering Company, Oklahoma City, Okla.

WOODWARD, OKLA.—The Woodward Cotton Company has submitted a proposal to the City Council offering to sell its electric plant to the city.

ALICE, TEX.—The Alice Ice & Light Company has awarded contract for erection of power house, 38 ft. by 50 ft., 22 ft. high, to A. E. Hinrichsen of the Alice Ideal Concrete Stone Company; also to install engine and electric apparatus.

WOODVILLE, TEX.—The Woodville Light & Power Company is contemplating the installation of an electric-light and power plant in Woodville.

Pacific and Mountain States

BREMERTON, WASH.—The County Commissioners have permitted the Mason County Power Company to erect electric transmission lines on the highways of the county to supply electricity to the navy yard and to various towns and villages in the county. The company has a power plant on the North Fork of the Snohomis River, near Hoodsport on Hoods Canal.

OTHELLO, WASH.—Steps, it is reported, will be taken by the Council toward equipping a municipal electric-light plant. Extensive improvements are also contemplated to the water-works system. The cost of the work is estimated at $14,000.

SEATTLE, WASH.—The city of Seattle has rescinded its call for bids for construction of an auxiliary unit to the Lake Union steam power plant. New bids will not be called until the question of issuing bonds for the plans has been definitely settled by the courts.

SEATTLE, WASH.—Plans have been approved by the Board of Public Works for a new hydroelectric power plant, to cost $3,000,000, for which bids will soon be asked by the city. The proposed plant will have an output of 13,000 continuous kw., 25,000 kw. for five hours and 10,000 kw. for the remaining 19 hours.

SEATTLE, WASH.—Plans have been completed and work will begin at once on the construction of a one-story addition to the municipal steam auxiliary power plant at Eastlake Avenue and Nelson Place, Lake Union, to cost between $75,000 and $80,000. Bids will be asked at once for driving 6000 ft. of piles for foundations, and considerable sheet steel piling for the coffer dam.

SPOKANE, WASH.—The Washington Water Power Company is considering the erection of a high-tension transmission line from its plant at Long Lake, 25 miles down the Spokane River to Northport. The proposed line if built will be about 90 miles long.

TACOMA, WASH.—Plans are being considered to double-track the extension line of the municipal street car system to the Todd plant. The cost is put at $75,000.

TWISP, WASH.—Extensions are contemplated to the local electric-light plant, including the installation of a larger water wheel and dynamo.

WAPATO, WASH.—The City Council has granted the Pacific Light & Power Company of Portland, Ore., a franchise to supply electricity for lamps and motors in Wapato for a period of 50 years.

SPRINGFIELD, ORE.—The Booth-Kelly Lumber Company is adding several new motors to its present installation. E. N. Willard is chief electrician.

ATWATER, CAL.—An election will soon be held to vote on the proposal to form highway lighting districts in the unincorporated towns and villages in the county.

BLYTHE, CAL.—Application has been filed with the State Railroad Commission by Floyd Brown for authority to install and operate an electric-light and power plant in Blythe.

LODI, CAL.—Steps have been taken by the Business Men's Association for the installation of an ornamental lighting system in the residence districts.

TWIN FALLS, IDAHO.—At an election to be held April 24 the proposal to issue $420,000 in bonds for installation and improvements to water supply and distribution system, reservoir and filtration plant, also for $176,000 in bonds for construction of a pipe line from Rock Creek to the reservoir of the present water system, will be submitted to the voters. In connection with the proposed water-works improvements a proposition is being considered which will provide both power and water for the city with a power plant costing $242,000 and a pumping plant to cost $350,000. At the proposed site at Clear Lake, 21 miles west of Twin Lake, it is estimated that 8000 hp. can be developed. The transmission line would be routed through Buhl and File.

GRANTSVILLE, UTAH.—Plans are being considered by a company represented by C. F. Anderson and J. P. Ericson, for the construction of a hydroelectric plant on North Willow Creek, to develop about 210 hp. Energy will be supplied mainly to the local potash plant and a number of mills in this vicinity.

GLOBE, ARIZ.—The City Council has granted E. Sultan a franchise to construct an electric railway on Broad Street. Plans are being considered to build an electric railway between Globe and Miami.

MESA, ARIZ.—The city of Mesa will purchase the electric and gas plants of the South Side Gas & Electric Company, at $113,000.

NOGALES, ARIZ.—Plans are being prepared for erecting lamps on Frank and Merley Avenues, Arroyo Boulevard and Park and Court Streets.

SHERIDAN, WYO.—Extensive improvements, including the installation of a 500-hp. boiler and a 5000-hp. surface condenser, will be made to the plant of the Sheridan County Electric Company. Extensions will also be made to the ash-conveying equipment. Orders have been placed for the machinery. The cost is estimated at $30,000.

Canada

CHAMPION, ALTA.—A lighting plant will be installed in connection with the proposed new opera house, which, it is understood, will furnish lighting service in the town. W. A. Carmichael is secretary and treasurer.

BLAKENEY, ONT.—Arthur Burgess of Carleton Place is reported to be considering a power development.

BRUSSELS, ONT.—A new hydro power project is under consideration by the town of Brussels.

KITCHENER, ONT.—The construction of an electric railway between Guelph and Kitchener is under consideration. The project, it is understood, is to be part of the proposed hydro-electric line.

TORONTO, ONT.—The Water Works Department is asking for tenders to install an additional pump and motor, to cost about $25,000, at the Riverdale pumping station.

SASKATOON, SASK.—Extensions to the municipal street railway, involving an expenditure of $35,000, have been authorized by the City Council.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until April 30 for furnishing steel rails, spring steel, electric cable and wire, conduit fittings, cable grips, pipe straps, electrical fittings, shop machines, chain blocks, duct reel, mica, soldering compound and salts. Blanks and general information relating to this circular (No. 1136) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York City; Whitney Central Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

1,221,013. POWER TRANSMISSION SYSTEM; Wilhelm Morrison, Chicago, Ill. App. filed Sept. 9, 1910. (Reissue.) For use on automobiles.

1,221,013. VENTILATING PLATE AND SPACER FOR ELECTRICAL APPARATUS; Carl B. Auel, Wilkinsburg, Pa. App. filed Jan. 7, 1911. Employed in laminated magnetizable core structures for the purpose of providing ventilating passages or air ducts.

1,221,034. OSCILLATING-CURRENT GENERATOR; Lee De Forest, New York, N. Y. App. filed March 26, 1915. Circuit arrangement to cause intensification of the oscillating currents generated.

1,221,039. FLAME-ARC LAMP AND ELECTRODE THEREFOR; Georg Egly, Berlin-Treptow, Germany. App. filed Nov. 26, 1915. Formation of slag on the negative electrode is prevented by incorporating salts of the alkalis in the negative electrode as an essential constituent evenly distributed throughout the entire mass thereof.

1,221,050. CIRCUIT-INTERRUPTING SYSTEM; Albert L. Harvey, Wilkinsburg, Pa. App. filed Feb. 17, 1915. Interlocking devices for circuit interrupters.

1,221,061. GALVANIC CELL; Morduch L. Kaplan, Brooklyn, N. Y. App. filed June 1, 1914. Consisting of a negative zinc electrode, a positive carbon electrode and an electrolyte containing ammonium chloride.

1,221,062. GALVANIC CELL; Morduch L. Kaplan, Brooklyn, N. Y. App. filed Nov. 20, 1914. Leclanché type.

1,221,095. MEANS FOR COLLECTIVELY ACTUATING AND CONTROLLING ALTERNATING-CURRENT MOTORS; Joseph L. Routin, Paris, France. App. filed March 26, 1915. Provides means for maintaining the synchronism between the receivers even when they operate in synchronism with an alternator, to render the speed of the receivers practically independent of the resistant couple.

1,221,106. ELECTRIC WATER HEATER; Emil Stranszky, New York, N. Y. App. filed Oct. 14, 1916. Heated water is adapted for use at a distant station, in which a local supply of water is maintained constantly heated and for use at the immediate heating station.

1,221,139. APPARATUS AND METHOD FOR PRODUCING METALS OF IMPROVED QUALITY; Henry M. Chance, Philadelphia, Pa. App. filed June 12, 1916. Reduction of ore by fuel (i.e., the production of metal) and the refining of the metal by means of reactions induced or produced by an electric current are combined.

1,221,143. AUTOMATIC WEIGHING SCALE; Samuel G. Crane, Toledo, Ohio. App. filed June 9, 1913. Pair of solenoids which act upon a common armature or movable core to which the poise is attached, whereby the latter is moved in one direction or the other according to which solenoid is in circuit.

1,221,175. AUTOMATIC TRAP NEST; George A. Heatherbell, Deep Bay, Port Cygnet, Tasmania, Australia. App. filed Jan. 17, 1916. Improvements.

1,221,177. SELECTIVELY OPERATED SYSTEM; Ralph N. Hill, New York, N. Y. App. filed March 21, 1914. Circuit at any particular location along a transmission line may be interrupted from a main or dispatching station without interfering with other portions of the line.

1,221,199. IGNITION SYSTEM; Robert McClenathen, Akron, Ohio. App. filed Feb. 13, 1913. Only the magneto is used, the operation of the engine being dependent upon the uninterrupted performance of the magneto.

1,221,200. IGNITION SYSTEM; Robert McClenathen, Akron, Ohio. App. filed Feb 20, 1913. Improvements.

1,221,201. ELECTRIC IGNITION SYSTEM; Robert McClenathen, Akron, Ohio. App. filed Feb. 20, 1913. Control means used in connection with such systems.

1,221,206. ELECTROLYZING APPARATUS; Rudolph J. J. Mueller, Sheboygan, Wis. App. filed Aug. 16, 1915. For producing hydrogen and oxygen from water.

1,221,208. MAGNETO; Alfons H. Neuland, San Francisco, Cal. App. filed Jan. 29, 1917. Used in connection with internal-combustion engines to generate the electric current for producing the firing spark.

Record of Electrical Patents

Notes on United States Patents issued on April 3, 1917.

1,221,232. AUTOMATIC CUT-OUT; Joseph M. Sherman, Seattle, Wash. App. filed May 1, 1916. Improvement.

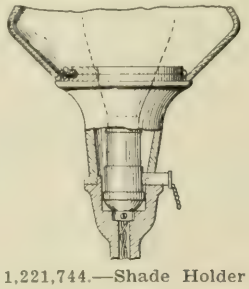
1,221,238. PHANTOM-CIRCUIT LOADING; James B. Speed, New York, N. Y. App. filed March 31, 1916. Improvements.

1,221,239. ELECTRICAL CONNECTOR; Charles E. Stahl and John F. Cavanagh, Meriden, Conn. App. filed June 20, 1916. Improved.

1,221,255. CONNECTOR SOCKET FOR ELECTRIC LAMPS OR THE LIKE; Richard H. Welles, Kenosha, Wis. App. filed May 19, 1916. Bayonet type.

1,221,270. THERMO-COUPLE; Jacob W. Bard, Springfield, Ill. App. filed Jan. 30, 1914. For use in connection with mercury motor meters.

1,221,275. CARTRIDGE FUSE; Warren F. Bleecker, Washington, Pa. App. filed Nov. 18, 1915. Readily adjusted for replacing a fuse without the use of tools.



1,221,744.—Shade Holder

1,221,308. APPARATUS FOR TRANSMITTING IMPULSES OF CURRENT IN ELECTRIC CIRCUITS; Charles L. Goodrum and Bert G. Dunham, Rochester, N. Y. App. filed Sept. 4, 1906. Device for controlling circuit contact members.

1,221,311. APPARATUS FOR OBTAINING DIRECT CURRENTS FROM ALTERNATING CURRENTS; Leslie B. Graham, East Chicago, Ind. App. filed Oct. 7, 1915. Without any make-and-break in the alternating-current circuit and without objectionable sparking when rectifying high-potential currents.

1,221,327. ELECTRICAL REGULATING DEVICE; Gottlob Honold, Stuttgart, Germany. App. filed Nov. 13, 1913. Comprises a container holding a mass of finely divided resistance material, such as carbon.

1,221,345. CONTROLLER; William A. Marschke and Friedrich W. Marschke, Indianapolis, Ind. App. filed Dec. 24, 1915. Snap-switch action.

1,221,377. SIGNALING MECHANISM; Henry E. Reeve, New York, N. Y. App. filed Nov. 8, 1913. Reduces the power required to rotate the hammer.

1,221,379. SHEEP SHEARS HOLDER AND CONTROLLER; Bert Ross, Idaho Falls, Idaho. App. filed May 2, 1916. Holder arranged so as automatically to shut off the power to the clippers when the latter are mounted thereon.

1,221,391. FEEDING DEVICE; Louis H. Thullen, Brooklyn, N. Y. App. filed May 20, 1915. Improvements.

1,221,418. INCANDESCENT LIGHT FOR PROJECTION APPARATUS; Emerson L. Clark, Lakewood, Ohio. App. filed Oct. 17, 1912. Incandescent filament.

1,221,443. SYSTEM FOR RECORDING METER OPERATIONS; Chester I. Hall, Fort Wayne, Ind. App. filed July 14, 1916. Mechanism for printing a record from the recording devices periodically by means of time-controlled apparatus.

1,221,451. CONTROLLER DEVICE FOR ELECTRIC LIGHTING AND HEATING PURPOSES; Frederick H. Hoffman, Philadelphia, Pa. App. filed March 3, 1916. For controlling two sets of electric circuits.

1,221,486. CIRCUIT CLOSER; Jesse W. Stutts, Florence, Ala. App. filed Feb. 24, 1916. Operated by a thermostat to complete an electric circuit to give warning or perform work when the temperature in the room in which it is placed rises above a predetermined degree.

1,221,499. ELECTRIC SWITCH; Paul H. Zimmer, Milwaukee, Wis. App. filed Nov. 6, 1911. Applicable to circuit breakers.

1,221,512. ELECTRIC WELDING APPARATUS; John P. Cluley, Green Bay, Wis.; App. filed Jan. 10, 1917. Attachment or tool to be used in conjunction with a welding machine of some standard type.

1,221,524. EXTENSION ATTACHMENT FOR TESTING CLIPS; Harry Frankel, New York, N. Y. App. filed April 20, 1916. Tests may be made in places now inaccessible.

1,221,527. ELEVATOR SIGNAL; Robert H. Gaylord, Pasadena, Cal. App. filed Oct. 26, 1915. Means whereby selective signals for different cars and for different directions of movement of the cars may be received on one and the same receiving device at a landing.

1,221,560. ELECTRIC METER; Edwin H. Messiter, Brooklyn, N. Y. App. filed Aug. 12, 1913. Rotary type.

1,221,590. INDICATING ELECTRIC SWITCH; Joseph Rado, Cleveland, Ohio. App. filed Jan. 11, 1917. Pilot lamp or signal in association with the switch which is automatically caused to light when the room becomes darkened.

1,221,607. MOUNT FOR MAGNETO DISTRIBUTORS; Emile J. J. Salmson, Billancourt, France. App. filed March 27, 1916. Ignition magnetos of internal-combustion engines.

1,221,609. AUTOMATIC SWITCH; Elmer H. Schwarz, New York, N. Y. App. filed May 27, 1912. Opens automatically upon the occurrence of overload or other abnormal conditions and can ordinarily be closed and opened at will without difficulty.

1,221,611. LOCKING SWITCH; Edson O. Sessions, Chicago, Ill. App. filed July 10, 1916. For use in connection with alternating currents of large capacity.

1,221,647. ELECTRODE OF METALLIC VAPOR RECTIFIERS OR OTHER APPARATUS; Albert Aichele, Baden, Switzerland. App. filed Jan. 19, 1914. Renders it possible to remove the heat from the anode in an effective manner without impairing the insulation.

1,221,652. FACE PLATE FOR FLUSH RECEPTACLES; Harry U. Badeau, Bridgeport, Conn. App. filed Sept. 12, 1916. Stop device for limiting the movement of the door or shutter which normally obstructs the face-plate opening.

1,221,676. PNEUMATICALLY OPERATED CAM CONTROLLER; Frank E. Case, Schenectady, N. Y. App. filed June 11, 1915. Improved means whereby electric motors are started, stopped and generally controlled.

1,221,713. SPRING-FASTENING DEVICE; Ernest B. Fahnestock, Brooklyn, N. Y. App. filed Oct. 4, 1911. For use in electrically connecting a plurality of conducting wires at a given point or location to an equal number of wires terminating at the same point.

1,221,744. SHADE HOLDER; Herbert Kienzle, New York, N. Y. App. filed July 15, 1916. Direct arrangement for supporting a certain lamp shade or scarf or reflector in connection therewith.

1,221,780. PHOTOTELEGRAPHIC MACHINE; George Wald, United States Army. App. filed Oct. 28, 1914. Method for transmission of photographs, sketches, etc., by wire, at a high rate of speed, locally or at a distance.

1,221,801. SELECTIVE SIGNALING SYSTEM; John A. Hulit, Chicago, Ill. App. filed March 16, 1912. For telephone or telegraph lines.

1,221,812. SAFETY OIL GAGE FOR INTERNAL-COMBUSTION ENGINES; John C. McMurray, East Boston, Mass. Improvement

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The Pacific Coast Section

THERE has long been a tendency among central station men of the Pacific Coast to feel that the distance from N. E. L. A. headquarters and the peculiarity of Pacific Coast problems somewhat limited the extent of the co-operation they could give and receive through the national association. In the Northwest this feeling was one of the reasons that brought about the formation of the Northwest Electric Light and Power Association and drew to it the stanch support of representative men of the industry. To the south, beyond the scope of this northern association, there has long been a recognition of the same local needs and problems, and now, after some three years, the demand for an organization in which a community of interests could be represented has resulted in the Pacific Coast Section of the N. E. L. A. How cordially the coast has welcomed the formation of the new organization is shown by the enrollment of a thousand members in the few weeks since the first announcements went out.

The first gathering at Riverside, Cal., this week will be far more than a section meeting. To Pacific Coast men it will be the forum where for the first time there will be official and effective co-operation among coast companies on coast problems and opportunities. In the territory embraced by the new organization there is an investment of approximately $500,000,000 in central station properties. So long as these companies feel that they have peculiar problems it is proper that they should come together in a local organization to debate them, and the power for good of a community of such interests is very apparent. Coast members of the N. E. L. A. are to be congratulated upon finally effecting a section organization which simultaneously permits the desired closeness of local co-operation and the breadth resulting from national affiliation.

N. E. L. A. Patriotic Meeting

WARM-HEARTED patriotism and indispensable central station work are akin. Both summon to public service. The need for such service is great, and the purpose of the electrical industry is to meet it with earnest will. It is particularly fitting that the National Electric Light Association should plan a great patriotic session to crown its Decoration Day meetings at the forthcoming Atlantic City Convention. No industry in the land will give finer service to the nation. None should be more forward in the emphatic expression of desire to use the vast resources of men and plant most effectively. As individual men, as individual companies, the industry to-day energizes and conserves human power and machine power. It is already successfully mobilized in units. By conference at the annual convention the ways and means of giving freely will be made clearer and more definite and better action will follow.

The Demand Upon Manufacturers

STAGGERING figures, telling an impressive story of overwhelming demand upon electrical manufacturing facilities in 1916, give a new sense of the great proportions of the pre-war industrial boom. The largest individual unit, the General Electric Company, received orders last year for electrical machinery and supplies of an aggregate value of $167,000,000. This is exclusive of special war munitions, the orders for which were small in amount. It represents an increase of 70 per cent above the 1915 total and of 50 per cent above the previous record figure in 1913. It is a fair index of the rate of growth in the industry as a whole. It shows an unparalleled need for electrical products far beyond the capacity of manufacturing plants to meet without delay. The difference between orders received and sales billed is roughly $33,000,000. This showing does not complete the picture of present conditions, for it is well known that throughout the industry orders received since Jan. 1 of this year are much in excess of the possible productive capacity. The industry can be operated for a long time on unfilled orders.

New England's Biggest Hydroelectric Plant

WE GIVE an account in the current issue of the new power station of the Turners Falls company, which plant is far and away the biggest generating station in the Connecticut Valley. Owing to the low head, normally 55 feet (16.76 m.), and the size of the units, low-speed machinery has been adopted. The wheels are a little out of the ordinary, being of a single-runner type with vertical shafts bearing the usual umbrella-type generator adopted for such construction. The generating units, despite their low speed, were of moderate cost, figuring only $6.31 per kilowatt on full rating, while the total development cost only $65 per horsepower, an unusually low figure for this part of the country. There are some interesting details in the way of safety devices, in particular temperature alarms for the transformers, for the water supply to the governor system, and the oil supply for the bearings. The hydroelectric development was decided on after a thorough examination of the possibilities of the situation, ending in the present scheme of enlarging and extending the

earlier canal from the old site, utilizing the water at one point so far as possible and thereby avoiding a second dam across the river. The result appears to have been a particularly well-planned and efficient plant which can not fail to be of great service to the manufacturing industries of the territory served.

Protective Relays for High-Tension Lines

AT the recent American Institute of Electrical Engineers meeting in Chicago, two papers were presented on the use of protective relays, by Philip Torchio and R. F. Schuchardt respectively. These papers illustrate the widespread use of relays on large urban transmission and distribution systems, for the rapid automatic disconnection of defective elements.

In the early days of low-tension city networks of three-wire direct-current mains leaden fuses used to be inserted at the street-junction terminals of each block; so that if a bad ground occurred in that set of mains, the main fuse or fuses would melt and automatically disconnect the faulty element from the network. Later on, however, it was found that these fuses were apt to melt on small provocation, to the detriment of continuity in the service; so that the junction-box fuses were discarded in favor of solid non-fusible couplings. This plan ordinarily worked well. If a short-circuit occurred in the mains, the rush of current into the short from the system was frequently sufficient to deflagrate the main at and close to the fault; so that the short would automatically dissipate itself. Occasionally, however, a short of somewhat higher resistance would form, and this would be capable of lowering the voltage of the system for some little time, while the entire generating plant was straining to burn off the defect. A storage battery floating on the system was often helpful in bringing the disconnection about.

The advent of higher-tension alternating-current systems, however, rendered necessary some new automatic cut-off for disconnecting defective mains because a swinging arc was otherwise capable of being developed which, in its turn, could set up powerful and dangerous electric surges in the system. To meet this need, various types of cut-off relays have been devised, and many are in satisfactory service. It is very important that such relays may be depended upon not to come into action prematurely, and on the other hand that when the occasion arises the relays shall surely operate. The case is like that of a gun in Texas. Its need may be rare, but when the need arises it is apt to be appallingly urgent. Moreover, in case of a heavy short, the relay should not stand upon the order of going but should go on short notice; whereas in the case of a mild short it might properly deliberate and ask itself whether it really had constitutional authority, so as to give the offending short time and opportunity to repent. All these and other requirements have already been met in fairly satisfactory degree; but for their absolute fulfillment to the complete satisfaction of the station manager's specifications each relay would have to be replaced by an angelette from heaven.

Sulphur in Coal

AS the price of coal rises more and more care has to be exercised in the investigation of its real value as a fuel. The effect of one common impurity, sulphur, on the thermal value of the coal should be noted. In general terms sulphur most commonly appears in coal in the form of iron pyrites. Not uncommonly there may be also sulphur in combination with carbon and hydrogen and more rarely small quantities of free sulphur. In the case of weathered coal that has lain long exposed to air there is apt to be formation from the sulphur content by oxidation of sulphates, usually of iron or calcium. Sulphur itself and its organic compounds of pyrites have a certain heating value in their combustion to sulphur dioxide. The sulphates, on the other hand, have no value as fuel and rather tend to absorb heat than to give it out. Freshly mined coal containing sulphur is therefore on the whole much more desirable than a sulphur-containing coal which has been weathered. Aside from their fuel values, pyrites unfortunately, burning to iron oxide, tend to produce clinkers, which may give considerable trouble. The moral plainly is that sulphur is an undesirable citizen in its general effects, as has long been known. The facts also seem to us to point very plainly to the desirability of utilizing sulphur-containing coal on the spot and when freshly mined. If it could be burned at the mine's mouth and the power transmitted it would not get a chance to lose value by weathering. In the systematic working of a large plant at the mine there is an admirable chance for handling a cheap and comparatively undesirable fuel more efficiently than if that fuel were shipped and distributed, for the shipping expense is high per calorie, and when used on a large scale better conditions of combustion are usually available. This is now becoming more generally recognized.

Micarta-Core Glass-Disk Insulators

THE problem of the high-tension power-transmission line is closely connected with that of the high-tension insulator. Terminal apparatus capable of withstanding increased working voltage was forthcoming long before line insulators could be found to protect the line conductors. During recent years the porcelain suspension insulator, or string of insulators, has been successfully developed; but it is questionable whether the string of insulators can long retain supremacy in this field. What is wanted is a single insulator of greater capability and less cost than the present string of insulators.

An interesting type of high-tension single insulator is described in this issue by Lincoln Nissley. It consists of a long micarta tube the inside of which is filled with insulating compound, on the outside of which disk glass insulators are strung like large beads. End castings are fastened to the tube and hold the system together. The tube thus takes the entire mechanical stress and also the principal share of the electrical stress, but the superficial electric stress is carried by

the glass bead surface, which is appropriately lengthened out. It is claimed that an eleven-disk insulator, only about one meter long, can stand 300 kv. for one minute. The surface distance between the end castings, as measured over the glass, is given as 2.2 meters, or more than twice the total length.

If an insulator of this kind, which substitutes micarta and glass for porcelain, can be made to stand the tests of time and experience, it should be a great boon. Strictly speaking, we should try to use glass for our windows and outdoor insulators, retaining porcelain for teacups and tableware. It is a pity to use our dishes on tower suspensions of high-tension lines.

Preparedness for the Central Station

A PARTICULAR responsibility lies on the central station, as upon other public utilities, in war time. It is a fundamental duty not only for itself but for the community that the orderly course of its supply shall not be interrupted, particularly since so large an amount of power for manufacturing purposes is now supplied from central stations. To this end it is necessary that every central station, especially those in important centers, should take every possible precaution to avoid the only too evident dangers of attack from within or without. The necessary precautions may be divided into three classes: First, the protection of generating stations and substations; second, the protection and conservation of fuel supply, and, third, the proper guarding of the distribution system.

Many organizations are now doing very thorough preparedness work along these lines. The first necessary step is to suppress disloyalty with a heavy hand. A carefully arranged system of identification passes will also be necessary in any large company to prevent the access of supposed employees to a plant. Beyond these personal matters most stations will find it desirable, as many have already, to organize careful protection for the stations and substations. This means operating behind locked or guarded gates and, if necessary, the free use of barbed wire and other protection to prevent access to the grounds.

The concrete dangers to which a plant is exposed are the planting of bombs to wreck apparatus, switchboard or cable tunnels. There is also more or less risk of explosives being worked into the fuel. To prevent this protection of the whole grounds is necessary by day and by night, reinforced by general flood-lighting of the fences and entrances. With this goes actual thorough guarding, not always an easy job. It can, however, be often facilitated by stationing guards in one or more watch towers so arranged as fully to command the premises. In the case of plants on tidewater this vigilance ought to be extended to the coal-handling apparatus and the condenser tunnels.

Outside the plant itself a material danger exists in the interruption of vulnerable and important parts of the distributing system. Such spots should be rigorously guarded, a duty which would usually be up to the local police or to the troops. There is a further danger which may come from organized attempts to put out of action the electric lighting system simultaneously with other hostile activities directed against the water supply and important buildings. Outside the plant such movements may be checked by suitably guarding the city, and to avert danger at power houses all entrances except those absolutely necessary should be permanently closed and barricaded. The others should be put in condition to be easily defended. A word here about arming guards may be in place. Pistols are practically useless unless in the hands of particularly skilled men, while rifles are likely to be of more danger to the neighborhood than to the marauder. The policy adopted by the military guards in various places of using repeating shotguns and buckshot is highly to be recommended. Some of the precautions here enumerated may seem extreme, but the risks to be avoided, although possibly remote, are so serious in their effect on the community that it is hard to exercise too much vigilance.

Adding Conductors to Networks

IT IS evident that it becomes a matter of practical importance to know what the effect will be of adding conductors to a network when the existing conductors become incapable of meeting the conditions of load. In fact, some reasonable estimate of the beneficial effects of such new conductors must be forthcoming in advance, before the necessary new capital can be asked for. The article by M. C. Rodi in this number deals with the computations by which the effects of such new conductors can be arrived at in advance. It is evident that the complexity of these calculations may be great even in comparatively simple cases. There is evidently need for some simple mechanical model for evaluating the desired solutions without the necessity of long arithmetical processes. Nevertheless, the arithmetic is interesting as a process, if only as an instigator to swifter operations.

The Coming Issues

SHOULD the central station look after its customers' appliances, repair them and keep them in good working order, all for nothing? In performing such service does the central station, by keeping energy-consuming appliances in use instead of standing idle on a shelf, really gain more than the good-will of the customer? It is an interesting question, and a full discussion on it will be found in our next issue. In addition there will be an article on the operation of the Hartford battery exchange system, which has now been in continuous operation for nearly five years. There will also be articles on lighting and other subjects, besides the regular departments devoted to central station service and to the plant engineer and operator. In the first issue of May several articles on broad questions of public policy will be published.



Largest Hydroelectric Plant in New England

Features of the Montague City Station of the Turners Falls Power & Electric Company, Representing the Latest Development of Large Capacity in the Connecticut River Valley

THE new 36,000-kw. generating station of the Turners Falls (Mass.) Power & Electric Company at Montague City is not only the largest hydroelectric station thus far built in New England, but one of the most interesting installations from an engineering viewpoint now in operation in the Atlantic seaboard states. The plant is the operating center of one of the largest high-voltage transmission systems in the Northeast. It represents an ultimate investment of about $4,000,000, and supplies energy to 66,000-volt lines extending from the Greenfield district to the city of Springfield, Mass., and meets the needs of industrial, municipal, central station and electric railway service through low-tension distribution networks in the middle Connecticut Valley.

Although only four of the six units for which the station is designed are installed at present, the plant has enabled various smaller and less efficient steam and water-power stations on the system to be shut down and held in reserve. At Leverett, Mass., the high-tension lines of the system are arranged for interchange of energy with the 66,000-volt lines of the New England Power Company, and through substations connections are also provided with the Northern Connecticut Light & Power Company south of Agawam and with the United Electric Light Company at Springfield. Affiliated interests operate the local central station systems at Greenfield, Amherst, Easthampton and smaller towns. The electrical service of the city of Chicopee is also furnished in large part by this system.

Water-power development in the Turners Falls district dates back over a century. In 1792 the predecessors of the present company built a dam about 3 miles (4.8 km.) above Montague City and excavated a canal for navigation purposes. After the Civil War a new dam and canal were built and water power was leased to mills erected between the canal and the river. Twelve years ago the canal was extended for hydroelectric development in a station which now has a rated capacity of 5050 kw. in seven units, the available head being 39 ft. (12 m.). This station is now held in reserve most of the time, although it is connected with the new plant at Montague City by two 13,200-volt, three-phase tie lines.

With the growth of the load in the territory occupied by the Turners Falls company and allied interests, the development of additional power became a necessity. Besides the Turners Falls station a steam turbine plant of 3250 kw. rating at Mount Tom Junction and a 2750-kw. steam plant in Greenfield were in service, with a 2680-kw. hydroelectric plant on the Deerfield River at Gardners Falls. After a thorough investigation it was decided that the future prospects of the middle Connecticut Valley warranted a comprehensive power development at Montague City, just outside Turners Falls. Three years' study led to the conclusion that the most economical plan was to enlarge and extend the former canal, handling all the water possible at one new plant instead of building a second dam across the river which would be a low-head dam and subject to the disturbance of back-water.

In 1912 it was decided to reinforce the old timber-crib dam (which was built in 1866 and divided in halves

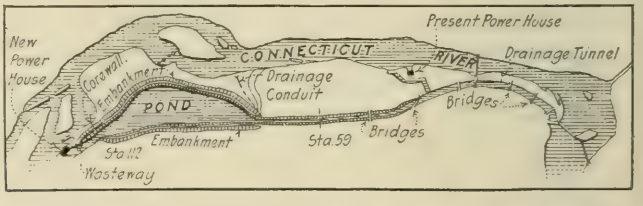


FIG. 1—COURSE OF CANAL AND POSITION OF POND ABOVE TURNERS FALLS STATION

by an island) with 350 ft. (106.7 m.) of concrete dam, filling in the space between this and the old dam with stone. During the following year the remainder of the dam on the Turners Falls side of the island was built. Six sluicegates of the submerged type and operated from a tunnel inside the dam were built at the same time, with a new abutment and new canal head-

gates. These gates, nine in number, are operated by an induction motor through geared hoists, with a small waterwheel in the abutment as a reserve in case of interruption of the power supply. In 1915 the remainder of the dam, with six additional sluicegates, was built. The completed dam with flashboards creates a pond about 20 miles (32 km.) long above the spillway.

Sluices were built in the headgates to enable log drives to be taken through the headgates into the canal instead of carrying the logs through the dam into the river. There is an ample supply of water in the tailrace, and less water is required for sluicing there than above. To have continued sending the logs through the rapids would have reduced the generating capacity by about 1000 hp., and the labor requirements of the lumber interests would have been much greater. A concrete log sluice has been built at the lower end of the new power house, and only enough water to minimize friction need be used in handling a log drive. The station design provides for the installation of a mechanical log haul of about 70-hp. rating just above the sluicegate mentioned.

From the headgates through the town of Turners Falls the canal runs through rock, but beyond this town the canal broadens out into a rock-lined earth cut. At the lower end the canal widens still further into a forebay pond about 600 ft. (183 m.) wide on the average and 3000 ft. (915 m.) long. For the last one-fifth of a mile (0.32 km.) to the generating station the canal narrows down to 150 ft. (45.7 m.) wide by 25 ft. (7.6 m.) deep. A 5-ft. (1.5 m.) drainage conduit extends from the head of the pond to the river. Because of the size of the pond sudden increases in load can be handled without drawing down the head to a troublesome degree before the headgates can be opened.

On the river side of the canal just above the power house is a wasteway, with a concrete spillway and ten 12-ft. by 10-ft. (3.7-m. by 3-m.) wooden gates mounted between piers. The gates are operated by hoists mounted on a concrete platform extending across the piers, the hoists being gear-driven through a common shaft by a 50-hp. motor controlled from the generating station switchboard. The wasteway has sufficient capacity to handle the full canal flow. In addition it can be used for the removal of ice from the canal, in unwatering the latter, and in case of a sudden dropping of the load can be used as a spillway. The discharge of the wasteway follows a gentle slope to the river, a part of the incline containing a rocky bed which breaks up the rush of water.

Special Arrangements for Cleaning Headgate Racks

The power house is 235 ft. (71.7 m.) long and 85 ft. (24.9 m.) wide, the long axis being parallel to the river and making an angle of 20 deg. with the center line of the canal. The head wall of the station contains racks and headgates, the latter being raised by an electric gantry crane running on the head wall. The crane, which was built by the Exeter Machine Works, Pittston, Pa., is equipped with a mechanical trash collector by which the racks can be cleared, the trash then being dumped into a special sluice behind the racks and discharged into the river by flushing parallel to the canal and thence into a canal drain at the lower end of the power house.

Behind the racks are concrete piers separating the intake into three penstock chambers per generating unit. The headgates were designed by E. L. Broome, New York, and are specially planned to secure tightness, simplicity and ease of operation. They are made of steel and operate on a chain of rollers which enables them to close by force of gravity. Strictly speaking, there are no penstocks in the plant, there being instead merely passages in the concrete foundation of the building leading to the various wheels. These passages curve downward from the headgates to the scroll cases of the wheels, the latter being set 18 ft. (5.5 m.) above low water. At the scroll cases the three passages from each group of three gates merge into one. Water enters each wheel through twenty openings around the circumference, each opening having a wicket gate controlled by the governing mechanism. The head on the wheels is normally 55 ft. (16.8 m.). The penstocks, scroll cases and draft tubes are faced with smooth concrete 12 in. (0.3 m.) thick of a slightly different mixture from that used for the station foundations. Foundations are now completed for all six units.

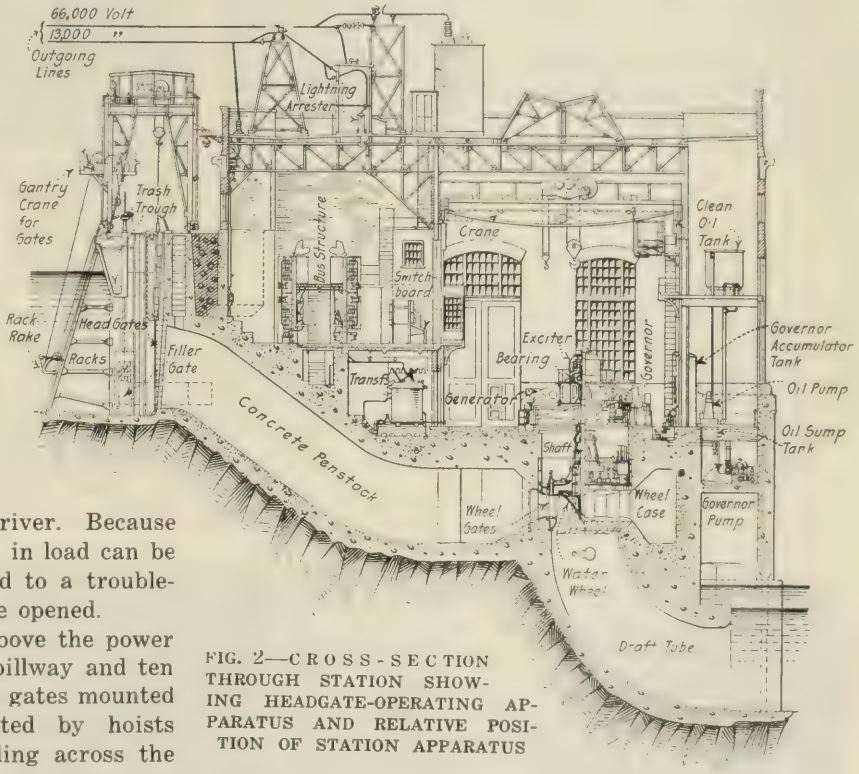


FIG. 2—CROSS-SECTION THROUGH STATION SHOWING HEADGATE-OPERATING APPARATUS AND RELATIVE POSITION OF STATION APPARATUS

The wheels are of the vertical, single-runner type, rated at 9700 hp. each. They were built by the I. P. Morris Company of Philadelphia, which also furnished the governors. Kingsbury thrust bearings are provided for these units. Each wheel drives a 7500-kva. General Electric 6600-volt, three-phase, revolving-field alternator at a normal speed of 97.3 r.p.m., the system frequency being 60 cycles. On top of the main shaft of each unit is mounted a 95-kw. exciter, designed for 250-volt service to save copper. The governors are connected with the shafts by flexible gear drive, which is said to eliminate the troubles sometimes arising from belting. A spare motor-driven exciter rated at 100 kw. is installed in a fireproof compartment off the operating

room for emergency service. Each generating unit has a lignum-vitae guide bearing lubricated by water received from the scroll case through a Terry cloth filter. The total area of the water passages leading from each set of gates to each unit is about 15 ft. by 27 ft. (4.5 m. by 8.2 m.). Single runner vertical units were selected because they offer no obstruction to the flow of water out of the wheel and because they are reliable and simple. The tailwater is discharged into the river 22 ft. (6.7 m.) below the surface. The ultimate rated capacity of the plant (36,000 kw.) is based on a river flow of 10,000 second-feet.

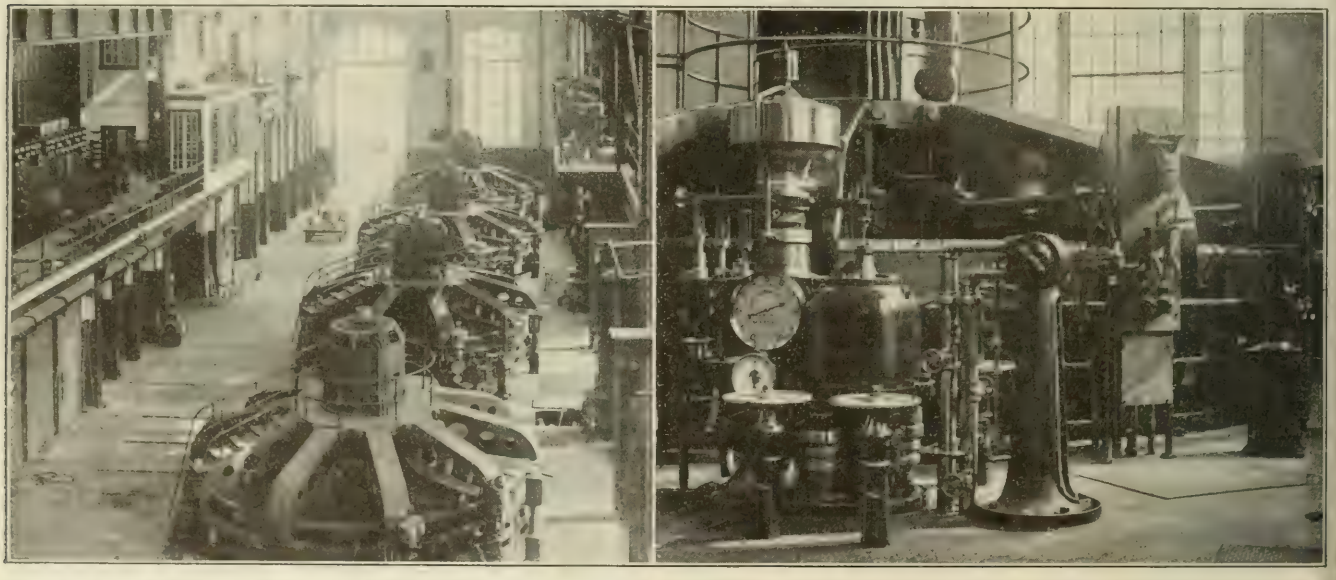
Arrangements for Lubricating and Governing

Since operation began the company has installed a water-cooling coil in each thrust bearing, consisting of 145 ft. (44.2 m.) of 1⅛-in. (2.8-cm.) copper tubing per unit. Fifteen gallons (57.1) of oil per minute is required to carry off the heat developed in each thrust bearing. The water for the auxiliary cooling service can be taken either from the canal or from the municipal supply. In the center of the station over the tailrace is a pump pit containing motor-driven oil and water pumps for lubricating and governor-operating service. The governor pumps are I. P. Morris horizontal centrifugal units rated at 325 gal. (1234 l.) per minute each against a 525-ft. (160-m.) head, and are directly driven by 100-hp. induction motors which are automatically started and stopped from alternating-current motor control panels, all furnished by the General Electric Company. Two sump tanks are installed in the pump pit and are cross-connected by a suction main from which the pump suctions are taken. The pumps discharge into a pressure main, to which is connected a pair of accumulator tanks mounted on the operating-room floor, the governor-operating cylinders being fed from the pressure main and discharging into a receiving main leading back to the sump tanks.

Each accumulator tank is divided into two sections by a diaphragm, the upper section being open to the air and connected with the discharge main by a relief pipe.. Once a week compressed air is forced into the governor-operating system to provide an air cushion at the top of the lower section of each accumulator tank. The air is furnished by a compressor driven by a 5-hp. General Electric motor, a 0.5-in. (1.27 cm.) supply pipe being run to each accumulator tank. A hand-operated pump is installed on the operating-room floor to enable the gates to be closed if the water supply is interrupted. Five sets of wooden block brakes actuated by compressed air are provided on each generator as they may be forced against the rotor-rim flange when it is desired to bring a machine to a standstill promptly. Waterwheels were furnished with a rating of 9700 hp. in order to insure the driving of the generators at full load even under back-water conditions. The stream flow past the plant is extremely variable, ranging from about 1800 second-feet (50.4 cu. m. per sec.) minimum to 100,000 second-feet (2800 cu. m. per sec.) maximum during a year. At times the head is cut down from 5 ft. to 15 ft. (1.5 m. to 4.6 m.) below normal. As shown by tests these generators will readily deliver 7000 kw. each at 80 per cent power factor. According to a statement made by President Philip Cabot of the Turners Falls company before the Massachusetts Gas & Electric Light Commission, the unit cost of the total development figures $65 per horsepower. The plant, therefore, is one of the lowest cost developments recently constructed.

The guide and thrust bearings of the generating units are lubricated with ordinary machine oil supplied by gravity from a tank and filter located on a gallery at the west side of the operating room, about 65 bbl. of oil being maintained in the system. The tank is automatically filled by two vertical Buffalo oil pumps, each directly driven by a 5-hp. Western Electric induction motor. Oil discharged from the bearings is piped into a receiving tank under the operating-room floor, whence it is pumped to the filter and supply tank previously mentioned. The oil-pump motors are controlled by Cutler-Hammer control switches governed by tank float connections.

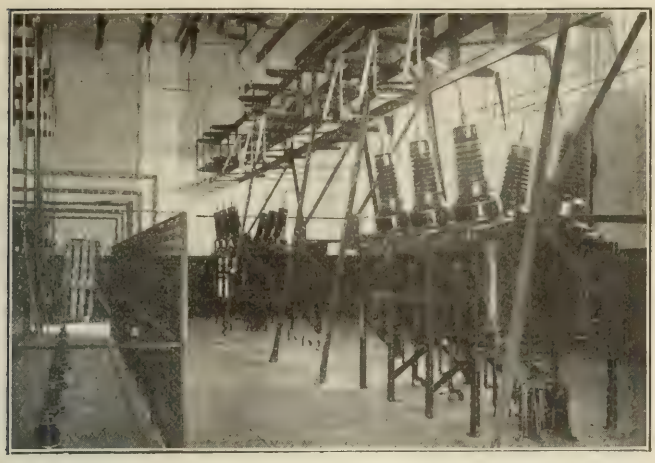
At each generating unit on the operating-room floor are located the governor, with tachometer and gate-position indicator; the air brake valve for controlling the rotor brakes; an engine telegraph stand connected with the switchboard gallery; a Peterson oil meter;

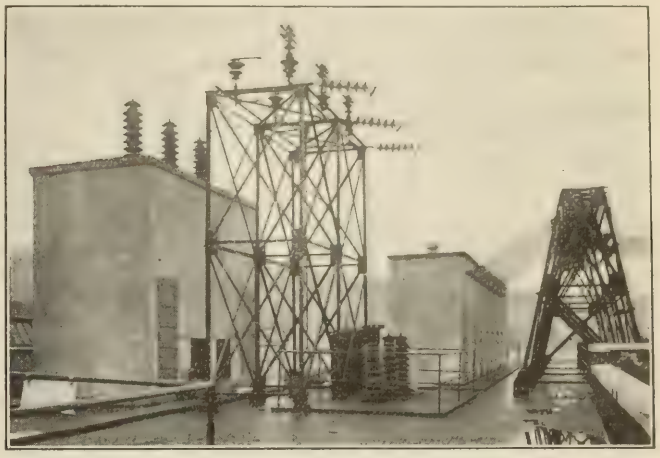


FIGS. 3 AND 4—GENERATOR ROOM AND SOME OF THE CONTROL APPARATUS USED WITH EACH UNIT. ADJOINING THE GENERATOR ROOM ARE THE TRANSFORMER COMPARTMENTS; ABOVE THESE, OVERLOOKING THE GENERATORS, IS THE SWITCH ROOM

one Schaeffer & Budenberg and three Peterson thermometers reading to 60 deg. C. and connected with the oil piping; valves controlling the supply of oil and water to the generator bearings and governor; a Schaeffer & Budenberg recording thermometer on the thrust-bearing oil-discharge piping, and a field switch panel.

The exciters are of the shunt-wound, interpole type, and a Tirrill regulator is provided on the benchboard for each generator, there being no rheostat in the alternator field. Any machine may be either self or separately excited by operating a switch on the floor panel near each unit, provision being made for transfer by either manual means or remote control from the switchboard gallery. Along the wall of the operating room behind each unit are dampers arranged for circulation of either indoor or outdoor air through the rotor air ducts, these dampers being manually adjustable through a wide range. Sixty-six-hundred-volt generators were selected on account of their superior efficiency, due to thinner insulation, compared with 13,200-volt generators, and also because of the decreased corona loss at the lower voltage.





FIGS. 5 AND 6—OIL-SWITCH MOUNTING AND ROOF TERMINAL FOR TRANSMISSION LINE

Provisions for Isolating Transformer Fires

The transformers are located in fireproof bays on the east side of the operating room, provision having been made for an ultimate installation of four 66,000-volt banks for the outgoing long-distance lines and two 13,200-volt banks for local transmission. At present two 10,500-kva. and one 15,000-kva. bank of 6600/66,000-volt transformers and one 4500-kw. bank of 6600/13,200-volt transformers are in use. The switchboard gallery is 15 ft. (4.5 m.) above the operating-room floor and over the 13,200-volt transformers. At the rear are concrete structures for the 6600-volt and 13,200-volt buses, the 66,000-volt bus being carried across the station from end to end in the upper part of the building. Switches connected with this bus are divided into two groups, each group being mounted in a high-tension room above the 66,000-volt transformers. Two sets of 6600-volt buses are provided, with two sets of 13,200-volt buses. Any generator or transformer group can be connected to either 6600-volt bus and any 13,200-volt line can be thrown upon either 13,200-volt bus. Normally each of the four 66,000-volt lines leaving the station is connected with the secondaries of one particular transformer bank, but through the manipulation of the necessary oil switches and disconnectors the outgoing lines can be connected to the through 66,000-volt or high-tension transfer bus within the station and thus fed from any other bank of high-tension transformers. All of the transformers are of the water-cooled type and were supplied by the General Electric Company. Circulating water is furnished from the canal through a twin strainer, an auxiliary town-water connection also being available. The transformers are mounted on wheels bearing upon rails extending into the several bays so that any unit can easily be removed by crane. A 60-ton (54.4-metric ton) Whiting electric crane serves the operating room. The main and auxiliary hoist motors as well as the lateral-motion and longitudinal-travel motors are General Electric three-phase, 550-volt induction units.

Rolling fire doors held open by fusible links are provided for each transformer bay. Under the transformers are reinforced-concrete pits 18 in. (0.45 m.) deep, which are connected with the river through traps for emergency oil discharge. A valve handle controlling this discharge is extended through the bay wall into the operating room to enable the oil to be discharged even when the fire doors are closed. A small filtration plant for transformer, switch and lightning-arrester oil is installed in the station and equipped with a 5-kw. General Electric drying oven, a 12-in. (0.3-m.) filter press and storage tanks. A 7.5-hp. motor-driven pump is used in connection with the filter.

The benchboard is an eleven-section General Electric remote-control installation, there being four generator panels with two blanks, two 66,000-volt line panels, one station panel and two 13,200-volt panels. Each generator is equipped with a power-factor indicator. At the rear of the switchboard, carrying the usual edgewise-type indicating instruments, are mounted curve-drawing kilowatt meters on all outgoing lines, a curve-drawing 6600-volt busbar voltmeter and a watt-hour meter for each generator and each outgoing line. Testing contacts are provided for current and potential readings, double-plug screws being provided for keeping the current transformer secondaries closed while taking readings. At one side of the benchboard is installed a dummy bus and transmission system, with miniature incandescent lamps indicating the open or closed position of all high-tension switches. The lamps are controlled by buttons at the operating desk. The latter is provided with four private and three public telephone lines and with facilities for log-sheet work.

In front of the switchboard is a platform of 2.5-in. (0.75 m.) hard maple, no nails being used in its construction.

Immediately behind the switchboard is the bus structure devoted to 6600-volt service, and behind this is the 13,200-volt bus structure. The oil switches are mounted above and at the rear of their respective bus structures. The current and potential transformers for the two

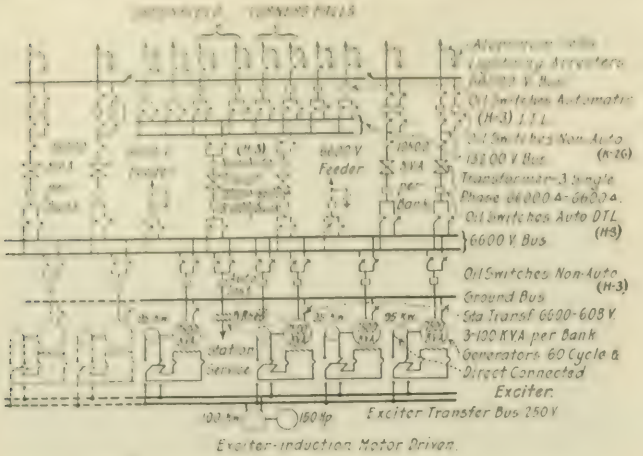


FIG. 7—PRINCIPAL SWITCHING ARRANGEMENTS

lower-voltage circuits are located inside the bus structure. On the 66,000-volt circuits bushing-type current transformers are used, being installed in the switch terminals. The 6600-volt and 13,200-volt wiring is carried in fiber duct, control wiring being run in iron conduit. The leads from the generators are run downward into the floor of the operating room and thence to the 6600-volt switch and bus connections, the transformers being fed from the latter through switches. The 13,200-volt circuits from the transformer secondaries are carried from the controlling oil switches out of the building by conduit and open lines, as recently described in the ELECTRICAL WORLD.

SWITCH MOUNTINGS AND ALARM SYSTEM

The 66,000-volt oil switches are of the General Electric K21 type and are installed with tanks raised above the floor sufficiently to allow removal of tanks by windlasses. The latter are permanently attached to the switch-supporting frames. Disconnecting switches are mounted immediately above the oil switches. The high-tension oil switches, which are solenoid-operated, are piped so that the tanks can be emptied into a receiving tank in the lower part of the building for filtration, provision being made for pumping this oil back into the switch cans again after filtration. General Electric No. 12 or No. 14 switch oil is used in the tanks. Steel structures support the oil switches and disconnecting switches. The 66,000-volt conductors, which consist of copper tubing, are screened in from the rest of the switch room as illustrated. All 6600-volt potential transformers are air-cooled, the 13,200-volt equipments being oil-cooled. Fuses for the latter are supported in separate fireproof compartments. The battery furnishing direct current for solenoid operation consists of sixty cells, which are charged by a 3.5-kw. motor-generator set placed in the station auxiliary bay.

The lightning arresters are of the electrolytic type and are mounted in fireproof compartments on the roof. The various outgoing lines are dead-ended on strain insulators carried on steel towers, the leads from the station interior being carried upward through roof bushings inclosed by railings to prevent the approach of persons within the danger zone. Taps from the outgoing phases are carried to horn-gaps at the tops of the supporting structures as shown, and thence leads are taken through roof bushings into arrester houses. The latter are divided into fireproof compartments, with provision for oil drainage into the river through traps. Wire-glass removable skylights enable arrester cones to be removed and replaced conveniently compared with the usual task of dismantling arresters on the inside of a low and narrow compartment.

Among alarm systems used in the plant are devices for indicating when the temperature of transformers exceeds 80 deg. C., when the transformer cooling water is interrupted, when the governor-system water supply is too high or too low, when the bearing oil supply is too high or too low, when the thrust bearings overheat, and when the guide-bearing lubrication is interrupted. Alarm bells and annunciators are energized by a storage battery located beneath the switchboard gallery, the indicating apparatus being mounted on the gallery. A Bristol recorder is also placed near the benchboard to show the water level in the forebay, and near by is a pair of tubular gages showing the height of water on each side of the racks, any difference in level between the two tubes indicating an obstruction.

Hourly readings are taken on the floor at each generating unit of the flow of oil to the thrust bearing, the oil temperatures at the inlet and outlet of the thrust bearing, water temperature at the outlet of the guide bearing, gate opening and governor hydraulic pressure. The temperature of the transformers in each bank is also taken hourly. A machine shop with motor-driven tools is located in one of the bays below the switchboard, and another bay is provided for station auxiliary equipment, including the motor-driven exciter above mentioned, 300 kw. in power and 15 kw. in lighting transformers. The station operators work in three eight-hour shifts. On each shift one foreman, one switchboard operator and one floor operator are required, with a fourth man at the canal headgates.

The engineering on the Montague City development

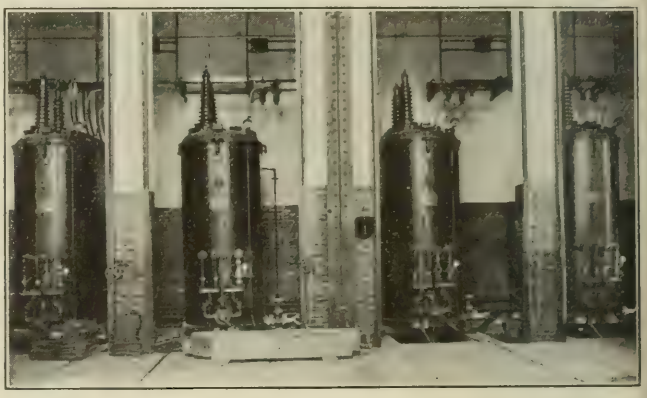


FIG. 8—TRANSFORMER COMPARTMENTS PROTECTED BY ROLLING FIRE DOORS

was the work of the staff of the Turners Falls company. F. L. Hunt is chief engineer, H. M. Turner is hydraulic engineer, H. A. Moody was resident engineer, and Arthur T. Safford was consulting hydraulic engineer. Charles F. Mosher is superintendent of stations, and Haller David Seavey is superintendent of distribution of the system of the allied companies.

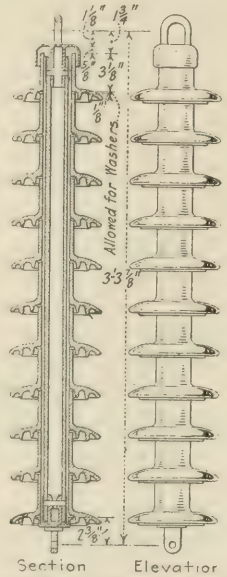
CHARACTERISTICS OF GLASS MICARTA-CORE INSULATOR

Results Obtained with High-Voltage Insulator Developed to Overcome Inherent Faults of Porcelain Insulators

BY LINCOLN NISSLEY

During the last two years the engineering department of H. M. Byllesby & Company has made an extensive investigation of insulator problems with a view toward producing a better insulator than the present market affords at the same cost, and to using materials which do not have the inherent defects that porcelain is known to have. The possibility of producing the insulators in quantities without delay was also considered, since insulator manufacturers at present are unable fully to meet demands and make prompt deliveries.

In designing the Byllesby insulator careful study was made of first principles and their application, fundamental laws of mechanics and materials, electrostatic and magnetic laws, and economic principles. Electrical and mechanical tests made upon the insulator which was finally developed indicate that the principles were correctly applied. This indication is strengthened by a year of successful operation and the experience gained in the assembly of more than 15,000 units, not a single one of which has failed to date.



MICARTA-CORE GLASS INSULATOR

The insulator consists of a micarta core on which are assembled glass disks separated by asbestos washers and held in place by a simple interlocking washer and cotter key. Castings are fastened to each end of the core for attaching it to the support and conductor. After the parts are in place the unit is heated uniformly to a temperature of 100 deg. Fahr. and compound poured into the core through the top casting. Thus only the end castings and micarta core are subjected to mechanical stress, the disks being required only to increase the leakage surface and arc-over distance. The compound poured into the core is employed principally to prevent moisture entering the insulator shell, but also serves to prevent puncture from power arcs. Corresponding parts of these insulators, regardless of size, are interchangeable. An additional advantage of the insulator is its relatively light weight, which permits economy in freightage, cartage and labor and reduces dead-load on the tower supports. Some of the principal characteristics of the Byllesby insulator are given in the accompanying table with the dimensions and weight of a well-known porcelain suspension cap and pin-type insulator.

From a number of tests made on the 11-disk insulators it has been found that they do not arc over when dry until 310 kv. has been impressed. When wet 240 kv. is necessary. Subjected to high-frequency oscillations from a machine capable of developing 600 kv. at 100,000 cycles, this type of insulator successfully withstood 200 kv. for one-half minute and 300 kv. for one minute. The voltage was gradually increased over a period of five minutes to 550 kv., when the insulator arced over. It is interesting to note that when these insulators do flash over the arc curves outward; thus the disks are less liable to destruction.

During tests that have been carried to the point of destruction the top casting and lower clamps were melted and destroyed and two of the end disks melted but the micarta core and central group of disks were uninjured. In this condition the insulator withstood 290 kv. before arcing over. From this experience it appears that the micarta core alone would answer all operating requirements during fair weather. To test the value of the compound the insulators have been submerged in solutions of soda and other lyes for twenty-four hours and while still dripping have been subjected to 200 kv. before arcing over.

CHARACTERISTICS OF BYLLESBY INSULATOR AND COMPARISONS WITH PORCELAIN SUSPENSION CAP AND PIN-TYPE INSULATOR

Working Voltage (Kv.)	Leakage Surface (in.)	Arcing Distance (in.)	Diameter (in.)	Total Length (in.)	Number of Disks	Total Weight (lb.)
60	40	23	7	21.5	5	19
				23.75		**40**
110	88	43	7	40	11	36.5
				46		**92.**

Dark or bold-face figures refer to a well-known porcelain suspension insulator.

The eleven-disk insulators will be used exclusively on the 110,000-volt line which is being built from Wisconsin to Minneapolis to serve the Twin Cities. The line west of Stillwater is being equipped with them. Five-disk insulators of the micarta-core glass-disk type are also being placed on a number of 60,000-volt lines in various parts of Minnesota. The Montana Power Company was one of the first companies to try out the glass disk feature.

Subaqueous Sound Transmitters

In submarine signaling strong vibrations are set up by means of an electromagnet fed from an alternating current supply. In a patent, No. 1,218,934, to Messrs. Evershed and Kilroy two U-shaped electromagnets are disposed at right angles to each other on opposite sides of the sound-transmitting diaphragm, to which are attached two laminated armatures for completing the magnetic circuit of each electromagnet. In this way the periodicity of vibration of diaphragm is twice that of the alternating-current supply connected with the electromagnets.

Measuring Magnetic Drop

Dr. Walter Rogowski of Berlin-Charlottenburg, in Patent No. 1,204,489, suggests a very simple device for determining the ampere-turns necessary for magnetizing any magnetizable part of electric machines, such as yokes, teeth, magnet bodies, armatures and the like. Upon a core which may be made of rubber or other flexible material in the form of a flat band of elliptical cross-section is provided a winding.

For finding the magnetomotive force between the two points of an iron body, the free ends of the rubber are laid against these places in such a way that the center line of the coil at its ends will form an angle of 90 deg. with the contact surface. Then the mmf. may be measured at the instrument by sending an alternating flux through the iron body.

WEDGE CLAMP TO SUPPORT VERTICAL CONDUCTORS

Method of Constructing and Applying Device Designed to Meet Code Requirements for Conduit Risers

BY GUY MAXFIELD

In the National Electrical Code it is specified that all conductors in vertical conduit risers must be supported within the conduit system in accordance with the following table:

No. 14 to 8, inclusive, every 100 ft. (30.5 m.)
No. 6 to 0000, inclusive, every 80 ft. (24.4 m.)
Above 0000 to 350,000 circ. mil, inclusive, every 60 ft. (18.3 m.)
Above 350,000 circ. mil to 500,000 circ. mil, inclusive, every 50 ft. (15.2 m.)
Above 500,000 circ. mil to 750,000 circ. mil, inclusive, every 40 ft. (12.2 m.)
Above 750,000 circ. mil, every 35 ft. (10.6 m.).

Figs. 1 and 2 illustrate the construction and application of a wedge clamp for supporting vertical con-



FIG. 1—ELEVATION AND PLAN VIEW OF WEDGE CLAMP

ductors to meet the above outlined Code requirements. In a conduit wiring installation this clamp must be arranged within a sheet-iron case or cabinet to satisfy the Underwriters' specifications. Usually in a vertical conduit run there are a number of conductors that must be supported. All of the conductors in any given run may be sustained, in accordance with the arrangement delineated, in the same steel cabinet. Frequently it is feasible to pass a U-bolt through the steel plate forming the back of the box instead of through an angle-iron support as suggested. The method can also be utilized for supporting and insulating vertical open-work conductors.

The insulating clamping blocks should preferably be

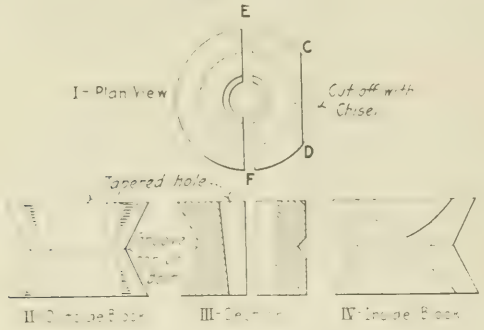


FIG. 2—INSULATING CLAMPING BLOCK

made of a noncombustible material. However, in dry places, noncombustible materials can be used for making the blocks. Hard maple, thoroughly impregnated to prevent the absorption of moisture, has been used in certain cases. Hard fiber can be utilized. In making the block, a spool of the general proportions indicated at II, Fig. 2, is turned from two pieces of insulating material held together so that the dividing plane between them occupies a central position longitudinally in the block. This is necessary so that after the spool has been turned out it will comprise two sections, as at I, Fig. 2. Then a portion *CD* (I, Fig. 2), is machined or cut off with a chisel to provide a smooth surface to bear against the angle iron or other support. Also some material should be planed off of the surfaces *EF* so that when the blocks are clamped around the conductor they will grip it firmly without touching one another. Note that the hole through the center of the clamping blocks is tapered. This construction is used so that the weight of the conductor will tend to tighten it in the blocks.

The distance *A*, Fig. 1, should, where the clamp is to be used for supporting an open-work conductor, be such that it will equal at least 0.5 in. (1.27 cm.) where the pressure on the conductor is 300 volts or less, and equal at least 1 in. (2.54 cm.) where the pressure is between 301 and 500 volts, this clearance being in accordance with Code requirements. In open-work wiring adjacent conductors should be separated by at least 2.5 in. (6.35 cm.) for voltages up to 300 and by 4 in. (10.16 cm.) for voltages from 301 to 500. In a conduit-wiring installation clearances such as above indicated are desirable, though not necessary.

Direct-Reading Capacity Meter

An instrument for measuring capacities with the same convenience that is experienced when potential is measured with a voltmeter is the development of Burchard P. Romain of South Orange, N. J. (patent No. 1,217,827). Two fixed coils connected in series with a fixed condenser are connected across an alternating-current line to furnish the dynamometer field to a movable element made up of two coils arranged perpendicular to each other. The latter two coils are also connected in series with each other and with a fixed condenser making up part of the instrument body. With an unknown capacity placed in series across the line with the movable coils and its fixed condenser, deflection will result, depending upon the condensance of the unknown capacity.

ELECTRICITY VERSUS OTHER POWER FOR COAL MINES

Comparative Data on the Cost of Operating a Coal Mine After Steam-Electric Operation Had Been Substituted for Steam Drive

In connection with the article which appeared in the March 24 issue of the ELECTRICAL WORLD on page 559, the following revisions should be made: In Table II, under "steam plant," the wages paid to firemen, ash handlers and water tenders amounted to $598 during twenty-six working days. Under "electric plant," the cost of supplies, engineers' wages and cost of additional labor and operating the ventilating fan motor should be $700 per month, making the grand total for the steam-electric plant $6,430. In Table V, under "electrically operated mine," read "tons of coal produced per month, 4444.3." The fifth line under Table II should read "the former was only being opened," etc. The fifth line in the second column on page 560 should read "thus bringing the equivalent cost to $0.1107."

Effect of Adding Conductors to D. C. Networks

Simple Solution for Problem Caused by Installing a Conductor of a Given Size in a Particular Position—Superimposing Currents and Voltages Upon Those Already Existent

BY MERWYN C. RODI

DIRECT-CURRENT networks such as exist in the downtown districts of many large cities are in general not so much the product of a single original design or layout as they are the result of a gradual growth. New feeders and mains are added from time to time as demanded by the increasing load, and these additions affect the current and voltage relations which formerly existed in the neighboring conductors. In view of the high cost of large cables and the importance of this class of service, it becomes advisable to know beforehand, quite definitely in some cases, what will be the effect of installing a conductor of a certain size in a particular position in the system. A relatively brief solution of the problem is given in the following columns with an illustration of the manner in which currents and voltages may be superimposed upon other currents and voltages in direct-current calculations.

Suppose that one or more new conductors are to be added to a direct-current network, and that the loads connected with the system will be the same after the change as before. Also, suppose that the potential differences between the station buses feeding the system remain the same. In determining the effect of the change all of the station buses feeding the system are considered to be tied together, and all currents and voltages existing in the system before the change are considered removed. Imaginary emfs. numerically equal to the potential differences which existed in the network before the change are assumed to act in the new conductors between the respective pairs of points which were to be joined by new conductors. The currents which will flow in the network under these circumstances are then determined. The values obtained are the currents which must be added to those which previously flowed in the various branches to find the currents which will flow in the respective branches after the change. Where the addition of conductors is to be accompanied by a change in loads these may be taken into account with hardly any additional calculations. This general method may also be used in experimental determinations with miniature models of direct-current systems.

Usually plenty of data are available upon which to base the calculations. The currents in the existing feeders are known from the station ammeter readings, and the pressure wires give data on the voltage relations. Furthermore, data are usually available upon the flow of current in mains as well as in the feeders under peak-load conditions. Such data are obtained from readings of maximum-demand ammeters and split-type cable-testing ammeters, and from measurements of millivolts drop over the link fuses in junction boxes.

For illustrative purposes a very small direct-current system, such as shown in Fig. 1, may be considered. It consists of a loop of mains and two feeders, one from a high bus and one from a low bus. The high bus is maintained at a potential of 3 volts, on a side, above the low bus. There are three loads on the system, two of 400 amp. each and one of 200 amp., taken off at the points shown. The resistances of the feeders and mains, one side only, are shown in the diagram. The current in each feeder and main is known and is marked in the figure with an arrow indicating the direction of flow. The voltage at each feeding point is known or may be readily computed. In the particular problem under consideration, it is proposed to add a new feeder from the high bus to the point where the 200-amp. load is taken off from the mains, and also to add another main in parallel with the main between the 200-amp. load and the 400-amp. load which is farthest from the buses. With the same loads on the system and the high bus still maintained at a potential of 3 volts above the low bus, what will be the current and voltage relations in the system after the new conductors are added?

There is a difference of potential of 17.735 volts be-

	A	B	C	D	
A	+0.05	—0.02	—0.01	—0.01	0
B	—0.02	+0.03	0	0	+ 1.588
C	—0.01	0	+0.07	—0.02	+17.735
D	—0.01	0	—0.02	+0.07	0

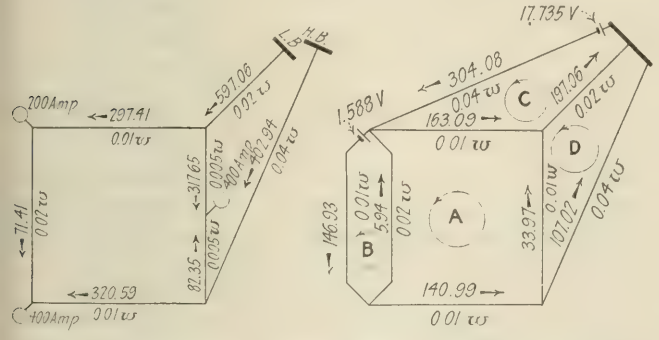
A	B	C	D	
~~0~~	~~0~~	~~0~~	~~0.01~~	~~0~~
—0.02	+0.03	0	0	+ 1.588
—0.11	+0.04	+0.09	—0.02	+17.735
+0.34	—0.14	—0.09	+0.07	0

A	B	C	
~~0.02~~	~~0~~	~~0~~	~~0~~
—0.11	—0.125	+0.09	+ 9.001
+0.34	+0.37	—0.09	+26.996

$$B = \frac{(9.001 \times -0.09) - (26.996 \times 0.09)}{(-0.125 \times -0.09) - (0.37 \times 0.09)} = +146.93$$

$$C = \frac{(-0.125 \times 26.996) - (0.37 + 9.001)}{(-0.125 \times -0.09) - (0.37 \times 0.09)} = +304.08$$

Substituting in a row of second determinant, $A = +140.99$.
Substituting in a row of first determinant, $D = +107.02$.



FIGS. 1 AND 2—SMALL DIRECT-CURRENT SYSTEM OF MAINS AND FEEDERS, AND NETWORK WITH IMAGINARY CURRENTS FLOWING IN THE MESHES, WITH SOLUTIONS THEREFOR

tween the fifth bus and the feeding point of the proposed feeder. Between the two points to be connected by the proposed main is a potential difference of 1.588 volts. These emfs. are represented acting in the new conductors in Fig. 2, and the buses are shown tied together. This system was solved for the currents flowing in the various branches due to the imaginary emfs. and the currents were noted on the figure.

The currents were obtained by finding the imaginary currents in the "meshes of the net." The use of these imaginary currents dates back to J. Clerk Maxwell. They are here represented by the letters *A*, *B*, *C* and *D*, and are considered as flowing in a counter-clockwise direction around the meshes in which the respective letters are placed. If any of the imaginary currents should be found to have a negative value, this would mean that it would flow around its mesh in the opposite direction to that assumed. The imaginary currents when superimposed upon each other give the currents flowing in the branches of the network.

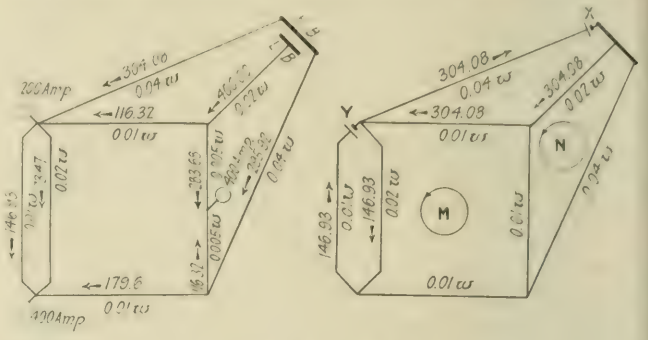
Equations are formed representing summations of voltages around the meshes or loops. An equation is formed for each mesh and every conductor in the figure is contained in one or more of the meshes. The sum of the voltages around any closed loop must equal zero, and the total current flowing to any point on the network must equal the total current flowing away from it. The second condition is evidently fulfilled if the currents are found by the superposition of currents flowing in closed loops.

Only a small number of simultaneous equations are required in this example, but the number of equations may be large in actual practice, so it is advisable to carry out their solution by means of a determinant. The table illustrates the solution of a determinant by the simple routine method. The methods given in most text-books for juggling determinants apply only to special forms. In the first reduction step given in the table column *D* is multiplied by +5 and the result is added to column *A*. It is also multiplied by —2 and added to column *B*, by —1 and added to column *C*, and by zero and added to the column to the right of the vertical line, so that a determinant containing a row of all zeros, except the term —0.01 in the *D* column, is obtained. The row and column containing this term are then crossed out and the determinant is reduced further in the same manner until it may be readily evaluated.

The value of any letter in a determinant such as this, representing simultaneous equations, is found as follows: The determinant exclusive of the column at the right of the vertical line is evaluated. Then the same determinant, except that in place of the column of the letter which it is wished to find the column at the right of the line is substituted, is evaluated, and the value of the letter is obtained by dividing the latter result by the former. However, it is not necessary to carry out two separate solutions for each letter. The column at the right of the line is carried along in the process of reduction and worked with in the same manner as any of the other columns. The numbers which were taken out of the determinant, as —0.01 in the first reduction, were dropped because they would appear in both numerator and denominator in the result, and therefore would not affect the ratios which give the letters solved for. Superimposing *A*, *B*, *C* and *D* upon one another, the currents shown in the diagram of Fig. 2 are obtained, and superimposing these upon the currents of Fig. 1, the currents shown in Fig. 3 are secured. These currents represent those that will flow after the installation of the new conductors. It will be seen that these values are consistent and fulfill the conditions of the problem.

Removal of Conductors

The occasion would be rare where it would be desirable to calculate the effect of removing conductors from a direct-current distribution system. The desired information could usually be readily obtained by pulling a switch or a fuse. However, suppose that it is desirable to calculate the effect of removing the two conductors (Fig. 3) which were considered as new in the previous discussion. Fig. 4 is drawn showing the system of Fig. 2 with all loads removed, the buses tied together, and with emfs. acting in the conductors which it is proposed to remove. The values of these emfs. are unknown, but they are such that they will cause currents in the conductors to be removed which are equal



	M	*N*	*X*	*Y*	
M	+0.05	—0.01	0	0	— 5.979
N	—0.01	+0.07	0	0	— 6.082
X	—0.01	—0.02	+1.00	0	+21.286
Y	+0.02	0	0	+1.00	+ 4.408

FIGS. 3 AND 4—SYSTEM FORMED BY ADDING CONDUCTORS TO SYSTEM IN FIG. 1, AND SOLUTION FOR CURRENTS IN FIG. 4

but opposite in direction to those which were originally flowing in them. The currents return through the other branches of the network, and it is desired to know the magnitude of the current in each branch.

The current is represented as returning by any convenient path, and imaginary currents of unknown values are represented as flowing in loops of the network, which include all of the branches except the conductors which are to be removed. These are carrying a definite known current. Equations representing summations of voltages around the loops are formed as before. One equation is formed for each loop containing an imaginary current and one for each conductor containing an unknown emf. These simultaneous equations are solved for the imaginary currents. In this case $M = -140.99$ amp. and $N = -107.02$ amp. The imaginary currents are superimposed upon one another and upon the numerical currents. This gives the current in each branch which must be added to or subtracted from the current in each branch in the original network to give the currents which will exist after the proposed removal of conductors is made. In this case a diagram exactly similar to Fig. 2 is obtained, except that the currents and emfs. are directed oppositely to those shown there. These currents added to those of Fig. 3 give those shown in Fig. 1.

The use of the general method will now be illustrated by an example which is typical of cases arising in practice. It may be seen that it is not necessary to solve

the entire network, but that the calculation may be applied to a portion of a network such as shown in Fig. 5. However, an allowance will be made to take care of the effect of conductors outside of this area. The resistances of the mains, mostly 500,000-circ. mil mains, are marked on the diagram. The feeding points are shown by small circles and the resistance of each feeder is marked at the feeding point.

A new load of about 200 amp. under peak-load conditions is to be connected with the network at the point marked *s* and another new load estimated at 100 amp. under the same conditions is to be connected at the point *r*. In addition it is proposed to install a new feeder of 1,000,000 circ. mils cross-section from the high bus of one of the stations to the point *s*. During peak load the potential of the bus is 15 volts, on a side, above that at point *s*. The feeder should take care of the new loads, improve voltage conditions and lighten the duty of a couple of smaller nearby feeders. It is desired to find

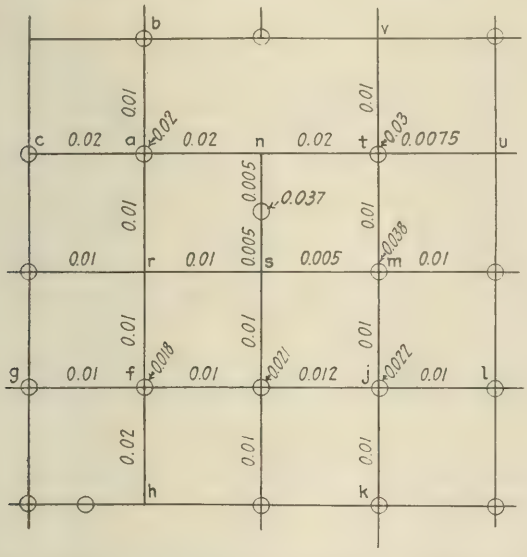


FIG. 5—PORTION OF NETWORK, SHOWING RESISTANCES AND FEEDING POINTS

out what effect the proposed installation and the new loads would have upon the system.

SIMPLIFYING THE DIAGRAM

Before applying the method previously outlined the network diagram may be simplified by introducing some modifications which will have only a slight effect on the distribution of the current to be taken from the new feeder. The voltage is nearly the same at different points on the network and is nearly the same at all the intersections of mains on the periphery of the square shown in Fig. 5. If it were exactly the same at all of these points and if additional current were supplied at the point *s*, then the current would flow from *s* in very nearly the same way that it would if the periphery of Fig. 5 consisted of heavy copper bus having negligible resistance. However, it would not flow in exactly the same way, as regards distribution among the various conductors, because the new current itself would produce some slight voltage inequalities.

Assuming that the ring inclosing the section considered has negligible resistance, sets of lines connecting any point with the ring bus may be considered in parallel. Thus the mains *ab* and *ac* may be represented by one line of 0.00666 ohm resistance, and *fg* and *fh*, *jk* and *jl*, and *tu* and *tv* may also be combined, giving lines of the resistances shown in Fig. 6. The feeders which feed inside the section are connected to the station buses, the latter being tied together as was done in the preceding problem. Between the ring bus of Fig. 6 and the bus *BB*, which represents all the station buses feeding the system tied together, is a resistance of 0.000775 ohm, or a conductivity of 1290 mhos. This, of course, represents the total conductivity between the ring bus and the station buses. It would involve a very large amount of work to compute the value of this quantity accurately, but it is a very simple matter to estimate it approximately and a very rough estimate will answer the purpose. A part of this resistance or conductance is the sum of the conductivities of all the feeders whose feeding points lie on the ring bus. The rest of it may be estimated as the sum of the conductivities of a number of paths made up of mains and feeders such as shown between *A* and *B'B'* in the lower right-hand corner of Fig. 6.

The solution may be further simplified by another change in the circuit which will have little effect upon the flow of current in the mains and feeders of Fig. 6. The ring bus and the connected station buses may be tied together and the conductivity of 1290 mhos divided and placed in series with the lines running inwards from the ring bus in Fig. 6. The 1290 mhos are here divided among these lines in proportion to their conductivities. This is equivalent to multiplying the resistance of each of these lines by a constant, which in this case is 1.8. This constant need not be estimated very closely and the figure here given is probably fairly representative for examples of this kind in moderate-size or in large direct-current networks. Most of the feeders in Fig. 6 may now be combined with one of the lines whose resistance has been multiplied by the constant. Thus multiplying the resistance of the main *mq* (Fig. 6) by 1.8 and combining this with the resistance of the feeder to the point *m*, the resistance 0.0122 ohm of Fig. 7 is obtained.

According to the general method discussed above, an emf. of 15 volts is represented acting in the new feeder. In this case there is not only a new conductor, but there are also new loads to be added to the system which will have an effect upon the current and voltage relations. The effect of the new loads may be conveniently found in the same calculation as that used to find the effect of the new feeder. It is only necessary to indicate in the diagram used for the calculation that the currents which the new loads will require flow from the bus and leave the network at the points at which the new loads are to be placed. Twelve imaginary currents are also represented in Fig. 7 by the first twelve letters of the alphabet. Each one is considered as flowing around the mesh in which it is placed in a counter-clockwise direction. However, *A* and *B* flow around longer loops than simple meshes. *A* flows around the loop *dsei* and *B* flows around the loop *dswz*. The determinant for these imaginary currents shown in Fig. 7 is formed in the same way as the small determinant in the table was formed and is reduced and evaluated in the same way. From the values obtained the currents shown in Fig. 8 are obtained. When superimposed upon the currents flowing in the direct-current system before the change these currents will give the currents which will flow after the change.

Most of the outer lines in the diagram connecting directly with the bus represent more than one single

main or feeder. Should the currents added in any of these lines be desired it would be necessary to work the diagram backward. However, the current additions in the lines chiefly affected are found directly by solving the diagram, and these results are obtained more accurately than the smaller current additions for the outer lines.

Work Involved in Solving Problem

The routine work of reducing such a determinant is simple and can be carried out by any one accustomed to making computations after being given a few instructions. But there are two or three cautions which it seems advisable to give here regarding the carrying out of the solution mathematically. It is highly advisable to check the work as it proceeds, instead of waiting till the final result is obtained. The large number of zeros in these determinants affords opportunity to reduce the necessary amount of work by judicious choice of the numbers taken out. It is very important, however, in the large determinants to let this choice depend also upon one other consideration, and that is to make the increments added to the different columns relatively small. If very large increments are added which increase the numbers in the determinant greatly, the final evaluation would be obtained by the subtraction of numbers which would be very nearly equal. In that case the final result would not be accurate to the number of places to which the work of obtaining the result was carried out.

In networks which are not all in one plane—that is, where wires cross each other without being connected—it is sometimes possible to represent the imaginary currents as flowing in such paths that no values may be assigned to them which will fulfill the conditions of the problem. It is advisable, therefore, when one or more of the conductors cross others without intersecting them (as the feeder *WZ* does in this example) to represent the loop of the imaginary current through it as flowing from the starting point of the main current to the point where this current flows, unless it is known that whatever alternative system is adopted will work out. The numerical currents here and the others not flowing around simple meshes flow from the point *s* either to the bus or to the points where they leave the system.

Comparison of Mathematical and Experimental Solutions

As in the mathematical solution of the problem it is not necessary to work with the entire system, so in the experimental solution it is not necessary to use a miniature testing model of the entire system. Wires of different lengths, and also of different sizes, if so desired, may be connected together to represent the portion of the circuit which it is desired to investigate. Such a scheme of connections for the above example is shown in Fig. 6. Although some lines in this figure represent the combined conductivities of two conductors, there is no object in taking the trouble to form such combinations when the solution is made experimentally. The wires are made to correspond to the conductors of the system according to a definite scale of resistances. Voltages representing the differences of potential on the system between the points which the proposed new conductors are to connect are then applied to the wires representing the new conductors. Any new loads which are to go on the system simultaneously with the installation of the new conductors can, of course, be taken care of by removing current at the points where the loads are to be placed, as in the analytical solution. The fall of potential over any conductor on the test board can evidently be multiplied by a constant which will give the current flowing in the corresponding system. The current increments and decrements for the system may be found by measuring the millivolts drop over the wires representing the various cables and multiplying these values by the proper constant.

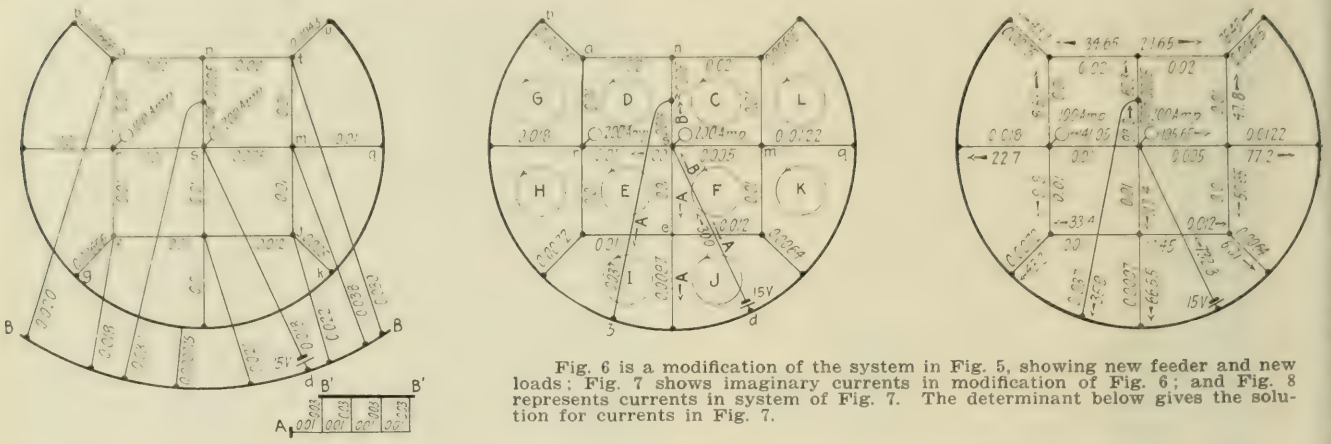


Fig. 6 is a modification of the system in Fig. 5, showing new feeder and new loads; Fig. 7 shows imaginary currents in modification of Fig. 6; and Fig. 8 represents currents in system of Fig. 7. The determinant below gives the solution for currents in Fig. 7.

	A	B	C	D	E	F	G	H	I	J	K	L	
A	+.0377	+.018	0	0	−.01	+.01	0	0	−.0097	+.0097	0	0	+9.6
B	+.018	+.060	−.005	+.005	0	0	0	0	0	0	0	0	+9.6
C	0	−.005	+.045	−.01	0	−.005	0	0	0	0	0	−.01	0
D	0	+.005	−.01	+.05	−.01	0	−.01	0	0	0	0	0	+1.0
E	−.01	0	0	−.01	+.04	−.01	0	−.01	−.01	0	0	0	−1.0
F	+.01	0	−.005	0	−.01	+.05	0	0	0	−.012	−.01	0	0
G	0	0	0	−.01	0	0	+.0355	−.018	0	0	0	0	0
H	0	0	0	0	−.01	0	−.018	+.0352	−.0072	0	0	0	0
I	−.0097	0	0	0	−.01	0	0	−.0072	+.0269	−.0097	0	0	0
J	+.0097	0	0	0	0	−.012	0	0	−.0097	+.0281	−.0064	0	0
K	0	0	0	0	0	−.01	0	0	0	−.0064	+.0286	−.0122	0
L	0	0	−.01	0	0	0	0	0	0	0	−.0122	+.02835	0

FIGS. 6, 7 AND 8—METHOD OF CONSIDERING NETWORKS WHEN STUDYING CURRENT RELATIONS

Part-Slot Fractional-Pitch Windings—II

Effect of Armature Winding Distribution on the Electromotive-Force Wave Shape as Generated by Non-Sinusoidal Field Forms, with a Discussion of Fractional-Slot, Fractional-Pitch Windings and Their Application

BY THEO. SCHOU
The State University of Iowa

IN the first section of this article, which appeared in the March 17 issue of the ELECTRICAL WORLD, it was pointed out that chording or applying a fractional-pitch winding may tend to improve the wave form and reduce the larger high harmonics to a minimum. This type of winding is most desirable with high-speed machines having large pole pitch and least

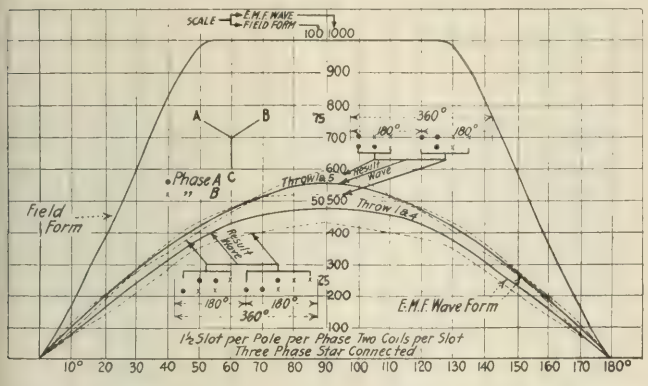


FIG. 15—EFFECT OF COIL THROW ON EMF. OF STAR-CONNECTED WINDING HAVING ONE AND ONE-HALF SLOTS PER POLE PER PHASE

desirable with low-speed machines with small pole pitch. This is evident since a chorded winding having the same number of effective conductors per slot as the pitch winding must necessarily have more conductors per slot. A novel and practical method of laying out any winding of this description was then explained. In addition, the effect of chording windings was shown

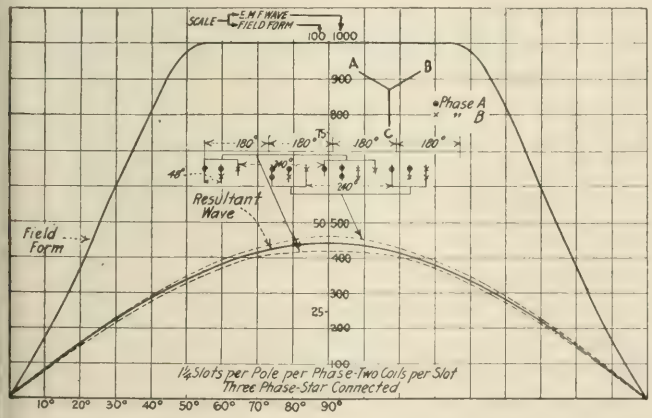


FIG. 16—EMF. FORM* WITH STAR-CONNECTED WINDING HAVING ONE AND ONE-QUARTER SLOTS PER POLE PER PHASE

graphically and by data for different types of winding and various coil throws. More information on the latter subject is presented in this issue.

The effect of one and one-half slots per pole per phase with coil throws of 1 and 5 and 1 and 4 on the wave form produced by star-connected windings is shown in Fig. 15. Owing to the distribution of conductors used in this construction, two separate groups were considered moved through the field and the resultant emf. wave plotted. As indicated before, throw 1 and 5 produces exactly the same wave form as throw 1 and 9

TABLE I—CHARACTERISTICS OF WINDING SHOWN IN FIG. 13

Throw of Coil	Per Cent Pitch	Chord Factor	Maximum Deviation from Equivalent Sine Wave in Per Cent	
			Star	Delta
1 and 7	100	1.00	2.15	7.2
1 and 6	83.4	0.966	0.9	4.18
1 and 5	66.7	0.866	2.09	2.15
1 and 4	50.	0.707	2.08	5.73

for three slots per pole per phase (star connection), and throw 1 and 4 the same as throw 1 and 7 for three slots per pole per phase (star connection). Fig. 17 gives the emf. wave form for delta connection of one and one-half slots per pole per phase winding with

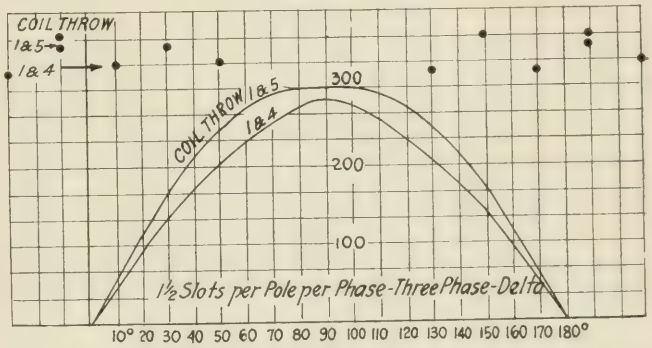


FIG. 17—WAVE FORM* WITH DELTA-CONNECTED WINDING HAVING ONE AND ONE-HALF SLOTS PER POLE PER PHASE

throws of 1 and 5 and 1 and 4. These wave forms are the same as those obtained from delta-connected phases with three slots per pole per phase and throws of 1 and 9 and 1 and 7.

With one and one-quarter slots per pole per phase the

TABLE II—CHARACTERISTICS OF WINDING SHOWN IN FIG. 14

Throw of Coil	Per Cent Pitch	Chord Factor	Maximum Deviation from Equivalent Sine Wave in Per Cent	
			Star	Delta
1 and 10	100	1.00	1.62	7.2
1 and 9	89	0.985	1.18	5.05
1 and 8	77.8	0.94	1.05	2.96
1 and 7	66.7	0.866	1.95	1.62

wave form is as shown in Fig. 16. It has a maximum deviation from the equivalent sine wave of 0.74 per

*Based on field form (Fig. 11) ordinarily obtained with alternators.

cent and has approximately the same characteristics as the emf. wave produced by star-connected windings with five slots per pole per phase and a coil throw of 1 and 13. The effect of 1.2 slots per pole per phase on the wave form produced by a three-phase star-connected winding with a coil throw of 1 and 4 is shown in Fig. 18. The wave is practically a sine wave, having a maximum deviation from the equivalent sine wave of 0.37 per cent.

Figs. 19a and 19b show emf. forms plotted for open-type two-phase windings having two slots per pole per phase with coil throws of 1 and 5 and 1 and 4 and three slots per pole per phase with throws of 1 and 7, 1 and 5, and 1 and 4. The windings have the characteristics that are given in Table III.

The wave form of a two-phase, open-type winding with 1.2 slots per pole per phase and a coil throw of 1 and 3 is shown in Fig. 20. The maximum deviation from the equivalent sine wave is 1.87 per cent. Since three slots is the minimum number that will make a balanced winding for a three-phase two-pole armature, and since four slots is the minimum number for a two-phase

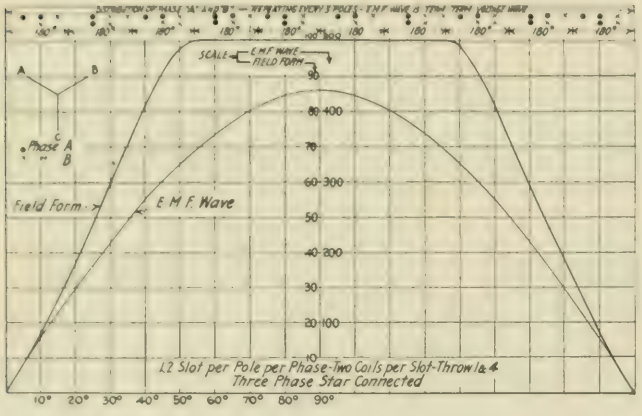


FIG. 18—EMF* PRODUCED BY STAR-CONNECTED WINDING WITH 1.2 SLOTS PER POLE PER PHASE

The upper diagram refers to a part-slot winding having two slots per pole per phase. The lower one refers to a winding with three slots per pole per phase.

bipolar machine, it follows that the numerator of the fraction *total number of slots ÷ number of poles* reduced to its lowest term must be divisible by the number of phases to give a balanced winding. Depending,

TABLE III—CHARACTERISTICS OF WINDINGS SHOWN IN FIG. 19

Slots Per Pole	Throw of Coil	Per Cent Pitch	Chord Factor	Maximum Deviation from Equivalent Sine Wave in Per Cent
4	1 and 5	100	1.00	5.83
4	1 and 4	75	0.924	2.75
6	1 and 7	100	1.00	3.43
6	1 and 6	83.4	0.966	2.30
6	1 and 5	66.7	0.866	2.20
6	1 and 4	50	0.707	3.95

therefore, upon the number of poles and phases, the application of part-slot windings is limited. For example, a two-phase part-slot winding is not possible with two, four, eight, sixteen and thirty-two poles, and an armature good for both two and three-phase part-slot windings is only possible with ten, fourteen, twenty, twenty-two, twenty-six, twenty-eight and thirty poles. The number of possible parallel circuits is also limited by part-slot windings except with windings having one and one-half, two and one-half, etc., slots per pole per phase, which, in this respect, are similar to any whole-slot winding.

As mentioned before, the part-slot winding is most applicable and desirable with low-speed machines, where

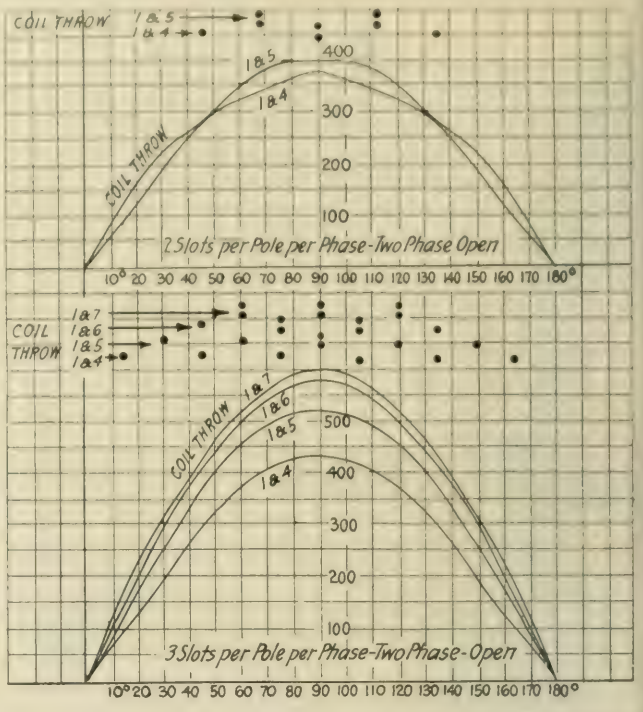


FIG. 19—EMF. WAVE* PRODUCED BY OPEN TWO-PHASE WINDINGS WITH DIFFERENT COIL THROWS

good electrical characteristics may be obtained with great economy of manufacture. As this type of winding has the effect electrically of many narrow slots per pole, the principal points in favor of applying such a winding might be summed up as follows: (1) It enables a more economical design, especially with low-speed synchronous machines. (2) It saves insulation

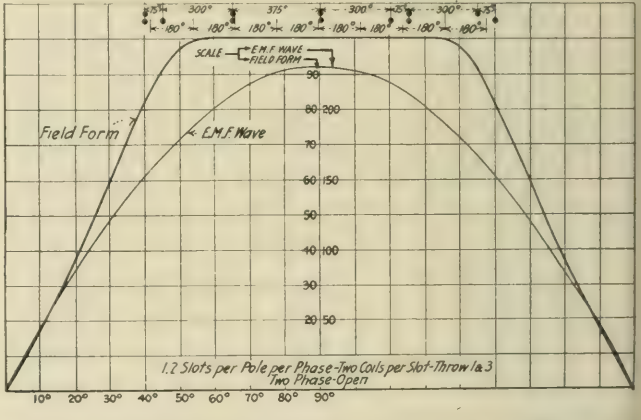


FIG. 20—WAVE PRODUCED BY OPEN TWO-PHASE WINDING WITH 1.2 SLOTS PER POLE PER PHASE

and labor involved in manufacturing and connecting the armature coils. (3) It practically eliminates dead points with motors of the synchronous and induction type. (4) It has a tendency to produce noiseless machines with a desirable emf. wave form.

*Based on field form (Fig. 11) ordinarily obtained with alternators.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

RUNNING CONDUCTORS THROUGH CONCRETE BEAMS

Providing Holes for Passage of Conductors Through Concrete Beams by Using Round Wooden Plugs While Pouring

To provide holes for the passage of conductors through beams at the new mill of the Naumkeag Steam Cotton Company, round wooden plugs were placed in the forms before concreting and were later driven out and replaced by porcelain bushings. It was impracticable to place the bushings before concreting as they are not



CONDUCTORS PASSING THROUGH CONCRETE BEAMS

strong enough to stand the ramming, etc., incident to concreting. Sleeves made of any magnetic material could not be considered on account of inductive effects, and brass or similar non-magnetic sleeves would have been very expensive. With only triple slow-burning braid on the conductors, it was considered that the insulation to ground would not be sufficiently good if heavy fiber tubes were used. As there is a rather loose fit between conductors and bushings, split porcelain insulators are clamped around the conductors on both sides of every third beam to prevent "slacking off" of the wires for any great distance in case of breakage. The electrical equipment was installed by Lockwood, Greene & Company of Boston.

RECTIFYING CONNECTIONS

Five Principles to Observe in Correcting Starter Connections of Two-Phase Motors

BY H. H. GETTER

The method of correcting starter connections described on page 513 of the ELECTRICAL WORLD for March 7 finally brought about the desired results, but it must have involved considerable time that would not have been wasted if the following principles had been observed: (1) When a compensator switch is in the starting position the entire compensator winding should be across the supply line or secondary circuit of the line transformers, one end being permanently connected thereto and the other through the switch. (2) In the running position the compensator should preferably not be energized. (3) Furthermore, with the switch in the running position the combined supply line and compensator terminal and the remaining supply line should be connected with the same terminals of the motor that are joined with the combined supply line and compensator terminal when the switch is in the starting position. (4) In addition the fuse in the combined supply line and compensator terminal should be designed for a larger current than the fuse in the other supply line. (5) It should also be remembered that each pair of phase wires should be connected to the terminals of the corresponding windings of the motor.

If the first condition had been observed no attempt would have been made to connect the transformer secondary with the alternate compensator, thus placing them in series. Again, if conditions (3) and (5) had been observed full potential would not have been applied across winding not designed for it, and the no-voltage release coil would have operated as it should.

MODIFIED INSTRUMENT TO TEST LIGHTNING ARRESTERS

Jack-Bearing Ammeter and Test Leads Provided with Bayonet Joint to Permit Using Different-Length Handles

The portability of a standard General Electric ammeter and jack such as is used for testing the charging current of aluminum-cell lightning arresters has been increased by the Cumberland County Power & Light Company of Portland, Me., by the expedient shown in the accompanying illustration. When purchased, this apparatus was mounted on a pole about 5 ft. (1.52 m.) long. This length was suitable for some plants on the company's system, but did not prove convenient for others on account of space limitations. Consequently the rod was cut off and a 6-in. (15.24-cm.) sleeve of 1-in.



PARTS OF MODIFIED JACK FOR TESTING LIGHTNING ARRESTERS

(2.54-cm.) brass pipe fitted onto the short section holding the ammeter and its connections. In this was cut a ¼-in. (6.35-mm.) slot 2¼ in. (57.15-mm.) long, with a bayonet joint at the inner end. In addition a suitable rod, from 3 ft. to 5 ft. (0.9 m. to 1.5 m.) long, according to conditions, was provided for each station. Each rod is turned down from a diameter of 1¼ in. (31.75 mm.) at the end to 1 in. (25.4 mm.) to fit the ferrule

as shown. A screw set into the rod near the end of the reduced section provides a means of locking the rod in the sleeve when the apparatus is in use. As the proper length of rod, with reduced section and locking screw, is kept at each station, it is only necessary for the test men to carry the short section bearing the sleeve, ammeter, jack and leads from one plant to another.

COST OF CONSTRUCTING PUMP FOR MANHOLES

Structural Details of a 300-Gal. (1135.6-l.) Pump Constructed by the Lincoln Park Commission, Chicago, at Cost of $769.49

Because it has unusual quantities of water to contend with in its underground distribution system, the electrical department of the Lincoln Park Commission, Chicago, has constructed an extra heavy-duty, portable, manhole pump. The entire equipment is mounted on a small-wheel truck so that it can be hauled behind an automobile or a truck. The prime mover consists of a 12-hp., 1500-r.p.m. marine engine. It is connected directly to a centrifugal pump which is rated at 500 gal. (1892.67 l.) per minute at 2000 r.p.m. The compact method of mounting this equipment, together with a 23-gal. (87-l.) gasoline tank, a 5-gal. (18.9-l.) automobile radiator, a 20-gal. (75.7-l.) circulating system tank and a 66-gal. (249.8-l.) priming tank, is shown in the accompanying illustration. Pumping against a head of 15 ft. (4.57 m.), including suction and discharge heads, this outfit will deliver 300 gal. (1135.6 l.) of water per minute. Fitted as it is with a 4-in. (10.16-cm.) intake line and a 3-in. (7.6-cm.) discharge hose, it will lift water 30 ft. (9.14 m.).

One of the features of the outfit is that the entire control, including the spark and gasoline levers, the outlet and air-vent valve handles and the circulating-system valves, is all grouped at the front of the machine. This plan has worked out to facilitate one-man operation. Another feature is that means have been provided for obtaining access readily to any part by making the inclosing walls either hinged or entirely removable. Although the pump has been in operation only a few weeks, it has already proved its value by pumping dry a line of ten 3-in. (7.62-cm.) ducts that lie along the shore of Lake Michigan. A detailed statement of the cost of constructing this outfit in the shops of the commission under the direction of C. H. Shepherd, electrical engineer, is given in the accompanying table.



ARRANGEMENT OF UNITS IN A COMPACT, PORTABLE MANHOLE PUMPING OUTFIT

COST OF CONSTRUCTING EMERGENCY MANHOLE PUMP

One marine engine and muffler	$90.00
One radiator	25.00
Construction of truck for engine pump and wheels	225.30
Installation of engine on pump truck	69.07
Painting pump truck	21.50
Suction hose, valve and fittings	12.58
Three valves (1¼ ft.) (38.1 cm.)	2.85
One cap	0.10
Twelve bolts (various sizes)	0.12
Five pipe plugs (various sizes)	0.30
Five bushings (various sizes)	0.45
Water pipe (various sizes) (12 ft.) (3.66 m.)	2.38
Twenty-eight nipples (various sizes)	2.24
Four T's (various sizes)	0.36
Six unions (various sizes)	0.99
Fifty-six screws and nuts (various sizes)	1.00
Nineteen L's (various sizes)	1.61
Six padlocks (various sizes)	6.60
Miscellaneous material	24.13
Total	$599.50
Labor:	
Mechanic, thirty-one hours at 50 cents	$15.50
Helper, 104 hours at 32 cents	33.28
	$48.78
Garage expense (overhead)	120.81
Total	$769.49

TRUCK FOR CONVEYING MOTORS

Vehicle Which Will Transport Motors Up to 30 Hp. Designed So as to Make Unloading Easy

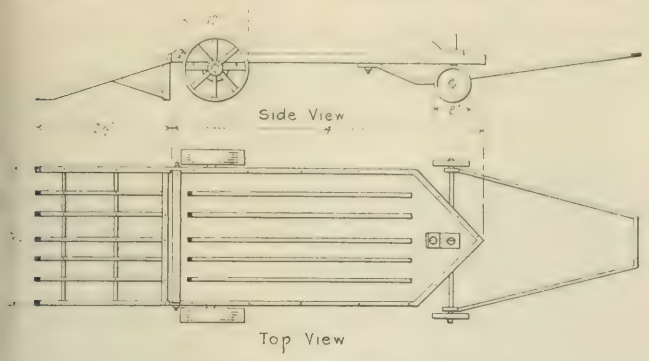
BY H. S. RICH

A handy truck for conveying electric motors around a shop, and which is made from common material such as is found in almost any large mill, is shown in the accompanying illustration. The rear axle is made of cold-rolled steel shafting 1 in. (2.54 cm.) in diameter and 2 ft. (0.61 m.) long, the rear wheels being 12 in. (0.3 m.) in diameter and 2 in. (5.08 cm.) wide. The front axle is 0.75 in. (1.90 cm.) in diameter. The platform is made of 1.5-in. (3.81-cm.) maple, bound on the two long sides and front with 1-in. (2.54-cm.) angle iron, which projects over the rear end on both sides about 1.5 in. (3.81 cm.), so that a 1-in. (2.54-cm.) pipe roller can be fitted thereto. Between the roller and the bar carrying it should be packed long hard-wood slats, which will enable the roller to turn easily.

A flat bar 1.25 in. (3.18 cm.) wide by 0.5 in. (1.27 cm.) thick is bent in the form of a flat-topped arch and welded to the top of the front axle about 3 in. (7.62 cm.) from each end, first having a hole drilled through it to receive the king bolt. The truck is drawn by a 0.5-in. (1.27-cm.) round bar bent from one piece.

The tailboard may be made of 1-in. (2.54-cm.) angle iron, assembled in the form of a grid, or of 1.5-in. (3.81-cm.) maple, which should be bound with 1-in. (2.54-cm.) angle iron and should be hinged to the end of the platform with the same bar that holds the roller. Half-round bars should be fastened lengthwise of the platform

with countersunk screws, about 4 in. (10.16 cm.) apart, on which a motor can slide without any obstruction crosswise. The front end of the platform is held down over the king bolt, passing through the front side with a washer and cotter key. Over the king bolt is slipped a flat bar about 2 in. (5.08 cm.) wide, 3/8 in. (9.5 mm.) thick and 5 in. (12.7 cm.) long, bent slightly upward



TWO VIEWS OF MOTOR-CONVEYING TRUCK

at one end and provided with an extra large hole in one end to receive a tackle hook.

To unload the truck the motor is slid toward the rear, the front end of the truck tipped up and the motor allowed to slide down the tailboard. When not in use the tailboard can be thrown back on to the truck. Braces are needed between the floor and the upper ends of the tailboard to prevent the truck from tipping backwards. This truck will easily transport any motor up to 30 hp., or a weight of about 1000 lb. (453.6 kg.).

WHY CONVERTER VOLTAGES WERE NOT BALANCED

Necessity of Recognizing in Installing Synchronous Converters That Most Operating Conditions Are Far from Ideal

BY E. C. PARHAM

It is fair to assume that any electrical machine that is designed and adjusted to give good performance under average operating conditions is not likely to give as good performance under extreme conditions. Unfortunately, nearly all operators seem to feel that the conditions of their own operating are average ones. Usually this proves not to be so, especially in instances where troubles arise. The manufacturer can, within reason, supply a machine that will operate satisfactorily under almost abusive conditions, but such a machine will cost more and operators generally are unwilling to pay the increased cost.

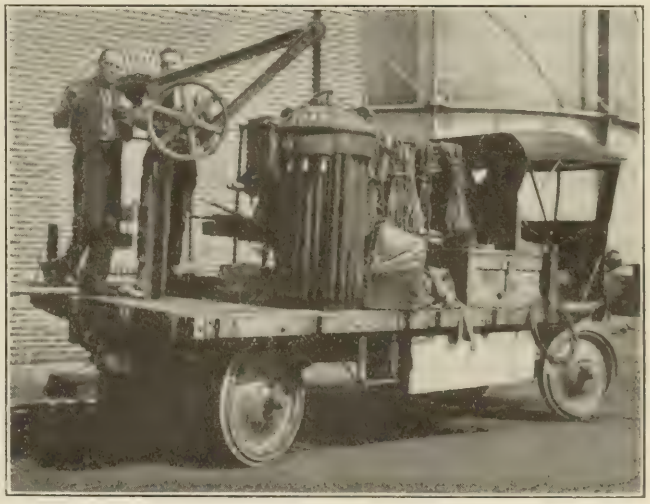
A synchronous converter was furnished in one case to operate under specified conditions that were fairly average. The operator had paid for a machine of liberal rating and he had received, in good measure, what he had paid for. The machine was installed and without in any way modifying the factory adjustments. On starting, it took excessive current and the brushes sparked badly even after the converter was up to full speed. As the operator had seen the machine tested and had accepted it without the least doubt that it would be entirely satisfactory, naturally he did everything that he could to eliminate the trouble before calling for assistance. He failed to locate the trouble because he was handicapped by his own assumption that everything for which he might be considered responsible was all right and that something must have happened to the machine between the time of testing it and the time of starting it.

The engineer who was called upon to locate the trouble began work with only one assumption, and that was that something was wrong; what was wrong was not evident. His first move was to measure the alternating voltage applied to the machine, expecting to find the voltage excessively high. He did not find the voltage excessively high but he did find that the phase voltages were 40 per cent unbalanced. That is, the voltage of the phase of highest voltage was 40 per cent greater than the voltage of the phase of lowest voltage. Had the converter been carrying anywhere near its rated capacity, the unbalancing would have manifested itself further by excessive heating. The unbalancing proved to be due to the incorrect transformer connections. On correcting this irregularity commutation became satisfactory.

REMOVABLE CRANE USED WITH TRUCK

With Geared-Type Derrick Hoist 2-Ton (1.81-Metric Ton) Loads Are Easily Lifted Aboard Truck or Unloaded Therefrom

The San Diego (Cal.) Consolidated Gas & Electric Company has recently placed in service a portable crane which may be mounted on any of the company's 2-ton or 4-ton (1.81 or 3.62 metric ton) trucks, of which there are eight in use. Ordinarily the crane is kept on the transformer platform. If any truck is required to deliver a load which can be advantageously handled with the portable crane, such as transformers or motors, it is the work of only a few minutes to drop the base of the crane into a socket at the rear of the truck. The crane has a capacity of 2 tons (1.81 metric tons). With it two men can easily pick up a 50-kw. subway trans-



READY TO UNLOAD TRANSFORMER WITH CRANE

former, swing it overboard at the rear of the truck and lower it into a manhole.

The removable feature is desirable in that one crane is sufficient for several trucks. When loads are delivered such as poles or pipe, the handling of which does not necessitate the use of a crane, the entire bed of the truck is clear for the load.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

CAMPAIGNS SHOULD BE ARRANGED IN ADVANCE

Analysis of "Off"-Month Conditions by Toledo Company Showed Insufficient Preparation Given to Campaign for These Months

Last year the Toledo (Ohio) Railways & Light Company set a sales bogie for each month. Its sales exceeded the mark for each month but two. An analysis of the reason for failure to reach bogie in the two "off" months showed, according to E. R. Kelsey, that not enough time and thought had been given to preparing campaigns for those months. For this reason the Toledo company began working on its 1917 campaigns in October of 1916. All of the printed matter for its February campaign was prepared and delivered to the company early in January.

"We believe," said Mr. Kelsey, "that we should plan our work and work our plan. No campaign should be attempted without at least thirty days' preparation. Every company, large or small, can and should do the same thing. The small company cannot, of course, operate campaigns on a large scale, but it should have some sort of a separate campaign offer every month. The small companies especially should do more business on trial and on small-payment propositions. The advertising used in connection with the offer should be planned and scheduled in advance.

"We have even found that it is a very good idea to have each individual salesman planning ahead. Our men know a month in advance what the next campaign will cover. It helps them to lay out their work, and it helps the company's total sales."

SOME REASONS FOR SELLING FANS ON DEFERRED PAYMENTS

The Opinion Held by the Commonwealth Edison Company's Salespeople Is That at Least Four Payments Should Be Permitted

No voice was raised against a proposed plan for selling fans on deferred payments when E. A. Edkins of the Commonwealth Edison Company asked for opinions on such a policy before a recent meeting of employees engaged in merchandising. Every one who spoke favored time payments. Some thought the payments should be small, but the majority believed 25 per cent cash and the balance in three equal amounts, payable each month, was the proper division. Those who had had experience with the deferred-payment plan said it did not cause customers to return fans without full payment.

The greatest advantage seen in the policy is that it would probably act to spread the fan season over a greater number of summer months. In proof of this it is pointed out that many persons have now the idea that they can buy fans from the Edison company on the deferred-payment plan, an impression gained from time-payment offers made on other appliances. When a customer with such a mistaken idea arrives at one of the shops early in the summer, selects a fan, and then finds he cannot buy it on the deferred-payment plan, he gives up the idea of buying it, or at least defers the purchase until the hot weather makes it impossible longer to withhold it.

If the deferred-payment plan were in force, the prospective buyer would become a purchaser at the time of his first visit, and thus fan sales early in the season would result. This would have the effect of making the fan-sale period begin earlier, and would to some extent relieve the period of rush during the hot months. It was also thought that the deferred-payment plan, combined with proper and intelligent salesmanship, would tend to make the fan more of an all-year proposition than one restricted to the summer season.

CENTRAL STATIONS' CHANCE TO SERVE THE NATION

By Encouraging Patriotism Through the Use of Electric Flags and by Promoting the Sale of Government Bonds

An opportunity is now at hand for central stations to encourage patriotic display and at the same time to take on an added lighting load through the electric flag. Never in the history of the United States has the national emblem been so widely displayed as it is to-day. In fact, flag and bunting manufacturers are absolutely sold out, and orders now placed cannot be filled before June or July.

Ordinary flags have a daytime display value only, but electric flags have a full twenty-four-hour display value. Every building is now a real "prospect" for an electric flag. Not only may electric flags be used for outside display but for interior display also. They have been used widely in the Middle West by theaters, being placed either just over or to one side of the stage. Hotels and restaurants are using them for conspicuous display in dining rooms. In fact, they can serve as an emblem of national pride and patriotism in every place of amusement.

Industrial establishments are using electric flags in the shops, where they offer practically the only means of displaying the red, white and blue.

Besides the load value, there is an element of policy involved. It has been half a century since the American people, drawn from every quarter of the globe, have been welded together in a struggle for the right and the best principles of democracy as they are to-day. Patriotism in this wide and glorious sense is a new thing to this nation, and it is only just beginning to grip the hundred million people. To stimulate and increase this patriotism, to help fire the American people

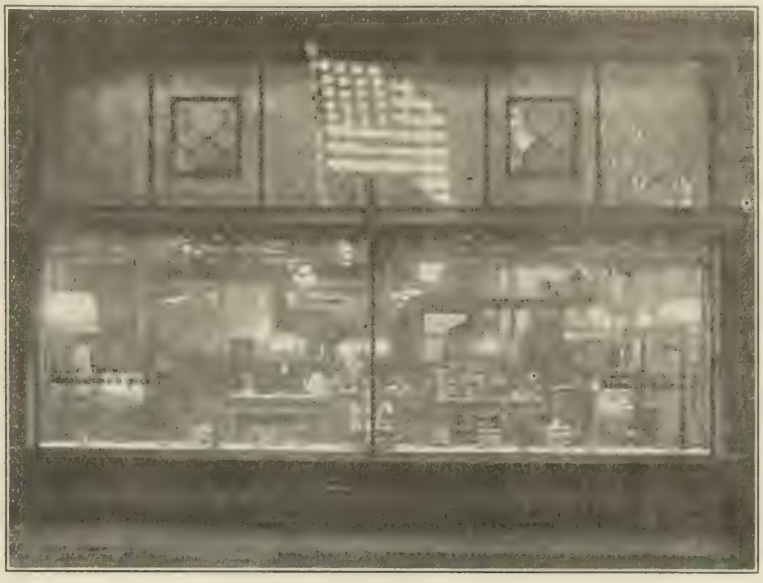
with the noble ideals for which President Wilson has pledged the manhood and resources of the United States, the central stations as a matter of policy should do their share. One way is by actively promoting the display of the Stars and Stripes through the electric flag.

By Selling War Bonds to Consumers Cause of Nation Is Helped

Another patriotic measure which central stations are well equipped to promote is the sale of government bonds to consumers. By subscribing for a block of these bonds and selling them at the same price to consumers the central stations would be doing a great service to their country.

Department stores, drug stores, tobacco stores and others have already announced their intention of acting for the government in the sale of bonds to the public if their services are needed. But with none of these is the opportunity to serve the government so great as with the central station. The expense will not be large. Practically all that will be necessary will be a letter to each consumer as an inclosure with the monthly bill which is soon to be mailed.

Should the central stations feel inclined, they could offer to finance the payment of these bonds through installment privileges and so promote a wider distribution of them.



PATRIOTIC—INSPIRING—TIMELY

The electric flag should be displayed not only by all central stations but by every industry, store and public place in the community.

WHY THE CENTRAL STATION STANDS ALONE TODAY

Much New Vision Needed Before Light Companies Will Regard Customers as Something More Valuable Than Personification of Meter

BY C. A. MAGEE

Manager New Business and Merchandise Department, Consolidated Gas, Electric Light & Power Company, Baltimore, Md.

In all that has been said of central station selling, one very important point has been almost entirely disregarded. Commercial enterprise in the appliance field, it is true, sells goods and makes a profit; it wins new customers and keeps a closer contact with consumers, but then it does another thing. It tends to bring the central station down into the classification of a merchant or a manufacturer and establish it before the people as a normal, natural, necessary kind of business.

Therefore in insisting upon recognition as manufacturers and dealers, and placing very little emphasis upon our "public service corporation" nature, we are moving to correct an error which has hampered and restrained us, has narrowed our vision, and has built up around us a hedge that shuts us out of consideration by the public as ordinary commercial concerns. For we are isolated to-day, a thing apart, expected to read our meters, collect our bills, and to be content with that. And this isolation has been accomplished with our own consent and co-operation, merely because of the peculiar nature of our delivery system.

It is interesting to consider just how we must look to the other people. If we could manufacture our product and deliver it in wagons, drawn through the streets by horses, or on motor trucks or bicycles, there would be no such feeling. We would be as other manufacturers and dealers, with no one to question our freedom of action. But will any one say, in these present times of underground systems and streets congested with motor traffic, that our delivery system disturbs or inconveniences or discommodes the great public to anything like the extent that a large fleet of department store delivery wagons does?

Suppose we imagine a single department store serving an entire city of 600,000 people, as the Consolidated of Baltimore does, with 150,000 charge customers on its books, each receiving a supply of our product each day. What would its delivery system amount to? Five, three, two, one-ton trucks, thousand-pound light wagons, motorcycles, bicycles, one and two-horse wagons—an incessant movement of them through the streets, crowding, jamming, congesting, contesting with pedestrians and with other wagons, occasionally colliding to relieve the monotony, and maiming or even killing people, with the constant menace of the reckless or incompetent driver. Contrast this with our own delivery system, either gas or electric. But the public naturally has not stopped to think of this. While other delivery systems have been forcing the public to ever-increasing expense and discomfort, with constantly growing traffic problems, ours, on the contrary, is less in evidence than ever before. It is built better, is less obtrusive, less unsightly, more permanent, and almost entirely free of annoyance or danger to the public. Of the two types of delivery system, ours is entitled to the greater consideration. We ought, then, to forget the isolation that was forced upon us solely because of our delivery system, and insist upon our right to be classed with other manufacturers and dealers upon equal terms, allowing us full freedom to extend our activities as we may see fit.

If it be granted, though, that we are manufacturers and dealers, how very much out of focus some of our actions are! We have so much to learn before we can call ourselves equals in the commercial world. How many public service companies would survive if forced to such competition as is a part of the daily life of a department store? We talk service, service, service, and we spend large sums of money on it; but in com-

paratively few cases do we seem to take the department store attitude toward a customer. Think of the system that permits a clerk to dip into a cash drawer and give a customer his money back, with no hesitation at all, for goods returned! It would take an average of four or five days in a public service company to put through such a transaction. Any woman "keeping house" can give us information on this subject that will open our eyes wide.

And what department store, with 20 per cent of the population on its books as regular customers, would ever think of hiding itself away on a side street? No department store that is really alive would feel satisfied and contented merely to get a customer enrolled. It would want to sell more and more to that customer. It would never restrict itself to one article. It would never permit itself to say that a saturation point was possible; much less would it relax its effort in the belief that it had been reached. Above all it would hold forth right where the most people congregate and where its location would be familiar to all.

Much new vision will be required before the time arrives when gas and electricity manufacturers and dealers will regard a customer as something more valuable than the personification of a meter.

Manner of Cultivating Good Will Crude

We try to cultivate good will, of course. We all do now. But we are, if I may take the liberty of saying it, rather crude in our manner. We talk too much about our desire for good will. We are too stiff about it. We don't know how to unbend gracefully. We are self-conscious, and too often we treat ourselves to a warm glow of approval for our virtuous attitude. We are inclined to make a wonderful fuss over some new wrinkle that we put into effect, when a department store would discharge a department head who had overlooked the same thing. Curiously enough, we sometimes make ourselves a nuisance to our customers by forcing our attentions upon them in an ungraceful way. We spend money to do things for them; but they would be quite as well satisfied if we treated them as fellow-men, not fawning about or fussing over them.

Has the central station a personality? Where or how do we really try to cultivate it or to show it? Who among us is really trying to get acquainted with his own customers? But a live retail store in the busiest part of the shopping district will do more than sell appliances. It will sell energy, because it will put the company on a footing with other merchants. It will humanize and educate the "public service" fraternity, which very much needs to learn ordinary commercial intercourse with the public before it can expect that public to trouble itself to cultivate the gas or electric company.

E. C. Simmons, who built up the largest hardware business in the world, during his entire active connection with his immense business kept his desk just inside the front door of his store, where nowadays we of the central stations have the "information desk," usually commanded by a boy. And Mr. Simmons personally greeted every visitor to his immense establishment. He gave his business a personality; he made it a human, living thing. And I can't think of a greater need in the "public service" line than that it should come out of its shell, wake up, get alive, exhibit a little real red-blooded action, get acquainted with its customers, and see how it would feel to earn a living instead of being retired on a pension. It would do the industry no harm whatever to take a chance once in a while.

TRANSMISSION LINES TO SERVE SMALL TOWNS

Adequate Revenue from Street Lighting Must Be Stipulated in Beginning—Unincorporated Communities Present Special Problem

Before the price of copper rose to its present height service for small towns from transmission lines was interesting central station managers in every section of the country. Many problems are involved owing to the peculiarities of this class of communities, their class of load and their relation to the central station.

A discussion of a paper on transmission lines to serve small towns presented at the recent Wisconsin electrical association convention developed into an experience meeting that brought out several ideas.

Those who would give transmission service were counseled to take a firm stand at the very beginning of negotiations as regards the street-lighting contract. This, it should be specifically stated at the outset, should be of such nature as to yield the company $1.50 per capita per year. One operator said his experience had shown that it is much better to make this demand at the beginning and get the point conceded than to try to "get in" with a lower price and later attempt to increase it.

It was also pointed out that there are certain contract stipulations which are valuable both to the community served and to the company. For instance, if the energy is sold to the community at a straight rate of 3 cents per kilowatt-hour, a provision should be made whereby large or off-peak business in the small community can be taken directly by the serving company. This is essential because the community buying energy at 3 cents sometimes cannot afford to resell it at a price attractive to a large or off-peak user. Still, it would be desirable from the standpoint of revenue to the serving company, and also from the standpoint of encouraging industry in the community, to serve this business. Such a provision generally takes the form of a clause permitting special contracts between the serving company and certain probable customers in the community.

Problem of Unincorporated Communities

Unincorporated communities wanting service present a special problem, because there is no official body with which the serving company can contract. The best plan seems to be to urge incorporation. If this fails, service is sometimes given if the business men of the city will form themselves into a self-appointed committee to sign a contract, agreeing individually and collectively to guarantee the payment of the electricity bill of the community.

In all the discussion it was the opinion that in towns from 200 to 2000 inhabitants it is desirable, in order to reduce overhead expense, to conduct billing and meter reading from the home office. In this case the street lighting is controlled by an eight-day time switch that is wound by the town marshal for $5 a month. Under this plan some local merchant is usually selected to handle lamps on a 10 per cent commission basis.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

ANALYSES OF COALS

Data on Coals Purchased by the Government in the Past Eight Years—Combustion in the Fuel Bed of Hand-Fired Furnaces

TWO recent publications of the Bureau of Mines are noteworthy far beyond the mining industry, as they refer to the use of coal as fuel. The first publication referred to is Bulletin 119 of the Bureau of Mines, the title being "Analyses of Coals," by George S. Pope. The government of the United States annually expends approximately $8,000,000 for coal. Prior to 1906 this coal was purchased mainly on its reputation, or trade name, rather than under contracts specifying the heating value of the coal, its contents of ash and moisture and other characteristics. In recent years the government and other large consumers have appreciated more and more the desirability of definitely determining by chemical analyses and tests the character and quality of coal deliveries. Studies of engine-room and boiler-room efficiencies and economies point forcibly to the necessity of devoting more thought to the improvement of the boiler-room end. This calls for an intimate knowledge of the character and quality of the fuel used. The analyses and tests of delivered coal furnish such data, whereby the power-plant results can be comprehensively studied and a continuous check maintained on the coal and on the conditions of plant operation.

In Bulletin 119 are summaries of coal analyses made from 1908 to 1915 for the government. First a table is given referring to Pennsylvania anthracite coal. This is followed by a second table, much larger, covering forty-four pages and referring to 734 different kinds of foreign and domestic coals other than Pennsylvania anthracite. In each case the mine from which the coal came, its commercial name, the size, its approximate analysis and its calorific value per pound are given. In addition data are given regarding the place and date of delivery, purchaser, price and contract guarantees for the coals that were sampled and analyzed.

The other publication referred to is Technical Paper 137 of the Bureau of Mines, entitled "Combustion in the Fuel Bed of Hand-Fired Furnaces," by Henry Kreisinger, F. K. Ovitz and C. E. Augustine. This report is the second of a series of publications of the Bureau of Mines on the general subject of combustion of coal in boiler furnaces and similar apparatus where coal is burned completely for the purpose of producing heat at high temperature. The first publication of this series was Technical Paper 63, which treated of the combustion of gases and other combustible substances rising from the fuel bed of the side-feed type of mechanical stoker. The main object of the present investigation (Technical Paper 137) was to determine the conditions governing the process of combustion in the fuel bed of a hand-fired furnace. The results of this investigation furnish data for correct design of coal-burning grates and furnaces and their efficient operation. They also cast light on the important problem of clinker trouble as related to fusibility of ash. A summary of results and conclusions is as follows:

The fuel bed in most types of furnaces acts primarily as a gas producer. With a 6-in. (15.2-cm.) fuel bed the oxygen in the air rising through the grate is all used up in combustion in the first 4 in. (10.2 cm.) from the grate. At a distance of 4 in. (10.2 cm.) from the grate the carbon dioxide content of the gases has reached or passed a maximum of 10 to 16 per cent and begins to drop. At the surface of the fuel bed the gases contain no oxygen, only 6 to 8 per cent of carbon dioxide and 20 to 32 per cent of combustible gases. The composition of the gases is practically independent of the rate of air supply. The larger the quantity of air forced through the fuel bed the faster the fuel burns or gasifies, but the ratio between weight of air supplied and weight of fuel burned remains constant at about seven to one. In general the temperature in the fuel bed is the highest 3 in. to 5 in. (7.6 cm. to 12.7 cm.) from the grate, which is also the point of maximum carbon dioxide content.

Practical Operation of Boiler Furnaces

In the practical operation of boiler furnaces the significance of these results of the tests is as follows: As most of the oxygen is consumed in the first 4 in. (10.2 cm.) of the fuel bed, it is not necessary with the ordinary rates of combustion to run a fuel bed thicker than 4 in. to 6 in. (10.2 cm. to 15.2 cm.) in order to obtain a high carbon dioxide and a low oxygen content in the flue gases. The rate of combustion or gasification of coal depends on the amount of air that can be passed through the fuel bed. The thicker the fuel bed the higher is its resistance to flow of air through it and the less air can be passed through with a given chimney draft. A thick fuel bed, therefore, reduces the rate of combustion and thus reduces the capacity of the boiler.

A thick fuel bed is further undesirable because it increases the tendency of the coal to form troublesome clinker. Perhaps the only apparently defensible excuse for carrying a thick fuel bed is the fact that the chances of burning holes in the fuel bed are reduced. A skillful fireman avoids holes in the fuel bed by firing frequently and placing coal on the thin spots. A claim that fuel beds cannot be kept in good condition if carried thin is a confession of neglect and lack of skill.

A fuel bed is understood to be only the layer of incandescent and freshly fired fuel, and does not include the layer of dead ashes and clinker on the grate. The ash fuses in the upper layers of the fuel bed, and as it sinks it solidifies 2 in. to 4 in. (5.1 cm. to 10.2 cm.) from the grate. In most cases the fusion occurs in a reducing or partly reducing atmosphere; consequently

in studying the fusibility of ash the determinations should be made in a partly reducing atmosphere.

Since the gases at the surface of a fuel bed contain 20 to 32 per cent combustible gas and practically no free oxygen, additional air must be introduced over the fuel bed to obtain complete combustion. This statement is true of all the fuels which were tested, including coke. As a general statement, about one-half of the 15 lb. (6.8 kg.) of air used to burn 1 lb (0.45 kg.) of coal in a boiler furnace is supplied through the fuel bed; the other half must be supplied over the fuel bed.

Generators, Motors and Transformers

Artificial Loading of Generators in Water-Power Plants for Test Purposes.—ROBERT TREAT.—In making tests in hydroelectric plants it is quite frequently found necessary to provide artificial loads for the generators. The author describes a test which has been in use by Ross & Company and by O. H. Ensign. The method consists merely in connecting another generator (when one is available) to the machine under test, with one phase reversed, so that the load generator runs in the opposite direction of rotation as a synchronous motor (Fig. 1.). When both machines are up to speed and are

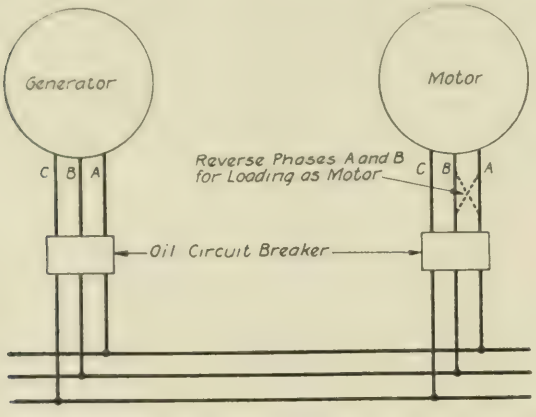


FIG. 1—CONNECTIONS FOR REVERSING PHASES FOR ARTIFICIAL LOADING OF GENERATORS

excited to full voltage, the gates of the wheel which is "motoring" are gradually opened until the required load is obtained, the wheel in this case acting as a water brake. The generator and motor fields may now be varied to produce any power factor and voltage desired. Several hints are given on details of the best way of carrying out the tests.—*Gen. Elec. Review*, April, 1917.

Lamps and Lighting

Nernst Vapor Lamps.—A note on two types of lamps. In the first an arc passes between carbon electrodes in a closed bulb through an atmosphere of zinc chloride or zinc bromide. The pressure of the vapor should be in the neighborhood of atmospheric pressure. Aluminum or titanium can be used instead of zinc. The efficiency is similar to that of high-pressure mercury-vapor lamps. The carbons should glow slightly and the arc should be not less than 1 3/16 in. (3 cm.) long. In the second type mercury is used in combination with various chlorides, and small conical pieces of glass are fixed within the bulb to guide the condensed drops from the arc and the vapors to the arc. A specially suitable salt mixture is said to be 70 per cent zinc chloride, 15 per cent calcium chloride, 5 per cent thallium chloride 5 per cent lithium chloride, and 5 per cent caesium chloride. The efficiency is about 0.16 watt per hefner cp. The volatilization of the salt in the first type of lamp is effected by some form of external heating; it is suggested that the series resistance may be used for this purpose.—From *Elek. Zeit.*, Oct. 5, 1916, and German patents 288,228 and 288,229, abstracted in *Science Abstracts*, Feb. 26, 1917.

Traction

Transformers in Single-Phase Traction.—W. KUMMER.—In single-phase traction systems the voltage is changed three times; therefore the design of the transformers is of special importance. The first part of the paper deals with the dimensions of the transformer and the author shows that the "specific transformer volume" (the ratio of the active transformer volume to the apparent power) equals a constant C divided by the fourth root of the product of emf. and current. That is, the specific transformer volume decreases with increasing size of the transformer. The transformers on locomotives are therefore less of a ballast than on motor cars in view of the usual values of the capacities of locomotive and motor-car transformers. In other words, the advantages of voltage transformation on the vehicles of a single-phase system are fully utilized only with locomotives. The specific transformer volume may best be given in cubic decimeters per kil

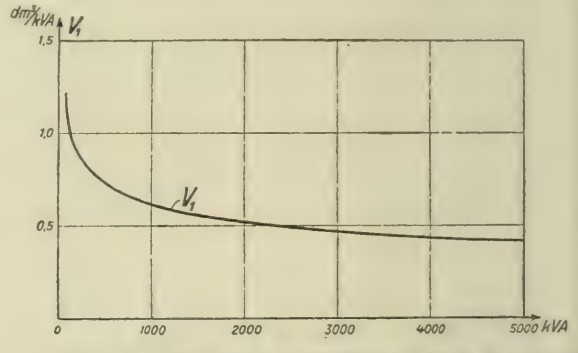


FIG. 2—CURVE OF SPECIFIC TRANSFORMER VOLUME AS FUNCTIO OF THE APPARENT POWER

volt-amperes (1 cu. dm. = 1 liter = 61 cu. in.). F single-phase roads with a frequency of 15 to 16 cycl the constant C may be taken as 3.5 for the units ju mentioned. The curve of the specific transformer vo ume V_1 as function of the apparent power has a form shown in Fig. 2. The author then shows that for transformer which is to be designed for smallest si and weight the percentage total loss may be considere as fixed. He then shows that in view of the requir ments of the magnetizing currents the designer h not a free choice with respect to dividing the total lo into iron loss and copper loss. For lighting tran formers it is usual to make the iron loss considerab smaller than the copper loss, in order to render t total yearly iron loss as small as possible, these tran formers with their small capacities being continual connected to the network. On the other hand, f transformers used in connection with motors and di connected from the network together with the motor the requirement is that the iron loss and the copp loss should have about the same value in order to g maximum efficiency at normal load. The author sho that for single-phase traction transformers in the st

tions as well as in the locomotives the total losses should be divided in the same way as with lighting transformers so that the iron losses are considerably smaller than the copper losses. In modern commercial designs of specially cooled single-phase transformers of large capacities in which best alloy steel is used the ratio of iron loss to copper loss is 0.4.—*Schweiz. Bauzeitung*, March 10, 1917.

Installations, Systems and Appliances

Parallel Operation of Distant Generating Stations.—P. Normier.—An article analyzing concisely the different factors or conditions which influence the operation in parallel of two or more generating stations at a distance. The author discusses in succession the influence of the flywheel, the influence of the prime mover, the influence of the characteristic curves of the alternator, and finally the parallel operation of three-phase alternators with the neutral point earthed.—*L'Industrie Elec.*, March 25, 1917.

Magnetic Control Appliances.—C. B. Bradish.—In former articles of his long illustrated serial on industrial control, the author has discussed the application of magnetic control to both standard and special electric drive. The author now takes up the discussion of magnetic control appliances. He first deals with the detailed construction of contactors and discusses the different types for low voltages and high voltages. He then deals with relays, the following types being mentioned: gravity-reset instantaneous overload relay, electrically reset overload relay, hand-reset overload relay, inverse-time-limit overload relay, current-limit relay, direct-current current-limit relay, time-limit accelerating relay, air dash-pot relay, step-back relays, field protective relay and field accelerating relay.—*Gen. Elec. Review*, April, 1917.

Wires, Wiring and Conduits

Use of Stranded Wire in Great Britain.—An editorial note referring to an advertisement by the (British) Cable Makers' Association asking that solid wires be used instead of stranded wires for the smaller sizes of cable. "This request is due to the fact that government requirements in small stranded wires at the present time are very great, and if stranded wires are ordered for other purposes delay will necessarily occur in completing government orders. The objections to the use of solid wires are well known, but under the circumstances the needs of the country must come first, and those who are responsible for the type of wire that is to be used in installations will accept the position and will comply with the request of the Cable Makers' Association."—London *Electrician*, March 2, 1917.

Electrochemistry and Batteries

Use of Waste Heat in the Electrochemical Industry.—In a recent paper before the Newcastle Section of the Society of Chemical Industry Henry Peile described the use of the waste heat at the Blaydon & Rowlands Coke Works for the production of electricity. For example, at Rowlands Gill Mine Stirling water-tube boilers were erected on the main flues, which carried the waste heat from the ovens to the chimney, and the steam generated is employed to drive four Westinghouse turbines coupled to three-phase alternators working at 6000 volts. The current is transformed down and supplied to the Newcastle Alloy Company at a voltage suitable for electric furnaces. Other transformers furnish power for pumping, hauling and lighting purposes. The power produced is largely used for the production of non-ferrous alloys, and in other cases the electric energy generated from waste heat is delivered to the mains of the Newcastle Electric Supply Company.—London *Electrician*, March 16, 1917.

Units, Measurements and Instruments

Marconi Vacuum Ampere Gage.—An illustrated description of a simple instrument for measuring small currents, both direct-current and alternating-current. The instrument is designed primarily as a maximum-current gage to indicate the condition of syntony in wireless circuits; it may also be employed as a substitute for a thermo-junction and galvanometer combination in the measurement of wave-lengths and decrements. The principle involved is that of the bifilar suspension, one pair of the filament ends being fixed and the other pair attached to a pivoted arm, the rotation of which is controlled by a spring against the tension of the filaments. When a current passes through the filaments, heating them and causing them to elongate, the arm takes up a new position, and the angular displacement, as indicated on the scale, is a measure of the current. The movement is inclosed in a glass bulb exhausted of air. The sensitiveness is thus greatly increased and the movement protected against damage and preserved from dust or corrosion. Fig. 3 shows the construction of the device, which is made up after the fashion of an incandescent lamp, with either a bayonet socket or Edison screw, as preferred. Other forms are made with terminal caps at both ends. The variation in zero, which usually characterizes thermal instruments, is said to be negligible in this type, and the movement is very dead-beat. The instrument may be used either as a low-reading voltmeter or ammeter, or as a shunted ammeter, having a normal resistance of about 12 ohms; a high-resistance pattern has a resistance of 30 ohms. These gages have maximum readings of 0.11 amp. and 0.035 amp., 1.44 volts and 1.25 volts, respectively, and read down to 0.02 amp. and 0.007 amp. The cross-arm seen in the figure carries two pointers for reading amperes and volts respectively. With a wavemeter using the new vacuum gage the wave length of the primary circuit of a 1½-kw. set can quite easily be read when the wavemeter is held with the plane of its inductance coils parallel to that of the primary of the oscillation transformer at a distance of 2 ft. or 3 ft. (about 0.75 m.). The noise of the spark, which often hinders the reading of a wavemeter by means of a crystal and telephones, in the case of the vacuum gage gives no trouble, as the variable condenser has simply to be rotated until the pointer of the gage gives the maximum reading. In this way circuits can be tuned rapidly as well as accurately. A range of ammeters from 50 amp. to 500 amp. is also being designed.—From *Wireless World*, February; abstracted in London *Elec. Review*, March 9, 1916.

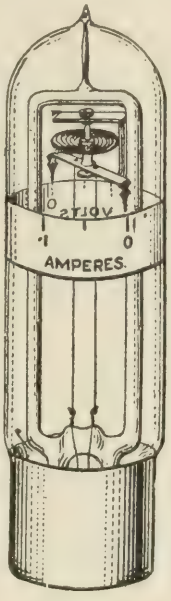


FIG. 3—VACUUM AMPERE GAGE

Scientific and Industrial Research

A Department Devoted to Interchange of Ideas, Investigations Contemplated, Facilities Available, and Suggestions for Co-operative Work.

Conducted by PROF. VLADIMAR KARAPETOFF
Cornell University

INVESTIGATIONS PLANNED AND WORK UNDER WAY

Since the Scientific and Industrial Research section of the ELECTRICAL WORLD was started, March 17, research laboratories of industrial plants, educational institutions, etc., have reported that investigations are being conducted on the subjects that follow. These subjects have been arranged under apparatus heads where convenient to do so. Following each subject are the name of the institution conducting the investigation and that of a representative from whom more detailed information can be obtained. This arrangement has been chosen because it permits any one to find the subject in which he is interested without having to go through the whole list of subjects. In addition, it facilitates filing the information in card index form.

SUBJECTS BEING INVESTIGATED (RESEARCH WORK REPORTED SINCE MARCH 17)

ACCIDENT PREVENTION.
Appliances, means for preventing fire hazards from.—*Underwriters' Laboratories, Dana Pierce.*

ELECTROMAGNETS.
Plunger type, oscillograph tests and basis for economical construction.—*Acme Wire Company, C. R. Underhill.*

FURNACE, ELECTRIC.
Production of fused-quartz insulators.—*Oregon Agricultural College, R. H. Dearborn.*

GENERATOR, ALTERNATING-CURRENT.
Field distortion due to armature reaction in a 20-kw. salient-pole two-phase alternator.—*West Virginia University, A. H. Forman.*

HARMONICS.
Determining current harmonics set up by a sinusoidal emf., taking into account the transformation of the generalized permeability factor into the reluctivity factor.—*University of Oklahoma, A. Press.*

HEATER, ELECTRIC.
Induction type having high power factor (over 98 per cent) for use in residences in connection with hot-water heating systems (experimental part completed).—*University of Washington, C. E. Magnusson.*

INDUSTRIAL APPLICATIONS.
Nitrogen fixation by means of silent electrical discharge in air.—*Purdue University, C. F. Harding.*

INSULATORS.
Depreciation, effect of cement expansion on (method of mixing cement to secure best results from an insulation standpoint without sacrificing mechanical strength).—*Oregon Agricultural College, R. H. Dearborn.*
Depreciation study using petrographical microscope and high-voltage equipment.—*Oregon Agricultural College, R. H. Dearborn.*
Fused quartz made in electric furnace.—*Oregon Agricultural College, R. H. Dearborn.*
(These insulator tests are being conducted with co-operation of manufacturers, who have been furnishing insulators with known history.)

KILN, ELECTRIC.
China-firing type, more economical and convenient than oil or gas kilns (experimental part completed).—*University of Washington, C. E. Magnusson.*

LEAKAGE CONSTANTS.
Tests to improve upon constants presented by Dr. Goldschmidt in his work on "The Leakage of Induction Motors" and to calculate the end-connection leakage.—*University of Oklahoma, A. Press.*

MEASUREMENTS.
Standards for measuring extra-high voltages particularly with respect to the use of the force acting in an electrostatic field, as applied in the Kelvin balanced-disk electrometer.—*Purdue University, C. F. Harding.*

MOTORS, INDUCTION.
Characteristics of, with capacity in rotor circuit.—*West Virginia University, A. H. Forman.*
Performance as phase splitter, when constants like moment of inertia, etc., are varied.—*West Virginia University, A. H. Forman.*

TRANSMISSION.
Corona losses at high voltages, especially between line and ground.—*Purdue University, C. F. Harding.*
Inductive interference between transmission lines and grounded telephone lines.—*State University of Iowa, A. H. Ford.*
Interference between transmission and telephone lines (well equipped for investigation by having high-voltage transmission lines paralleled by telephone circuits).—*Purdue University, C. F. Harding.*
Line design for maximum economy; chart prepared by means of which commercial problems can be solved rapidly.—*University of Washington, C. E. Magnusson.*

SUBJECTS ON WHICH INVESTIGATION IS CONTEMPLATED

ALLOYS
Magnetic permeability of.—*University of Washington, C. E. Magnusson.*
(Probably beyond the facilities of this laboratory.)

HEATING, ELECTRIC
University of Washington, C. E. Magnusson.

TRANSIENTS.
University of Washington, C. E. Magnusson.

TRANSMISSION LINES.
University of Washington, C. E. Magnusson.
Inductive interference, study of, by harmonic filtration.—*Oregon Agricultural College, R. H. Dearborn.*

Suggestions from Central Station and Manufacturers' Representatives

Several representatives of the Public Service Electric Company of New Jersey have suggested that operating companies are in need of information on various subjects. For example, P. H. Chase calls attention to the lack of data on rupturing capacity of oil switches and the factors which determine the ratings; causes of high-tension cable failure, bringing in such factors as dielectric losses, temperature, nature of compound, voltage surges and heating; effect of reactors and reactance in tie lines on the stability of an operating system; whether the use of reactors for oil-switch protection may be disadvantageous with a large system by causing different units to drop out of synchronism more often; methods of relay protection and operating tests that determine best method of applying relays; mechanical stresses in buses, leads, etc., under momentary short circuit and the effect of different spacings, shapes, frequencies, etc.

C. E. Hebbert, with the same company, points out the need for practical information on line disturbances due to switching operations, lightning, etc. For instance, do live surges actually "pile up" just outside protective reactors or other inductive apparatus on overhead lines? Based on readings taken with oscillographs or other apparatus, what are the maximum surge voltages due to switching that can be expected on a transmission system of mixed radial and tandem feeders? In addition, are the surge voltages in direct proportion to the operating voltage?

The effect of static electricity on braided high-tension cables with single and multi-conductors is another subject for investigation, according to E. Buchert, another Public Service man. For instance, is there any chemical action due to ozone on the cable itself or on surrounding structures, steel work, etc., and will the use of high-resistance metal braid remedy this trouble?

Experience seems to indicate that with a given voltage the clearances required with oil and disconnecting switches have to be increased with the generating capacity. P. H. Adams, with the New Jersey company, calls attention to the need of definite information on this subject.

J. Lester Woodbridge, chief engineer of the Electric Storage Battery Company, calls attention to the need of information regarding the effect of malleabilizing cast iron on its magnetic properties.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

INJUNCTION IN FUSE CASE VACATED BY COURT DECISION

Justice Pendleton Rules That Conspiracy and Bad Faith Were Not Shown by Electrical Committee of N. F. P. A.

On April 14 Justice Pendleton of the Supreme Court of New York State denied the motion of the Economy Fuse & Manufacturing Company against the members of the electrical committee of the National Fire Protection Association. The court declared that conspiracy and bad faith on the part of the defendants was not shown.

A temporary injunction granted by the court made it impossible to hold the biennial meeting of the electrical committee in New York on March 28, as reported in the ELECTRICAL WORLD of March 31, 1917, page 621. In the court proceedings the electrical committee was represented by Jerome, Rand & Kresel, New York City, and the Economy company by Platt & Field.

The opinion of Justice Pendleton, vacating the temporary injunction, follows:

> By this action plaintiff seeks in substance to enjoin defendants, as members of certain committees of experts, from acting as to matters within their jurisdiction on questions involving expert knowledge and opinion. The gist of the action is bad faith and conspiracy to injure plaintiff's business.
>
> Assuming, without deciding, that plaintiff has shown ill will and malice on the part of the original five members of the switch and cut-out committee, there is no such sufficient evidence as to the four other members of that committee or as to the other defendants.
>
> That the defendants, with the ramifications of their aggregate interests, exercise great power is plain, and if it appeared they were about to exercise that power in bad faith to injure plaintiff, a cause for equitable interference would doubtless be made out, but the moving papers fail to sufficiently establish such facts.
>
> That certain action of defendants in recommending or not recommending certain devices will have an injurious effect on plaintiff's business, or that the court might on testimony taken, if it could decide a question which really involves expert judgment, come to a different conclusion as to the merits of the recommendation, is not sufficient. Unless bad faith and conspiracy is shown there is no cause of action.
>
> The proposed action by defendants, as alleged, if carried out, affects not only plaintiff, but other manufacturers of similar articles, and is not directed specially against plaintiff, and the evidence fails to satisfy me that the action alleged to be contemplated does not represent the real opinion of the members. An injunction such as here asked should not be granted *pendente lite* unless the conspiracy and bad faith are shown; the burden is on plaintiff, and where denied, unless the contrary fairly appears, a restraining order in advance of trial should not be granted. Motion denied. Order signed.

It is understood that a recommendation has been made to the executive committee of the National Board of Fire Underwriters that another meeting of the electrical committee be called at an early date.

President Wilson's stirring proclamation to the people is printed in full by the publishers of the ELECTRICAL WORLD on pages 4 and 5, immediately following the table of contents. Its warm-hearted appeal for co-operation, its patriotic call for "service without regard to profit or material advantage," its lofty and extremely practical sentiments, will find loyal response from electrical engineers, manufacturers, dealers and contractors and workers.

N. E. L. A. CONVENTION PLANS MAY BE ALTERED

Necessity of Mobilization of Industries Makes Change in Character of Meeting Probable—Suggested Executive Conference on War

The program for the proposed annual convention of the National Electric Light Association, scheduled for May 28 to June 1 at Atlantic City, has been completed and, together with other information bearing on the meeting, was issued from the headquarters in New York this week.

Information received just before the time of going to press, however, leads the ELECTRICAL WORLD to withhold the program from publication. A feeling that a convention of the usual character should not be held under the stress of war conditions is now uppermost in the minds of those who are guiding association affairs and it appears probable that, owing to matters of national importance requiring the earliest possible consideration, the meeting will be advanced to an earlier date and curtailed materially in scope.

MEMBERS NEEDED AT HOME

The reason for this position is that the officials and employees of member companies who would attend the convention in normal times cannot be spared from their regular duties under present conditions. Their services are felt to be needed within the organizations at home.

There is also, however, a strong feeling that an opportunity should be furnished for the executives to confer on questions of public policy created by the war. Such questions are arising in the individual companies for decision day by day, but it is thought that great advantage would result from a free discussion of them by officials in executive session. For this reason it is suggested that such a conference may be arranged for a date early in May.

The plan to hold a great patriotic meeting on the evening of May 30, Decoration Day, will of course be held in abeyance until a final decision is reached on the question of the main convention. A patriotic gathering, however, may be arranged.

Precautions to Safeguard Service

Guards and Protective Wire by Day, Flood-lighting by Night, Are the Accepted Means of Defense for Electrical and Industrial Property

EARNEST acceptance of the condition of war characterizes the activities in every branch of the electrical industry.

Pending the reorganization of the nation's industries on a war basis, officials of electrical companies are giving such service as they know will be of value in defense.

In no direction is this form of service more plain than in the protection of plants which may have potential usefulness in military value to the country. In taking the precautions which are being adopted at points of danger the managers and executives are guided by considerations of both patriotism and business prudence.

It is a service to the Republic to safeguard physical property, to prevent destruction and maintain uninterrupted service. It is a clear duty to the company to keep its investment intact and in a position to provide energy for commercial and home consumption.

Reports to the ELECTRICAL WORLD from various sections show that no uniformity of method in protecting plants is being followed. In conformity with its policy, established when war was declared, of not giving information as to the location of protected plants, the ELECTRICAL WORLD withholds details relating to individual companies. Its information shows, however, that the importance of giving assured protection to the properties is generally appreciated.

In some instances the broad lines of protection policies are laid down by the controlling interests in holding companies located in the financial centers. In other cases the executive officials of holding companies are leaving to the local managers of operating plants the details of the measures taken. Some holding company officials feel that their subsidiary officials at the various plants are the best judges of the extent and nature of the necessary precautions.

It has been suggested in some quarters that insurance might be taken by companies to prevent financial loss in case actual destruction should develop. An inquiry by one official of a large holding company interest showed that such insurance can be obtained. The rate of course is determined by the individual circumstances in each case.

Another suggestion which has been received is that in their protective steps the managers of electrical companies be guided by the instructions of the military and police authorities. The practical idea which is back of this suggestion is that while the electrical people are authorities on the subject of operation of their plants the military and police officials are trained in the best methods of protection. Another advantage is that in what they do to safeguard property under the direction of the constituted authorities the electrical manufacturers and central station officials act under rigid orders.

Means of protection for the properties are, as stated in previous issues, guards and protective wire and fencing by day and flood lights by night.

MANUFACTURERS ORGANIZED

How the Great Interests Can Serve the Nation

FROM ROBERT K. SHEPPARD, PRESIDENT ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES

To the ELECTRICAL WORLD:

More than fourteen months ago, on Jan. 25, 1916, the Associated Manufacturers of Electrical Supplies offered their services to the federal government at Washington to facilitate the mobilization of the resources of the American makers of electrical supplies. That devotion to our country's welfare, spontaneously offered when a great emergency seemed to be foreshadowed by world happenings, is only intensified by the actual national need which now summons us to supremely unselfish service.

The board of governors of the association will consider immediately various ways by which this organized body of manufacturers can co-operate systematically and effectively with those in authority in the conduct of the war and in the control of domestic resources.

Organized service will save time, substance, effort. Consider one simple illustration out of many that might be cited:

When twenty manufacturers can make a given article much needed by a branch of our public service, those twenty manufacturers can quickly increase their normal total output by operating jointly. Some may have what others lack, raw materials for weeks or months ahead, while those who lack the stock perhaps could put labor and machinery at work instantly if the materials were at hand. Most quickly to utilize all the stocks, all the machinery, all the labor of those twenty manufacturers is a huge task for intelligent, generous men, for practical patriots.

Individual manufacturers both can and will thus aid one another. But our emergency should impel whole groups of manufacturers to plan together, pool their resources, combine or jointly rearrange their facilities, apply their executive powers intensively and without jealousy, to perpetuate the freedom of our people and to extend liberty and justice to all those who cherish or may be groping toward "government of the people, by the people, for the people." ROBERT K. SHEPPARD.

Boston, Mass.

Status of Patents

Thomas Ewing, Commissioner of Patents, said in Washington on April 17 that the status of patents held in this country by residents of foreign countries now at war with the United States would remain unchanged for the present. He added that he did not believe that it would ever become necessary to take over such patents. Mr. Ewing said:

"The United States laws provide that in emergency the government can take over and make use of any patents. If the output of any manufactured article controlled by a patent is inadequate, the government can authorize manufacture by another concern, the amount of damages to be adjusted later in the courts."

Russia and Germany alone have adopted a policy toward each other of forfeiture of enemy patents.



SAFEGUARDING ELECTRICAL GENERATING SYSTEMS FROM POSSIBLE HARM

Daytime protection of valuable central station property by the effective means of strong-armed guards and forbidding barbed and charged wire fences is just as vital a military precaution as painstaking protection at night, when brilliant flood-lighting supplements the other measures and lessens the possibility of trouble. It is imperative to protect the service.

ELECTRICAL EQUIPMENT FOR BATTLESHIPS COSTS $2,000,000

Contracts for Electric Propulsion of the Colorado and the Washington Are for Equipments Like That on the Tennessee

Contracts totaling approximately $2,000,000 have been placed recently with the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., by the New York Shipbuilding Company for furnishing the necessary electrical equipments for the propulsion of the new superdreadnoughts Colorado and Washington.

The equipments to be furnished are practically duplicates of that contracted for by the Navy Department for the Tennessee, now under construction. The four propellers, as in the case of the Tennessee, instead of being mechanically connected to driving engines or turbines, are to be driven by individual motors. The energy for the motors will be furnished by two turbine generators.

In addition to the main generating equipments and propelling motors, the contracts include auxiliaries for the main turbine generators and smaller auxiliary turbine generators for supplying light and power throughout the ships. Westinghouse electric motors will also be utilized for doing nearly all the work on board from raising the anchor to steering.

COAL COST TO GOVERN POWER CONTRACT OF CENTRAL STATIONS

Expense for Fuel and the Time at Which Energy Is Used Enter Into Rates in Massachusetts Arrangement

A contract closed recently between the Amesbury Electric Light Company and the Newburyport Gas & Electric Company of Massachusetts for the supply of energy to the former by the latter contains interesting provisions respecting hours of use and relation of rate to fuel cost. Energy is furnished to the Amesbury company from a steam plant at Newburyport completed recently, via a 13,200-volt transmission line; in addition, the Amesbury company obtains part of its electricity from other sources.

The contract provides for a maximum of 1000 kw. prior to a maximum advance notification of six months for additional energy up to 2500 kw. total demand. It terminates in 1926. Energy furnished under the contract is measured at 2300 volts on the Newburyport company switchboard. The meters are arranged to record automatically all kilowatt-hours to be paid for at two rates. For energy delivered between 6.30 a. m. and 6 p. m., except between 12 noon and 1 p. m. and except legal holidays and Sundays, the rate is 1 cent per kilowatt-hour; for energy received at other times, including between 12 noon and 1 p. m. each day and on legal holidays and Sundays, the rate is 8 mills. During the first twelve months during which energy is taken regularly the Amesbury company agrees to receive or pay for not less than 750,000 kw.-hr., and during each succeeding year not less than 1,000,000. Any deficiency in the total is to be paid for at the average rate per kilowatt-hour for such electricity as is received, with a local exception which need not be noted in detail.

The contract is based upon a coal cost delivered f.o.b. at Newburyport, Mass., of $4.55 per gross ton of 2240 lb. If during any six months beginning Oct. 1 or April 1 the average cost is more than $4.75 per gross ton delivered, the Amesbury company agrees to pay an additional amount equal to the actual increased fuel cost per kilowatt-hour, as shown by the production records, above what the cost would have been had coal of a similar quality been purchased at an average of $4.75. If the average price is less than $3.50 per gross ton, the Newburyport company is to reduce its price by an amount equal to the actual decreased fuel cost below what the cost would have been had coal of similar quality been purchased at an average of $3.50.

The Newburyport company furnished, installed, owns and maintains apparatus and cables required to deliver 13,200-volt energy to the Amesbury company at a point on the Merrimac River opposite the Newburyport station; for this equipment the Amesbury company pays an annual rental of 15 per cent on installed cost.

The contract thus contains a provision for a noon-hour differential and takes account of the desirability of attempting to reduce the load drop which the great majority of central stations experience on at least five days each week. So far as it is possible for the Amesbury company to develop continuous-process customers or to stimulate electric cooking at midday, the arrangement may be of practical advantage to the Amesbury company and helpful to load conditions at the Newburyport station. The Newburyport company is operated by the Cabot interests and the Amesbury company by C. D. Parker & Company, both of Boston.

COAL AND WAGES START RATE INCREASE IN NEW HAMPSHIRE

Company at Plymouth, Serving a Small Population, Shows Higher Costs as a Reason for Advance in Schedule

Permission to increase rates will be sought by the Plymouth (N. H.) Electric Light Company at a hearing before the Public Service Commission at Concord on April 26. Recently the company notified the board of its intention to raise rates, setting April 1 as the effective date. The commission suspended the proposed schedule until June 1, pending a thorough investigation.

Present and proposed rates subject to change are:

COMMERCIAL LIGHTING

Kilowatt-hours Proposed	Cents	Kilowatt-hours at Present	Cents
First 30 or less	18	First 33⅓	15
Next 70 or less	16	Next 133⅓	11¼
Next 100 or less	14	All above in one month	7½
Next 100 or less	12		
Next 100 or less	10		
Thereafter	8		
Minimum charge, month, $1.25.		Minimum charge, month, $1.00.	

HEATING AND POWER RATES

Kilowatt-hours Proposed	Cents	At Present	Cents
First 100 or less	6		5
Next 100 or less	5½		4
Next 100 or less	5		3½
Next 100 or less	4½		3
Next 100 or less	4	All after	2½
Next 100 or less	3½		
Thereafter	3		
Minimum charge, month, $1.25.		Minimum charge, month, $1.00.	

The company informed the commission that a supply of coal had just been contracted for at an increased cost of $2,000 over last year's price; also that the wages of plant employees have been raised and another increase promised this year which will add about $500. The company has a five-year contract with Plymouth at $7 for each 32-cp. lamp furnished. Sales of energy for the fiscal year 1916 totaled $13,115. The town pays the

company approximately $3,000 per year, and if no customers are lost, the new rates would yield the company approximately 20 per cent on $10,000.

The proposed rates would apply in Plymouth and Holderness. The company has never paid any dividends, but has followed a policy of building up plant out of earnings. Population of the territory served is about 2200. The company was organized in 1892 and is controlled by the Ayer interests of Plymouth. Its total capital is $10,000, and the total plant investment on June 30, 1916, was $18,215, the total assets, including $4,551 in materials on hand, being $26,696.

NEW YORK & QUEENS COMPANY REDUCED RATE OFFER ACCEPTED

"At This Juncture the Commission Would Not Be Justified in Drastic Order Which Would Disturb Stability"

The New York Public Service Commission, First District, has accepted an offer made by the New York & Queens Electric Light & Power Company to reduce the maximum electric rate from 12 cents per kilowatt-hour to 9 cents with certain contingent provisions. The commission has issued an order putting the provisions into effect and has approved an opinion by Commissioner Travis H. Whitney. The new rates are to take effect on May 1. The company serves all of Queens Borough except the Rockaway section.

It is proposed to eliminate the minimum charge of $1 and institute instead a service or meter charge of 60 cents per month. It is, however, specifically set forth in the order that no consumer's bill shall be increased under the operation of the new rate, and that every consumer shall enjoy a reduction in the present rate at least as great as such consumer would have enjoyed if the present maximum rate of 12 cents with the $1 minimum charge had been reduced to 11 cents per kilowatt-hour with the same minimum monthly charge.

The company further agrees that on Jan. 1, 1918, provided business conditions warrant at that date, it will reduce further the charge from 9 cents to 8.5 cents, continuing the monthly service charge of 60 cents.

The commission was led to accept the proffer, which was made on Jan. 24, by a close study of the affairs of the company and examination of the bills submitted recently to a large number of customers. The commission became convinced that substantial reductions would be effected for consumers. The company estimated that the saving to consumers would be about $100,000 yearly.

Opinion of Commissioner Whitney

In his opinion Commissioner Whitney says:

"The superficial criticism made against the present and also the proposed rates of the company is that they are greater than those which have been prescribed in the borough of Manhattan and in the borough of Brooklyn. The comparison does not, however, afford a just basis for determining the reasonableness of the rates, in view of the dissimilarity in the circumstances and conditions under which the electrical companies in the different boroughs operate. The borough of Queens is still largely a rural territory, with many portions sparsely settled, unpopulated tracts separating former towns and villages, although due recognition is given to the fact that it has a number of developing residential and industrial centers. Although the territory served by the New York & Queens Electric Light & Power Company has an area equal to the combined territories of the boroughs of Manhattan, Brooklyn and the Bronx, it has less than a tenth of their population.

"Upon the question of substituting the consumer charge for the minimum charge this commission, as have most other regulatory commissions, recognized the constant consumer cost which should be borne equitably by all consumers.

Recognizes Increases in Cost

"In view of the unsettled economic conditions arising out of the state of war, the increases in cost of production and distribution which have taken place during the past two years, and which are likely to continue, together with the wider recognition of labor in greater remuneration and improved working conditions enhancing costs to the company, the effect of a reduction in the rates upon the company's operations must be problematical.

"Certainly at this juncture the commission would not be justified in making a drastic order which would disturb the company's stability. There is all the more reason for this as the character of the territory served by the company and the development which it is undergoing, not only as a part of the growth of the city but also as a result of the extension of rapid transit lines, connecting a number of parts of the borough of Queens with the population and commercial centers in other parts of the city, will give rise to demands upon the company for extensions of facilities and service which it must meet promptly but which will not be immediately remunerative.

"It would be in the public interest, directly affecting the consumers and also an economy to the company, to put into effect this substantial reduction in the cost of electricity to the company's consumers, prior to the conclusion of a detailed appraisal and other statistical examinations which will be continued to completion. The preliminary inquiry and data of the commission indicate that the reduction is fair to the consumers. The acceptance of the proposal is not, however, in lieu of further proceedings and conclusions herein by the commission at some later time when, in the judgment of the commission, operations, costs and revenues are restored to a normal state."

UNDERWRITERS' LABORATORIES NEW YORK OFFICE TO REMOVE

Laboratory and General Offices Will Be Located Together in Larger Quarters at 25 City Hall Place

The New York City office of the Underwriters' Laboratories, Inc., is to be moved from 135 William Street to the Evening Mail building, 25 City Hall Place, on April 28. Dana Pierce, vice-president, says that the laboratory, now at 92 Vandam Street, will also be moved to the new location so that it will be with the office. The combined quarters will be larger than those which the offices and the laboratory have occupied separately.

MEETINGS OF THE ASSOCIATED MANUFACTURERS

Board of Governors Discusses Ways and Means of Giving the Government Every Possible Assistance—Section Gatherings

Several meetings within the organization of the Associated Manufacturers of Electrical Supplies were held in New York during the present week.

The board of governors met at the offices at 62 Cedar Street on April 18. Among the topics under consideration was that of assisting the government in every possible way.

A meeting of the wire and cable section was held on April 17 at the Yale Club. Dana Pierce, vice-president Underwriters' Laboratories, Inc., made an address illustrated by a moving picture film on the work of the underwriters in safeguarding life and property.

The magnet wire committee met on April 18 at the Cedar Street offices and considered general matters, including cost accounting.

The line material section will meet on May 4 and 5 in the offices at 30 East Forty-second Street, to which the headquarters are to be removed on April 28.

Work for Outlet Box Section

As stated previously in the Electrical World, the outlet box section will meet on April 24 at the Cedar Street offices. To guide the members in their meeting the standardization committee of the section has prepared the following memorandum:

"All members should attend this meeting ready to devote all necessary time to a complete review and study of conditions which have arisen, due not only to the possibilities for economies we might work out among ourselves, but also properly to protect our interests upon such material as we might manufacture, co-ordinating with action taken by other sections on subjects wherein we would be compelled to add to our costs. The following subjects are to be considered at this meeting:

"(1) Change of by-laws governing the time of meetings to allow members to attend other sections on the same trip.

"(2) Appointment of committee to co-operate with other sections that manufacture shelf goods, to consider, (a) package quantities, (b) methods of boxing and packing.

"(3) Methods of procedure in adopting our uniform cost-accounting system to co-ordinate our methods to that of a system to be suggested by our board of governors.

Standardization Matters

"(4) Work of standardization committee in the endeavor to decrease costs as follows:

"(a) By co-operation with other sections, reducing the number of holes in boxes, covers, etc., tapping of same, and the furnishing of unnecessary accessories.

"(b) Standardization of dimensions, thus eliminating unnecessary and rarely called-for stocks.

"(c) The elimination of stocks of unnecessary sizes and shapes, and finishes of boxes, covers, etc.

"(5) Uniform system of cataloging.

"(6) A standardized system of box numbering.

"(7) Consideration of new requirements which will be brought about due to the requirements suggested by the Underwriters' Laboratories, and which will be brought out shortly in a new standard of outlet boxes which is to be submitted to you by your industry conference committee.

"These subjects deserve the earnest consideration of all members, not only from the standpoint of saving in costs, but also from the standpoint of self-preservation of our industry."

CO-OPERATION COMMITTEE ON TECHNICAL SUBJECTS

Representatives of Six Societies Effect Permanent Organization with Farley Osgood as Chairman and A. H. Moore as Vice-Chairman

A meeting of the conference committee on co-operation on technical subjects was held at the headquarters of the National Electric Light Association, New York, on April 14. I. E. Moultrop presided. Representatives of the following were present: N. E. L. A., Edison Association of Electric Illuminating Companies, American Institute of Electrical Engineers, Electric Power Club, American Electric Railway Engineering Association and Railway Signal Association. This was the second meeting of the committee, the first having been held on Dec. 15, 1916.

Permanent Organization Effected

Permanent organization was effected. Farley Osgood, vice-president and general manager Public Service Electric Company, Newark, N. J., was elected permanent chairman. A. H. Moore, General Electric Company, Schenectady, N. Y., was elected permanent vice-chairman.

It was decided to follow in general the plan of assigning definite subjects to existing committees of the various associations rather than to create new committees for each specific topic. The subjects of transformer and apparatus terminal markings and standardization of apparatus voltages were assigned to committees of the Electric Power Club.

NATIONAL FIRE PROTECTION ASSOCIATION MEETING PLANS

Annual Gathering in Washington to Discuss Ammunition and Safeguarding Life in Theaters and to Visit Bureau of Standards

The National Fire Protection Association will hold its annual meeting in Washington, D. C., on May 8, 9 and 10. All sessions on Tuesday and Thursday, May 8 and 10, will be at the New Willard Hotel. The whole of Wednesday, May 9, will be spent at the Bureau of Standards.

On the first day there will be a round table conference on "Ammunition: Manufacture, Storage, Transportation."

During the day at the Bureau of Standards there will be a regular morning session in the bureau auditorium, followed by luncheon, column and panel tests and an inspection of the laboratories.

The final day will be devoted to a round table conference on "Safeguarding Life in Theaters."

A number of members expect to reach Washington on Monday, May 7, and are planning to visit Mount Vernon in the afternoon of that day, via the Potomac River boat.

LARGE VOLUME OF BUSINESS OF GENERAL ELECTRIC COMPANY

Orders Received in 1916 Aggregate 70 Per Cent More Than the Total of 1915 and 50 Per Cent More Than Previous High Record

Orders received by the General Electric Company for electrical machinery and supplies in 1916 amounted in value to $167,169,058, or 70 per cent greater than the orders for electrical products in 1915 and 50 per cent greater than in 1913, the largest previous year. The amount of sales billed was $134,242,290, an increase of 57 per cent over 1915.

After conservative charges against the plant account the earnings applicable to the stock were equal to 18.3 per cent on the outstanding issue.

Earnings for three years compare as follows:

Year ended Dec. 31—	1916	1915	1914
Sales billed	$134,242,289	$85,522,070	$90,467,691
Less: Cost of goods sold, including all operating, maintenance and depreciation charges	118,948,198	76,898,183	81,496,728
	$15,294,091	$8,623,887	$8,970,963
Interest and discount	$1,539,499	$1,434,269	$1,306,876
Income from securities owned	1,844,645	1,554,843	1,313,989
Sundry revenues	482,738	694,996	263,555
	$3,866,882	$3,684,108	$2,884,420
Total	19,160,973	12,307,995	11,855,383
Less: Interest on debenture bonds	571,445	570,085	567,556
Available for dividends	$18,589,528	$11,737,910	$11,287,827
Dividends paid	8,121,646	8,129,918	8,142,767
Net surplus for the year	$10,467,882	$3,607,992	$3,145,060
Surplus at Jan. 1, 1916	23,692,871	20,084,879	16,939,819
Surplus at Dec. 31 1916	$34,160,753	$23,692,871	$20,084,879

Operation at Capacity

C. A. Coffin, chairman of the board, says in the report:

"The extraordinary demand for the various products of your company throughout the year 1916 has made it necessary to operate its manufacturing and other facilities to the limit of their capacity.

"The orders for special war munitions received during the year, amounting to $2,416,000, were merely supplementary to previous contracts.

"The number of employees engaged in your factories and offices and in those of your subsidiary companies at the end of 1916 was about 79,000.

"The company has followed its customary practice in writing off against income its total expenditures during 1916 for patents, applications for and licenses under patents and other outlays relating thereto, amounting to $891,880. The patent account is carried at $1, as in previous years.

"Stocks, bonds and other securities are carried at a valuation of $33,773,678, of which $21,675,213 represents securities of subsidiary companies, and $12,098,464 those of public utility and other companies.

"The current accounts and notes receivable are carried at $26,816,297. They have been carefully appraised by a special committee, and the reserves for possible losses thereon are regarded as adequate.

"The increase in merchandise inventories was due not only to the greater volume of business, but to the necessity for carrying, at the existing high prices, larger than normal stocks of all kinds of material as a safeguard against uncertainties of delivery. The inventory accounts have been protected against possible depreciation by reserves which are considered ample.

"Urgent pressure upon the management for immediate and extensive additions to your manufacturing facilities involved the expenditure of $8,828,254 for plant account during 1916. This outlay, as compared with ordinary costs, was abnormal and excessive, in view of which it has seemed wise to write off against income an amount substantially equal to the year's disbursement. The cost of all the special tools, jigs, dies, drawings and patterns was thus disposed of, and also the greater part of the cost of the large machine tools and apparatus. Advantage was taken of the opportunity to reduce the book value of building accessories such as piping, wiring, etc., covering additions for a period of years, which will explain the fact that the amount written off for 'real estate and buildings' was larger than the expenditure thereon for the year.

"Quarterly dividends at the rate of 8 per cent per annum have been paid during the year.

"The company has no note payable, nor is there any paper outstanding bearing its indorsement.

"George F. Morrison, who has rendered most valuable service to the company for many years in the development of its incandescent lamp business and in other important directions, was elected a vice-president.

"The extraordinary business conditions during the past year imposed most exacting demands upon the employees in all departments. Their loyal and efficient co-operation has been of the most gratifying nature, and the board desires to record its hearty appreciation of the value of their services."

Manufacturing Plant Expansion

The factory floor space in 1916 aggregated 15,300,000 sq. ft. as compared with 14,830,000 in 1915.

On Jan. 31, 1893, the book value of the manufacturing plants was $3,958,528. In the twenty-four fiscal years to Dec. 31, 1916, additional expenditures were made aggregating $88,634,909, making a total of $92,593,437. During this period $62,688,673 was written off, leaving the book value of all plants at Dec. 31, 1916, $29,904,764. The details of the changes in plant account in 1916 were:

	Net Book Value Jan. 1, 1916	Additions During Year	Written Off	Net Book Value Dec. 31, 1916
Real estate and buildings	$20,038,337	$1,860,729	$2,452,875	$19,446,191
Machinery	9,524,992	5,732,187	4,798,608	10,458,571
Patterns	1	113,888	113,888	1
Furniture and fixtures	1	1,121,450	1,121,450	1
Total	$29,563,331	$8,828,254	$8,486,822	$29,904,764

Cash on hand as of Dec. 31, 1916, was $12,167,707. Notes and accounts receivable were $26,816,297, advances to subsidiary companies $4,739,819 and installation work in progress $4,196,020. Merchandise inventories stood at $51,160,639.

ELECTRIC RANGES FOR THE MASSACHUSETTS NAVAL RESERVE

"Somewhere in the United States" a Rush Job Is Done at Night Time in Order to Provide Good Cooking Facilities

Twenty electric ranges were installed in the record time of about nine hours during the night of April 7 to provide cooking facilities for the Massachusetts Naval Reserve Battalion.

The ranges are of the Westinghouse 3-18 type, with left-hand ovens, and are wired from special circuits in open leads with cleat supports. Central station service is near the point at which the battalion is located. A force of fifty electricians handled the job.

CENTRAL STATION AND ISOLATED PLANT CO-OPERATION

Economical Handling of Peak and Off-Peak Loads Held Feasible by Speakers at Boston A. I. E. E. and A. S. M. E. Meeting

That practical co-operation between the isolated plant and the central station for the economical handling of peak and off peak loads is feasible was asserted in a paper by P. R. Moses and W. F. Schaller of New York at the recent power plant symposium in Boston under the auspices of the American Institute of Electrical Engineers and the American Society of Mechanical Engineers.

The authors presented an exhaustive discussion of the cost of handling peak loads by central stations and came to the conclusion that in a representative case this may amount to 12 cents per kilowatt-hour in addition to operating expenses, taking the large user into consideration. They contended that the diversity factor of the large user is much less than that of the small consumer, and that the use of a centralized system for supplying peak loads of short duration is undesirable from the economic standpoint.

In not more than twenty-five of a hundred private power plants designed by the authors in the last twenty years has the boiler capacity been affected by the electric load. The cost of providing for peak loads in such plants will vary from $60 to $100 per kilowatt of demand, they stated. On the basis of 400 hours' use per year, allowing 13 per cent fixed charges, the cost per kilowatt-hour is between 1.95 and 3.3 cents, comparing with 12 cents on the same basis of use of the peak with the public utility. It would appear that the central station would save between 8 and 10 cents per kilowatt-hour on the winter peak if it could arrange for the supply of this peak by localized private plants.

The accompanying table shows the plant capacity in a number of typical buildings in New York City and the capacity held in reserve for spare purposes, which could be utilized for the supply of peak loads in the districts adjoining:

Plant	Kw. Rating	Maximum Demand	Kw. Spare	Per Cent
Columbia Trust office.....	375	195	180	92
A. M. & Co. office and store...	500	285	215	75
Bonwit-Teller store	875	600	275	46
103 Park Avenue, office.....	225	111	114	102

In these cases the spare capacity is about 75 per cent of the present maximum demand, so that there is already available a large amount of peak-load capacity which under suitable rate conditions could be utilized without the expenditure of a cent. In private plants the fixed charges per kilowatt of maximum demand are not so important as operating costs at light load periods.

Load curves of some typical buildings show periods of from eight to twelve hours when the load is only 5 to 10 per cent of the maximum. This means comparatively high labor and fuel costs, except when low-pressure steam is required all night and every day for heating or industrial uses. During seasons when low-pressure steam is not needed a kilowatt-hour may cost the private plant 10 cents and will usually be found to cost over 6 cents for fuel, labor, repairs and supplies, exclusive of fixed charges. The period of this light load corresponds to the light-load period of the public utility.

A low rate for off-peak power will encourage private power plant operators to shut these installations down at such periods and purchase energy from the public utility, and these low rates for off-peak service might properly be coupled with agreements to buy power from the private plants at the period of peak demand at rates which would cover the cost to the private plant operator of extra fuel and labor, if any, at a reasonable profit.

Such a plan was proposed by the Longacre Electric Company several years ago in New York, but was not put into effect because of franchise troubles. The authors concluded that no insuperable engineering difficulties are in the way of carrying out their program.

HIGH COST OF VALUATION OF TELEGRAPH PROPERTY

Appraisal of Western Union Physical Property Means $1,000,000 Expense—1916 Business Increases 21 Per Cent

That the volume of business during 1916 was the largest in the history of the Western Union Telegraph Company is shown by the amount of gross operating revenues, $61,919,141, or 21 per cent over 1915.

Newcomb Carlton, the president, calls attention in the report to the considerable increase in operating expenses, due not only to material prices and increased taxes, but also to large increases in salaries and wages. Mr. Carlton writes in part as follows:

"The installation of the automatic printing telegraph system, known as the multiplex, has been continued with satisfactory results. The extended use of this method of operation has greatly increased the capacity of the telegraph plant and has made possible the generally satisfactory handling of the increased traffic.

"Despite difficulties in obtaining material, the work of reconstructing lines and offices has steadily advanced and substantial progress has been made in the standardization of the company's offices, both as to their external appearance and their internal arrangements and appointments.

"The physical inventory of the company's property which is being made by the Interstate Commerce Commission is approximately half completed, but no appraisals have yet been announced. It is expected that this work will be finished in 1920 at a cost to the Western Union Company of $1,000,000, as estimated in 1914."

COAL MINE IS BOUGHT BY BARSTOW INTERESTS

West Virginia Coal-Producing Land Acquired to Safeguard Supply and Reduce Price for the Operating Systems

The Utilities Coal Company is being incorporated by the W. S. Barstow & Company interests to acquire a large coal operating property in West Virginia. Its output will be available almost immediately for use by subsidiaries of the General Gas & Electric Company and the Eastern Power & Light Corporation. It is announced that the coal will be sold to the subsidiary companies at the contract price in effect last October.

The original intention of the Barstow interests was to purchase undeveloped coal lands, but in view of the delay in securing apparatus and labor for opening such lands and insuring a large output it was deemed advisable to secure a property already in operation. The coal mine purchased covers 10,000,000 tons of coal.

LARGE REFUND AND EXPENSE IN PHILADELPHIA RATE CASE

Sum Returned to City on 1915 Street-Lighting Contract and Cost of Valuation and Rate Proceeding Amount to $481,000

A deduction of $481,102 was made from the surplus of the Philadelphia Electric Company during the year ended Dec. 31, 1916, to cover a refund to the city of Philadelphia on the street-lighting contract for 1915 and expenses of the valuation and the rate case.

Joseph B. McCall, the president, calls attention in his annual report to the extraordinary increase in gross earnings as well as to the corresponding increase in expenses. He adds: "It is obvious that if an abnormal increase in gross earnings had not prevailed, due principally to the unusual demand by large power installations and for railway purposes, the reductions made in rates by all the companies owned by you would have resulted in a reduction in dividend. In formulating the new tariff of rates, the calculations based upon the business connected, the new business secured and in prospect, justified the reductions made, which benefited principally the small and average customers and still enabled us to meet the increasing cost of labor, coal and material of all kinds, provide for the fixed charges and continue the dividend upon the stock." Earnings were:

	1916	1915
Gross earnings	$10,260,072	$8,777,924
Operating expenses, taxes, fixed charges and reserve for renewals and replacements	7,466,021	6,363,374
Net income	$2,794,051	$2,414,551
Cash dividends during the year	1,574,312	1,574,311
Surplus for the year	$1,219,739	$840,240
Previous surplus	$2,311,986	
Refund to the city on street-lighting contract for 1915, expenses of valuation and rate case	481,102	
Balance	$1,830,884	
Total surplus, Dec. 31, 1916	$3,050,622	

Regarding improvements Mr. McCall says:

"During the year the large generating station known as 'A-2,' capacity 65,000 kw., was completed; additions were made to substation capacities and nearly 1000 additional arc lamps for street lighting erected; a large portion of the construction of the high-tension transmission lines between Philadelphia and Chester completed; overhead and underground lines extended, and your properties are in first-class condition.

"A large generating station, located on the Delaware River, at Chester, to be known as the 'Chester waterside station,' having an ultimate capacity of 120,000 kw., which will be connected with the generating stations in Philadelphia by a tie line, the right-of-way for which has already been secured, is now being erected by the Beacon Light Company, and it is expected the first unit will be in operation this coming fall."

The unification of the various plants and subsidiary properties in Philadelphia (with the exception of the Edison Electric Light Company of Philadelphia) into one ownership has been accomplished and provision has been made for the future financing of the company. As a result Mr. McCall expresses the hope that in the near future it will be possible to submit a plan for the exchange of the stock of the company for the stock of the Pennsylvania company. The financial plan placed $10,332,193 in the treasury, leaving, after provision for loans of $4,950,000, a final cash balance of $5,382,193.

The total commercial connected load as of Dec. 31, 1916, was equivalent to 4,715,121 50-watt lamps, an increase of 756,592; and the increase in the number of consumers was 13,620.

The connected load of railway and other utilities was 33,450 kw. on Dec. 31, 1916, an increase over the preceding year of 1200 kw.

WOMEN OF NEW YORK N. E. L. A. SECTION AID THE RED CROSS

More Than 400 Volunteer Workers Give Their Services for Two Hours Daily in Making Materials for Aid in War

Women of the New York Edison Company and the other electric companies of the New York Section of the National Electric Light Association have banded together and equipped a Red Cross workshop in the Consolidated Gas Company building, Fifteenth Street and Irving Place. More than 400 women have volunteered, and groups have been at work ever since war was formally declared. This work will be continued daily between 5 and 7 p. m.



NEW YORK ELECTRICAL WOMEN IN RED CROSS WORK

One member of every group is designated as group leader and two are group instructors. The group instructors are those who have received Red Cross certificates and are thus qualified to teach. Mrs. Walter Neumuller is honorary president of the auxiliary and Miss Clara Porter the executive chairman. Other members of the committee are Miss Evelyn Neudorfer of the United Electric Light & Power Company, Miss F. G. Newman of the Yonkers Electric Light & Power Company, Miss M. L. Mauer of the New York & Queens Electric Light & Power Company, and Miss Elsa Detmold, Miss Florence Evans, Miss Helen Ormsbee and Mrs. O. W. Smith of the New York Edison Company.

The funds for carrying on the work have been obtained by private subscription from officials and employees of the companies and appropriations from the companies themselves. Interesting features of the room equipment are sewing machines which are electrically operated and an electric cutting machine.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Invasion of Territory Alleged in California.—The Vallejo Electric Light & Power Company, which supplies electrical energy in Solano County near Vallejo, has filed with the California Railroad Commission a complaint against the Great Western Power Company, asking the commission to compel the Great Western Company to stop building its distribution lines in that district. The Vallejo company says that it has a franchise to serve electricity in Vallejo, and also in the district alleged to have been invaded, and that its plant is adequate to serve all the present needs of the district. The complaint says that the Great Western Company is constructing distribution lines in the district to duplicate the Vallejo company's system, and has no franchise to conduct its business in Solano County.

Colorado Commission Overrules Denver Company.—The Public Utilities Commission of Colorado has ordered the Denver Gas & Electric Light Company to proceed with an inventory of its physical property preparatory to an investigation and hearing by the commission on a complaint alleging "excessive rates for electricity and gas, inadequate service in the furnishing of electricity and gas, and insufficient heating quality of gas," in Denver. The commission overrules the contention of the company that the commission has no jurisdiction over the corporation or authority to regulate rates and service of the utility. The commission also rules against the contention of the company that the commission has no right to change the terms of the franchise contract between the municipality and the corporation.

Important Valuation Work in Maine.—Comprehensive valuation work is being conducted at present by the Maine Public Utilities Commission and also by several of the electric service companies, according to the second annual report of the commission to the Governor. Holding that the aggregate of all the securities should not exceed the value of the property, the commission concluded that thorough appraisals were a necessity. The board is now conducting an exhaustive valuation of the entire property of the Central Maine Power Company, and among the companies which are carrying on similar work are the Cumberland County Power & Light Company, the Bangor Railway & Electric Company and allied utilities, and the Lewiston Gas Light Company. In some instances rate cases are pending upon these valuations. Each of the above-named companies estimates that about a year will be required to complete its valuation. In general, the classification followed in the electric utility valuations of the board is based on the National Electric Light Association classification of accounts.

Combination of Electric and Heating Departments.—A valuation of its property has been submitted by the Colorado Springs Light, Heat & Power Company to the Public Utilities Commission of Colorado. The company asks the commission to approve a valuation of $3,663,964 on its property in Colorado Springs and to increase the maximum electric rate from 8.5 cents per kilowatt-hour to 12 cents and the gas rate from $1.10 per 1000 cu. ft. to $1.25. Permission was asked to combine the electrical and steam-heating departments on the theory that heat is a by-product of the electrical department. The valuation figures of the company are: Fixed capital—Electrical department, $2,055,248; gas department, $837,989; steam heat, $195,727; total, $3,088,964. Development cost—Electrical department, $285,000; gas department, $125,000; steam heat, $30,000; total, $440,000. Working capital—Electrical department, $90,000; gas department, $40,000; steam heat, $5,000; total, $135,000. Total on which the company claims it is entitled to return—Electrical department, $2,430,248; gas department, $1,002,989; steam heat, $230,727; grand total, $3,663,964.

Discontinuance of Service Overruled in Missouri.—A decision has been rendered by the Missouri Public Service Commission in the complaints of W. H. Roach and others against M. O. Danciger & Company, Weston, Mo. One complaint alleged that M. O. Danciger & Company operated an electric light and power plant and a brewery, and "cut off the light and power current from our printing office because of our advocacy of the dry cause in the local option campaign prior to June 3, election day." In three of the complaints the defendant's reason for discontinuance of service was not alleged. The defendant denied jurisdiction by the commission on the ground that its business was private and not public. The company has been furnishing energy for light and power to private persons and to the city. It has no distribution system or city franchise and does not construct wires on streets or public places. The consumer furnishes wire and poles and bears all cost of constructing the line. Answering the question whether the defendant is an electrical corporation, the commission says that it is an electrical corporation, not falling within the exceptions mentioned in the statutory definition. The fact that the defendant did not use the streets and public places of the city was considered as of little importance in its bearing on the case under review. On a motion for a rehearing of this case the commission held that the corporation could not be permitted to entirely cut off service from some of its consumers while continuing to furnish service to others who were similarly situated.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public-utility companies.

Time Necessary for Repair of Defective Wires.—The breaking of a telephone wire not carrying a current of sufficiently high voltage to be dangerous unless it came in contact with other wires was notice that it might become dangerous and imposed the duty of such examination as would protect the public from danger, it was held by the Supreme Court of Pennsylvania (100 A. 126). A telephone company is entitled to a reasonable opportunity and time to discover and repair defective wires, it was held.

Right to Cut Off Service for Non-Payment.—While the decision of the Supreme Court of South Carolina in the case of Johnson vs. Carolina Gas & Electric Company (91 S. E. 734) deals directly with water supply, the case is of particular interest to all companies engaged in public service. It was held by the court that a public service water company, though authorized by franchise to discontinue service for nonpayment, had no right to cut off a consumer's water supply on account of a debt due for water supplied at a previous time and by another company and assigned to the present company.

Power of City in Eminent Domain.—Statutes authorizing the exercise of the power to take private property without the consent of the owner are to be construed with reasonable strictness, according to the Supreme Judicial Court of Massachusetts in the case of Comiskey vs. City of Lynn (115 N. E. 312), and the authority of the city to take property under the statute is not to be inferred from vague and doubtful general phrases. The law provides that the city of Lynn may take by purchase or otherwise all lands, rights-of-way and easements necessary to establish filtration beds to hold water taken by purchase or otherwise under authority of the act, and for conveying it to the city, and may erect on the land thus taken or held proper dams, buildings, fixtures and structures, and may make excavations, procure and operate machinery and provide such other means and appliances as may be necessary for the establishment and maintenance of complete and effective waterworks. The court held, however, in the light of contemporaneous legislation with reference to the maintenance of lines for the transmission of electricity, that the Legislature did not intend to authorize the city to condemn a strip of land, to construct and maintain thereon an electric power transmission line to a pumping station on the banks of a river taken for water supply, since the strip of land did not coincide with the pipe line for the water.

Dinner Postponed by American Museum of Safety.—The country now being at war, President Arthur Williams of the American Museum of Safety has announced that it was thought undesirable to hold the proposed dinner in connection with the presentation of the medals of the museum. The dinner was planned for April 19 and for the reason stated above the invitations were recalled.

More Power for St. Paul Railway.—A contract has been made by the Intermountain Power Company to furnish more energy to the Chicago, Milwaukee & St. Paul Railway. The Intermountain Company is a subsidiary of the Montana Power Company and the Washington Water Power Company. It will purchase at first 7500 hp., which will be received from the new hydroelectric station of the Washington Power Company at Long Lake. The energy will be used for operation of the railway lines in the State of Washington.

Chicago Changes Standard for Street-Lighting Pole.—The electrical department of the city of Chicago is considering a change from its standard type of pole for carrying street-lighting circuits. In the past all proposals for poles for outlying street-lighting service have specified tubular steel poles only. A proposal issued on April 10, however, specifies tubular steel poles or their equivalent. The proposal defined equivalent poles as "expanded steel-truss poles or concrete poles which may in the judgment of the Commissioner of Gas and Electricity be equivalent to tubular steel poles." The change is to be made, according to William G. Kieth, Commissioner of Gas and Electricity, on account of the increasing prices now asked for tubular poles and the uncertainty as to time of delivery that has prevailed.

Chicago Central Station Institute Broadens in Scope.—The Chicago Central Station Institute, which was founded in 1912 as the bureau of education for the Commonwealth Edison Company, the Federal Sign System (Electric), the Illinois Northern Utilities Company, the Middle West Utilities Company and the Public Service Company of Northern Illinois, has been educating college graduates and other ambitious young men for positions in the commercial departments of these companies. In the future the institute will conduct its graduate student course so as to provide men for the operating, engineering and all other departments. The student will receive practical experience in the various departments combined with classroom study of many branches of the business. A college undergraduate may take the first of five periods of training during vacation after completing the sophomore college year and can take the second period during vacation after completing the junior year at college. The course consists of a total of fifteen months, divided into five periods of three months each. Fred R. Jenkins is secretary and manager of the Chicago Central Station Institute.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Growth in Business of Ohio Companies.—The Alliance Gas & Power Company, Toledo Railways & Light Company, Trumbull Public Service Company, Warren, Massillon Electric & Gas Company, and the Lorain County Electric Company, Elyria and Lorain, Ohio, comprising the Ohio electric subsidiaries of the Cities Service Company, are continuing to show marked growth in business. The combined sales of these properties were 54 per cent greater for the twelve months ended Feb. 28, 1917, than in the preceding year. The sales of one of the properties increased 98 per cent for the year.

Adjournment of Lighting Rate Inquiry Denied.—The Board of Public Utility Commissioners of New Jersey has refused the application of the Public Service Electric Company for an indefinite postponement of the investigation of lighting rates to allow the company to devote its efforts to protecting its properties and extending its service facilities in a way that will help national defense. The board holds that, in view of the expense already involved in the inquiry and the fact that the engineers on both sides are prepared to proceed to a determination of the physical value of the property, the hearings should continue until a valuation of the company's properties has been arrived at.

Hydroelectric Progress in France.—Hydroelectric development in France is described as follows in a letter received by the Philadelphia Bourse from the Chamber of Commerce of Paris: "One of the good results of the war will be to have aroused throughout France intense industrial activity, and consequently a considerable increase in electrical power works, formerly scarce in this country. Electrometallurgy has been rapidly improving during the war, as well as chemical manufactures. The manufacture of large-caliber shells and armor plate is assured by the help of water power. Thanks to the facilities that the transporting of electrical power offers, the works which undertake to produce it can combine the advantages of water descending from the glaciers of the Alps, very plentiful in summertime, with the force to be obtained from the waters of the rivers, which are swollen by the snowfalls of winter and autumn. Before 1914 factories were scarce in the Southwest. And one of the most remarkable results of the war will be the industrial activity produced in the regions of Languedoc, Gascony and Guyenne, which indirectly causes the development of electrical power works and enterprises."

Electric Illumination for the Lincoln Highway.—The Stark County Jovian League, meeting at Canton, Ohio, decided to start a movement to light the Lincoln Highway by electricity. This league includes Jovians of Canton, Massillon and Alliance. The Lincoln Highway, extending 3284 miles from New York to San Francisco, is essentially a national movement, and the Jovian Order will be asked to enlist its various leagues in the proposed illumination. About 33 miles of the highway are in Stark County, and the cost of illuminating this part is estimated at $4,000 a year. Directors of the Electrical League of Cleveland indorsed the movement at a meeting on April 2. At the meeting of the Jovian Congress and special commission in Cleveland on April 3 and 4, J. M. Bateman, first tribune in Cleveland, presented the suggestion that the movement should have the indorsement and support of the order.

United Gas & Electric Corporation Subsidiaries Experience Abnormal Conditions.—Settlement of rate and other regulatory matters is mentioned in the annual report of the United Gas & Electric Corporation for the year ended Dec. 31, 1916. George Bullock, chairman of the board of directors, says on this subject: "The abnormal conditions incident to the effect of the foreign situation resulted during the year past in considerable agitation in respect to public utility rates and other matters falling within the jurisdiction of the public service commissions under whose supervision the various subsidiary companies of this corporation are operated. The management is gratified to be able to state that substantially all of these questions have been satisfactorily settled and upon a basis not prejudicial to our operating subsidiaries. Concurrently labor difficulties developed in connection with several of the subsidiaries, but these have now been satisfactorily adjusted, generally for a period of three years."

Standardization of Farm Lighting Sets.—In order to be assured that the majority of manufacturers of farm lighting sets are figuring ratings on the same basis, the American Society of Agricultural Engineers has recommended certain standard ratings and specifications for these low-voltage lighting plants. The movement is one for the convenience of the purchaser. The pamphlet issued by the society describing the standard recommends that 30 volts be adopted as the potential for low-voltage electric lighting plants, and that with such sets sixteen lead-sulphuric acid cells in series or twenty-four Edison cells in series be adopted as the standard. In the opinion of the committee which framed the standards, these numbers of cells with the average house wiring and with the usual number of lights will give approximately 30 volts at the socket. It was also recommended that the manufacturers of farm lighting sets agree upon a standard lamp of a certain voltage range to be known as the farm service lamp.

Applications of Electricity in the Steel Industry.—At the meeting of the Philadelphia Section of the Association of Iron and Steel Electrical Engineers to be held on May 5, G. E. Stoltz will talk on "Some Recent Applications of Electricity in the Steel Industry."

Electrical Supply Jobbers' Association.—The annual meeting of the Electrical Supply Jobbers' Association will be held at the Homestead Hotel, Hot Springs, Va., on May 22, 23 and 24. The Atlantic and central divisions of the association will meet at Hot Springs on May 22.

New York Electrical Society.—A joint meeting of the New York Companies Section of the N. E. L. A. and the New York Electrical Society was held on April 17. Homer Croy spoke on "Behind the Film," and explained how motion picture films are made and how many thrilling episodes are staged.

Association of Iron and Steel Electrical Engineers.—The April meeting of the Association of Iron and Steel Electrical Engineers will be held to-day, April 21, in Pittsburgh, Pa. The following short papers by members of the standardization committee will be presented: "Résumé of Standardization Work of Other Organizations," by H. D. James; "Control," by T. E. Barnum; "Motors," by F. B. Crosby; "Cranes," by D. M. Petty, and "The Need of and a Plan for Standardization," by W. T. Snyder.

Electrical Contractors' Association of Pennsylvania.—The annual convention of the Electrical Contractors' Association of Pennsylvania will be held at Philadelphia on June 19, 20 and 21 inclusive. The headquarters will be at the Hotel Adelphia. A very large attendance is expected owing to the great interest which was displayed last year when the convention was held in Wilkes-Barre. Prominent persons in the electrical and business world will address the meeting, and there will be open sessions which should be most interesting. Elaborate entertainment of delegates and guests will be provided. A special feature of the convention will be an electrical exhibit.

New York Jovians Have Patriotic Luncheon.—Dr. Talcott Williams, director of the Columbia School of Journalism, was the principal speaker at the patriotic Jovian League luncheon given in New York on April 11. He spoke particularly of the important part the electrical industry will play both in aggressive and defensive warfare. Following his address, Vice-President J. M. Wakeman introduced the following resolution, which was adopted: "Resolved, that the New York Jovians here assembled, in behalf of the 1400 New York Jovians, part of the National Jovian Order with a membership of 18,000 men engaged in the electrical industry, do hereby heartily approve the recent message of the President of the United States, indorse the action of Congress, and pledge themselves to an undivided loyalty and whole-hearted service to the constitution, the flag and the President of the United States."

Associations and Societies

A complete Directory of Electrical Associations is regularly printed in the first issue of each month on the next-to-last text page.

Radio Club of America.—David S. Brown and Walter S. Lemmon presented a paper on "Army and Navy Signaling Systems," on April 20, before the Radio Club of New York City.

Electrical League of Cleveland.—R. M. McClurg spoke on the "Electrification of the Chicago, Milwaukee & St. Paul Railroad" before the Electrical League of Cleveland on April 13.

Chicago Section, Illuminating Engineering Society.—S. G. Hibben, illuminating engineer of the Westinghouse Lamp Company, spoke on "Office Lighting" before the Chicago Section of the Illuminating Engineering Society on April 20.

Illinois State Electric Association.—The Illinois State Electric Association has appointed a committee on new-business co-operation following somewhat after the plan that has been used in Ohio. The new committee has arranged the following program for its first meeting, which is to be held at the Hotel Jefferson, Peoria, April 27: Address by chairman, John G. Learned, Chicago; paper, "Scientific Window Lighting," by Norman B. Hickox, Chicago, and discussion by H. L. Brandli of Mount Vernon, Ill., and Oliver R. Hogue of Chicago; paper, "Financing Contracts for Wiring Old Residences and Additional Wiring for Appliance Sockets in Premises of Residence Customers," by F. H. Scheel, Joliet, and discussion by W. A. Giffen of Rockford, W. P. Lyon of Chicago, L. E. Spear of Springfield, and W. P. Meiser of Peoria; paper, "Electrification of Coal Mines," by Orlie Rue, Mattoon, and discussion by R. S. Woltz of Springfield and E. R. Elan of Peoria; address on "Salesmanship," by A. F. Siebert, Dayton, Ohio; paper, "Electrical Merchandise, Its Sale and Its Upkeep," by E. C. Forest, Rockford, and discussion by Ernest A. Elkins of Chicago, Frank Lebkicker of Alton, C. A. Morse of Mattoon, George E. Dunn of Oak Park, and E. Giaciolli of Oak Park; a symposium on electric heating with papers on "Industrial Heating Appliances," by L. H. Knapp of Chicago and B. G. Tarkington of Jackson, Mich., with discussion by Roy Larson of Rockford, George H. Jones of Chicago, and C. W. Pen Dell of Chicago; paper, "Electric Cooking," by J. Paul Clayton, Mattoon, with discussion by Charles B. Yonts of Dixon, W. F. Corl of St. Louis, Mrs. Swanson of Rockford, and Adam Gschwindt of Rockford. John G. Learned, chairman of the committee on new-business co-operation, has directed attention particularly to the discussions to be prepared in advance, which, it is thought, will increase the value of the meeting.

National Association of Electrical Inspectors. The Western New England Section of the National Association of Electrical Inspectors held its spring meeting on April 11 at Holyoke, Mass.

Electrical League of Cleveland.—Major P. S. Bond, United States engineer in charge of the Cleveland district, recently addressed the Electrical League of Cleveland on the subject of "Universal Service."

Pittsburgh Section, Illuminating Engineering Society.—"Illuminating Engineering in the Motion Picture Industry" was the subject of a talk given by B. Perris of the National Carbon Company before the Pittsburgh Section of the Illuminating Engineering Society on April 16.

Pittsburgh Section, Association of Iron and Steel Electrical Engineers.—The May meeting of the Pittsburgh Section of the Association of Iron and Steel Electrical Engineers will be held on May 19. This meeting will be under the auspices of the power committee, of which W. O. Oschmann is chairman. The subject to be discussed is "Power Cost Accounting Systems as Practiced by Several Steel Mills in the Pittsburgh District."

National Electric Credit Men's Association.—Frederic P. Vose, secretary of the National Electric Credit Men's Association, delivered an address at the weekly meeting of the Cleveland Electrical League recently. Charles F. Kettering of the Domestic Engineering Company, Dayton, Ohio, was scheduled to make an address, but was called to Washington to consult about preparedness work with which he is connected. His address will be delivered later in the season.

New York Section of A. E. S. Elects New Officers.—At a joint meeting of the Chemists' Club and the New York sections of the Society of Chemical Industry and the American Chemical Society on April 13, the following officers were elected for the ensuing year by the New York Section of the American Electrochemical Society: Chairman, J. V. N. Dorr, president of the Dorr Company; vice-chairman, E. D. Kingsley of the Niagara Alkali Company, and secretary-treasurer, J. Malcolm Muir, business manager of *Metallurgical and Chemical Engineering*.

St. Louis Jovians Meet.—Seldon P. Spencer, a former judge and well-known St. Louis jurist, who has been making a study of military conditions in the United States, addressed the Jovian League at the Mercantile Club Tuesday on "The Necessity for Military Training." He advocated the adoption of a universal military system similar to that of the Swiss government, which, in addition to providing the maximum power for self-defense, has been found of great value in the physical development of the young men of the nation and has contributed a wonderful influence toward promoting wholesome living and a higher moral status of citizenship. C. E. Michel presided as chairman of the meeting.

Men of the Industry

Changes in Personnel and Position — Biographical Notes

F. C. Wilkinson has resigned from his position as manager of the Public Electric Light Company, St. Albans, Vt., and director and superintendent of the St. Albans & Swanton Traction Company. He is succeeded by George A. Murch.

D. C. Wood has been appointed by the State Public Utilities Commission of Illinois as acting chief of the service division in the engineering department, succeeding Stanley P. Farwell, resigned. Mr. Wood is a graduate of the University of Illinois in the electrical engineering course, and has been with the commission as assistant engineer for nearly three years.

John D. Ball, late of the consulting engineering department of the General Electric Company, has severed his connection with the company, where he has been engaged for the last ten years, and has accepted the appointment of professor of electrical engineering in the School of Engineering of Milwaukee. Mr. Ball is a graduate of the University of Illinois and a member of the A. I. E. E.

Robert Knight, assistant superintendent of the electric light and power department of the city of Edmonton, Canada, has resigned and joined the Army Service Corps. Previous to his leaving he was presented by the staff and employees of the department with a wrist watch. He is a native of Scotland, but has had varied experience of electrical engineering in the United States, having one time been employed by the General Electric Company at Lynn, Mass.

D. W. Flowers, who has been appointed superintendent of the electric department of the St. Paul Gas Light Company, operating the Edison Electric Light & Power Company of St. Paul, was born at Columbus, Ohio, and was graduated from the Ohio State University in the class of 1905. He became identified with the American Light & Traction Company of New York at Binghamton, where he reached the position of superintendent, which he held until May, 1909. He was transferred from Binghamton and promoted to the position of general superintendent of the Consolidated Gas Company of New Jersey at Long Branch, operating both the gas and electric properties. In December, 1913, he went to St. Paul as superintendent of the gas works, and he filled that post until his present appointment to succeed F. A. Otto, who has resigned.

Ludwig Kemper, who has been secretary-treasurer and manager of the Minnesota Gas & Electric Company at Albert Lea, Minn., has resigned to become connected with Field-Richards Company of Cincinnati, Ohio, as engineer. During the last two fiscal years Mr. Kemper was president of the Minnesota Electrical Association. He was born in Holland in 1887 and received his engineering education at the University of Delft and later at Karlsruhe. After two years of industrial engineering in Europe he came to the United States and was employed by the Pullman company on car-lighting design. Following a period of consulting engineering Mr. Kemper became in 1903 assistant electrical engineer for the Baltimore & Ohio Railroad, resigning in 1905 to become general manager of the Albert Lea property. His new work in Cincinnati will consist of making investigations and reports on such municipal, public utility and industrial properties as the Field-Richards Company is handling, and also in a general way to supervise the operation of properties in which the firm is interested.



W. C. ANDERSON

William C. Anderson, formerly manager of the Luzerne County Gas & Electric Company, Plymouth, Pa., has been appointed statistical secretary of the National Electric Light Association in charge of the newly created bureau of information and statistics. Mr. Anderson, who was graduated from Lehigh University in 1894, began his electrical engineering career with the East River Gas Company, New York City, with which company he remained in various capacities until the fall of 1895, when he joined the inspection department of the New York Edison Company. The following year he became assistant engineer of construction for the Consolidated Gas Company of New Jersey at Long Branch and a few months later he was appointed district superintendent, continuing in this post until early in 1900. During the next year he was manager of the Gas Company of Montgomery County at Norristown, Pa., and for the two following years was superintendent of the Port Chester district of the Westchester (N. Y.) Lighting Company. He next became engineer at Paris for the foreign sales department of the Stanley Instrument Company. In the fall of 1904 Mr. Anderson was employed as manager of the Bergen County (N. J.) Gas & Electric Company, which position he held until the following August, when the company was taken over by the Public Service Corporation of New Jersey. He then went with the Wyoming Valley Gas & Electric Company, which has since changed its name to the Luzerne County Gas & Electric Company. In 1912 Mr. Anderson was elected treasurer of the Pennsylvania Electric Association.

H. S. Slocum, who has lately been engaged on work on the Laurentide hydroelectric development at Grand' Mère, Province of Quebec, Canada, has entered the engineering department of the Aluminum Company of America as engineer in charge of construction, and will be located at Potsdam, N. Y. Mr. Slocum has had a long experience in the design and construction of hydroelectric plants. For six years he was with the Niagara Falls Power Company, and then went with Viele, Blackwell & Buck, working upon the Great Western and the Appalachian power developments. Terminating his connection with Viele, Blackwell & Buck, he became mechanical engineer for the Cedars Rapids plant of the Cedars Rapids Manufacturng & Power Company, and then was engineer in charge for the Northern New York Power Corporation. From there he went to Grand' Mère.

Oscar T. Crosby, one of the pioneers in the electrical industry and more recently identified with the work of the Commission for Relief in Belgium and with the League to Enforce Peace, has been nominated by President Wilson to be Assistant Secretary of the Treasury for work in connection with the loan to the Allies. Mr. Crosby has recently become a major in the Officers' Reserve Corps, and the government has agreed to release him for duty with the engineers in case of military necessity. His first connection with the electrical industry was early in 1887, when, on the invitation of Frank J. Sprague, he obtained a six months' leave of absence from his post at New Orleans as a military engineer, to become associated with him. Shortly afterward he resigned from the army and joined the Sprague Railway & Motor Company as Mr. Sprague's assistant in time to take an active part in the early development of electric traction. He soon assumed the duties of superintendent of the company and in that capacity was in charge of manufacture and of the installation department. He remained in the service of the Sprague company for two years and a half, and in the course of his professional work executed various researches on the problems involved in electric railway operation. Besides his work for electric traction, Mr. Crosby has been prominently identified with engineering research on many matters. In recent years he was president of the Wilmington (Del.) & Philadelphia Traction Company. Upon the consummation of the sale of his interests in that company in 1913 to the National Properties Company, he left this country for an extended tour of Asia and Africa. Mr. Crosby has written largely of his explorations and investigations and in the field of politico-sociology.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

GOVERNMENT REQUIREMENTS DELAY STATION CONSTRUCTION

Deliveries of Power Plant Machinery as Well as Building Materials Delayed in Some Cases as Much as Six Months

Central-station construction work is being delayed in some cases as much as six months because of contracts placed for government work in different factories. The expediting of these contracts has resulted in placing deliveries further back. As a result of government work a considerable part of the boiler output of the country has been put back from six to eight weeks. Other central-station equipment, such as generators, turbines, etc., is also greatly delayed in delivery.

While the actual government work so far is small, and does not amount to much when compared with the year's output, it is work that takes precedence of everything else, and for that reason holds up all work on commercial contracts.

Everything needing iron or steel in its construction is bound to be delayed. The steel mills have been busy on government work, and consequently have been forced to close down on regular customers until the government work shall not absorb so much of their attention. Beams and structural shapes are late in delivery, and will naturally delay construction. Iron conduit is becoming scarcer, principally because the demand for other material of greater tonnages is so pressing. Conduits are fabricated now but once in a while, when it is economically well to do so in view of other orders. Jobbers' stocks of iron conduit, it is understood, are about normal. With the spring construction work about to begin, and with deliveries so long delayed, it is believed that these stocks will not be adequate.

Inquiries have been made of the government regarding the classification of central-station orders for new equipment when these stations have on their lines factories engaged in turning out work for the government. No reply has been received to these inquiries as yet.

WAR DECLARATION HELPS THE SALE OF FLAG SIGNS

Larger Sizes of These Structures in Good Demand—Smaller Sizes Being Made Up in Large Quantities—Caution Is Urged in Campaigning

The sale of lighting equipment that can be used to give expression to patriotic feeling has received a marked stimulus as the result of the declaration that a state of war exists. The electric-flag signs which were brought out by several firms and were extensively campaigned during the earlier international crises are now moving with great rapidity without any particular effort on the part of the sign manufacturers to exploit this class of goods. There is reported from Cleveland a particularly heavy demand for the larger sizes of flags, the 10-ft., 12-ft., 16-ft. and 20-ft. sizes being exceedingly popular. One Chicago sign manufacturer said that he had sold fifty flag signs in the last three weeks, which is more than he had sold in the four months preceding that period.

The greatest buyers are industrial plants, municipalities and certain banks which wish to demonstrate their patriotism. One steel company employing foreign laborers recently ordered ten large-sized, double-faced flags, requesting prompt delivery, but asking no questions about price. These flags were delivered in four days, and it is said that almost equally prompt deliveries can be given on any of the standard flag signs. Flags of the smaller sizes are being made up in quantities by some of the manufacturers in anticipation of a growing demand for the 4-ft. and 6-ft. sizes.

The price of steel entering into the signs is still high, but it is much easier to get it now than it has been in the past. An interesting sidelight on the price situation in steel is that the businesses of most of the small, unreliable and more or less ignorant sign makers have been wrecked by the increase. These sign makers took business at figures based on normal steel prices when marked advances were being made every day. The result, of course, was not only that profits disappeared but that insufficient surplus and other assets were wiped out by losses occasioned from business taken at low figures. This has stabilized the sign market and left business in the hands of the more reliable and intelligent manufacturers.

Men who have a broad view of the present situation see a particularly opportune moment just now for central stations to advocate the electric display of the colors. An intelligently handled campaign along these lines could do much to mark the local company as a patriotic enterprise; it could also be of real value to the community and to the nation in spreading the fervor necessary if a volunteer army is to be raised. It is realized, however, that in any such campaign caution should be exercised to avoid creating the impression that the electrical industry, or any individual in it, is exploiting the national emblem from a purely commercial motive.

THE INSULATOR SITUATION NECESSITATES FORESIGHT

Factories Are Swamped with Orders and Deliv- Smaller Sizes Being Made Up in Large Quanti- Prices Are Becoming More Stable

The sale of lighting equipment that can be used to give insulators to let the manufacturers know just what their requirements are and what they are expected to be a year or eighteen months hence, in order to enable the manufacturers to schedule production and deliveries in such a manner as best to serve the needs of the entire industry. The need for this course is especially acute at the present time, because the factories have seldom, if ever in their history, been harder pushed to meet demands than they now are. While there have in the past been troubles with labor employed in the pottery production and difficulty in getting metals, the ruling cause for the present congested factory condition is one of an unusual demand for insulators from every section of the country.

The situation is perhaps best illustrated by the present method of handling insulator orders. On inquiries even for small lots the prevailing price on that particular style can be quoted, but no definite statements on delivery dates will be made by salesmen without taking the case up with the factory. Furthermore, the factories have practically abolished or greatly curtailed their follow-up systems and are making little effort to get business if response does not follow when prices and deliveries are quoted. The impression should not prevail, however, that factories have taken an arrogant stand. They have not. This is shown by a recent incident. A central-station company had to have 700 insulators of a particular type. After determining that it was absolutely necessary for the customer to have these insulators promptly, the manufacturer went over all of its orders for this type that were on file and wrote each customer asking if a delay in delivery of 700 insulators would cause inconvenience. As a result one large company

released enough insulators from its order to meet the immediate need.

The necessity of salesmen consulting with the factory concerning orders is illustrated by the following incident. A holding company wanted 3000 insulators of the small telephone type. Ordinarily these go through the factory in such great quantities that 3000 is a very small order to fill. The factory's reply to the inquiry, however, was that there were none on hand and that delivery before ninety days could not be promised. The reason for this long delay was that the machine for making this unit was shut down and conditions were such that it could not be started within sixty days.

The price of insulators has advanced sharply in the last few months, as was predicted in the ELECTRICAL WORLD of Nov. 11, 1916. Suspension units that formerly sold for 80 cents now bring $1.30. The present tendency, however, seems to be for a stable price. There is thought to be little likelihood of the insulator plants being commandeered by the government on account of their inadaptability as munition factories. The situation as regards demand for insulators is so acute, however, and its continuance is so likely, that buyers are strongly urged by producers to purchase at least a year in advance of actual need.

THE APPLIANCE MARKET ON THE PACIFIC COAST

Particularly Good Season Expected in All Lines, with Great Progress Being Made in Sales of Electric Ranges

Electric appliance campaigns, both sales and educational, have been under way on the Pacific Coast long enough to have built up a very active market for such devices. Particularly in a territory where the percentage of houses wired is greater than in any other part of the country, every appliance sold interests new prospective customers and paves the way for more sales.

One jobbing house last year sold from its several Pacific Coast branch offices a total of 650 motor-driven washing machines. With only slightly increased sales effort it is expected that this figure will be at least doubled this year. Much the same condition obtains in the electric range field. It is believed that 2000 electric ranges will be purchased this year by California consumers newly converted to the electric cooking idea. Sales of smaller appliances are advancing steadily, and an increasing percentage of energy is being used for this load. In short, a particularly good season is anticipated all along the coast this year in all electrical appliance lines.

It is notable that some central stations are carefully selecting the appliances which they will feature to the exclusion of others. For example, one company makes no special effort to sell electric washing machines, but concentrates rather on ranges, toasters, percolators and other appliances that are in daily use. If the consumer has a limited amount of money which he can spend for socket appliances, the greatest proportional profit will accrue to the company and the load curve will be affected most favorably if this investment is made in devices which are in daily use rather than those which are in service only once a week or at irregular intervals, as are electric washers, vacuum cleaners, hair dryers, etc.

The progress that has been made in Los Angeles territory is notable because in this field gas at a very low figure is in competition with the electric service. The sale of electric ranges this year in southern California is expected more than to equal the total number sold in all other parts of the State combined, including San Francisco.

This success is in marked contrast to conditions in central California, where the largest central station company cannot feature electrical appliances without detriment to the gas business which it also conducts. Actual sales effort on electric ranges is therefore limited to territory into which the company's gas service does not extend. San Francisco is consequently somewhat behind other coast centers in progress toward the electric kitchen.

In the Northwest, in spite of the handicap of colder weather, excellent progress has been made in placing electric ranges. In Seattle the cooking rate of 2 cents per kilowatt-hour helps future prospects. Another condition there which improves the market is the quantity of hot plates that have been sold. The lighting company in Seattle now has about 700 of these on its lines and has found that these appliances are frequently the forerunners of the electric range. The hot plate creates a demand for something on which all instead of portions of the family's meals can be prepared.

With the progressive attitude which is to be expected in a section developing as the coast now is, and with the impetus which has already been given to the electrical merchandising plan, it is believed in that field that previous sales records will be greatly surpassed year by year for some time to come.

COLLECTIONS UNSTEADY UNDER WAR CONDITIONS

Reports from Various Sections Are to the Effect That Accounts Are Now Being Settled with Less Freedom Than Was the Case Earlier in the Year

Reports from many different sections of the country, though by no means general, show an unsteady condition of collections. During the first two months of the year collections in the electrical industry were probably never larger. Since the United States has become involved in a war with Germany, however, accounts are being settled with less freedom. Buyers are apparently feeling their way and are increasing their liquid assets.

WEAKNESS CONTINUES IN THE COPPER MARKET

Buyers and Sellers Alike Await Government Decision Regarding War Contracts Before Deciding on Their Course of Action

Market quotations show still further decreases in both prompt and future deliveries. This, however, is due fully to the stagnant condition that now prevails. There has been very little copper offered for sale, and there has been but little demand for copper. What market there has been has been largely in nearby copper. Both buyers and sellers are waiting for developments.

What will the government do? Will Europe buy through the United States government in order to obtain the low price of 16 2/3 cents per pound? Will shops working on government contracts buy at the low price of 16 2/3 cents? When these questions are answered the market, it is felt, will become much more active.

April copper was quoted nominally on Tuesday last at 31.75 cents, May at 30.75 cents, June at 29.75 cents, third quarter at 28.50 cents, and fourth quarter at 27.50 cents.

NEW YORK METAL MARKET PRICES

	April 10 Selling Prices Bid	Asked	April 17 Selling Prices Bid	Asked
Copper:	£ s d		£ s d	
London, standard spot	136 0 0		135 0 0	
Prime Lake	33.50	to 34.00†	32.00	to 32.50†
Electrolytic	33.25	to 33.75†	31.50	to 32.00†
Casting	30.75	to 31.00†	29.00	to 29.50†
Copper wire base	39.00	to 41.00†	38.00	to 38.50†
Lead	9.00		9.00	
Nickel	50.00		50.00	
Sheet zinc, f.o.b. smelter	21.00		21.00	
Spelter, spot	9.92½	to 10.17½	9.55	to 9.80
Tin, straits	54.70		55.37½†	
Aluminum, 98 to 99 per cent.	55.00	to 57.00	56.00	to 58.00

OLD METALS

Heavy copper and wire	27.50	to 28.50	27.50	to 28.00
Brass, heavy	16.50	to 17.00	16.50	to 17.00
Brass, light	12.50	to 13.00	12.50	to 13.00
Lead, heavy	7.50	to 7.75	7.50	to 7.75
Zinc, scrap	7.50	to 7.75	7.50	to 7.75

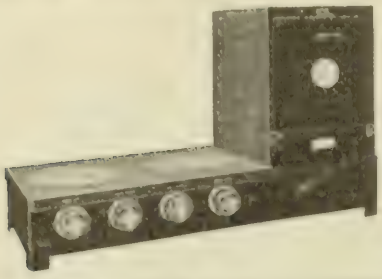
†Nominal.

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Kitchenette Range

Ranges for apartments of one, two and three rooms have been developed by the Hughes Electric Heating Company, Chicago. They have the same features incorporated in the other

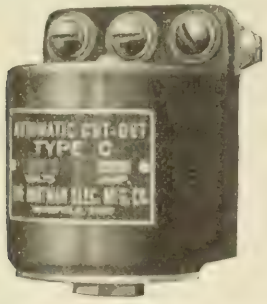


ELECTRIC RANGE FOR SMALL APARTMENTS

ranges made by this company. The surface burners require 660 watts each or may be rated for 550 and 1100 watts if desired. The oven burners are rated for 660 watts each. The cooking surface is 15 in. by 21 in. (38.1 cm. by 53.3 cm.) and the oven dimensions 10 in. by 10 in. by 12 in. (25.4 cm. by 25.4 cm. by 30.5 cm.).

Automatic Cut-Out

Automatic cut-outs intended for the protection of batteries used in connection with isolated lighting-plant systems and also for lighting, ignition and storage batteries while being charged in garages and service stations have been developed by the Hartman Electrical Manufacturing Company of Mansfield, Ohio. The cut-out shown herewith has a carrying capacity of 50 amp. and is adapted to 32, 65 or 110 volts, which



CUT-OUT FOR BATTERY CHARGING

are the standard voltages used on isolated lighting-plant systems.

The cut-out is made with two separate windings—a fine wire or shunt coil, which is connected across the generator and which closes the circuit as soon as the generator voltage rises to a predetermined point, and a series coil which comes into action as soon as the charging circuit is closed. The latter assists the shunt coil in holding the contact in the closed position. The moving contact is in the form of a cupped and slotted disk. It is directly connected to the solenoid core so that the full pull of the core is directly exerted on the contact. The contact is opened by gravity.

Elevator for Installing Motors Overhead

Installing from four to six motors in the time usually required for one, using ordinary methods, is the performance claimed by the New York Revolving Portable Elevator Company, Jersey



RAISING 35-HP. MOTOR INTO PLACE

City, N. J., for its "Revolvator." The device elevates and holds the motor in place until it is attached to the ceiling. The machine can also be used for inspecting the motors, taking them down for repairs, repairing pulleys, and for putting up shafting. As seen in the accompanying illustration, this machine consists essentially of two uprights or elevator guides, an elevating platform, and a revolving base which can swing around on its ball-bearing center like a turntable. Two sets of gears are provided, one for high speed and one for low. Loads up to 800 lb. (363 kg.) can be raised with the high gear and heavier loads by the low gear. The machines are built from 6 ft. to 20 ft. (1.8 m. to 6.1 m.) in height. All machines 7 ft. (2.1 m.) and larger have the frame hinged so that the top section may be folded over.

Conduit Hickey

In the accompanying illustration is shown a conduit hickey which, it is claimed, grips the conduit and will not slip. With this hickey conduit can be bent in awkward positions without denting it. Attention is called to the "non-



NON-SLIP CONDUIT HICKEY

slip" notches, the reinforced jaws and the convenient size. The end is threaded to take a 1-in. (2.54 cm.) pipe coupling. Any scrap length of 1 in. (2.54 cm.) pipe can be screwed thereon for a handle. This device is made by M. B. Austin & Company, Chicago.

Lighting Unit

A crystal glass unit for large type C lamps which, it is said, is both "nonglaring" and highly efficient has been added to the line of lighting units developed by the Holophane Glass Company, Inc., New York City. The glass is in two parts—the upper being a prismatic reflector that reflects the up-



REFLECTOR-REFRACTOR FOR TYPE C LAMPS

ward light of the lamp in a downward direction similar to the regular Holophane prismatic reflectors. The lower section consists of concentric prisms that serve the double purpose of shielding the lamp filament from the eye and also redirecting the light at an angle of about 45 deg. To decrease the glare

and to improve the appearance of the unit, the inner surface is provided with a special velvet finish. The two parts are securely held together by small nickel-finished clamps that engage with the horizontal prisms. A spun-brass hood with a porcelain mogul socket is furnished.

Vacuum Cleaner

The Pittsburgh Electric Specialties Company of Pittsburgh, Pa., has developed an electric vacuum cleaner with an improved dust bag and with its conductor cord embedded in the handle. A Cutler-Hammer switch is mounted on the handle within easy reach of the operator's thumb. A 14-in. (35.5 cm.) nozzle is used and the cleaner is driven by a universal motor.

Electric Linotype Pot

An electric linotype pot of the immersion type has been developed recently by the Cutler-Hammer Manufacturing Company of Milwaukee, Wis. Instead of being applied to the outside of the crucible, the heat is transmitted by means of an immersion element. The pot delivers the molten metal to the casting point at the temperature registered in the crucible, which, it is claimed, insures a perfect moldng of each character and slugs that are solid and close-grained.

The heating units are made in sections, inclosed in cases of special-grade steel. Two sides and all the edges of the cases are autogenously welded, making the structure liquid tight. The sets of heating units are immersed in the metal in the crucible. The entire surface of the pot throat and mouthpiece over which the molten metal flows is heated by units on the upper and under sides. Automatic temperature control is secured by the joint action of a dynamic thermometer and a magnetic switch panel.

While the machine is in operation the current input is 600 watts. Since these machines operate from eight to twelve hours per day, a steady non-fluctuating load is the result. In many newspaper publishers' plants this load is between midnight and morning.

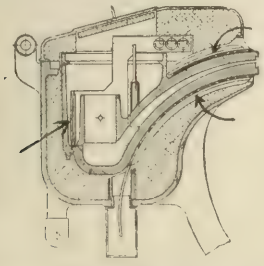


DIAGRAM OF ELECTRICALLY HEATED LINOTYPE POT

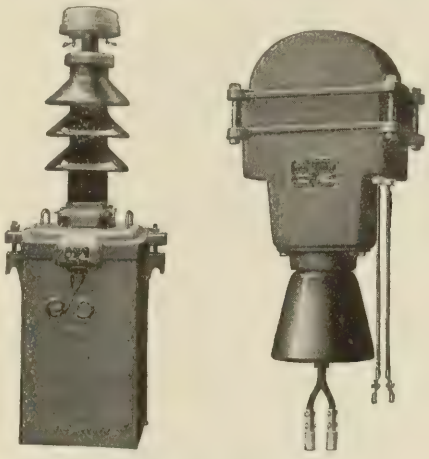
When the metal is cold the input is about 1600 watts for about fifty minutes. Therefore it can be seen that a considerable yearly revenue can be obtained by central stations even where only a few of these electric pots are in service—as few as twenty furnishing a yearly load of over 50,000 kw.-hr.

Snap Switch

The Chelton Electric Company of Philadelphia has developed a quick make-and-break snap switch, in which all wearing parts are of case-hardened steel. The current-carrying parts are of brass and phosphor bronze. The porcelain portion is light in weight and strong mechanically. The switch is furnished with either a round button or a winged button. These switches are made in single-pole, double-pole, and three-way types, with indicating or non-indicating attachments. The switches are rated at 3 amp., 250 volts, and 5 amp., 125 volts.

Outdoor Current Transformers

The Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., has recently developed a complete line of outdoor current transformers for voltages up to and including 70,000 volts. These transformers are of two



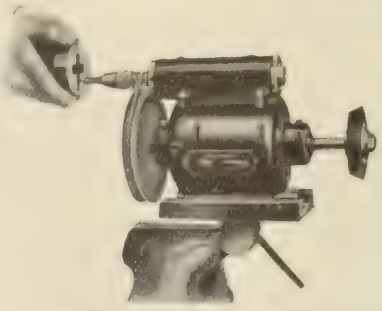
OIL AND DRY INSULATED TYPES OF TRANSFORMERS

general types—dry and oil-insulated. The dry-type transformers are for use on circuits up to 24,000 volts. For higher-voltage circuits the oil-insulated transformer is used. Both types are designed for 25 to 133 cycles, are rated at 50 volt-amp. and are compensated for 25 volt-amp. The dry-type transformers are furnished in three styles—one for voltages up to 8000, the second for 17,000 volts, and a third type for pressures up to 24,000 volts. The oil-insulated transformers are also furnished in three types—one for maximum voltages of 35,000, a second for 47,000 volts and a third type for pressures up to 70,000 volts. The primary current rating of the dry-type transformers varies from 5 amp. to 500 amp., and that of the oil-insulated transformers from 5-10 amp. to 200-400 amp. All give a secondary current of 5 amp.

The dry-type transformers are mounted in cast-iron end caps with the leads extending downward through suitable bushings and are impregnated with an insulating compound which thoroughly seals the joints between the laminations and the end caps. Wrought-iron hangers are provided which are shaped to engage standard cross-arms and punched to receive lag screws. All coils used in these units are vacuum-treated and impregnated with an insulating compound, giving a high factor of safety.

Electric Grinder

Portable electric grinders in which the motor spindle operates at a speed of 10,000 r.p.m. and the internal attachment at 30,000 r.p.m. are being offered



PORTABLE ELECTRIC GRINDER

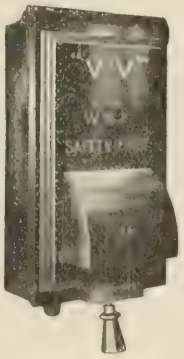
to the trade by the Wisconsin Electric Company of Racine, Wis. These grinders are dynamically balanced, insuring accurate work, free from chatter marks, it is said. One of the grinders is shown in the accompanying illustration.

Switch Plates

Porcelain-enamel switch plates which, it is claimed, are non-corrosive, durable and sanitary and require no labor for polishing are offered to the trade by the Chattanooga Stamping & Enameling Company of Chattanooga, Tenn. "Armco" iron is used as the base. These switch plates are furnished in various colors and in one to five gage sizes.

Safety Switch

Simplicity in construction, operation and protection are the features claimed for the weatherproof safety switch that has been produced recently by the V. V.



WEATHERPROOF SAFETY SWITCH

Fittings Company of Philadelphia. The switch operates with a straight pull, insuring a positive make and break, and can be locked in an open position to prevent tampering or accidental closing. The lid has an adjustable support for holding it in the open position while making connections and fusing.

Trade Notes

HARVEY HUBBELL, INC., Bridgeport, Conn., has now leased the last number of the Hubbell buildings used for general purposes.

THE AMERICAN CONDUIT MANUFACTURING COMPANY announces that L. E. Montgomery has retired the sales organization and will be stationed in New York.

THE KOLOMO OSCILLATING FAN COMPANY has changed its name to American Electric Fan Company. The factory of the company has been moved from Kokomo, Ind., to Logansport, Ind.

J. D. VAIL, former manager of the Salt Lake City office of the H. W. Johns-Manville Company, has been appointed manager of the roofing materials department of that company's branch at Chicago. In the future the Salt Lake City office will be under the management of C. F. Cate. The Great Falls (Mont.) office will be managed independently of Salt Lake City by J. H. Bee.

INFORMATION ON SMALL SEARCHLIGHTS WANTED.—The ELECTRICAL WORLD has received the following communication from Headquarters Southern Department, Department Aviation Officer, Fort Sam Houston, Tex.: "It is requested that your advertisers who manufacture small electric searchlights be informed that this office desires information concerning lights that might be suitable for use on an airplane during night flights."

THE RUSSO-AMERICAN MERCHANTS & MANUFACTURERS' EXCHANGE, INC., has recently been established for the purpose of bringing about a new state of conditions in regard to the American supply and the Russian demand for American-made products through a campaign among the Russian consumers, one of the features of which will be a directory of American industries intended to include all American manufacturers in any given branch of industry. This will be distributed throughout Russia, it is stated, to the number of 40,000 copies.

THE CROCKER-WHEELER COMPANY of Ampere, N. J., made record earnings for the first quarter of 1917. The dividends on both classes of stock have been earned for the year and a substantial amount added to the surplus, which is now near the million mark. The preferred stock pays 7 per cent and the common 8 per cent regularly. The company has just paid an extra dividend of 1 per cent on the common stock. At the present rate the profits, after paying dividends on the preferred stock, would represent $44.17 per share for the year. This company has been constantly and quietly increasing its equipment.

New Incorporations

J. F. HANDSHUH & COMPANY, of Philadelphia, Pa., have been incorporated with a capital stock of $10,000 to manufacture electrical devices. Charles Handshuh is president.

THE SOUTHERN OHIO POWER COMPANY of Greenfield, Ohio, has been incorporated with a capital stock of $10,000 by L. J. Cole, Walter A. Gray, J. S. S. Riley, W. E. Cole and Charles H. Uhl.

THE ELECTRIC CONTROLLER & MANUFACTURING COMPANY of Cleveland, Ohio, has been incorporated with a capital stock of $1,000 by R. C. Hyatt, M. N. Poe, Ralph Burroughs, W. T. Kinder and J. P. Prach.

THE DONNA (TEX.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $5,000 to supply electricity in Donna. The incorporators are: A. F. Brooks, Sr., J. B. Roberts, T. J. Hooks, H. C. Davis, and others.

THE INTERNATIONAL SPARK PLUG COMPANY of Indianapolis, Ind., has been chartered with a capital stock of $10,000 by Eugene Blackburn, Robert A. Blackburn and Elbert N. Copple. The company proposes to manufacture spark plugs.

THE PEERLESS WELDING COMPANY of New York, N. Y., has been incorporated with a capital stock of $5,000 by Leo Cohen, Morrell Cohen and Walter Williams. The company proposes to do a business of welding by an electrical process.

THE BILLWOOD ELECTRICAL CONTRACTING COMPANY of Brooklyn, N. Y., has been incorporated by Lloyd F. Duffy, Lyal Hesmer and Jesse J. Healy. The company is capitalized at $5,000 and proposes to do a general contracting and electrical business.

THE RYE (PA.) ELECTRIC COMPANY has been chartered with a capital stock of $5,000 to furnish electrical service in the township of Rye. The incorporators are A. J. Musser, M. S. Mitchell and P. T. Davis. The office of the company will be located in Bellefonte, Pa.

THE CONSUMERS ELECTRICIAN COMPANY of Carroll, Iowa, has been incorporated by F. C. Ross, Charles C. Hotchkiss of Carroll, and C. H. Utter of Grinnell, Iowa. The company is capitalized at $50,000 and proposes to do a general business as electricians, contractors, etc.

THE SAFETY ENGINEERING COMPANY of New York, N. Y., has been incorporated by James T. Wallace, S. Byron Fields and Benjamin F. Hamilton. The company is capitalized at $5,000 and proposes to manufacture and deal in electrical and mechanical appliances.

THE CAWLEY GLARE CONTROL COMPANY of Buffalo, N. Y., has been chartered with a capital stock of $100,000 to manufacture a device for controlling glare of light applied to autos. The incorporators are: William J. Reddington, William L. Hock and Ray E. Kirby.

THE ELECTRIC LAMP & PRODUCTS COMPANY, 513 Paterson Plank Road, Jersey City, N. J., has been chartered by A. W. Briton, H. B. Davis and S. B. Howard. The company is capitalized at $40,000 and proposes to manufacture lamps and kindred products. W. Kauffmann is local representative.

THE NEBRASKA ELECTRIC COMPANY of Cedar Rapids, Iowa, has been incorporated with a capital stock of $20,000 to construct and operate electric-light and power plants. The officers are: C. L. Van Valkenburg, president; Richard Lord, vice-president, and M. M. Thompson, secretary and treasurer.

THE MANCHESTER WATER POWER & MANUFACTURING COMPANY of Wilmington, Del., has been incorporated with a capital stock of $100,000 to operate plants for the distribution of water and electricity. The incorporators are: S. S. Adams, Jr., John G. Gray and M. B. F. Hawkins, all of Wilmington, Del.

CUTTING & WASHINGTON of New York, N. Y., have filed articles of incorporation with a capital stock of $200,000 to manufacture machinery, devices, wireless instruments, etc. The incorporators are: R. C. Cutting, R. B. Cutting, 32 Nassau Street, and F. Cutting, 26 Portland Street, Cambridge, Mass.

THE WATTS (PA.) TOWNSHIP ELECTRIC COMPANY has been incorporated by A. J. Musser, M. S. Mitchell and P. T. Davis, of Clearfield. The company is capitalized at $5,000 and proposes to supply electrical service in the township of Watts. The office of the company will be located at Bellefonte, Pa.

THE EUREKA ELECTRIC INDICATOR COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $100,000 to manufacture electrical signals and devices. The incorporators are: Isadore Martin of Philadelphia, Pa., and Edward E. Brent of Lawnside, N. J.

THE BRUSHLITE COMPANY of New York, N. Y., has been incorporated by H. A. Fluckinger, F. M. Van Wagonen and P. S. Hill, 27 Pine Street, New York, N. Y. The company is capitalized at $10,000 and proposes to manufacture and deal in motors, dynamos, machinery, electrical and mechanical devices.

THE BELL AUTOMOBILE CORPORATION of New York, N. Y., has been chartered with a capital stock of $500,000 to deal in automobiles and to do a general electrical and mechanical engineering business. The incorporators are: J. Bell, P. J. M. Sullivan and T. Tileston, 19 Liberty Street, New York, N. Y.

HATZEL & BUEHLER of New York, N. Y., has filed articles of incorporation with a capital stock of $50,000 to do a general contracting and electrical work. The incorporators are: J. C. Hatzel, 89 West 119th Street; H. J. Kurrus, 664 West 179th Street, and C. Metzger, 104 East 177th Street, New York, N. Y.

THE BARE WIRE COMPANY of New York, N. Y., has been incorporated with a capital stock of $500,000 to manufacture wire and cables, insulated and waterproof wire, etc. The incorporators are: J. W. Murphy, 189 Eighth Avenue; A. E. Fortmer, 53 Westminster Road; C. V. Burke, 734 Franklin Avenue, Brooklyn, N. Y.

THE EUREKA PNEUMATIC SPRAY COMPANY of New York, N. Y., has been incorporated by W. J. Smart, A. W. Smart and A. G. Kunz, 67 Ninth Avenue, New York, N. Y. The company is capitalized at $50,000, and proposes to manufacture and deal in automatic and pneumatic sprays, electrical machinery, signals, equipment, etc.

THE CONSTRUCTIVE UTILITY CORPORATION of New York, N. Y., has been chartered with a capital stock of $25,000 to do a general construction, contracting business, electrical work, etc. The incorporators are: P. Hirsch, 211 West Seventy-ninth Street; T. F. McMahon and R. C. Elliott, 1400 Broadway, New York City.

THE PENN (PA.) TOWNSHIP ELECTRIC SERVICE COMPANY has filed articles of incorporation with a capital stock of $5,000 for the purpose of supplying electricity in the township of Penn. The incorporators are: A. J. Musser, M. S. Mitchell and P. T. Davis, of Clearfield. The offices of the company will be located at Bellefonte, Pa.

THE INVINCIBLE VACUUM CLEANER MANUFACTURING COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $600,000 to manufacture and sell vacuum cleaners and electrical appliances of all kinds. The incorporators are: Herbert E. Latter, Carl Rimlinger and Clement M. Egner, local Wilmington (Del.) incorporators.

THE UTILITIES CONSTRUCTION COMPANY of Lorain, Ohio, has been incorporated with a capital stock of $25,000 by the officials of the Lorain County Electric Company for the purpose of taking charge of the construction of the new central power plant, to be erected on a site recently purchased on Second Street, Lorain, to cost about $1,000,000. The incorporators are: J. B. Johnson, R. E. Cuthbertson, G. R. Walsh, B. M. Baxter and F. M. Stevens, all of Elyria.

Trade Publications

TOOLS.—M. B. Austin & Company of Chicago, are distributing sheets No. 56A and No. 62, descriptive of their conduit tools.

LINE MATERIAL.—W. N. Matthews & Brother of St. Louis have prepared an illustrated folder descriptive of their "Teleheight" instrument.

FANS.—Marelli Fans for 1917 are described and illustrated in a folder now being distributed by H. Boker & Company, Inc., 101 Duane Street, New York City.

FUSWITCH.—W. N. Matthews & Brother of St. Louis are mailing to their customers an illustrated folder descriptive of the type BF Matthews "Fuswitch."

WIRE.—The Page Woven Wire Fence Company, Monessen, Pa., has sent out a very attractive notebook containing useful tables on Aristos "Copperweld" copper-clad steel wire.

ELECTRICAL SPECIALTIES.—The Anderson Electric Specialty Company of Chicago, Ill., has issued list No. 100, descriptive of its Anderson patent "reel-feature" electric lighting and automobile specialties.

AUTOMATIC CUT-OUTS.—Automatic cut-outs for battery-charging panels are illustrated and described in bulletin No. 17, now being distributed by the Hartman Electrical Manufacturing Company of Mansfield, Ohio.

LIGHTING.—"Show-Window Lighting" is the title of bulletin 28, just issued by the engineering department of the National Lamp Works of the General Electric Company, Cleveland, Ohio. This bulletin presents in a general way the essentials of good show-window lighting, emphasizing especially the possibilities of light direction and color.

A BOOKLET FOR ELECTRIC RANGE BUYERS.—The Hughes Electric Heating Company of Chicago has issued a booklet entitled "Care and Operation of a Hughes Electric Range." This fourteen-page leaflet is in reality a book of instructions for the careful, conscientious housewife. It has not only been written by several Hughes range specialists but has been edited, corrected and approved by more than fifty electric range demonstrators and domestic science experts of electric power companies from coast to coast. A particularly effective arrangement of the illustrations and letterpress has been obtained by presenting at the top of each page a picture of the demonstrator performing the operation described in the text.

New England States

BRATTLEBORO, VT.—The Twin State Gas & Electric Company has submitted a proposal to the Village Council offering to install 40 ornamental standards mounted with lamps of 400 cp. to replace the arches of incandescent lamps now in use on Main Street at $2,140 per year for a period of 10 years.

CHICOPEE, MASS.—Bids will be received at the office of the Electric Light Department, Front Street, Chicopee, until April 27 for the erection of a garage, storehouse and concrete culvert. Plans and specifications may be obtained at the above office upon deposit of $25.

LITTLETON, MASS.—The contract for the construction of the electric-lighting extensions in the town of Littleton has been awarded to Arthur M. Kittredge of Leominster.

EAST HAMPTON, CONN.—The East Haddam Electric Light Company and the Colchester Electric Light Company have been consolidated under the name of the Central Connecticut Power & Light Company, with headquarters at East Hampton.

Middle Atlantic States

BROOKLYN, N. Y.—Bids will be received by Robert Adamson, fire commissioner, eleventh floor, Municipal Building, New York City, until April 24 for installing one eight-section, 80-cell storage battery for the tractor of engine No. 217, borough of Brooklyn. Blanks and further information may be obtained at the above office.

BROOKLYN, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, Park Avenue and Fifty-ninth Street, New York City, until April 30 for alterations, fire protection, sanitary, heating, electric work, etc., duplicate school plan, at Public School 66, Osborn and Watkins Streets, near Sutter Avenue, and Public School 109, Dumont Avenue, Powell and Sackman Streets, borough of Brooklyn. Blank forms, plans and specifications may be seen or obtained at the above office and also at branch office, 131 Livingston Street, Brooklyn.

COURTENAY, N. Y.—Bids will be received by the Board of Trustees at Courtenay until April 30 for furnishing material for transmission lines for electric-lighting system. For details see proposal columns.

NEW YORK, N. Y.—Bids will be received by the Medical Supply Depot, United States Army, 543 Greenwich Street, New York, N. Y., until April 26 for hospital supplies including X-ray apparatus. Further information on application.

NEW YORK, N. Y.—Bids will be received by the Department of Public Charities at the office of the central purchase committee, Room 1220, Municipal Building, New York City, until April 26 for furnishing electric fans. Blank forms and further information may be obtained at the above office.

OLEAN, N. Y.—Bids will be received at the office of the Supervising architect, Treasury Department, Washington, D. C., until May 18 for a new heating boiler in the United States post office at Olean. For details see proposal columns.

JERSEY CITY, N. J.—The Public Service Electric Company has purchased a site, 202 ft. by 830 ft., on Halsey Street, adjoining its Marion power station. Extensions, it is reported, are contemplated by the company.

NEWARK, N. J.—The Board of Public Utility Commissioners has granted the Public Service Company permission to issue $2,000,000 in capital stock for extensions and improvements.

NEWARK, N. J.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 15 for installation of electrically-driven pumps, etc., in the United States custom house and post office at Newark, N. J. For details see proposal columns.

NEWARK, N. J.—Bids will be received by the Common Council until May 1 for electrical work and equipment in the Center Market Building as well as other work for extensions and improvements. H. J. and J. V. King, Union Building, Clinton Street, are architects. A. Archibald is city clerk.

NEWARK, N. J.—Bids will be received at the office of the board of education, City Hall, Newark, until April 23 for construction and completion of the addition to the East Side Commercial and Manual Training High School, including electrical work and lighting fixtures, heating and ventilating, and plumbing. Proposal blanks, specifications, etc., may be obtained at the construction department, fourth floor, City Hall. R. D. Argue is secretary of board.

NEWARK, N. J.—Bids will be received by the board of education of the Essex County vocational schools, 31 Clinton Street, Newark, until April 26 for electrical equipment as follows: Meters and instruments, motor-generator set, slate switchboard, storage battery, and small tools and supplies for electrical shop; also for three engine lathes, one planer, one automatic screw machine, one power hack saw, and supplies for machine and carpenter shop. Wesley A. O'Leary is director.

NEW BRUNSWICK, N. J.—The Public Service Electric Company has awarded the contract for construction of an engine and compressor house at its New Brunswick plant, to cost about $10,000, to the J. H. Morris Company of Trenton.

PATERSON, N. J.—The Little Falls Borough Council is negotiating with the Board of Freeholders for the installation of new street lamps.

PERTH AMBOY, N. J.—The State and Washington Street Taxpayers' Association has petitioned the Board of Aldermen for the installation of an ornamental street-lighting system on Washington Street, from Water to New Brunswick Avenue.

TRENTON, N. J.—The Board of Public Utility Commissioners has authorized the Electric Company of New Jersey to execute a mortgage for $5,000 000, and to issue $319,000 in bonds, the proceeds to be used for extensions.

TRENTON, N. J.—The contract for the installation of underground conduits and high-tension cables for the lighting of Mahlon Park has been awarded to the Carr & Schultz Electric Company. About 35 standards and 1¼ miles of cable will be used.

CHESTER, PA.—A new power plant, 60 ft. by 80 ft., will be erected at the new factory of the McCausland Engineering Company, Fifth and Penn Streets, Chester, Pa.

FORT MIFFLIN, PA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until May 7 for construction of three magazines and one shell house and also one office building, complete with plumbing, lighting and hot-water heating systems at the naval ammunition depot at Fort Mifflin. Drawings and specifications (No. 2338) can be obtained on application to the above bureau or to the commandant of the navy yard named.

HARRISBURG, PA.—The Harrisburg Light & Power Company has called a meeting of its stockholders on June 4 to authorize an issue of $250,000 in capital stock, the proceeds to be used for new equipment for power station.

JOHNSTOWN, PA.—Negotiations are under way between the City Council and the Citizens' Light, Heat & Power Company for the installation of an ornamental lighting system in the business district.

PHILADELPHIA, PA.—Work will begin at once on the construction of a one and two-story steel fabricating shop, 40 ft. by 112 ft., by S. G. Matthews & Company, engineers and contractors for structural steel and ornamental iron work, 916-932 North Ninth Street, Philadelphia. Orders, it is understood, have not yet been placed for air compressors, chain hoists, pneumatic riveters, etc. All machinery will be motor-driven. Electricity will be supplied by the Philadelphia Electric Company.

READING, PA.—The Metropolitan Electric Company has signed a contract to supply electricity to operate the French Creek Iron Mine of the E. & G. Brooks Iron Company.

WERNERSVILLE, PA.—The Berkshire Electric Company has applied to the Public Service Commission for authority to issue $45,000 in bonds for extensions and improvements to its system.

CHARLESTON, W. VA.—The construction of an electric railway to connect Charleston and Parkersburg is said to be one of the projects of the Monongahela Valley Traction Company of Fairmont, which recently took over the control of the Kanawha Traction & Electric Company of Parkersburg.

FAIRMONT, W. VA.—The Monongahela Valley Traction Company is reported to be contemplating the construction of another generating plant to develop 50,000 kw. Coal supply will be secured from its Baxter mines.

FAIRMONT, W. VA.—The eventual construction of an electric interurban railway to connect Parkersburg, W. Va., and Marietta, Ohio, has been announced by the Monongahela Valley Traction Company. The route of the proposed railway is via New Martinsville and the Ohio River. The Mannington line will be extended to New Martinsville, a distance of 20 miles. The Parkersburg-Marietta system will be connected by constructing a new line about 30 miles long.

KAY MOOR, W. VA.—The Low Moor Iron Company of Virginia of Kay Moor, W. Va., is reported to be in the market for the following machinery: One 150-kw 3300 or 3400-volt, three-phase, 25-cycle generator; one 200 hp. three-phase, 25-cycle, 3300 or 440-volt motor; one 35-hp., three-phase, 25-cycle, 440 or 3300-volt motor; one 125-hp., three-phase, 25-cycle, 440-volt motor; two 75-kva., 25-cycle, 3300, 440-volt transformers, and 15,000 ft. No. 0 hard-drawn copper wire.

RADFORD, VA.—The Radford Water Power Company, it is reported, has placed orders for equipment which will double the output of its plant on Little River. The cost is estimated at from $15,000 to $20,000.

WASHINGTON, D. C.—Bids will be received at the office of the superintendent of the United States Coast and Geodetic Survey, 205 New Jersey Avenue, S. E., Washington, D. C., until April 24, for furnishing and installing an electric lift. For details see proposal columns.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, War Department, Washington, D. C., until April 23 for furnishing a miscellaneous quantity of class 1, 2, 3 and 4 cords. Further information may be obtained upon application to Charles S. Wallace, major signal corps, U. S. A.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until May 7 for furnishing and installing ten electrically driven capstans and 20 hand-power capstans at the navy yards, Norfolk, Va., and Philadelphia, Pa. Drawings and specifications (No. 2351) can be obtained upon application to the bureau or to the commandants of the navy yards named.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until May 1 for furnishing coaling bags, blades for Curtis turbines, blowers, lamp and telephone cord, crucibles, coal tar, oil-burning lamps, dough-mixing and kitchen and cake machines, steel forgings, electric wire and cable, etc., at the navy yard, Brooklyn. Application for proposals should designate the schedule desired by number.

WASHINGTON, D. C.—Bids will be received by the secretary of the Board of Commissioners, Room 509, District Building, Washington, D. C., until April 25 for erecting an addition and remodeling the Elizabeth V. Brown School, No. 113, on Connecticut Avenue, McKinley and Northampton Streets. The plans provide for three wings, two 81 ft. by 36 ft., 42 ft. high, and one 95 ft. by 48 ft., 32 ft. high, to cost about $80,000; a plenum heating system and a direct-indirect electric-lighting system, electricity to be supplied from the local company, to cost $15,000. Plans and specifications may be obtained from the chief clerk of the Engineering Department, Room 427, District Building, Snowden Ashford, Room 104, District Building, is architect.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Brooklyn, N. Y., Schedule 945—1425 lb. monel metal blades for Curtis turbine, miscellaneous blading for Curtis turbine. San Diego, Cal., Schedule 937—one air compressor and motor and air receiver. Various, Schedule 943—five electrically operated dough-mixing machines complete, 15 electrically operated kitchen and cake machines. Puget Sound, Wash., Schedule 938—32,000 sq. yd. of waterproof paper for insulating purposes. Mare Island, Cal., Schedule 947—20,575 lb. condenser tube sheets, f.o.b. works, and Brooklyn, N. Y., Schedule 942—miscellaneous steel forgings.

North Central States

DETROIT, MICH.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until April 27 for installation complete of two new electric passenger elevators, etc., in the United States post office and court house at Detroit.

CINCINNATI, OHIO.—Bids will be received by the New Longview Hospital Buildings Commission of Hamilton County, Hamilton County Courthouse, Cincinnati, until

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

April 25 for the construction of the new women's dormitory building of Simpson Hospital and the power house, including boilers, engines, heating and ventilating plants, electric wiring, elevator and power plant equipment, to be connected with power and accumulation for the Parish of Calcasieu. Architect, Theatre Building, Lafayette, etc.

CLEVELAND, OHIO.—Bids will be received at the office of the superintendent of purchases and supplies, City Hall, Cleveland, Ohio, until May 3 for construction of a concrete chimney for division of light and heat. Specifications may be obtained at the office of the commissioner of light and heat, Room 700, City Hall, Cleveland.

HUNTSVILLE, OHIO.—At an election to be held April 7 the proposal to issue $5,000 for the construction of an electric-lighting system will be submitted to the voters.

WAVERLY, OHIO.—At an election to be held April 7 the proposal to issue $10,000 in bonds for the installation of an electric lighting plant to supply electricity for both street lighting and domestic purposes, will be submitted to the voters.

ELKHORN, KY.—A company is being organized by M. Bolling and others to establish an electric light and power plant in Elkhorn City this summer. The cost is estimated at about $15,000.

LOUISVILLE, KY.—The Louisville Cotton Mills have installed five motors of 10 and 15 hp., and contemplate other additions until the whole plant is equipped with electric motors, involving about 1,000 hp. Energy from a central station will be used.

SEBREE, KY.—The local electric-light plant has been purchased by J. J. Korb, Henry Powell and L. W. Walden, of Sebree. New equipment is being installed, including two 25-hp. Fairbanks-Morse oil engines, etc. Machinery, it is understood, has been purchased.

WEEKSBURG, KY.—Plans are being considered by the Elk Horn Gas Coal Mining Company for the installation of new generators and machinery at its plant in Wayland, which supplies service in Weeksburg.

HAMMOND, IND.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 16 for a new heating boiler, etc., in the United States post office and court house at Hammond. For details see proposal columns.

CHICAGO, ILL.—Plans have been prepared by the Central Manufacturing District, care John A. Spoor and Arthur G. Leonard, 38 South Dearborn Street, Chicago, for construction of power house and tunnels, to cost about $200,000. R. L. Vaniman, care of the United States Yards & Transit Company, Chicago, is mechanical engineer.

ASHLAND, WIS.—Plans are being prepared by the L. E. Meyers Company, which recently acquired the Appleyard interests, for extensive improvements to the local plant.

MILWAUKEE, WIS.—A permit has been granted to the Cutler-Hammer Company of Milwaukee, manufacturer of electrical appliances, for the erection of a six-story store and office building, to cost about $150,000.

MILWAUKEE, WIS.—Ground has been broken for a new paper mill, 100 ft. by 320 ft., four stories and basement, and a power house, 86 ft. by 100 ft., to cost from $600,000 to $700,000, for the Hummel & Downing Company of Milwaukee, manufacturer of paper and fiber boxes. The power house will be equipped for a generating capacity of 3500 hp.

ROYAL OAK, MINN.—The township of Royal Oak has awarded the Detroit Edison Company a contract for lighting Woodward Avenue through the township.

ADEL, IOWA.—The dam of the Adel Light & Power Company was recently carried away by high water, causing a loss of about $20,000.

ANITA, IOWA.—The property of the Anita Electric Light & Power Company has been purchased by the Iowa Railway & Light Company of Cedar Rapids. The Iowa company, it is reported, contemplates extending its electric transmission lines to the Missouri River.

BOYDEN, IOWA.—Bids will be received by Paul T. McCrum, secretary of school board of the independent school district of Boyden, until May 10, for construction of high and grade school building to be erected on the same site. Separate bids to be submitted on general construction, heating and ventilating, plumbing and sewerage, and electrical work. Plans and specifications are on file at the office of G. L. Lockhart, architect, Endicott Building, St. Paul, Minn., and at the office of the secretary of board, Boyden.

RED OAK, IOWA.—Bids will be received by the board of supervisors of Montgomery County at the office of the county auditor at Red Oak, Iowa, May 8, for sinking and furnishing bottom for the court house at Red Oak. Plans and specifications are on file at the office of the auditor of county, etc.

AURORA, MO.—An election will probably be called to submit to the voters the proposal to issue $15,000 in bonds for the installation of a municipal electric plant.

BOLIVAR, MO.—Plans are being prepared for improvements to the power house of the Kemper Military school for which bids will soon be called. The work will include the installation of additional boilers and generators.

KIRKSVILLE, MO.—At an election to be held May 4 the proposal to issue $118,000 in bonds for improvements to the municipal electric-light plant and water-works system will be submitted to the voters. The proposed work will include construction of approximately 27,250 ft. of 12-in. pipe line, two motor driven pumps, two 200 hp. oil engines, generators, coal line extensions, etc.

NEVADA, MO.—The Fort Scott & Nevada Light, Heat, Water & Power Company is installing a 200-hp. Hamilton boiler.

LESTERVILLE, S. D.—The City Council is considering calling an election to submit to the voters the question of issuing bonds for improvements to the municipal electric-light plant.

MOBRIDGE, S. D.—The local electric-light plant, owned by Bert S. Hill, has been purchased by the Ferris Brothers system. The new owners, it is understood, contemplate the construction of a new plant, to cost about $75,000.

PIERRE, S. D.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 16 for a new heating boiler, etc., in the United States post office and court house, Pierre, S. D. For details see proposal columns.

CREIGHTON, NEB.—Plans, it is reported, are being considered by the Iowa Railway & Light Company of Cedar Rapids, Iowa, and associated companies for the construction of a large central station in Creighton, from which service will be supplied to Hartington, Bloomfield, Wakefield, Emerson and other towns in this section of the State.

FREMONT, NEB.—Bids will be received at the office of the county clerk of Dodge County, Fremont, Neb., until May 1 for furnishing and installing two electric elevators, one jail and one passenger, for the Dodge County court house and jail in Fremont. Plans and specifications may be obtained on application to the A. H. Dyer Company, architect, Fremont, upon deposit of $10.

ALMA, KAN.—The Alma Light & Ice Company has entered into a contract with the Rocky Ford Mill & Milling Company for energy to operate its system by Oct. 1, 1917. The Rocky Ford Company will erect its transmission line through Wamego.

ARGONIA, KAN.—The Western Sumner Light & Power Company of Argonia is erecting a three-phase, 2200-volt transmission line, 29 miles long, to supply electricity in Norwich, Visla and Milton, which will be distributed by the Tri County Light & Power Company of Norwich, which is controlled and operated by the same interests as the Western Sumner company. Waltham L. Jones of Argonia is manager of both companies.

ELLIS, KAN.—The Union Pacific Railway Company has awarded contract for the construction of power houses, 46 ft. by 86 ft., one story, at its local yards to Joseph E. Nelson & Son, Chicago, Ill.

HERKIMER, KAN.—The installation of an electric-lighting system in Herkimer is under consideration by John Krug. The plans provide for the erection of an electric transmission line from Herkimer to Marysville, where energy to operate the system will be obtained from the Marysville Light, Power & Water Company.

KANSAS CITY, KAN.—A contract has been drawn up whereby the municipal electric-light plant will supply electricity to operate the meat-packing plant of Morris & Company.

MINERAL, KAN.—The Empire District Electric Company of Joplin is reported to be contemplating extending its electric transmission lines to Mineral to supply electricity for street-lighting and for operating the coal mines in this district.

QUINTER, KAN.—Bonds to the amount of $14,000 have been authorized for the installation of a municipal electric-lighting system in Quinter.

YATES CENTER, KAN.—At an election held recently the proposal to take over the local electric-light plant and water-works system, to be owned and operated by the municipality, was carried. Improvements are contemplated to both plants, for which plans are being prepared by Black & Veatch, engineers, Inter-State Banding, Kansas City, Mo.

Southern States

CENTRAL, S. C.—Bonds have been authorized for the installation of an electric-lighting system. S. D. Brown of Toccoa, Ga., is engineer.

COLUMBIA, S. C.—The Parr Shoals Power Company has recently closed a contract with the Winnsboro (S. C.) Mills for electrical energy to the amount of 2000 kw., which will necessitate the rebuilding of its electric transmission lines from Parr Shoals to Winnsboro, a distance of 16 miles, and the installation of additional machinery at its Parr Shoals plant.

ATLANTA, GA.—Extensions and improvements, involving an expenditure of about $700,000, are contemplated by the Georgia Railway & Power Company.

THOMASVILLE, GA.—At an election to be held April 27 the proposal to issue $160,000 in bonds will be submitted to the voters. Part of the proceeds is to be used for extensions and improvements to the municipal electric-light plant and for a fire-alarm system.

COCOA, FLA.—The Cocoa Light & Ice Company is planning to install new generating equipment and to establish a 24-hour service in Cocoa.

JOHNSON CITY, TENN.—The State Legislature has given the city of Johnson City authority to acquire the local electric-lighting plant.

MARYVILLE, TENN.—Rights of way have been secured by the Aluminum Company of America for the erection of an electric transmission line from its hydro-electric plant at Alcoa to its plant at Maryville. The cost of the line complete, including right of way, etc., is estimated at about $3,000,000.

MEMPHIS, TENN.—Improvements, involving an expenditure of $92,000, will be made to the yards of the Illinois Central Railroad Company in North and South Memphis. The proposed work will include steam, air, gas and hot and cold water lines laid in trenches; also a Harris air lift and booster pump attachment on deep wells to increase the efficiency of the present power plant, truck drop pit and electrical car-charging apparatus.

ANNISTON, ALA.—The American Net & Twine Company contemplates the construction of an additional mill, 162 ft. by 114 ft., three stories high, equipped with 5000 spindles and accompanying machinery; also the erection of 11 cottages with electric lighting, hot and cold water service, etc., involving a total expenditure of $200,000.

BIRMINGHAM, ALA.—The City Commissioners have decided to take prompt action necessary to construct and equip the proposed municipal electric-light and power plant for which $500,000 in bonds have been authorized.

BIRMINGHAM, ALA.—Plans are being considered by the Sloss-Sheffield Steel & Iron Company for the installation of an electric haulage system at its mines. The cost of equipping all the mines of the company is estimated at about $1,000,000.

GENEVA, ALA.—The Geneva Power & Manufacturing Company is contemplating a water-power development. As yet nothing definite has been decided upon. D. O. Vaughan is president.

BASILE, LA.—Preparations are being made for the installation of a municipal electric-light plant. A 40-hp. engine and a 20-kw. generator, it is understood, have been purchased.

NEW ORLEANS, LA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until May 7 for construction of stable, complete stable fittings, and drainage, water and electric-lighting systems at the naval station, New Orleans. Drawings and specifications (No. 2350) may be obtained on application to the above bureau or to the commandant of the naval station named.

CARMEN, OKLA.—At an election held recently bonds to the amount of $25,000 were authorized for improvements to the municipal electric-light plant.

GRANDFIELD, OKLA.—Plans are being considered by Messrs. Maple & Green to rebuild their electric plant, recently destroyed by fire.

HEALDTON, OKLA.—The Healdton Ice, Light, Power & Supply Company, recently incorporated with a capital stock of $15,000, proposes to install an electric plant in Healdton. C. V. Miller of Healdton, and R. N. Martin of Wirt, Okla., are interested.

NORMAN, OKLA.—The Oklahoma (Okla.) Gas & Electric Company contemplates extending its electric transmission line from Oklahoma City to Norman.

BEAUMONT, TEX.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 15 for a new heating boiler, etc., in the United States post office and court house at Beaumont. For details see proposal columns.

DONNA, TEX.—The Donna Light & Power Company, recently incorporated with a capital stock of $5,000, is planning to install an electric-light and power plant.

HOUSTON, TEX.—The Houston, Gonzales & San Antonia Traction Company is planning to erect a new passenger station at a cost of about $100,000.

KINGSVILLE, TEX.—The St. Louis, Brownsville & Mexico Railroad Company is planning to install an electric-light and power plant to supply electricity at its local shops and terminals.

Pacific and Mountain States

ALDERDALE, WASH.—The Alderdale Light & Water Company, recently incorporated, with a capital stock of $25,000, is planning to supply electricity in this town and locality. William Warner, R. F. Simms and others are interested in the company.

SEATTLE, WASH.—The property owners on Olive, Stewart, Howell and Virginia Streets, between Eastlake and Westlake Avenues, have petitioned the City Council for an extension of the cluster-lamp lighting system to cover the above district.

SUMNER, WASH.—At an election to be held soon the proposal to issue $41,000 in bonds for an addition to school building, including a gymnasium and power plant, will be submitted to the voters.

LOS ANGELES, CAL.—The Pacific Electric Railway Company is contemplating the construction of a new substation at Alhambra.

VALLEJO, CAL.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until May 21 for construction of a three-story and basement extension of Mess Hall, including plumbing, steam heating and electric wiring, at the navy yard, Mare Island, Vallejo. Drawings and specifications (No. 2358) may be obtained on application to the above bureau.

DRUMMOND, IDAHO.—At a special election to be held April 24 the proposal to issue bonds for the installation of a municipal electric-light plant will be submitted to the voters.

KINGMAN, ARIZ.—The Chloride X-Ray Mining Company is contemplating the installation of an electric plant at its mine, consisting of a 100-hp. engine and five drill compressors.

WICKENBURG, ARIZ.—Bonds to the amount of $12,000 have been authorized for the installation of an electric-light and power plant.

ENGLEWOOD, COL.—The proposal to issue bonds for the installation of a municipal electric-light plant in Englewood will be submitted to the voters.

Canada

HULL, QUE.—The purchase of conduits for the local service of the Bell Telephone Company is under consideration by J. E. McPherson, superintendent of the Bell Telephone Company, Queen Street, Ottawa.

SHERBROOKE, QUE.—Tenders are now being asked by the city clerk for the purchase of 30 miles of No. 4 copper wire, wooden poles, six transformers and other equipment, etc., for use in connection with the erection of a transmission line to the Two Miles Falls power plant, recently purchased by the city. Plans and specifications are on file with J. R. McGregor, superintendent.

RADVILLE, SASK.—The Town Council is considering the question of establishing a municipal electric-light plant in Radville, to cost about $12,000.

REGINA, SASK.—Estimates are being received by the city of Regina for a pump with a daily capacity of 3,000,000 gal., directly connected to a 2200-volt alternating-current motor. Two similar units will be installed at a later date. J. R. Ellis, 2852 Rae Street, is engineer.

SHAUNAVON, SASK.—The Town Council is considering the establishment of a municipal electric-light plant in Shaunavon.

Record of Electrical Patents

Notes on United States Patents issued on April 10, 1917

1,221,818. ELECTRIC-CURRENT BRUSH STRUCTURE: Oliver E. Becker, Chicago, Ill. App. filed Oct. 27, 1913. Includes contact elements formed of carbon or a combination of carbon and copper, etc.

1,121,821. CALIBRATING ELECTRIC METERS; Otto T. Blathy, Budapest, Hungary. App. filed Dec. 15, 1914. Employs a magnetic shunt.

1,221,859. SIGNAL HORN; Gottlob Honold, Stuttgart, Germany. App. filed April 7, 1915. Improvements.

1,221,880. ALTERNATING-CURRENT MAGNET BRAKE: William D. Lutz, Allendale, N. J. App. filed March 15, 1913. Danger due to residual magnetism which causes sticking of the operating parts is entirely eliminated.

1,221,885. SAFETY ELEVATOR MECHANISM; John A. Martin, Spokane, Wash. App. filed Aug. 11, 1915. Preventing accidents while passengers are entering or leaving the car.

1,221,893. SAFETY REPAIR DEVICE FOR HIGH VOLTAGE TRANSMISSION LINES: George S. Neeley, Overland Park, Mo. App. filed Sept. 30, 1915. Improvement.

1,221,894. SAFETY REPAIR DEVICE FOR HIGH-VOLTAGE TRANSMISSION LINES; George S. Neeley, Overland Park, Mo. App. filed July 19, 1916. Improved form of wire-gripping member which can be easily and quickly applied to insulators of the type now in general use.

1,221,934. ELECTRICITY METER; Otis White, Springfield, Ill. App. filed Jan. 30, 1914. Mercury motor.

1,221,944. JUNCTION OR OUTLET BOX; William Wurdack, St. Louis, Mo. App. filed Feb. 3, 1915. Intended to receive and securely support switches, fuse blocks and the like.

1,221,958. WATER-COOLED WELDING ELECTRODE; Harry O. Bernard, Birmingham, Ala. App. filed July 23, 1913. Cooling jacket which is adapted to entirely surround the electrode.

1,221,963. WATER-INDICATING MEANS FOR STEAM BOILERS; William C. Bundell, Los Angeles, Cal. App. filed Feb. 7, 1916. Combined audible and visible indicator.

1,221,981. ALTERNATING-CURRENT RECTIFIER; Thomas A. Edison, Llewellyn Park, West Orange, N. J. App. filed Dec. 30, 1911. Vibrating contacts are employed.

1,221,991. METHOD OF MAKING BATTERY DEPOLARIZERS: Major E. Holmes, Lakewood, Ohio. App. filed Aug. 25, 1913. Improvement.

1,221,998. ELECTRICAL CONDENSER FOR IGNITION-CURRENT GENERATORS: Franz Kratz, Stuttgart, Germany. App. filed Jan. 30, 1914. A coil condenser, preferably of oval shape, having its two conductive bands individually projecting on the two lateral sides of the condenser.

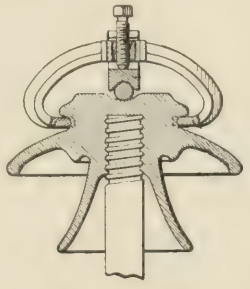
1,222,001. ELECTRICAL HEATING UNIT; Robert Kuhn and Archie Oakes, Detroit, Mich. App. filed July 9, 1914. Construction which may be used in small electrically heated instruments such as curling-iron heaters.

1,222,022. CONNECTOR FOR ELECTRICAL TERMINALS; Christian F. Paul, Jr., Peekskill, N. Y. App. filed Sept. 20, 1912. Comprises two separate holders, each carrying one or more terminals for coming into contact to complete an electrical circuit.

1,222,042. ELECTRIC METER; Konrad R. Singer, Nuremberg, Germany. App. filed March 24, 1915. Alternating current.

1,222,052. MAGNETIC CHUCK; Oakley S. Walker, Worcester, Mass. App. filed July 23, 1914. Face adapted to support and grip iron or steel pieces.

1,222,078. SIGNALING DEVICES FOR AUTOMOBILES: Ernest C. Cox, Newport News, Va. App. filed April 19, 1916. Placed at the rear of the vehicle.



1,221,893—Safety Repair Device for High-Voltage Lines

1,222,083. DISPLAY APPARATUS; Fred G. Dickerson, Chicago, Ill. App. filed Dec. 2, 1915. Plurality of sets of different display elements.

1,222,107. HORN; Arthur A. Kent, Philadelphia, Pa. App. filed June 17, 1911. Used in motor cars.

1,222,119. FILAMENT FOR INCANDESCENT BULBS; Albert S. Moffat, Belmont, Mass. App. filed Dec. 23, 1915. For stereopticons and moving-picture machines.

1,222,159. ELECTRIC BELL; Michisoye Suwa, Tokyo, Japan. App. filed July 3, 1915. Novel arrangement of the armature with respect to the poles of the electromagnet forming part of the bell.

1,222,165. METALLIC RECEPTACLE AND METHOD OF WELDING THE SAME; Frederick G. Wacker, Chicago, Ill. App. filed July 26, 1916. Improvements.

1,222,181. ELECTRICALLY HEATED FIRELESS COOKER; Carlyle B. Carman, Salineville, Ohio. App. filed July 20, 1916. To obviate the necessity of providing heat plates and the like.

1,222,182. COMPRESSION RHEOSTAT; Emerson L. Clark, Lakewood, Ohio. App. filed May 19, 1915. Resistor elements consist of carbon, graphite or mixtures of these substances with other materials.

1,222,187. CONTROLLER; William R. Davis, Springfield, Ill. App. filed April 3, 1913. For controlling motor-operated valves.

1,222,189. FLOAT-CONTROLLED ELECTRIC INDICATOR: Simon Deutsch, Detroit, Mich. App. filed June 3, 1915. Applicable to the liquid-fuel tanks of automobiles.

1,222,196. ELECTRICAL HEATING RESISTANCE; Frederick M. Furber, Revere, Mass. App. filed April 16, 1914. Used in the manufacture of boots and shoes.

1,222,197. ELECTRIC UNIT; Frederick M. Furber, Revere, Mass. App. filed June 28, 1915. Heating.

1,222,207. MOTOR CONTROLLER; Clark T. Henderson, Milwaukee, Wis. App. filed Nov. 2, 1914. For electric vehicles.

1,222,214. ELECTRIC SWITCH; Charles J. Klein. Milwaukee, Wis. App. filed May 29, 1911. Door switch.

1,222,215. CIRCUIT CONTROLLER; Charles J. Klein, Milwaukee, Wis. App. filed Oct. 3, 1914. Improved device for controlling automobile lighting systems.

1,222,225. LAMP SOCKET; Arthur C. McWilliams, Chicago, Ill. App. filed April 14, 1916. Improvement.

1,222.239. ELECTROLYSIS OF ALKALINE HALOIDS; Karl Ochs, Charlottenburg, Germany. App. filed Aug. 26, 1913. Anodes are arranged above and the cathodes below the filtering diaphragm, and the salt solution by reason of its hydrostatic pressure permeates continuously and slowly the diaphragm in a manner depending upon the strength of the current applied.

1,222,257. STORAGE-BATTERY CHARGER; Charles Auth, Brooklyn, N. Y. App. filed Jan. 22, 1915. Apparatus for automatically connecting the storage-battery system with a source of current supply.

1,222,305. ELECTROSTATIC SEPARATOR FOR INFLAMMABLE MATERIALS; Jakob Kraus, Brunswick, Germany. App. filed Oct. 27, 1914. Electrodes or poles serving to form the electrostatic field will be made of such material as to entirely avoid the production of sparks.

1,222,333. FIRE-ALARM SYSTEM; Charles Z. Smith, South Bethlehem, N. Y. App. filed March 31, 1915. Improvement.

1,222,355. SWITCH: Samuel Buchsbaum, Chicago, Ill. App. filed Oct. 18, 1915. Automatically quick-acting mechanism is used to break the circuit.

1,222,412. VOLTAGE REGULATOR; Charles H. Kicklighter, Pasadena, Cal. App. filed Sept. 29, 1910. Make-and-break type.

1,[illegible] Electrical Apparatus. John H [illegible]. App. filed June 17, 1912. Not used in connection with automatic coupler.

1,[illegible] Apparatus for Signaling by Electricity. William [illegible]. App. filed Oct. 12, 1914. Improvements.

1,[illegible] Electrical Signal. Earl B Mc[illegible], Schenectady, N. Y. App. filed June [illegible], 1911. [illegible].

1,[illegible] Telephonic Conveyance. Samuel Frederick W. Meier, Pittsburgh, Pa. App. filed March 13, 1914. Provides circuits and apparatus whereby a motor may be continuously regulated at both sending and receiving stations and over telephonic circuits in a simple and efficient manner.

1,[illegible] Dynamo Electric Machine. Edward D. Priest, Schenectady, N. Y. App. filed Oct. 3, 1914. Commutator type, the high resistance of which are provided with resistive pole

1,[illegible] Variable Speed Electric Motor. Thomas Lonergan, Allentown, Pa. App. filed Oct. 9, 1911. Commutator-wound motor is employed, the field winding of which is excited by current which is varied in accordance with the speed of the motor, so that at low speeds the characteristic of the motor resembles very closely that of a series motor and at high speeds it resembles that of a shunt motor.

1,[illegible] Means for Boiler Superheater. Charles [illegible], Little Rock, Ark. App. filed Oct. 6, 1916. Smoke box type.

1,[illegible] Face Plate for Flush Receptacles. George H. Thomas, Bridgeport, Conn. App. filed Sept. 9, 1916. Improvement.

1,[illegible] Protective Device for Systems of Distribution. Archibald H. Davis, Schenectady, N. Y. App. filed March 13, 1914. Relates to protective devices for systems of distribution, and especially to those systems in which a plurality of feeders are connected in parallel between the generating and receiving ends of the system.

1,225,527. Keep-Alive Anode; David C. Davis, Swissvale, Pa. App. filed May 11, 1914. Operates to give a stable arc for a long period of time without artificial cooling.

1,225,547. Synchronizing Device; William B. Jackson, Chicago, Ill. App. filed May 19, 1913. Improvements.

1,225,574. Machine for Forming Heels and Toes of Horseshoes; William B. Miller, Pittsburgh, Pa. App. filed Sept. 15, 1913. Improvements.

1,225,585. Circuit Coupling for Electrically Heated Utensils; Frederick E. Carlson, New Britain, Conn. App. filed Nov. 28, 1914. Swivel connection.

1,218,195. System for Transmitting Communications; C. V. Logwood, New York, N. Y. App. filed Jan. 12, 1916; issued March 6, 1917. Uses an oscillator of the audion type for producing radio-frequency alternating currents which are impressed upon a radiating system. Is used for radio-telegraphy or radio-telephony, modulation being secured by a Morse key or microphone and transformer connected in a high resistance leakage path between the grid and filament of the oscillating tube.

1,218,237. Method and Apparatus for Determining the Direction of a Hertzian Disturbance; A. Blondel, Paris, France. App. filed Nov. 1, 1913; issued March 6, 1917. Directional system in which a transmitting station sends out a series of waves in a series of vertical planes rotating about a vertical axis passing through the sending aerial. Each set of waves in a given plane is indicated by a special signal allotted to that plane, thus showing the bearing of the transmitting station. The waves are localized in planes by use of a radiogoniometer, the coil of which is revolved to change the direction of transmission.

1,219,215. System of Space Signaling; J. C. Armor, Brooklyn, N. Y. App. filed July 26, 1912; issued March 13, 1917.

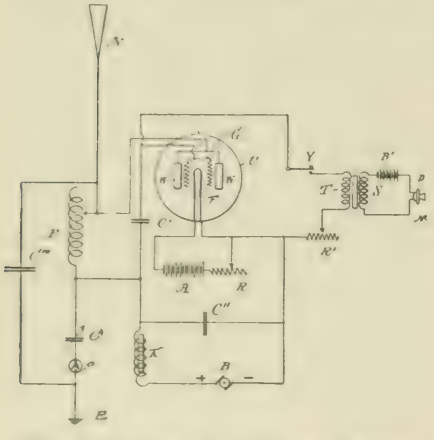


Fig. 1—Logwood's Oscillating Audion Transmitter

Magnetic control of radio-frequency currents for radio-telephony by impressing speech-carrying pulsating currents upon a magnetic device so arranged that the radio-frequency field does not set up current in the input circuits. The radio-frequency current is controlled in accordance with the speech current by reason of the resonant changes brought about by changes of inductance in the magnetic device.

1,219,216. System of Space Signaling; J. C. Armor, Ingram, Pa. App. filed Oct. 14, 1913; issued March 13, 1917. Various forms of inductive device for practicing the radio-telephone modulation of the preceding patent. The preferred instrument has one high-voltage radio-frequency winding and two low-voltage direct-current windings which carry the modulating speech current. The windings and core are arranged so that no radio-frequency current is induced in the input circuit.

1,219,550. Antenna Structure on Aeroplanes for Wireless Signaling; Walter Hahnemann, Kitzberg, Kiel, Germany. App. filed Jan. 13, 1915; issued March 20, 1917. Uses two masts supported above the outer ends of the wing surfaces and carrying an aerial between them. An alternative form mounts a third mast on the tail of the aeroplane and has three aerials swung between the masts. The height of the masts is thus reduced as compared to that which would be required if but one wire were used.

Recent Radio Patents

Notes and Comments on United States Patents on Radio Signaling and allied topics issued during March, 1917.

1,219,682. Recording Correlated Light and Sound Effects; William B. Vansize, Brooklyn, N. Y. Orig. App. filed June 29, 1915; divided Sept. 24, 1915; issued March 20, 1917. Arrangement for making talking motion pictures, in which the performers are equipped with portable radio-telephone transmitters adapted to signal to a recording telegraphone or phonograph associated with the camera. Thus their speech is recorded coincidentally with their actions, the sound-modulated radio waves passing directly from the actors to the radio-receiver placed at the motion-picture camera.

1,219,888. Combined Receiver and Detector for Wireless Use; Frank Wallberg, New York, N. Y. App. filed Sept. 21, 1915; issued March 20, 1917. A magnetic telephone receiver has its shell extended and a tuning inductance wound thereon. A switch for varying this inductance is mounted on the back of the earpiece and a crystal detector placed inside. The device is connected between an antenna and the ground in the usual way.

1,220,005. Wireless Signaling System; James H. Rogers and Henry H. Lyon, Hyattsville, Md. App. filed Nov. 10, 1916; issued March 20, 1917. The usual radio-frequency apparatus is associated with "antenna" wires buried beneath the earth's surface but insulated therefrom and running parallel therewith. A directive system is thus secured and one which is inexpensive to erect and maintain. One ground connection and one buried insulated ground wire may be used, in place of two insulated wires.

1,220,072. Method of Wireless Signaling; Louis Cohen, Washington, D. C. App. filed Nov. 13, 1915; issued March 20, 1917. Oscillating arc transmitter in which signaling is effected by stopping and starting undamped waves of a single frequency, in contrast to the usual method involving two-wave frequencies.

Discussion.

Fig. 1 shows the oscillating audion circuit of the Logwood patent No. 1,218,195. As shown, the aerial and ground are connected across a closed circuit comprising an inductance, two condensers and a radio-frequency ammeter. The terminals of the variable inductance are connected to the plate system of the audion and, through a third condenser, to the grids. The filament is heated by the battery *A*, whose output is controlled by the variable resistance *R*. Direct current for the plates circuit is derived from a generator *B* connected through the impedance coil K, both being shunted by an additional condenser. At the right side of the diagram is shown the high-resistance leakage path between grids and filament, which passes through the Morse key *Y*, the secondary of the telephone transformer *T* and the variable high resistance *R'*. The primary of the telephone transformer *S* has connected to it a carbon microphone D and battery *B'*. In operation, the audion produces radio-frequency oscillations when the grid leakage path is of the proper resistance. By opening the key *Y* the oscillations may be stopped, and thus telegraph signals may be produced by its manipulation. If the key is held closed and the microphone is spoken into, the grid potential will be changed by the action of the telephone transformer. This causes corresponding changes of amplitude in the generated oscillations and consequently makes possible the transmission of speech by radio.

The second illustration presented herewith (Fig. 2) is from Cohen's patent No. 1,220,072. It has long been recognized that the "compensation wave" method of signaling with arc generators, in which waves are constantly sent out at one of two frequencies, is unsuitable for telegraphic purposes when a large number of stations are located within a single radio zone of communication. The present arrangement is designed to overcome the interference difficulties by sending the signals upon a single undamped wave and changing its amplitude (or stopping and starting it) in accordance with the elements of the Morse characters.

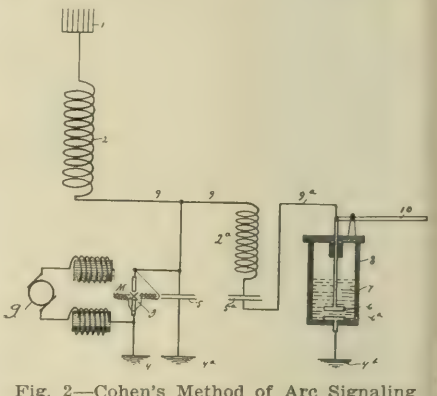


Fig. 2—Cohen's Method of Arc Signaling

The diagram of connections shows the usual arc arrangement with direct current supplied through two impedance coils. One terminal of the arc is connected to earth and the other, through a loading coil, to the antenna. A condenser, 5, is placed in parallel with the arc, and across this are serially connected a second loading coil 2*a*, a condenser 5*a*, and a high-potential switch for producing the Morse signals. With this switch open, the auxiliary circuit is disconnected and the arc produces a stream of waves in the ordinary way. When the switch is closed, however, the shunt circuit robs the antenna of energy, and waves substantially or entirely cease to pass off from the antenna. By connecting the high-potential breaker to a Morse key through a back-stroke relay, the operation is made to correspond closely to that which is secured by the use of a radio-frequency alternator.

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"Better Business" the Watchword

"WE MUST insure the business success and general prosperity of the country during the war if we are to hold our present strong place among nations in the commercial competition of the future." This statement of Howard E. Coffin of the Advisory Commission of the Council of National Defense is sane, clear-visioned and necessary. The public needs such an admonition against indiscriminate economy. Our industrial forces must not lose momentum, but must be strengthened and reinforced to undertake the great service and sacrifice that the government asks. In 1914 buying stopped abruptly with the spread of the war in Europe. Markets closed, labor was thrown out of employment, expansion plans and future outlook were scrapped, and all for naught. Just how mistaken big business and little business were then is a matter of history. Our greatest industrial boom was coincident with the war, and war demands keep business active. The government asks only a discriminating economy. We should not waste food, but we should be prodigal in expenditure and output where war supplies are concerned. And "war supplies" is an all-inclusive term which embraces the great basic industries. Certainly the electrical industry has a sound commercial reason aside from the national crisis for going ahead at full speed. Business confidence is wonderfully infectious. It is our duty to be individually responsible for its increase and thus to promote a national prosperity which will best meet our national need.

The N. E. L. A. Convention

IT IS a radical change that the National Electric Light Association has made in substituting a two-day meeting in New York for the usual great annual convention. It is radical because time and need call for such action. It is a time, not for peaceful deliberation over routine problems, important though they may be, but for developing industrial efficiency to the highest pitch with the one aim of finishing the national business now in hand. The need is to mobilize every resource to carry out that purpose firmly, successfully and as quickly as it is possible to do a thorough job. The N. E. L. A., with enormous potential power in well-invested capital and trained men, is a national resource of highest rank. Brought together by patriotic spirit, strengthened and made more useful in service by the proposed conference, the industry will meet the military demand with honor and credit. President Wagner's action is a wise recognition of national urgency. It has the cordial and loyal support of the membership. The Electrical World commends the new plan as patriotism of the first order. It takes pleasure in showing also that the action of the association officials receives the hearty indorsement of leaders of the industry.

The War and Electric Transportation

WAR is welding our industries into closer union. This is not the time to commercialize patriotism, but, as Howard E. Coffin has pointed out, the fact of war should not numb our senses to the need of business action.

Now is the time to investigate the relation of the industry to war conditions and to act definitely to establish a working organization to get the thing done. Some of these broader relations of the electrical industry to the war have already been pointed out. One service should be especially emphasized, first, because it offers immediate opportunity for action helpful in meeting the general problem of facilitating transportation and increasing the output of our factories, and, second, because it is the focal point of several groups in the industry.

Electricity—the electric industrial truck, the electric crane, hoist and telpher, the electric motor vehicle—is being widely applied for the handling of goods. Industrial plants in particular, and transportation companies in general, have found that electricity may take the place of human labor and cut the time of handling products within the factory and facilitate deliveries at this time when such questions are paramount. Experience abroad we may expect to serve as a basis for action in this country. Statistics recently gathered by the Electric Vehicle Section of the N. E. L. A. show that in 1914, at the beginning of the war, there were 150 electric vehicles in use in England. To-day there are 858. Gasoline cars are serving on the field of battle and "electrics" in the transportation field at home. No motor vehicle can be imported into England without a permit from the government, and no cars can be imported for commercial use except the electric vehicle. The government has taken over the railroads, and one railroad, the Midland, has purchased a hundred electric vehicles for auxiliary service. Electric transportation without tracks has increased also in Germany and Austria. Reports indicate that trackless trolley lines have been installed between industrial centers, and where the trolley ends the cars are self-propelled into the byways by batteries.

The meeting of manufacturers of electric vehicles, trucks and accessories outlined on another page has

therefore a timeliness that should result in immediate action. Every branch of the industry should support the plan to put it solidly behind electrical transportation as proposed at this meeting. Differences of opinion as to details should be forgotten in the necessary discussion of these details in working out the plan. The main facts are these: First, that local transportation and transportation methods are to receive more attention in the next few months than ever before; second, that the electric industrial truck and the electric vehicle, including the truck, the taxicab and the pleasure car, have an economic place in this problem; third, that the manufacturers of these forms of transportation and their accessories are now a part of a compact organization capable of definite action, the Electric Vehicle Section of the N. E. L. A., and, fourth, that a definite plan has now been formulated to insure constructive work.

The ELECTRICAL WORLD has faith in the electric vehicle for transportation. Its faith is based on results accomplished in cities where co-operation is tangible and the driving force of personal action has proved that the "electric" is fundamentally sound. War will strip aside false values, and patriotism as well as business judgment will list the electric vehicle as a transportation utility. Gasoline and gasoline cars are needed for long-distance and military service. Electric vehicles thus have their inherent economic advantages for local service emphasized. The plan of action proposed at the meeting of vehicle manufacturers makes possible the correlation of all these general factors into purposeful action.

Oil-Cooled Transformers

TRANSFORMER specifications require that the temperature elevation of the windings shall not exceed a specified value under assigned conditions of load. In the case of oil-cooled transformers access to the windings by means of thermometers is very difficult, and the A. I. E. E. standardization rules require that the temperature rise of transformer windings shall be obtained by electrical resistance measurements. Ordinarily this means that immediately after shutdown the transformer windings shall be switched over to resistance-measuring apparatus.

It may easily happen, however, that even when all preparations have been made and the transformer windings are promptly switched over from the power buses to the measuring terminals some little time is lost before a measurement can be secured. Meanwhile, of course, the transformer windings are attending strictly to their business of cooling, with the result that their temperature may already have fallen a degree or two before its value can have been revealed by the measurement. Under favorable conditions, the discrepancy may be trivial, but under unfavorable conditions it may be very appreciable, and then the opportunity opens for uncertainty and dispute.

The recent A. I. E. E. paper by V. M. Montsinger, referred to in our Digest, discusses this question. One way of dealing with the difficulty is to note the time of shutdown and the time of first measurement, and also the times of subsequent extra measurements made after the cooling has become more noticeable. By plotting the measurements against time the curve may be extrapolated back to the zero of shutdown. Occasionally even this correction may be open to uncertainty, and, as a check upon it, a method of approximate calculation is recommended, in which the initial cooling can be expressed as a function of the specific dissipation in watts per pound or kilogram of bare copper in the winding. The formula promises to be a useful one.

Lighting in War Time

WE LOOK with mingled regret and amusement on the somewhat hysterical inclination to suppress all lights along our seacoast in preparation for raids of a wholly improbable, not to say impossible, character. There are very few points on the coast where a U-boat would venture to operate on the surface in face of the searchlights of the naval patrols. Actual attack of the coast by such craft is more likely to occur at gray of dawn, after the lamps are extinguished and searchlights become comparatively useless, than at night. There is little likelihood of any airship peril, in view of the fact that every plane would necessarily be lost by having to descend into a hostile country or an unfriendly sea. In the case of London, where a base for Zeppelins was within easy flying distance, extreme precautions were justified; but even there the actual damage done by repeated raids was comparatively small, despite the huge amount of explosive carried by each of the great airships.

As regards lights on the coast, lighthouses and beacons of every kind well known and serving to guide a nocturnal prowler may reasonably be extinguished. It also might be desirable to suppress the brilliant illumination of conspicuous headlands, so as to rob the shore of its familiar marks. This done, it makes little difference whether the far-spread casual lamps along the shore are lighted or extinguished, for any town of considerable size betrays its presence by a conspicuous glare in the sky, visible for many miles and serving as a far better guide than scattered lights low along the shore line. It is so easy a matter to cut off all public lighting at a few minutes' notice that if the necessity arose any coast city could be darkened as thoroughly as London has been. Experience there seems to show that so long as there is light enough on the streets by which to see the city is not dark in a military sense at all. The extreme public inconvenience of darkened streets is so great that casual risks do not justify the complete darkening of coast towns on mere rumors. And nothing except complete darkness can deceive an enemy as to the position of his sought-for point of attack. The best defense against raids on the coast is an aggressive patrol, and in reality much more is to be feared from hostile operations treasonably conducted on shore, and greatly assisted by the absence of illumination, than from any attack by sea.

Free Appliance Repairs

WHETHER or not customers' appliances shall be repaired free of charge is a question which local conditions should answer. The existing and probable future attitude of the people toward the public utility company should be a large factor in the decision, because if there is any pre-eminent advantage which accrues to a company from free appliance repairs it is one of more desirable public relations. Those who are in a position to know testify that the cost is as nothing compared with the tremendous return in good will, not to mention revenue, which the plan secures. However, if the utmost benefits are to be derived from such a policy as a means for winning public favor, a plan insuring co-operation in the actual work of repair with local electrical contractors should have serious consideration. To omit them from the scheme would be a great mistake.

Agriculture and Nitrates

THE appeal of the President for extensive and intensive agriculture is one which should be earnestly heeded. The world is in the extraordinary situation of scant crops, meager from the unfriendliness of nature and the absence of tillers of the soil, threatening to create a serious scarcity. In all those countries now war-stricken there is lack not only of workers but of fertilizers, and while at the present we are in no straits for either of these necessities, a crop shortage may come upon us, from the second cause much more probably than from the first. Germany, in particular, is reputed to be suffering seriously from lack of nitrates which can be applied to agricultural uses. The available supply is scarcely sufficient to keep the fighting fronts supplied with high explosives. If the war rises to first-class magnitude so far as America is concerned, the same stress is likely to be felt here, all the more keenly because we lack Germany's huge potash supply. It is to be hoped, therefore, that Congress will at the very earliest opportunity take measures to encourage the building of plants for the fixation of nitrogen, adding to the provisions already made in behalf of the government legislation which will give better opportunities for private plants. At the last session the water-power legislation failed, thereby putting off, as is too often our wont, the time when adequate preparation can be made. This lack ought to be remedied at once, not only for the sake of nitrate plants, but to facilitate the general supply of power, which lessens the call for human industry, not always easy to meet in time of war.

Automatic Generating Plants

OCCASIONS not infrequently arise in transmission work where it would be exceedingly desirable to operate an auxiliary station with a minimum of attendance or with no attendance at all. In the current issue J. H. Siegfried of the Pacific Power & Light Company gives a most interesting account of the way in which this desideratum was attained in a plant near North Yakima, Wash., equipped with a 1400-kw., 2300-volt hydraulically driven induction-type generator. Now, the commendable feature of the induction generator is that it is excited by magnetizing current fed from the synchronous apparatus of the system so that it gives no trouble in excitation. The frequency of the current generated is regulated by the frequency of the synchronous generators. The power delivered is proportional to that mechanically applied, and if the magnetizing current is broken the generator simply drops its load. A unit of this kind is, therefore, as Mr. Siegfried remarks, practically foolproof. It cannot be over-excited nor under-excited, nor can it be overloaded, since the waterwheel capacity is insufficient to accomplish this result. The high-tension line is controlled from the main plant through an outdoor electrically operated switch with three current transformers in its leads to work the ammeters and relays on the switchboard. Hence a plant like this can practically work without attention. A patrolman sees to it that the lubricating oil is pumped into the storage tank, takes the wattmeter readings, and reports to the load dispatcher over the telephone. He is then instructed to open the waterwheel gates until the requisite load is reached, and then the plant takes care of itself until the next visit of the patrolman. At night he closes the gates to a point indicated by the load dispatcher, and the plant operates without further ado through the night. The result of the two years' operation has been nearly 12,000,000 kw.-hr. with probably the lowest operating cost ever reached by an installation of this rating.

The Coming Issues

PUBLIC policy in a central station company, if really effective in upbuilding the property, means careful commercial management as well as public relations. In the company of average or small size the commercial and public policies are very likely to be closely merged. The manager, to be successful, should keep both before him in planning and executing. In the next issue the Electrical World will publish suggestions, based on experience and long-time contact with the problem of the station of average size, which will aid in the development of business and the maintenance of cordial relations with consumers. There will also be published articles relating to regulation and to the intimate connection between financing methods and favorable public approval. Such articles help to impress the lesson that good service is not the only desirable feature of management, but that sound financing plans are of vital import. The Electrical World has arranged to present in a Special Report Number, dated May 12, the reports of the proceedings of the National Electric Light Association's conference to be held in New York City, May 9 and 10, together with summaries of the work of the year contained in papers and reports of the association already prepared for presentation at the convention which was to be held at Atlantic City.

Battery Exchange Service at Hartford

A Total of Eighty-eight Electric Trucks Is Now in Operation Every Day, with an Average Energy Consumption of Approximately 1.3 Kw.-hr. per Rated Ton-Mile

FOR almost five years the battery exchange plan has been in force at Hartford, Conn., and since the beginning it has continued to grow until there are now eighty-eight commercial electric trucks of different sizes operating under this plan. No figures on return on investment or showing profits are yet available because the long life of the nickel-iron battery has made it impossible to set apart proper depreciation. Operating figures are available, and an analysis of them is given further on.

The Hartford Electric Light Company, realizing how little effort was being made by local agents to sell commercial electric cars, took the agency for General Vehicle trucks early in 1910. When snow was on the ground or conditions were otherwise unfavorable two batteries were used in some of these vehicles in the winter. The batteries were handled in individual trays and exchanges made in less than ten minutes.

This led to the evolution of the battery exchange plan, which was first announced to Hartford firms in a letter dated Nov. 1, 1911. The first car purchased for operation under this system was delivered to the Eagle Dye Works Company and went to work on June 5, 1912. All cars previously sold were changed over for operation under the exchange service as rapidly as possible.

Under the battery service system as developed by the Hartford Electric Light Company the customer purchases from the company a truck without battery while the company buys the batteries, charges them and installs them in the customer's truck. For service the customer pays a flat sum and for operation he pays on the mile basis, different rates being charged for trucks of different size.

According to the contract with the customer, the electric light company agrees to furnish him with a fresh battery on demand. The truck is brought up to the station when fresh batteries are needed, and the odometer on the truck is read, giving the company the number of miles of travel for billing. Two attendants are ready with a fresh battery, which is put in place of the one returned. The whole operation from the time the truck comes in the station until it leaves consumes normally about two to two and one-half minutes. The time lost therefore is less than the time required to fill up the gasoline tank of a gasoline truck.

The operation of changing batteries is very simple and is essentially as follows: The incoming truck is run up on a couple of slightly elevated tracks and comes to rest with the battery directly over a hydraulic lift. An attendant who is waiting slips a Cowan truck under the battery, the lift raises it to the battery, the hooks and connection of which are quickly unfastened, and the battery is lowered and taken to one side. The battery which is to take its place is all ready near by and is quickly wheeled into position, raised by the lift and the hooks, and the connection fastened. The battery box is then locked up and the truck backs out.

To perform this changing operation three men are employed, two for battery change and one shift man who reads the odometer.

The changing peak occurs as a rule between 6.45 and 8.30 a. m. From then until noon there is a let-up, depending on the weather and day. The cars commence to come faster around 11 o'clock, and from 12.30 to 3 there is a continual rush. Friday and Saturday are the two busiest days, and particularly Saturday, when the stores keep open until 9 o'clock. There is a heavy demand all day Monday, which next to Saturday is the busiest day of the week on exchange. On battery watering Monday is the heaviest day of all.

Batteries are charged during off-peak hours. When the peak comes on, or should an accident occur, the batteries are pulled off the lines.

But 1.4 Batteries Needed per Car

For the battery exchange system it has been found that 1.4 batteries are needed per car. There is therefore 0.4 of the total number of batteries always in a position to be in charge, the remainder of course being in service. For the charging of these exchange batteries forty-three charging panels are used. These are housed in the battery exchange building which used to be the company's battery substation, and even now is used as a substation to some extent. Here the company



FIGS. 1 TO 3—A FEW OF THE TRUCKS ON EXCHANGE SERVICE OUTSIDE THE STATION PRELIMINARY TO RECEIVING A FRESH BATTERY—THE MIDDLE TRUCK IS RATED AT 3½ TONS BUT IS HERE SEEN WITH A 5-TON LOAD OF COAL

also distills its own water for the batteries, using one small electric and one small steam still. The water is distilled into 5-gal. (18.95-l.) carboys, of which forty-six are in use. On the average about 100 gal. (379 l.) of distilled water is used daily. Altogether this service, with the small lighting battery business, requires the employment of about twenty-one men. Three shifts are used.

In addition to this building the company's service to truck owners includes a garage owned by the Commercial Electric Garage Company. This is a garage company through which the company bills customers for garaging and making repairs according to a contract which will be described later. The repairs are made by employees of the electric light company in their spare time at night. This garage is for night service and requires three men at work from 11 p. m. to 7 a. m.

The garage company owns the building, but all of the electric equipment is owned and operated by the electric light company. The building equipment includes charging equipment for thirty-eight cars at one time, and also a 250-kw. rotary and a 200-kw. motor-generator set. The batteries receive a fresh charge while standing idle at night.

As supplementary to the battery exchange system the company charges regularly between 600 and 700 lighting and ignition sets. A charge of 50 cents per week per battery is made. This business is not solicited but the company takes what comes in. Ordinarily these batteries stay out from two to three weeks, when the owners bring them in and receive charged batteries in exchange. The input to these batteries averages about 0.75 kw.-hr. The value of this service is that it adds additional revenue without a large portion of the additional expense that would be incurred were it operated apart from the exchange system for trucks. In fact, it helps to carry the labor necessary for the exchange service, which must be a twenty-four-hour service.

Since the exchange system was put into effect the number of trucks using it has increased materially, thereby lowering the cost of service per truck. For this reason a substantial reduction in the price of service went into effect on July 1, 1915, and the rates then made are still in effect.

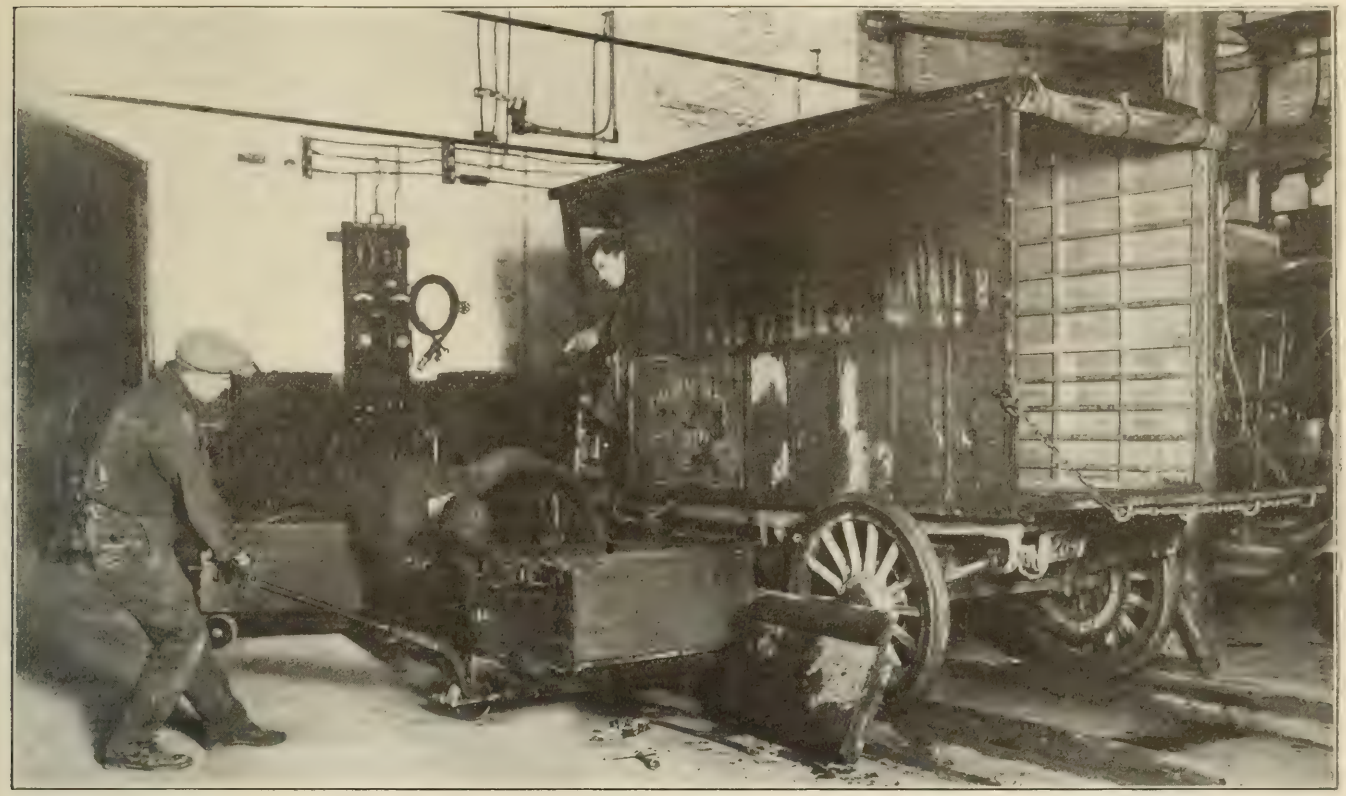


FIG. 4—IT TAKES ABOUT TWO MINUTES TO CHANGE BATTERIES. WHILE ONE MAN IS PULLING OUT THE BATTERY THE OTHER MAN READS THE ODOMETER ON ONE OF THE FORWARD WHEELS. THE FRESH BATTERY IS SEEN IN THE BACKGROUND

Rates are divided into two classes, Scale I and Scale II. Under the former the battery is not charged in the truck and the truck is stored in a place convenient to the owner with no provision for charging. Under Scale II the battery is charged in the truck at night by the company and the truck garaged by the Commercial Electric Garage Company.

The rates under the two scales are shown in an accompanying table, with old rates in parentheses. The only difference between the two scales is in the fixed charges, which it will be noticed are lower for Scale II. than Scale I, the mileage rates being the same for both. The rates for cars using garage service are lower than for those with their own garage, on the principle that a smaller number of extra batteries are required to operate the service when the batteries are charged at night and do not stand idle until morning.

The garage company furnishes space for trucks under the following scale of charges based on yearly contracts: 750-lb. (0.34-metric ton) to 1-ton (0.9-metric ton) sizes, $100 a year; 2-ton (1.80-metric ton) size, $120 a year; 3½-ton (3.15-metric ton) size, $125 a year, and 5-ton (4.5-metric ton) size, $150 a year. These charges for space include ordinary oiling and greasing of trucks. Cars are washed on orders from owners at 50 cents for each washing. Repairs are made only on orders from

owner, when the charge is 60 cents an hour for labor with material and parts extra. Ordinarily repairs and replacements on the trucks can readily be made at night, so that except in the most exceptional cases no time is lost by the trucks for making repairs.

Mechanical Maintenance Contract

Efforts are being made by the lighting company to sign up exchange customers under a mechanical maintenance contract. The aim of this contract as stated therein is "to keep the truck in the best of running condition at all times and at the lowest cost to the truck owner by increasing the driver's interest in the proper

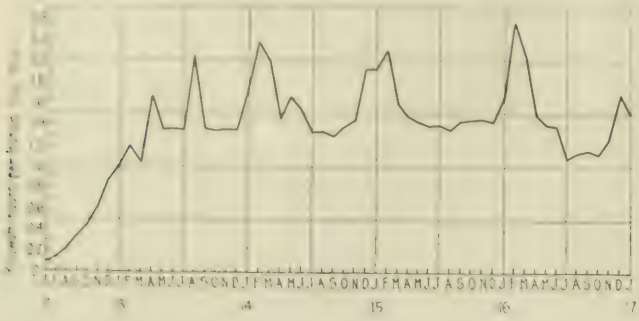


FIG. 5—ENERGY CONSUMPTION PER RATED TON-MILE

operating and care of his truck." It is this last part relating to the drivers that is of especial interest. The company uses it as part of its refund scheme. Should the amount paid by the customer at the end of each year be in excess of the repairs actually made the excess is divided as follows: 60 per cent returned to the customer; 20 per cent kept by the light company, and, provided the owner approves, 20 per cent to the driver of truck as a bonus. It is recommended that the truck owner shall pay the driver a further bonus for keeping down repair costs.

However, should the amount of repairs exceed the customer's contract price he agrees to stand for 50 per cent of the excess. The schedule on which this plan operates is: 750-lb. (0.34-metric ton) truck, $100 per year; 1000-lb. (0.45-metric ton) truck, $125 per year; 1-ton (0.9-metric ton) truck, $150 per year; 2-ton (1.80-metric ton) truck, $175 per year; 3½-ton (3.15-metric ton) truck, $225 per year, and 5-ton (4.5-metric ton) truck, $250 per year. These charges are payable in twelve equal monthly payments.

This contract is for one year and covers all bills rendered by the garage company for material and labor used in the mechanical and electrical upkeep of the truck for certain items as described and with certain exceptions. The contract includes the regular care of controller, Morse chain and motor and one overhauling. Where the truck owner does not carry accident insurance payable to the light company the latter does not agree to be liable under the contract for repairs made necessary by the wrecking of the car through unusual and serious accident. The light company is authorized to issue all orders to the garage company to make such repairs as the monthly inspection of the light company indicates to be necessary and to order such other repairs as may be found to be necessary from time to time.

Renewals of and repairs to the following items are included in the contract:

Provisions of Contract

1. The steel frame with the attached parts, such as spring hangers, battery cradle hangers, etc.
2. Countershaft case, Morse chains, housing with parts used for attaching same.
3. Springs, spring links, and bolts with bushings where used.
4. Axles, steering head forks, and spring seats with bushings.
5. Steering mechanism, complete from steering wheel to steering head, including steering pins, sector pinion and all other parts.
6. Driving mechanism—motor pinion, Morse chain, differential gear, differential, countershafts, sprockets, side chains, rear sprockets, roller bearings or other similar parts for above.
7. Brake mechanism—foot lever with ratchet, brake radius, equalizing bar, brake shoes, brake linings and brake springs.
8. Wiring—the main wiring from battery leads through controller to motor, including controller resistance and motor with all their parts; auxiliary wiring; wiring for lamps, including switches and fuses, headlight and tail-light and one inside light; glass and other parts for the lamps; the electric bulbs and sockets; bell where used with wiring and foot push.
9. Lubricating devices on all parts of the car, such as grease cups, spring link handles, etc.
10. Wheels—wheel bearings; the woodwork of wheels with the exception noted under No. 5.

It is agreed that the contract does not cover the following exceptions:

1. Items already covered under the service system.



FIG. 6—THE COMMERCIAL ELECTRIC GARAGE HAS CHARGING EQUIPMENT SUFFICIENT FOR THIRTY-EIGHT TRUCKS

2. Ordinary greasing and oiling.
3. Washing, painting of car or repairs to body of truck, including cradle doors.
4. Tires and skid chains.
5. Metal rims for tires or damage to wood felly caused by changing make of tires.

The customer agrees to keep his truck properly oiled and greased if it is kept in a place other than the garage of the Commercial Electric Garage Company.

It has been very difficult to interest customers in this plan because the customers as a rule figure that the cost involved is too high and that they can do better on maintenance themselves. Out of eighty-eight trucks sold on the exchange plan only fifteen are on the maintenance contract. The plan, however, has been in effect too short a time to procure any figures. The contract has the valuable feature of heading off unfair criticism on the part of the customer in the matter of repairs.

From the customer's point of view the larger-size trucks are best, the operation being more economical. The demand for trucks of less than 1-ton (0.9-metric ton) capacity has fallen off to a point where the company has stopped selling these smaller sizes. The new rates have increased and stimulated the sale of the large sizes.

For every truck sold a dividend is paid on each truck purchased in the previous year up to twenty-five trucks as follows: 750-lb. (0.34-metric ton) size, $4 per truck sold, with a $2 increase for each size up to 5 tons (4.5 metric tons), on which the dividend per car sold is $14.

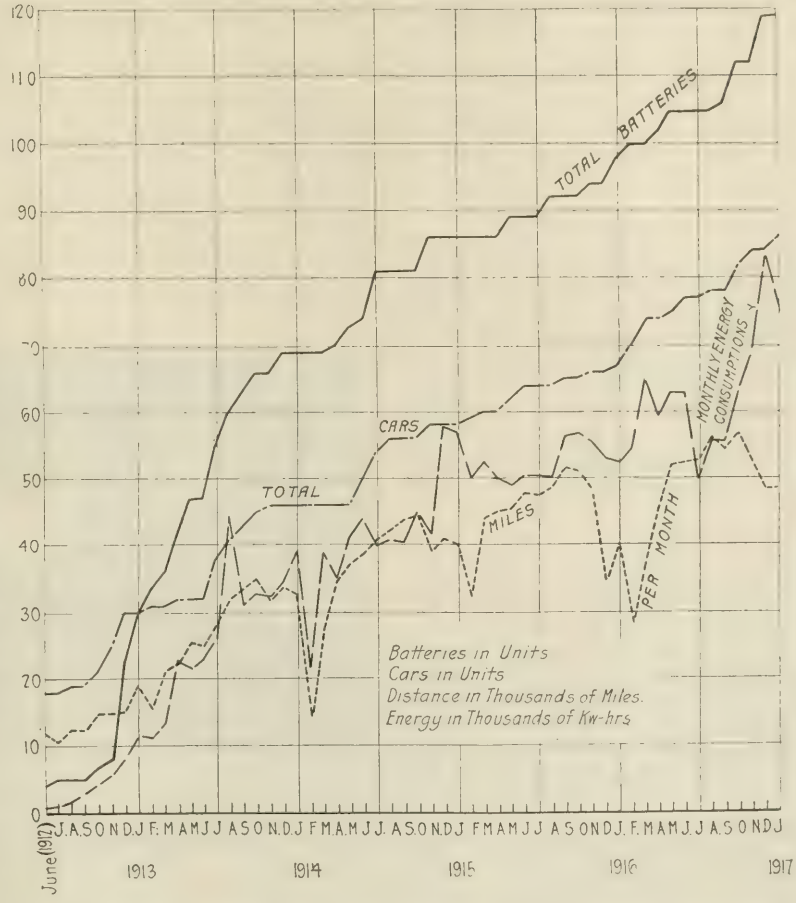


FIG. 7—TOTAL NUMBER CARS AND BATTERIES, AND MONTHLY MILEAGE AND ENERGY CONSUMPTION

Customer's Point of View

From the point of view of the customer the service is very satisfactory and economical in operation and maintenance. D. C. Perkins, proprietor of the business known as Downing & Perkins, draymen, who has been using the service since 1912 and has increased his number of trucks to seven, when interviewed by a representative of the ELECTRICAL WORLD was very enthusiastic. Mr. Perkins said:

"Here is what sold me the first truck. Mr. Thayer [the superintendent of the exchange system] talked electric cars to me, but I couldn't see the dollars in them. I said to him, 'Suppose I went out on a hurry-up job and the battery gave out. The car then isn't worth a cent. If you had along a pail of electricity that you could dump in the battery when it ran out, then it would be fine!' Then came the battery exchange system, and of course all objections were removed.

"About one month in the year my competitors lay up their gas cars and hire my electric cars for this service for about $150 apiece. The electric car should be taken down about once per year. It takes but a day or two. The parts are here. We don't have to send for them.

"I used to keep three horses for every two wagons. Now the horses only do short runs. No spare horses are needed with electric cars.

"I have a 1-ton (0.9-metric ton) truck that averaged 37 1/5 miles (60.35 km.) per day for two years and seven months, at a cost of $5.97 per day, including driver's pay, depreciation, interest and all other expenses. This car earned 40 per cent on the investment above all expenses, besides dispensing with a pair of horses. With the car I did all of the long runs that with a pair of horses were formerly done at a loss.

"I had a hard time getting the drivers to take hold of the electric trucks. They felt that it was a scheme for helping the boss. Now they like to drive the cars, principally because they don't have to take care of horses after they get through work and on all holidays.

"I keep a debit and credit with each car. It is up to the men to make a profit with it. This profit is divided with the men. If my men can't make a profit, I don't want them. Accidents take off profits, and I have not had an accident on an electric car in two and one-half years. The men are now eagerly watching for orders which they can fill on each trip."

Mr. Perkins is so enthusiastic that when one of his competitors has trouble he calls on him and talks electric haulage. He now has seven trucks, having purchased his first truck in 1912 and his second truck Feb. 15, 1915.

Operating Results

Since the battery exchange system was started, in June, 1912, and up to the end of January, 1917, the total mileage was 2,009,807 miles (3,234,476.87 km.). The largest mileage in any single month was 56,402 miles (90,770.4 km.) in October last. The average miles per car per month since the plan was first started has been 678 (1091.14 km.), with the largest month that of March,

1914, when the average mileage per car was 810 (1303.57 km.), and the smallest month that of February, 1914, when the average mileage was only 309 miles (497.3 km.). It will be noticed from the accompanying table that the best mileages are obtained between March and November. The winter months as a rule show a very small falling off in mileage.

TABLE I. MONTHLY SCALE OF CHARGE—UNDER BATTERY SERVICE SYSTEM

	500-lb. Wagon	1000-lb. Wagon	1-Ton Truck	2-Ton Truck	3½-Ton Truck	5-Ton Truck
Fixed charge, Scale I	$14.00 $15.00	$18.00 $20.00	$27.00 $30.00	$32.00 $40.00	$40.00 $50.00	$48.00 $60.00
Scale II	$10.00 $10.50	$15.00 $14.00	$19.00 $21.00	$25.00 $40.00	$32.00 $50.00	$45.00 $60.00
Rate per mile for 0–500 miles	2½	3	3½	4½	6	7
500–750 miles	2½	2¾	3	4	5	6
750–1000 miles	2	2¼	2½	3½	3	4
For all excess above 1000 miles	1½	2	2	3	3	4

The average miles per month for the 750-lb. (0.34-metric ton) truck during the first fifty-six months was 655 miles (1054.12 km.); for the 1000-lb. (0.45-metric ton) size, 743 miles (1195.75 km.); for the 1-ton (0.9-metric ton) size, 456 miles (733.86 km.), and for the 2-ton (1.8-metric ton) size during the first forty-three months of its operation, 562½ miles (908.5 km.). The 3½-ton (3.15-metric ton) size has not been in operation long enough to make any deductions.

Energy Consumption

The energy consumption through January last amounted to a total of 2,252,162 kw.-hr. In 1916 the energy used for this service was 733,326 kw.-hr. The average energy consumption has been 1.12 kw-hr. per car-mile. In the winter months the energy per car-mile is large. The maximum was reached in February, 1916, with an average consumption per car-mile of 1.953 kw.-hr. In the summer the energy consumption is somewhat less.

The same general statements, of course, hold true for the energy consumption per rated ton-mile. A high consumption of 2.35 kw. per rated ton-mile was reached in February, 1916. In October last, however, the energy consumption per rated ton-mile was 1.107 kw.-hr. Ordinarily, however, the energy consumption per rated ton-mile is in the neighborhood of 1.3 kw.-hr. How this consumption varies month by month is shown graphically on an accompanying curve. The figures showing energy consumption up to January, 1913, are not accurate owing to the fact that up to that time trucks were being changed over from operating with lead batteries to nickel-iron batteries and the records of power at that time are not clear.

TABLE II—EXCHANGE LOAD AND CARS STALLED

	1912		1913		1914		1915		1916	
	June	Dec.	June	Dec.	June	Dec.	June	Dec.	June	Dec.
Car days	†	†	†	949	1091	1432	1594	1188	1631	1770
Battery exchanges	†	†	†	703	633	1284	988	1152	1143	1623
Per cent of cars changing	†	†	†	74	58	90	64	97	70	92
Number cars stalled	†	†	†	24	12	25	3	26	16	29
Cars stalled in per cent of car days	†	†	†	3	1%	2%	⅓%	2%	1%	2%

†No data obtained.

As the service has increased the plan has become less expensive per car to the light company. In the accompanying table are shown figures representing the percentage of cars changing batteries every day and the number of cars stalled for the months of June and December, 1912, 1913, 1914, 1915 and 1916. The number of stalled cars includes every cause whatever and does not necessarily imply a condition of exhausted batteries.

The energy used is measured by wattmeters and includes all losses incurred in transformation and stepping down.

The Edison batteries used on the exchange service are subjected to very hard usage. At the end of the first four and a half years the number of cells in use was 6936 and their service was equivalent to 226,812 cell-months. Only 225 cells have been returned to the factory for repairs in that period. Of these fifty-one were on account of leaks or broken seams and the rest for other causes, such as failure to charge up or broken terminals.



FIG. 8—OF THE 1.4 BATTERIES NEEDED PER TRUCK, 0.4 IS ALWAYS IN A POSITION TO BE CHARGED IN THE CHARGING PLANT, A CORNER OF WHICH IS HERE SHOWN

Since the exchange service was first started in Hartford it has been under the personal direction of Willis M. Thayer, who presented a paper on the experiences of the company with the system before the 1915 Electric Vehicle Association convention, which was held at Cleveland, Ohio.

The first electric truck sold by the Hartford Electric Light Company is still in use by its original purchaser, the Boston Branch Grocery, and this firm is now operating eleven electrics under the battery service system. The trucks are used in twenty-five lines of business, and sixty-three out of the eighty-eight have been purchased on repeat orders. The trucks sold have proved more advantageous than either horses or gas cars, and this advantage is principally one of economy. That is, in spite of the high first cost electric vehicles have proved economical. If the electric truck could be sold to the customer at a price corresponding to that of the gas truck and its excess investment cost distributed as an operating cost electric trucks would sell more rapidly. This result is in part attained through battery service. A wider distribution of charging facilities is also to be desired.

Experience with Induction-Generator Plant

Description of the Pacific Power & Light Company's Drop Plant in the Naches Valley, Which Has Been in Successful Operation for Two Years Without an Attendant

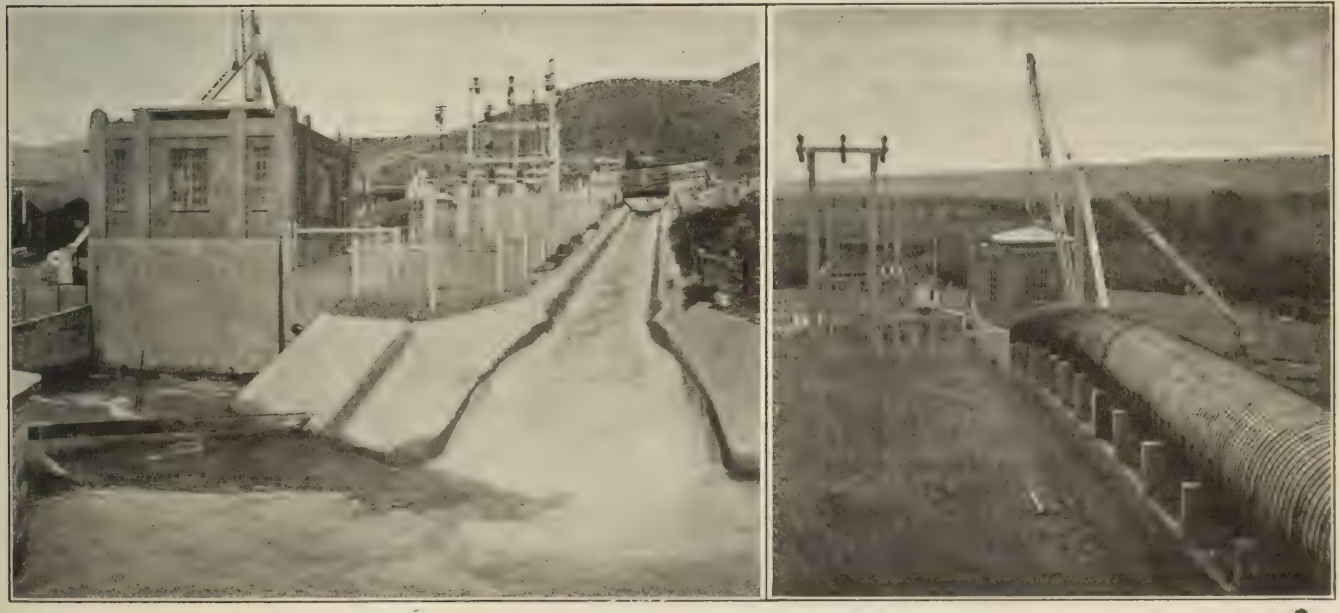
BY J. H. SIEGFRIED

Superintendent of Power, Pacific Power & Light Company

SEVERAL interesting features are connected with the construction and operation of the Pacific Power & Light Company's induction-generator plant, in the Naches Valley, 15 miles (24.1 km.) northwest of North Yakima, Wash. The Wapatox ditch, which supplies the plant with water, was built for irrigation purposes, but later was acquired by interests which enlarged it and extended it for power purposes. The canal is 9.4 miles (15.1 km.) long and supplies the Naches power plant with water under a head of 147 ft. (44.8 m.). Along the canal were several small falls, aggregating 52 ft. (15.8 m.), where power was wasted. In 1913 the canal was enlarged and lined with concrete its full length, and all falls were concentrated at one point near the middle of the canal, where a new plant (the Drop plant) was installed and put in operation, in the spring of 1915. The end of the canal at the upper level was enlarged to form a forebay, and trash racks, headgates, spillway, etc., were installed, as shown herewith.

Because the plant stood in the middle of the canal it was necessary to provide some means for carrying the water around it during the periods of light load or when the plant was shut down for any purpose. This was accomplished by providing a wasteway between the upper and lower levels of the canal and arranging a spillway at the forebay of such a length that the entire capacity of the canal could be spilled with a 12-in. (0.3-m.) rise of water in the forebay. Since the lower and upper levels of the canal are only 500 ft. (152 m.) apart, the wasteway had to be given a steep slope. As a result the problem of dissipating the kinetic energy of the water at the lower canal level was presented. Several different methods of solving this were considered, but the one finally adopted has proved very successful. The end of the canal below the plant was enlarged to form a "stilling" pool 20 ft. (6.1 m.) deep, 50 ft. (15.2 m.) wide and 102 ft. (31.1 m.) long. The sides and bottom were made of reinforced concrete, as was the apron at the end of the wasteway When not used through the waterwheel the water rushes down the wasteway into the stilling pool, where it rolls and churns until its kinetic energy is lost, after which it flows quietly out of the pool and into the lower section of the canal.

The forebay is triangular in form and is connected with the canal at its apex. The north side of the forebay is formed by the spillway wall, and one-half of the east side is occupied by an ice gate 35 ft. (10.7 m.) wide. From the end of the ice gate and parallel to the spillway wall extend the trash racks, consisting of eight panels of grates 8 ft. (2.4 m.) wide and 10 ft. 6 in. (3.19 m.) high. Thirty-five feet behind the grates are the headgates. Two gates, each made of a steel frame filled with concrete to give it weight, are provided. They are operated by a chain hoist, and the bearing surfaces have rollers and a flexible metal strip which serves as a seal alongside the gates. After passing through the grates and gates the water enters a cone-shaped chamber which connects with a steel pipe that leads to an 8-ft. (2.4-m.) wooden penstock. The penstock rests on concrete saddles, the spaces between being provided with a concrete gutter to catch the water in case leakage should occur. At the lower end of the penstock is a steel thimble which is connected with a butterfly valve placed inside the power-plant building.



FIGS. 1 AND 2—INDUCTION-GENERATOR PLANT FROM DISCHARGE END OF WASTEWAY, AND PIPE-LINE SERVING WATERWEELS

The power house consists of a steel framework cov-

ered with metal lathing, plastered inside and having a stucco finish outside. The building is 29 ft. by 30 ft. 6 in. (8.8 m. by 9.3 m.), is well lighted and is equipped with a hatch in the roof through which the machinery can be handled by means of a 70-ton (63.5-metric ton) stiff-leg derrick permanently erected near the building. The derrick also serves the outdoor high-tension transformers and lightning arresters.

The Interior Equipment

Inside the building are a waterwheel-driven generator and a switchboard. The waterwheel is a vertical Pelton-Francis unit which develops 1900 hp. at 200 r.p.m., and the generator is a 1400-kw., 2300-volt, three-phase General Electric induction-type unit. The weight of the revolving element is supported by a Kingsbury thrust bearing above the generator. Between the top of the generator and the hatch in the roof is a sheet-iron housing in which was placed a fan for forced ventilation. This fan is not needed, however, and has been disconnected. The waterwheel is not equipped with a governor, but is controlled by means of a large hand-wheel geared to the waterwheel gates.

The generator panel is equipped with a voltmeter, an ammeter and indicating and integrating wattmeters. The generator oil switch is of the General Electric K-12 type and is equipped with no-voltage release and overload trip. A tachometer is provided for indicating the speed of the unit when starting. The level of water in the forebay is indicated by a voltmeter, the scale of which is calibrated in inches.

A 400-gal. (1514-l.) oil storage tank is installed near the roof of the building, and the oil is carried through sight feeders to the Kingsbury thrust bearing and to the guide bearing. Overflow from the bearings flows by gravity to a sump tank, inside of which are filters. The oil is pumped from the sump to the storage tank by means of a motor-driven rotary pump. The storage tank is provided with an indicator showing the amount of oil it contains. Connected therewith is an electric alarm which operates when the quantity of oil reaches a predetermined amount.

Three 500-kva., 2300/38,000-volt transformers connected delta on the low-tension side and star on the high-tension side are provided to feed the 66,000-volt high-tension system. The line connecting them with the system is 2.9 miles (4.6 km.) long and consists of three No. 4 stranded BB steel conductors arranged in an equilateral triangle 6 ft. 6 in. (1.97 m.) on a side. This line is controlled from the Naches plant, where all power generated at the Drop plant is passed through a General Electric K-22 outdoor-type electrically operated switch equipped with three current transformers in its leads. These actuate the ammeters and overload relays on the switchboard of the Naches plant.

As is well known, an induction motor driven above synchronous speed will act as a generator when connected to a system fed by synchronous generators and will deliver power to the system in proportion to the force driving it. The frequency of the current produced will depend on the frequency of the synchronous generators connected to the system. Excitation of a generator of this type is produced by the wattless magnetizing current drawn from the synchronous generators or condensers connected with the system, so it is evident that an induction generator will lose its load should the wattless magnetizing current be interrupted.

The generator at the Drop plant is of this type and is practically fool-proof. It cannot be over-excited or under-excited by any action of an attendant and cannot be overloaded because the waterwheel capacity is less than the capacity of the generator. It cannot be burned out by means of short circuits outside the generator, for the reason that a short circuit will interrupt the magnetizing current and thus prevent the production of any emf. Furthermore the voltage or frequency of the system will not change as long as synchronous generators equipped with governors are operating on the system.

On account of these characteristics this plant is operated without an attendant. The canal patrolman stops at the plant in the morning, pumps the oil into the storage tank, takes the wattmeter readings and reports them to the load dispatcher at Kennewick. The load dispatcher then instructs him to open the waterwheel gates until the load desired is obtained, after which the machine is allowed to run without attention until the patrolman passes the plant again. At night the patrolman is instructed to close the gates and reduce the load to a point determined by the load dispatcher, after which the generator is left to run all night without attention.

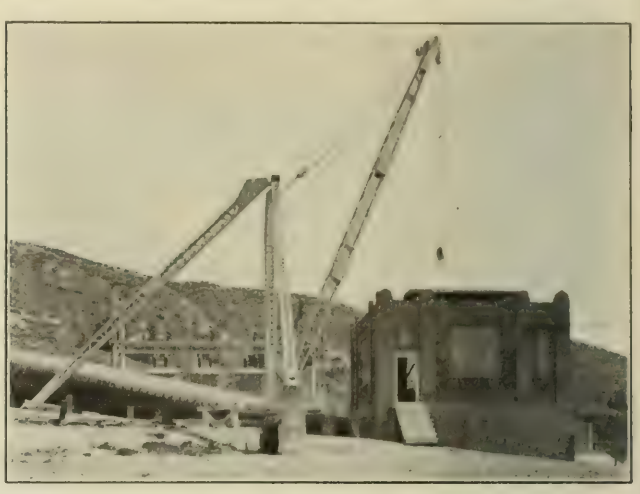


FIG. 3—PERMANENT OUTDOOR CRANE FOR HANDLING STATION APPARATUS THROUGH ROOF HATCH

This machine has been operating in this way without trouble for almost two years and in that time has generated 11,700,000 kw.-hr.

To put this unit in service after a shut-down, the waterwheel gates are slowly opened until the machine has reached approximately normal speed. In order to tell when synchronous speed is reached a stroboscopic indicator is provided. This consists of an arc lamp fed from the circuit to which the generator is to be connected and a series of black and white stripes on the generator shaft, the number of stripes corresponding to the number of poles of the generator. The arc lamp is placed inside the frame between the generator and the waterwheel. When the lamp is energized and the light shines on the striped shaft the stripes appear to move slowly ahead or back, depending on whether the generator is running above or below synchronous speed. When the stripes appear stationary—that is, when synchronous speed is attained—the attendant closes the generator switch. It has been found in actual practice, however, that less disturbance occurs on the system if the switch is closed when the generator is running slightly below synchronous speed.

The transmission system with which this plant con-

nects has 300 miles (482.8 km.) of 66-kv. and 112 miles (180 km.) of 25-kv. lines. The load is relatively light and the power factor of the system is leading except during the heaviest demand for power, which occurs in the irrigation season. The handling of the charging current of the system has been a problem on account of the lack of generator capacity at certain periods of the year when ice prevents normal operation of the hydraulic plants. The addition of the Drop plant generator has been of considerable benefit, however, for the reason that it requires 825 kva. for its magnetization. This is supplied from the lines of the high-tension system and relieves the synchronous generators to this extent. In the winter when ice prevents the operation of this unit by water the generator is allowed to run as an induction motor for the purpose of using the charging current.

If at any time the synchronous apparatus should be tripped off the system the induction generator will still maintain voltage on the system and carry load. The frequency and load is proportional to the waterwheel gate opening, while the voltage will depend on the length of line fed by the generator and the voltage of the system at the instant the synchronous apparatus was tripped off. If under these conditions the waterwheel gate setting is changed, the load voltage and charging current will change with the frequency.

Under certain conditions this generator will trip off the line and it is necessary to get into communication with the canal patrolman and send him to the plant to put the generator in service. This may appear to be a great disadvantage, but the patrolman's beat covers only four miles—one mile above and three miles below the Drop plant—and telephones are installed every mile along the canal. The patrolman reports to the forebay tender at Naches from each telephone station and is therefore fairly close in touch with the system at all times. At night he sleeps in a house near the forebay and can be reached by telephone at any time. From the time the generator is tripped off the line to the arrival of the patrolman at the station the generator speeds up, but as the machine is designed to withstand 100 per cent overspeed no damage can result. This plant has given excellent service at an extremely low operating cost.

PROFITABLE UTILIZATION OF WASTE MATERIAL

How the Public Service Company of Northern Illinois Attacks the Problem Presented by the Junk Pile

Probably no line of business is more seriously affected by the high cost of raw materials than the electrical industry. Recognizing this condition the Public Service Company of Northern Illinois has endeavored in all the branches of its organization to utilize waste materials or make it a point to dispose of them to the best advantage. In doing so, however, care is taken not to let the expense of selling or utilizing the material offset the price obtainable.

According to George R. Jones, purchasing agent of the company, the largest waste is by way of the junk pile. Selling this in job lots as is usually done brings a small price based on the least expensive materials in the pile. Higher prices are obtained by segregating the scrap into the following divisions: (1) Cast iron; (2) wrought iron; (3) malleable iron; (4) forge iron; (5) steel (tool steel should not be deposited in scrap piles); (6) cutting stock—(a) busheling (0.25-in. gage or heavier), (b) busheling (sheet iron); (7) borings and turnings (must contain no brass to avoid defective pigs); (8) usable pipe; (9) usable fittings, and (10) usable flues.

Copper and brass, except for wire and cable, are kept under lock and key and sorted as follows: (1) Red brass and bronze; (2) yellow brass; (3) red borings and turnings, and (4) yellow borings and turnings. When weatherproof wire and cable can be burned without losing an appreciable amount of copper this method of reclamation is employed. The ashes are usually saved as they contain copper flakes. The lead sheathing is stripped off large scrap cables so the copper can be sold separately, the lead being turned over to the gas department for calking pipes. Some of the lead is used for making expansion bolts. Small cable cannot be disposed of so profitably, however, as it has to be sold unseparated. The price obtained is approximately equal to the junk value of an equal amount of lead.

Plan Followed with Old Machinery

Before selling old machinery the amount of copper contained therein is computed to determine whether it will be advisable to separate the apparatus into its constituent materials or sell it as an operating unit. Transformers are never junked without their being tested first by the electric-service company and then by the manufacturer receiving them for repairs, to make doubly sure that they cannot be repaired and are not inoperative owing to manufacturing defects. Many thousands of dollars have been saved by this policy.

When meters are junked or returned to the manufacturers for credit, all parts are removed that are in good operating condition for use in repairing regular stock meters. Junk regulators and arc lamps are sold without separating the copper, iron and brass in them. Since some of the old series incandescent lamps have aluminum hoods these are sold separately as they command relatively high prices.

The solder on junk cable and the dross of molten lead are saved for future use. This dross, as well as babbitt dross, is readily marketable. All sorts of copper wire, even magnet wire, are saved for resale. Enough is reserved, however, to avoid the use of new copper wire for the tie wires.

All incandescent lamps that are turned in for renewals are saved. Those units which have been returned for reduction in candlepower are used in the generating stations. The remainder are sold to lamp-refilling companies, or the constituents sold separately. The bases can be sold for the brass or platinum filament supports they contain. The glass of which the bulbs are composed is high grade and brings a good price.

As the price of mercury has traveled a sky-rocket course since the war began every bit of quicksilver is jealously guarded. When rectifier tubes become useless the mercury is extracted and the bulbs returned to the manufacturers for the credit the platinum terminals and glass will bring. Rubber is another valuable part of the scrap pile. Since different forms of it bring different prices it is separated and classified as follows: (1) Tire casings; (2) inner tubes—lineman's protector shields; (3) hose; (4) gloves; (5) boots; (6) coats and slickers; (7) packing, and (8) hard rubber.

Who Should Pay for Appliance Repairs?

What the General Central Station Experience Has Been—Why Some Companies Charge and Some Do Not, and What It Costs—Data from Twelve Cities of the Middle West

A NEW and interesting problem of central station policy is rapidly developing with the growing use of small appliances in the household. For the last five years and more the aggregate number of these devices in use has been increasing by tens of thousands annually—yes, and by hundreds of thousands to-day—and as they are used they are subject to inevitable wear and tear. Enters the problem of repairs. From a small detail of commercial policy it rapidly is becoming a most important factor in the maintenance of an appliance load. In twelve cities in the Middle West, ranging in population from 2000 to 2,000,000 and totaling over 4,200,000 inhabitants, investigation shows that one repair was made last year for every thirty-one people in these communities. In nine of these cities the central stations made all of these repairs without charge to the customer—they believe that all such service should be free. In the other three cities a charge is made. The question arises therefore, which is the proper policy for the central station to pursue?

Why Some Companies Favor Free Repairs

S. B. Way, vice-president and general manager of the Milwaukee Electric Railway & Light Company, says: "We are convinced that a liberal policy respecting heating appliance repairs is good business. Heating appliances out of repair are of no value, and our efforts are directed toward keeping them in continuous use and keeping the customers satisfied with the results. About 8000 free electric appliance repairs are made in Milwaukee annually, and the cost of these repairs will average about 50 cents each. The free repairs constitute about 90 per cent of the total repairs to electric heating appliances, and the remaining 10 per cent are charged to customers for various reasons."

R. E. Flower, manager of The Electric Shop, which is the appliance department of the Union Gas & Electric Company of Cincinnati, agrees. He writes: "We have always given free repairs, and we feel that this policy has won us many friends. In the twelve months ended Dec. 31, 1916, we repaired 1170 appliances, of which about 60 per cent were repaired in our shop. The expense of making the repairs was $1,017.50, which makes the average cost 87 cents per repair." He feels that it is worth what it costs.

The Des Moines (Iowa) Electric Company, serving a city of 86,000, also sees the problem in a liberal light. H. W. Garner, the commercial manager, says: "The gratis repair department is expensive to maintain, but we believe that it is good policy and have no idea of discontinuing free service. We only ask the customer to bring his appliance to our office and to call for it. During 1916 we repaired 3450 flatirons and 463 miscellaneous appliances. The cost of making the repairs on the 3913 pieces was 58 cents each, which included labor and material."

While it does not operate on an entirely free repair basis, the Kansas Electric Utilities Company at Emporia, Kan., is also convinced of the fundamental correctness of the plan. M. Dunsworth, the local manager at Emporia, says: "In our opinion it not only keeps appliances in use and gives us the benefit of additional energy consumption, but also forms a friendship between the company and the consumer. When we show that we are interested in such matters it cannot but have a good effect on our public.

"We repair on an average about sixty electric irons and small heating devices per month. We make an average charge of 15 cents for labor, ample to cover repairs on irons and small heating devices. A charge of 25 or 30 cents is sufficient to cover the labor of repairing vacuum cleaners."

The Experience in Chicago

And in even smaller cities, of which Union City, Ind., with population of 3200, is a fair example, the same policies have been found profitable. "We have made it a custom," says Thomas T. Parker, manager of the Union City Electric Company, "to repair at actual cost for material all appliances, whether purchased here or elsewhere. We believe this plan is eminently fair to the customer, that it is good-will advertising, and that it helps very materially in keeping appliances in use." But in Chicago the central station officials have tried it out exhaustively and after giving free appliance repairs for years have decided to revise their policy. Their reasoning is interesting.

The Commonwealth Edison Company during 1913 repaired 28,144 heating devices; in 1914 the number increased to 48,880; in 1915 it was 59,351, and in 1916 it was 71,601. To show what the majority of repair jobs consist of, the following classification of jobs done in the shops in 1916 was given by P. J. Smith, who is in charge of the customers' service department: Cords, 30,889; irons, 14,907; percolators, 1302; toasters, 615; curlers, 803; heating pads, 272; stoves, 88; water heaters, 34; grills, 56; Christmas tree outfits, 27, and miscellaneous heating devices, 406. This gives a total of 49,409 repairs effected in the company's shops.

Of course the cost of making these free repairs in Chicago has grown from year to year. In 1915 the total cost was $18,000; in 1916 it was $27,835, and estimates show that the company receives about three time the amount of gross revenue per year from repaired appliances that it costs to make the repairs. About one-third of the cases that are cared for by the trouble-men who handle household calls were these free appliance repairs, about one out of every four customers being affected. The Commonwealth Edison policy, however, has recently been changed, and from now on a net charge of 50 cents will be made on all cord repairs, which will be accomplished by charging $1 per cord, allowing a credit of 50 cents for an old cord returned with the fittings of each end. In other words, the volume of the repair work has passed the point where it is considered expedient to make no

charge for it, and it is believed that the service should begin to pay its way.

OTHER COMPANIES THAT CHARGE

And this point of view is shared by many other companies. The United Electric Light & Power Company of New York City charges all repairs at cost where they are not covered by the manufacturer's guarantee. The Syracuse (N. Y.) Lighting Company charges cost on labor and material. The United Electric Light Company charges cost plus a slight amount for delivery, though it does not sell appliances itself. Its reasoning is well expressed by C. R. Phenicil, vice-president of the Wisconsin Public Service Company of Green Bay. He says: "We do not feel that it is proper to render such service free of charge, but believe instead that each class of service furnished the customer should bear its own proper portion of the total expense of conducting the business. Any other practice leads most surely to discrimination. Moreover, we have found that when customers maintain their own heating appliances they are more careful not to abuse them."

And to this J. E. Worth, commercial manager of the Springfield (Ohio) Light, Heat & Power Company, adds: "We do not believe in a free repair policy because we do not feel that it is necessary. It is my opinion that the business of a public utility company is just as legitimate as any other business, and the sooner companies rid themselves of the idea that it is necessary to continue making donations to the customer the better it will be for the business generally." But Robert Montgomery, commercial manager for the Louisville (Ky.) Gas & Electric Company, goes further and maintains that this whole function of appliance repairs belongs rightfully to the dealer and should be left there.

THE ALLENTOWN SCHEDULE

From a review of a very sizable pile of letters from central stations that have expressed themselves as to their experience and opinion in the matter, however, the trend of practice seems to be fairly well defined, and it is a middle course. It is recognized that it is profitable to keep appliances in use, which means in good repair; but on the other hand the customer is always willing to pay his way if the case is put before him clearly, and he appreciates and approves a liberal policy which offers "service" free but still expects him to pay for labor and material that entail direct expense to the company. To this end the Lehigh Valley Light & Power Company of Allentown, Pa., has a rather indefinite schedule, which aims to eliminate "red tape" and serve the customer yet reduce somewhat the burden of repair expense. Its policy is as follows: (1) Minor repairs requiring no material, no charge; (2) minor repairs requiring material, charge for material; (3) extensive repairs, charge time and material; (4) defective cords, other than at ends, if in service a reasonable length of time, charge for cord; (5) unsatisfactory toaster or flatiron, ascertain cause and remedy trouble, usually no charge; (6) guarantees at time of sale, transmit to customer any guarantee made by manufacturers.

As all heating appliances are put out on liberal trial periods, the customer is urged to be thoroughly satisfied before purchasing, and this eliminates any special necessity for guarantee, considering the general policy.

Surely it is to the interest of the central station that the appliance be in good repair and stay in use, but it is dangerous for the idea to prevail that the electric company is responsible for everything that happens to an energy-using device. When a free service of this kind is offered to the consumer with appliances on circuit there is an element of rate discrimination against his neighbor who, using none, receives no benefit and pays the same rate. There seems to be a steadily increasing opinion, therefore, that the time has come for every manager to investigate this cost of free appliance repairs and find a way to apportion it equitably in charges for the class of repairs that well may pay their way, leaving only the minor "fix-it" cases that really should be handled without charge, in the spirit of good service, to be charged against the benefit of a prompt return of the appliances to active service.

Of course such a policy will constantly develop those "border-line" cases where the decision must be made in the spirit of fairness and good service, and many expedients for fixing this border line are suggested. The Texas Public Service Company repairs all appliances gratis that have been sold from its own offices, but charges on devices purchased elsewhere. The Arkansas Valley Railway Company of Pueblo, Col., gives repairs free up to one hour's time with a reasonable amount of material. The Chattanooga (Tenn.) Railway & Light Company makes no charge for labor, but does charge for such parts as the customer can readily see entailed some expense, and in 1916 the material still given away amounted to $599.78. The Metropolitan Electric Company of Reading, Pa., charges for new cords or major parts, but not for minor repairs. The Virginia Railway & Power Company of Richmond makes without charge such repairs as can be cared for by its own trouble-men, but refers more serious repairs to dealers. The Toledo (Ohio) Railways & Light Company has discontinued all free repair service.

Against this we find a considerable number of companies which have recently adopted a service of free repairs to household appliances or extended its application, among them being the Kansas Gas & Electric Company of Wichita, the Union Electric Light & Power Company of St. Louis, Mo., and others. One finds the Edison Electric Illuminating Company of Boston entirely satisfied that this is a service worth its cost. And there may be found many combination gas and electric companies holding to the policy in part because such maintenance is partly standard practice in the gas field. But there seems to be a growing opinion in the industry that the idea of free repairs, like the sale of the appliances themselves below cost or without a proper profit, is not good business.

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GROUNDING TRANSFORMER CASES AS A PROTECTIVE MEASURE

Value of This Method in Reducing Damage from Lightning Storms—Is the Lineman's Hazard Thereby Increased?

BY J. C. RUTHERFORD

Grounding the cases of distributing transformers has been mentioned occasionally in a vague sort of way as a means of protecting the apparatus against lightning. In addition there has been some discussion as to whether a grounded case will or will not increase the hazard to linemen.

Theoretically, grounding the transformer case of a pole-type transformer should be effective as a means of protection, as a little reasoning will easily show. It is not of extreme importance that the potential due to the lightning discharge between winding and ground be kept down to a comparatively low value. On the other hand, it is of vital importance that the potential difference existing between the primary and secondary should not exceed a value much in excess of that for which the transformer is designed—a few thousand volts. If the lightning arrester be connected between line and case, and, further, if the case be connected to ground, the above result will be accomplished; namely, a limitation is placed on the potential difference between primary and case or the secondary, which, so far as insulation is concerned, may be considered as the equivalent of the case. As still further tending to assist the discharge of potential it has been suggested that the secondary be connected to the case through an air gap.

Should a lightning discharge occur with the above arrangement the potential of the transformer may be several thousand or even several hundred thousand volts above earth or ground, whereas the primary and secondary are at a difference of potential of only a few thousand volts. Connecting a transformer case to earth makes the lightning protection independent of earth resistance and reduces the effect of the impedance of the ground wire between arrester and ground. It will be observed further that the actual benefit that one may expect to derive from connecting arrester and case together will vary somewhat, and will be greatest where high-resistance earths only can be obtained and where the ground wires are long. The usual length of ground wires is about 30 ft. (9 m.), sufficient to offer quite a high impedance to a high-frequency discharge.

The question of life hazards is one that cannot be ignored when the advisability of grounding transformer cases is under deliberation. Grounding the cases does increase the life hazard, or may do so, and it is this fact, coupled with the additional cost of line work incidental to grounding and the absence of definite proof that doing so is efficacious, that has acted as a strong deterrent. Linemen often work on 2300-volt circuits alive, trusting to the insulating properties of the pole to protect them from shock. Where ground wires run down the poles most companies cover them with wood molding with a view to protecting the men from coming in contact with a grounded conductor. The presence of a grounded transformer case, which covers a far greater amount of surface than the small ground wire, must, therefore, constitute a greater risk than does the ground wire. The obvious way to overcome this difficulty is to install some form of link-switch between the transformer case and the ground wire, so that men working on the pole may open this switch and isolate the transformer case, should they desire to do so. As an additional precaution linemen employed on systems adopting the grounded transformer case should be especially warned of the increased hazards existing.

While theory tends to show that grounding transformer cases should be efficacious in protecting the transformer windings the results in practice have not substantiated the theory, actual operating data being negative rather than conclusively positive. The added expense, complication and danger to linemen resulting from such practice also tend to deter the grounding of cases even where the results are beneficial in other ways.

Another practice is being followed in some places that has afforded satisfactory protection, and that is the use of external reactance coils. Reactors have been used for many years on large outdoor and indoor apparatus, but not to the same extent for distributing transformers. The reactance coils have been placed between the transformer cut-out and line, thereby protecting both cut-out and winding. The reactors do not have to be large coils nor do they have to have large spaces between turns. About twelve to fifteen turns of No. 10 or No. 8 rubber-covered wire seem to suffice. In one instance at least the use of reactors has reduced lightning troubles 70 per cent, it is claimed.

The installation of lightning arresters upon the same pole as the transformer is recommended by the N. E. L. A. "Handbook of Overhead Line Construction," and is obviously the correct practice. The elimination of transformer tops and terminal blocks has been proved advisable by D. W. Roper of the Commonwealth Edison Company. The use of reactors should prove of further efficacy. From an economic viewpoint, their value will depend upon the severity of the lightning, value of continuity of service, cost of repairs, etc. The needs of distributing transformers in the way of protection and the ability of the various methods of protection to accomplish their function are now well known. Any one of the protective measures involves the expenditure of money and time, but probably the simplest is the reactance coil.

Improved Wireless Ammeter

A Marconi patent, No. 1,220,833, in the name of H. A. Ewen, shows an extremely sensitive mounting for a hot-wire instrument that suggests bifilar suspension.

According to the inventor, an arm or indicator is so mounted that the only movement of which it is capable is rotation in a plane around its axis subject to the controlling force of a spring. The latter is connected to one end of a stretched current-carrying filament the other end of which is connected to a support that is substantially parallel to the axis of the arm. Thus with a small contraction or expansion of the filament considerable rotation of the arm will be allowed.

Motion Picture Studio Lighting Layout

Description of Gas-Filled Lamp Installation Using Two Types of Lighting Frames, One Suspended from Overhead Trolley and the Other Adapted to Move Around on Floor

WHEN "movie stars" come as high as $670,000 per annum the producing company can ill afford to have working hours influenced by the vicissitudes of weather, even in southern California, where the normal year contains 316 sunshiny days. Lighting

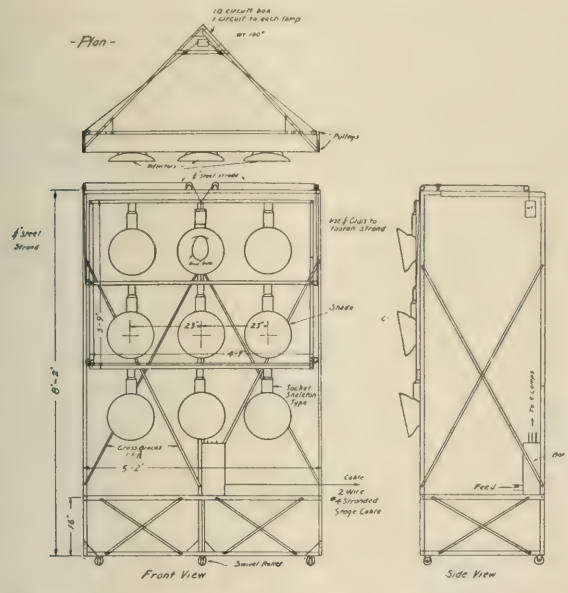


FIG. 1—FLOOR FRAME DESIGNED FOR MOTION-PICTURE LIGHTING SYSTEM

installations suitable for producing moving pictures on a large scale indoors have recently been installed at most of the larger studios, and incidentally the problem of an economical substitute for sunshine with a high actinic value has been studied very carefully.

The Keystone Film Company of Los Angeles recently found it necessary to complete a large order irrespective of weather conditions, and within a period of six weeks there was built at its plant a concrete building 100 by 150 ft. (30.48 m. by 45.72 m.) in plan and 25 ft. (7.62 m.) high, designed to be lighted by a system the rating of which will be 2000 kw. For immediate needs, and because of the urgency behind the construction, only 750 kw. of the total lighting equipment was installed, but this was arranged so that it adequately supplied one-quarter of the entire floor space, and the remaining area can be equipped by simply adding similar circuits as an independent system supplied from separate banks of transformers.

Theoretically the present lighting equipment is sufficient to provide for only three simultaneous scenes, but practically it has been found that the lamps actually average only one hour's use to nineteen hours of work on the part of those engaged in producing a picture, so that the diversity factor would enable the equipment now installed to take care of a large area. However, the new "indoor studio" is laid out for ten simultaneous productions, and to avoid even the possibility of occasional slight delays in waiting for lamps, provision is being made for equipment that can be left at the exclusive disposal of each director throughout preparation and rehearsal periods. The one to nineteen ratio, however, has been taken into account in selecting transformer room equipment.

Two types of lighting unit standards or frames are used. One type are mounted on rollers and moved about on the floor, while the other type are suspended from the overhead trolleys, on which they can be moved along as desired. The suspended frames are counterbalanced so they can be readily placed at any desired elevation. Structurally the two types of frames are much alike. They are made up of 1½-in. by 2½-in. (38.1 by 63.5 mm.) angle irons around the outside with 1½ by 1½ by 3/16-in. (38.1 by 38.1 by 4.76 mm.) cross-ties and 1 in. by 3/16-in. (25.4 by 4.76 mm.) boxes. The frames are bolted with ⅜-in (9.52 mm.) bolts and gusset plates are used at corners. Completely equipped suspended frames, in place, cost about $130 each and the floor frames $140 each.

Each frame carries nine 1000-watt gas-filled lamps in blue glass, which are operated at 128 volts. This includes a 10 per cent voltage increase provided by small step-up transformers. Each of these nine-lamp frames is considered a unit, and standard scene sets of various sizes call for a tabulated number of lighting units. The life of these lamps has been found to be about 800 hours, or the cost of maintenance per lamp per year is figured at approximately $1.90.

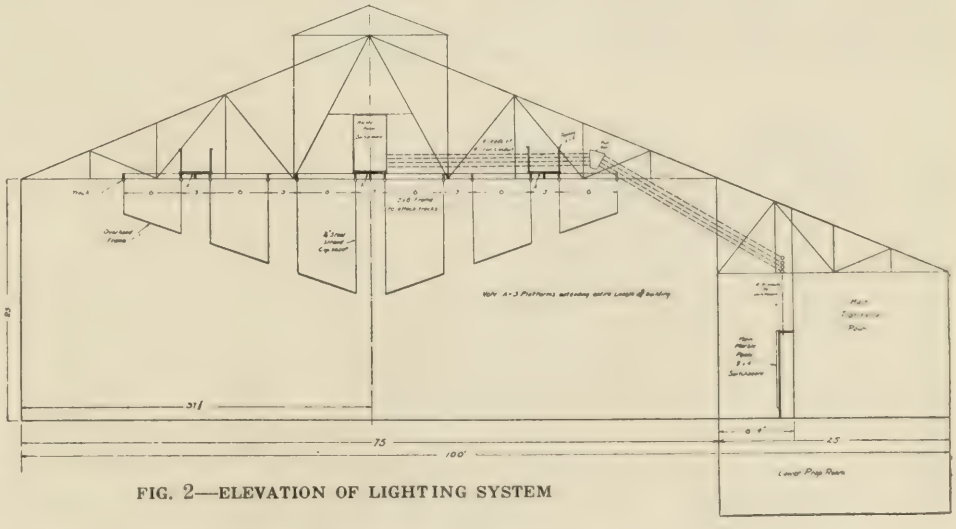


FIG. 2—ELEVATION OF LIGHTING SYSTEM

In comparing these lighting units with mercury-vapor tubes used for the same purpose, certain peculiarities have been noted. The electricians have pointed out

that sets 24 ft. by 32 ft. (7.31 m. by 9.75 m.) in size require about the same number of mercury-vapor tubes as gas-filled lamps. In smaller sets the "short throw" on the mercury-vapor tube is an advantage and a soft diffused light is secured with comparatively fewer units. On larger sets, however, the gas-filled units are the more effective and give photographic conditions up to three or four times the range of the others. The gas-



FIG. 3—AS AN ECONOMICAL SUBSTITUTE FOR SUNSHINE INCANDESCENT LAMPS WITH REFLECTORS HAVE BEEN USED VERY SUCCESSFULLY IN SOUTHERN CALIFORNIA STUDIOS

filled lamps have a further advantage in permitting the circuit to be cut in at full efficiency instantaneously.

The transformer room which serves the new Keystone installation is now provided with 50-kw. transformers, and there is space for additional capacity that will be required when the system is enlarged. From the transformer room 4-in. (10.16 cm.) iron condulets carry the leads to a remote-control switchboard on the lower chord of the roof trusses. This board is designed to serve only one-quarter of the entire floor area and will be supplemented by three others in other parts of the building when the installation is completed to full capacity.

The lamps in use in the new indoor studio were supplied by the Western Electric Company and the Los Angeles Gas & Electric Company furnishes the energy. Paul Guerin is chief electrician for the Keystone Film Company.

SENSITIVE SELENIUM CELL

Crystals Produced by Sublimation Allowed to Absorb Argon, Helium or Neon

A selenium cell having a sensitiveness a thousand times greater than the ordinary is described by Fay C. Brown of Berkeley, Cal., in patent No. 1,219,432. The chief feature is in the production of the crystals by sublimation and then allowing the crystals to absorb the gas argon, helium or neon at a temperature below that of crystal formation. Both large crystals and those of microscopic size were investigated, the inventor stating that crystals produced by his method after being exposed to most intense light twenty-four hours a day for thirty-five days in succession showed absolutely no deterioration. In another case a selenium cell subject to ordinary conditions showed the same sensibility after a period of a year.

CENTRAL STATION EQUIPMENT COSTS

Data Based on Prices Paid by a Massachusetts Company for Making a 2500-Kw. Extension to Its Plant

Recent improvements on the system of the Fitchburg (Mass.) Gas & Electric Light Company included the installation of a 2500-kw. high-pressure Westinghouse turbine with LeBlanc condenser and foundations, centrifugal feed pump, piping, superheaters, two 500-hp. Bigelow-Hornsby water-tube boilers, two Taylor stokers, feed-water meter, air compressor, pipe covering, coal-handling equipment, economizers, mechanical draft apparatus and a 1000-hp. feed-water heater. To house the additional equipment the plant was extended about 36 ft. (10.97 m.). From the cost sheets of the company the following items are printed to give engineers a general idea of the relative unit costs of equipment in a plant of this size:

One 2500-kw. Westinghouse double-flow turbine (not including generator), with one No. 14 LeBlanc condenser, complete with pumps	$19,779.40
Turbine foundations	2,221.76
One 300-gal.-per-minute Westinghouse centrifugal boiler-feed pump	1,545.00
Connecting turbine and condenser	472.86
Galvanized-iron air duct for turbine	236.00
One type C duplex piston automatic pump and receiver	125.40
Miscellaneous items, completed December, 1914	973.43
One 5-in. (12.7 cm.) and two 6-in. (15.2 cm.) Edwards check valves	318.68
Installation of above	114.30
New superheater for 240-hp. Stirling boiler	675.00
Piping, covering and brickwork for above	228.69
Freight, teaming, insurance and miscellaneous	111.94
Two 500-hp. Bigelow-Hornsby water-tube boilers	9,000.00
Masonry in connection with above	1,316.94
Foundations	4,206.67
Two Foster superheaters	2,900.00
Two feed-water controllers	160.00
Labor, Fitchburg company's force	418.19
Pipe covering	167.95
Miscellaneous	1,073.59
Labor and material installing floor grates	57.57
(Note.—Total additions to boilers, $20,782.34)	
Two Taylor stokers, grates, fans, engine and driving mechanism	9,785.00
Foundations for above (paid contractor)	704.13
Crushed stone, sand, etc., for foundation	165.00
Steel for coal hoppers	329.41
Labor for coal hoppers	157.20
Shafting, hangers, chains, etc	301.00
One 5-in. by 5-in. (12.7-cm. by 12.7-cm.) vertical stoker engine	248.00
Labor, Fitchburg company's force	592.49
Other items	711.87
Four sheet-steel boxes for stokers in ash pit	48.00
Labor and material installing above boxes	30.33
(Note.—Total additions on account of stoker cost, $13,072.43)	
One 4-in. (10.16-cm.) type M Venturi registering and indicating feed-water meter	465.00
Freight, teaming and installation of above	46.02
Piping installation, in connection with station increase	16,028.66
Coal-handling apparatus	4,967.10
One 1000-hp. Whitlock feed-water heater	575.00
Sturtevant economizer installation for additional capacity of plant	12,423.14
One 5-hp. motor and wiring for above	73.75
One 3125-kva. 60-cycle, three-phase, 2300-volt generator	9,879.60
Other labor and material	571.92
Three sheet-steel guards for generator flywheels (old units)	60.00
One 75-kw. motor-generator exciter set, 115-hp., 2200-volt motor	1,758.00
Two 2500-volt aluminum lightning arresters	234.00
Six 300-amp., 250-volt single-pole switches	29.70

It should be said that the total cost of the complete improvements outlined is not obtainable by adding items segregated herewith, since the data presented includes merely items of broad interest.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

STANDARDIZING TRANSFORMERS

Operating Company in Middle West Adopts 100-Kw., 6600-Volt Transformers for All Rural Lines

According to experiences related at a recent convention of the Wisconsin Electrical Association, the Wisconsin-Minnesota Light & Power Company is now operating small-town distribution systems at 6600 volts, but would change to 13,200-volt operation for this service and effect a further copper saving if suitable low-priced lightning arresters for 13,200-volt service were on the market. The same company has adopted 100-kw. transformers as standard for all small-town substations, even if the immediate load seems only to justify a 50-kw. unit. This plan is followed because there are only slight differences in the prices and losses of 100-kw. and 50-kw. units. In addition there is an advantage in providing initially for a generous increase in load and in having uniform-size units.

Considerable interest was also manifested at this meeting in the question, "What is the largest single-phase motor that can be placed in small towns at the ends of long lines without giving trouble?" The feed-mill business requires a 30-hp. or 40-hp. motor, and units of this size sometimes give trouble. The practical solution advanced was to install plenty of copper and a pole-top feeder regulator. In instances where this has been done the trouble produced by 40-hp. motors has been eliminated.

It was the universal experience of the engineers present that the unaccounted-for losses (with energy sold from the producing company's switchboard) are much higher in transmission service than is considered reasonable in local distribution work. One operator on a 33,000-volt line found that 65 per cent of the energy delivered to the step-up transformers at the sending end was dissipated in losses. This figure was higher than the average, however, it being the general opinion that the unaccounted-for loss is about 50 per cent.

KEEPING PEACE IN THE GANG

The Psychological Effect of Letting Workmen Select Their Own Foreman

After experiencing considerable trouble in getting laborers to obey orders and work together without friction, the superintendent of an Eastern central station hit upon an idea. He went to each man separately and asked whom he considered the best man in the crowd. Nine out of the twelve men in one gang assured him that "Tony" was the pick of the group. "All right," said the superintendent, "Tony is the foreman of this gang. Tony is your boss from now on." Then Tony was called into the office and informed of the importance of his new post. When it was explained that his salary would be increased a dollar a week in consequence, he assumed a proper dignity at once. Similar arrangements were made for each gang.

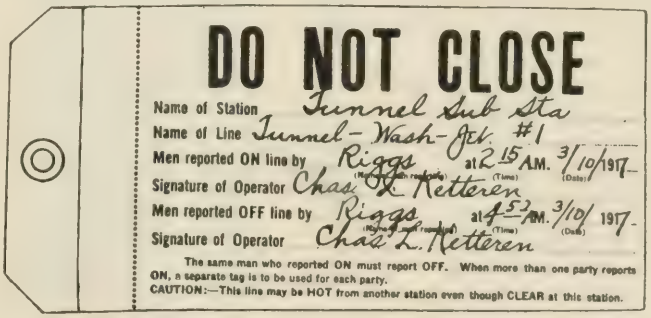
Now, when orders are to be given to a gang, the instructions are addressed directly to the foreman, who relays the message in a mixture of dialects that "gets to" all of his charges. Since the adoption of this plan the work has increased to a marked degree and there has not been a single fight—at least on the job.

HIGH-TENSION WORK

Use of Tag with Carbon Copy in Carrying Out Ten Safety Rules of Pittsburgh Operating Company

Ten safety rules governing work on high-tension lines have been put into effect on the system of the Pittsburgh Railways Company. The rules require the use of a tag like the one shown in the accompanying illustration. The tag, which is placed on the handles of high-tension oil switches, is so designed that a duplicate record is made of each tag used, a slip of paper coated with carbon on the back covering one side of each tag. When the operator fills out the blank slip the tag proper becomes the carbon copy. The paper slip is torn off and kept by the person signing it as his own record for reference in case of any future controversy. On the back of the tag are the following instructions: "Attach firmly to the switch handle so that the tag will be conspicuous and the switch cannot be closed without noticing the tag. Return the tag to the local dispatcher when report is complete."

In brief, the safety rules contain the following points: All high-tension circuits are to be considered "hot" except when cleared in accordance with these rules.



HOLD-OFF TAG WITH CARBON COPY

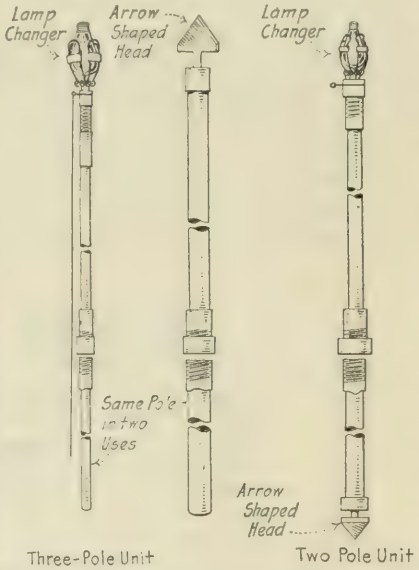
The responsibility for self-protection when working on high-tension lines rests entirely with the men doing the work and the station operators. All phases must be short-circuited and grounded at each point where work is being done. All stations on the line to be worked on must be informed of the work, and told when it is completed. Each man working on a line must report when

he goes on duty and when he quits. To clear a line, both the oil switches and the knife switches on that line must be opened and tagged in the prescribed manner. When the man signing the tag reports that the work is completed the tags are taken off the switches, the danger sign is removed and instructions are awaited from the load dispatcher. In emergency cases the operator can proceed on his own responsibility. All telephone orders have to be repeated by the person receiving them. Except in emergency, twenty-four hours' notice must be given the load dispatcher before any high-tension line can be taken off. The rules refer to circuits and equipment inside as well as outside the station.

CHANGING STREET LAMPS

Long-Handled Device for Replacing Incandescent Lamps or Removing Bases of Broken Bulbs

Each trouble wagon operated by the Electric Company of Missouri in the suburbs of St. Louis is equipped with a partly home-made lamp-changing outfit. Some of the outfits are made in three pieces and some in two pieces. The three-piece outfits consist of three 10-ft. (3-m.) poles, each of which is equipped with special devices at the ends. The upper end of pole No. 1 carries an ordinary gas-pipe coupling to which is attached a Matthews lamp changer. The other end of the pole is equipped with a similar pipe coupling. Pole No. 2 is fitted with a piece of gas pipe threaded so that it may be screwed into the coupling at the lower end of pole No. 1 to make a 20-ft. (6-m.) pole. This part of the equipment is used in removing unbroken lamps and in inserting new bulbs. Pole No. 3 of this outfit is fitted with an arrow-shaped head held in place by a ferrule. It is used as the upper section of the 20-ft. (6-m.) pole for removing the bases of broken bulbs.



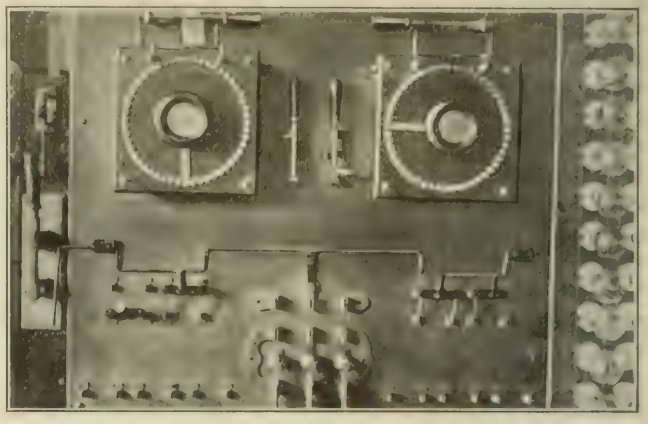
DETAILS OF THE THREE-POLE AND THE TWO-POLE UNITS

In the outfits employing only two poles, the arrow-shaped head is placed on the lower end of pole No. 2. The latter outfit can be used to perform any function of the three-pole outfit and it consists of one less piece. Furthermore, it is thought by some representatives of this company to be more convenient to use, since in replacing broken lamps it is only necessary to turn the pole end for end, while with the three-pole outfit the upper section must be changed between operations. The two-pole outfit is open to the possible objections that the cord controlling the clamping action of the lamp changer may become tangled when the pole is reversed, and that the point, being always on the lower end of the pole when the changer is in use, might constitute a hazard to workmen. Both types of outfits were made by the operating force of the Electric Company of Missouri.

MECHANISM FOR OPENING SWITCHES SIMULTANEOUSLY

Bent Rod Hinged at Each End, Passing Back of Handles to Knife Switches, Is Used in Opening the Latter

In the meter laboratory of the Cumberland County Power & Light Company of Portland, Me., means have been provided for opening all of the meter-testing switches simultaneously. As shown in the accompanying illustration, a ¼-in. (6.4-mm.) rod bent in the shape



PANEL EQUIPPED WITH BENT ROD FOR OPENING SWITCHES

of a crank shaft extends across the testing panel back of the knife-switch handles and is supported in bearings at each end. One end of the rod—that nearest the meter-testing board—is bent to form a handle so the rod can be turned by the test man without his leaving the board. When the rod is turned the offset portions strike the switch handles, thereby opening the switches. This mechanism is a decided convenience during routine work.

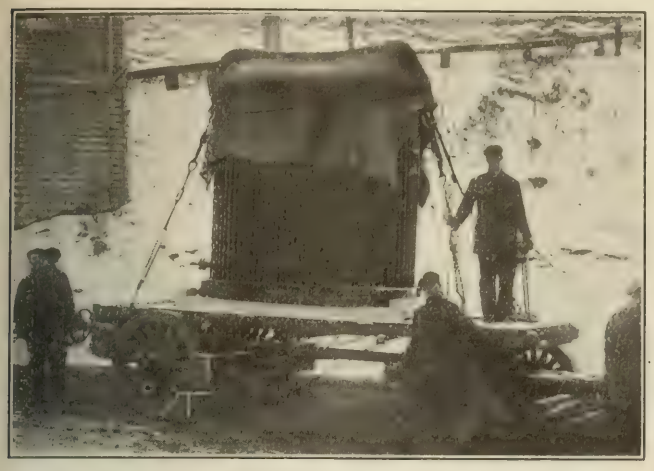
A BRAKE FOR TRUCK CARRYING TRANSFORMER

Blocks Are Arranged to Grip Rear Wheels of Vehicle When It Is Used to Move Heavy Transformers Down Inclines

To facilitate transporting a heavy transformer down an incline the construction department of the Rochester (N. Y.) Railway & Light Company developed the truck brake shown in the accompanying illustration. As will be seen, two heavy blocks are supported from the truck frame, one in front and the other in back of the rear wheels. These blocks may be made to grip the wheels like a vice by turning the hand wheels at the rear of the truck. The hand wheels are attached to rods which pass through and join the front and rear blocks, nuts being threaded on the ends of the rods where they protrude through the front block.

With this brake a load of ten tons (9.07 metric tons) may be safely conducted down a steep incline, but with heavier loads the following additional precautions are taken to avoid losing control of the truck.

On the ground in front of the rear wheels is placed a block the ends of which are shaped to the rims of the wheels. As the block drags on the ground there is a tendency for the rear wheels to ride over it, thus retarding the movement of the truck. Sometimes it is necessary to put a team of horses in back of the wagon and hitch it to the block which drags on the



TRANSPORTING A 11-TON (9.98-M. TON) TRANSFORMER DOWN HILL

ground, to obtain a secure holdback. In transporting loads weighing 20 tons to 25 tons (18.14 metric tons to 22.68 metric tons) it is necessary to employ two teams, and if loads ranging from 25 tons to 50 tons (22.68 metric tons to 45.35 metric tons) are hauled, a hoisting engine is usually attached.

HIGHER BOILER PRESSURES AND TEMPERATURES

Further Advances Depend Upon the Production of Commercial Metal with Higher Elastic-Limit Retention

The trend of station practice toward high pressures and temperatures was reviewed by Irving E. Moultrop, assistant superintendent of construction, Edison Illuminating Company of Boston, at the power plant symposium held in Boston recently. Further advances above temperatures of from 600 deg. to 700 deg. Fahr. (315 deg. C. to 372 deg. C.), it was said, depend materially upon the production of commercial metal which will have a higher elastic-limit retention than existing alloys. From the point of view of theoretical economy the incentive to use higher pressures is very great. Theoretically, the use of 300 lb. per square inch (21 kg. per sq. cm.) means a gain of 4.9 per cent in economy compared with 200 lb. per sq. in. (14 kg. per sq. cm.), keeping the temperature at 600 deg. Fahr. (315 deg. C.) and the vacuum at 29 in. (736 mm.). The use of 400 lb. per square inch (28 kg. per sq. cm.) under these conditions yields a theoretical gain of 9.7 per cent; 500 lb. per square inch (35 kg. per sq. cm.), 11.5 per cent; 600 lb. per square inch (42 kg. per sq. cm.), 13.4 per cent, and a maximum of 1574 lb. per square inch (111 kg. per sq. cm.), 22.6 per cent. At the present time boiler manufacturers are disinclined to undertake the special designs required by the use of steam pressure above 300 lb. to 350 lb. per square inch (21 kg. to 25 kg. per sq. cm.).

HOME-MADE APPARATUS FOR USE IN TESTING OIL

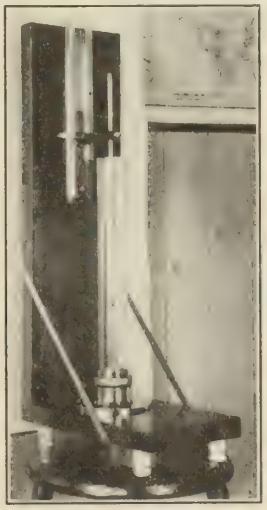
Quickly Adjustable Spark-Gap and Easily Cleaned Oil Receptacle Made This Stand a Useful Adjunct

Shown herewith is an oil-testing stand developed by L. G. Scott, head of the underground distribution department of the Cumberland County Power & Light Company, Portland, Me.

The apparatus has been used in testing with pressures up to a maximum of 35,000 volts. With it the performance of the oil can be watched with ease as the test voltage is raised or lowered. No micrometer is required in making the spark-gap adjustment. The apparatus can be cleaned far more thoroughly than the box form of oil-testing equipment or many of the tubes on the market for this work. The cost of making up this apparatus did not exceed $25.

The stand consists of two pieces of kiln-dried birch 1¼ in. (3.2 cm.) thick, treated with insulating varnish, the slabs being 8 in. (20.3 cm.) wide, 13½ in. (34.3 cm.) long and 28 in. (71.1 cm.) high, with two diagonal braces of ½-in. by ⅛-in. (12.7-mm. by 3.2-mm.) brass as shown. The bottom of the stand is supported on four porcelain insulators. Two binding posts at the rear connect with the spark-gap terminals, which extend inside a hydrometer jar 1¾ in. (4.4 cm.) in diameter. In constructing the stand the lower end of the jar was cut off and cemented into a brass collar which screws into a base flange. The latter is 5 in. (12.7 cm.) in diameter at the bottom and contains a recess ⅝ in. (15.9 mm.) deep and 2¼ in. (5.7 cm.) in diameter in which is mounted the lower electrode. This terminal is separated from the collar by a 3/16-in. (4.8-mm.) leather washer which serves the purpose of making a leak-proof joint.

The electrodes are ¼-in. (6.4-mm.) brass rods, the upper one being 16 in. (40.6 cm.) long and the lower one 6 in. (15.2 cm.). The usual hemispherical and cylindrical terminals are provided. The base flange is electrically connected with the lower binding post lead through contact with a semi-circular brass ring ¼ in. (6.4 mm.) high and ⅛ in. (3.2 mm.) wide, fastened by short pins to the lower wooden base. The upper electrode may be adjusted for height at two points, one where the rod passes through the support, which is carried by a plate sliding between guides on the upright board, and the other at the sliding plate itself. A vertical motion of 10 in. (25.4 cm.) is provided at the plate. In using the apparatus the jar and its collar are screwed into place on the lower part of the stand; the air-gap is then set to 0.2 in. (5.1 mm.) by the use of a gage and by adjusting the upper rod at its attachment to the supporting piece. The upper electrode can then be raised at the plate support and the jar filled or emptied. The correct gap can be obtained again by running the plate down the guides to a stop at the bottom of the latter.



OIL-TESTING SET

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

MECHANICAL REFRIGERATION GIVES A TIMELY LOAD

Cost of Electric Energy for Operating a 5-Ton Plant for a Butcher Shop at Special Refrigeration Rates

With spring here and summer close behind, refrigeration is a very seasonable topic. Mechanical refrigeration offers opportunities as a central station load in many different ways, from the small plant of the householder to the large plants of hotels, and including cold-storage plants for provisions and furs and for butcher shops and other stores.

COST OF OPERATING 10-HP. MOTOR FOR BUTCHER SHOP REFRIGERATION

Month	Kw-hr.	Cost	Month	Kw-hr.	Cost
January	266	$10.64	August	984	$29.52
February	278	11.12	September	922	27.66
March	294	11.76	October	656	26.04
April	354	14.16	November	490	19.60
May	388	11.64	December	338	13.52
June	514	15.42			
July	616	18.48	Totals	6100	$209.56
Average rate	3.43 cents				

In this connection an interesting rate is offered to butchers by the Public Service Electric Company, which charges them 4 cents per kilowatt-hour for the consumption in each month from October to April inclusive, and 3 cents per kilowatt-hour for the consumption in each of the five remaining months.

In a recent issue of the company's bulletin H. W. Smith, industrial power representative, gives the accompanying figures, showing the cost of operating for twelve months a 10-hp. motor driving a 5-ton refrigerating plant in a butcher shop.

AN APPEAL TO EXISTING CUSTOMERS FOR NEW ONES

Owing to Higher Operating Costs This Call for Co-operation, Made by New England Company, Has Met Marked Success

For a company to make a frank and honest appeal to its patrons to bring in more customers has been done before, but so far as records show always with some direct compensation of one form or another for helpful co-operation. When a company, however, relies on the good will of its customers to help it out of difficulties by themselves adding to their number and makes a success of the plan, it almost seems as if the central station Utopia had been found.

That is essentially what happened this spring in Pittsfield, Mass. H. W. Derry, contract agent for the Pittsfield Electric Company, addressed to every customer a printed circular entitled "Co-operation" in which was explained the increased cost of doing business and the necessity therefore of either increasing rates or greatly increasing the number of customers. Not wishing to do the former, the customers were asked to help the company in the latter way by furnishing names of those who might be interested in something electrical.

The appeal to the customers was as follows:

CO-OPERATION

A public service utility can operate successfully just so long as it has the good will of the people it serves.

We believe that we are particularly fortunate in having your good will.

While almost every other commodity has increased greatly in price, the cost of our service to you has remained the same, in spite of the facts that the cost of the coal we use to produce power has nearly doubled, that the cost of copper to transmit the power has increased four times, and that the cost of labor in all departments has also climbed upward.

In order to make both ends meet, we must increase the price or greatly increase the volume of business. We do not want to increase our prices, so we are making every effort to increase the amount of business.

Working on this line, we have recently succeeded in obtaining the power supply for three large mills, thereby increasing our power business 40 per cent.

We need more lighting business. Won't you help in the struggle to hold our prices down?

You will realize that every new customer and every electric appliance that goes onto our line helps to reduce the cost of your electrical service.

Think of some one who would be interested in something electrical, put the name on the inclosed post card and return it to us—sign your name if you wish—and by so doing co-operate with us to make our service to you more satisfactory.

With the appeal went a post card, reproduced herewith, for the customers' use in co-operating with the company.

Mr. .....

Address .....

Is interested in having his house wired .....

House is wired—wants service .....

Would like to try an Electric

Flatiron	Washing Machine
Toaster	Dish Washer
Percolator	Floor Polisher
Vacuum Cleaner	Sewing Machine
Curling Iron	Vibrator
Hair Dryer	Chafing Dish
Range	Fan
Air Heater	Water Heater
Heating Pad	Tea Samovar
Disk Stove	Grill

Name .....

Address .....

CUSTOMERS HAVE BEEN ASKED TO CO-OPERATE BY FILLING IN THE ABOVE CARD AND MAILING IT TO THE COMPANY

In describing the results of the appeal Mr. Derry informs the ELECTRICAL WORLD:

"This appeal has met with marked success, principally as it gives our customers an idea of the conditions which we are facing to-day. They have given this little letter

considerable publicity, and I have received a fair proportion of replies.

"We in Pittsfield believe that we enjoy the good will of our people to a remarkable extent, and do not hesitate to send a friendly and frank appeal to our customers."

ELECTRIC COOKING AND WATER HEATING IN WEST

Discussion of Central Station Practices with Deductions Presented Before Annual Convention of Pacific Coast Section, N. E. L. A.

Probably no other section of the United States has gone into electric cooking and all of its ramifications so deeply and so thoroughly as has the Pacific Coast. Local conditions are generally better in the Far West for electric cooking than elsewhere. For this reason the report on electric cooking and water heating by the commercial division of the Pacific Coast Section, N. E. L. A., presented at its annual convention last week, is of particular interest. The report was made by J. B. Black of the Great Western Power Company, San Francisco. Those parts of the report dealing with central station experiences and the deductions follow in full:

Advertising

"There is considerable difference of opinion as to the value of advertising in introducing electric cooking and water heating. Many of the member companies have used stuffers and pamphlets, as well as newspapers and other advertising mediums, with varying and in some cases indeterminate results; but it is apparently unanimous that advertising, while of certain value as an interest awakener, is absolutely valueless unless handled as a helper to an energetic house-to-house campaign.

"Owing to the many types of electric ranges on the market the consumers' requirements are taken care of remarkably well. In fact, many of the central stations have seen fit to choose several of the more popular types and concentrate on their sale to the exclusion of the others. This method not only materially cuts down the stock investment for the central stations but also enables them to reward the progressive manufacturer and also to make the salesman's task easier by enabling him to concentrate his effort.

Cost of Electric Ranges

"The rapidly increasing price of electric equipment, of course, multiplies the difficulties of the range salesman, and it is particularly important to the company just commencing sales activity in the range line to have the first cost of the electric installation as near as possible to that of gas or coal equipment. Many of the central stations have found that it is advantageous to sell the range 'installed,' and it has been the general practice to turn over the range and make the installation at actual cost to the company. In some cases the company has even seen its way clear to make the installation at less than cost.

"The general tendency, however, seems to be gradually to raise the price of the range equipment to the standard list price at which the dealer operates. This may indicate possibly that the time is approaching when the central stations will be able to turn the merchandising of electrical ranges and water heaters over to the dealer, but certainly the time is not yet ripe, and the central stations will have to look forward to several years more of expensive development work before they can with safety withdraw entirely from the merchandising field.

Water Heating

"The question of heating water electrically, and particularly in connection with electric range installations, is still characterized by a wide divergence of opinion among central station men. There is, however, a decided trend in the direction of placing the water-heating business, properly handled, on a par with the electric cooking business. From the standpoint of value to the central station a combination of the two is considered ideal, and in fact opinions have been expressed that the water-heating business alone (always assuming that it is properly handled) is even more valuable to the central station than the cooking business alone when considered from a standpoint of the sales effort needed, annual income per kilowatt and the resultant load characteristics.

"The vital problem lies, of course, in keeping the water-heating load off the range peaks. Two different methods of obtaining this result have been developed: First, placing the heater on a double-throw switch with the range, and, second, employing the use of a thermally controlled 'step-type' heater operating directly on the line. This latter type of heater is finding greater favor recently, and it is particularly suited for working in parallel with a solar heater or the ordinary water-back installed in a furnace or fireplace.

"The two most important faults of the ordinary immersion or circulation type heater when installed on a double-throw switch with the range are overheating or underheating due to abnormal or subnormal use of the range equipment by the housewife. These faults are completely overcome by the thermally controlled heater, and provided the load characteristics are such that the large water-heating demands will not coincide with the demands of the range, the thermally controlled heater will approach nearer to the ideal automatic electric kitchen, toward which we are striving, though due consideration must be given to the larger radiation losses when this type is used.

Individual Companies Must Make Own Decision Regarding Flat or Metered Rates

"The question as to the use of the flat or meter water-heating rate is still an open one, and must be settled by each company in a way that will best fit its operating conditions.

"When the water heater is placed on a meter rate, it is very important to the consumer and ultimately to the central stations that every possible method of economizing in the use of electric energy be used.

"The investigation and application of electric water heating has lagged behind that of electric cooking.

"The relation of storage capacity to the rate of use of water in the various classes of service to which electric water heating may be successfully applied, and also the relation of storage to the kilowatt rating, are of great importance, and probably more real advance in the solution of these problems has been noted than in any other phase of electric water-heating progress.

"The installation of spring faucets, lagging, and a

complete survey of both the plumbing installation and the habits of the various classes of domestic and commercial consumers, must be made and allowed for in order to insure satisfactory service. This survey is particularly essential when the installation of a thermally controlled heater on a meter basis is contemplated, as a very thorough study must be made in order to insure the resultant load characteristics which will enable the central station to grant the service the low rate which is necessary in order to make electric water heating universally practicable to the consumer and at the same time profitable to the central station.

Importance of Boiler Insulation Being Overlooked

"It is the opinion of the committee that we are all more or less overlooking the importance of insulation in our study of the water-heating subject. Plant tests indicate that while the manufacturers are giving us a number of very reliable heaters, we have very few convenient and economical methods of insulating boilers and piping. We believe that from now on more attention should be given to this phase of the subject. If more of the losses can be eliminated it will go a long way toward solving the problem."

ADEQUATE INCENTIVE TO SALESMEN IS NECESSARY

Salary Plus Commission Form of Payment Held to Be Most Satisfactory, with Ratio of One Salesman to 6000 of Population

The almost phenomenal results obtained by the sales department of one operating syndicate are largely attributed to its policy of fixing the commission on various appliances so as to enable its salesmen to obtain an income far above anything heretofore considered sufficient for the service rendered.

It is certain that in order to obtain good men the opportunity to earn a good salary must be as great as, if not greater than, in other lines of merchandising. It is also certain that a substantial return to the man selling the appliances is conducive to that encouragement and enthusiasm so necessary to success. There is a difference of opinion regarding the method of paying salesmen, whether straight salary, straight commission or a combination of salary and commission.

Probably the most satisfactory method of payment, it was stated by David R. Thomas, manager Michigan Power Company, in a paper before the Michigan Section of the N. E. L. A., is that of salary plus commission—the salary to cover the service rendered the company in the way of maintaining appliances already sold, the commission to apply on the sale of new appliances. The commission should be paid monthly on all sales that have been approved by the sales manager.

Distribution of Salesmen

The number of salesmen required for a given population has been found, Mr. Thomas said, to vary over a wide range. In one city there was found one salesman to every 25,000 people, in another one to every 6000. In the first instance the appliance sales ran $3,000 per month for five salesmen; in the second the sales ran $20,000 per month for thirty-two salesmen. The sales per man, however, ran about the same, namely, $600 per month. In the first instance washing machines and vacuum cleaners were handled by the manufacturers, while in the second instance the central station handled all appliances.

The ratio of one salesman to 6000 of population seems to Mr. Thomas to be nearer the proper one, as it permits of what might be termed "intensive cultivation." It is essential that to each man there should be an allotted territory which it should be his duty to cover periodically. In some instances Mr. Thomas thought it might be advisable to have each salesman's territory composed of part residence, part commercial or business houses and part factories, while in other instances it might be better to classify salesmen on the basis of residence, commercial and power. Irrespective of varying local conditions, the main requirement, it was pointed out, is that each customer be called upon periodically—once a month if possible, certainly once in two months.

TEMPORARY INSTALLATION FOR FLOOD-LIGHTING

Projectors Mounted on Cross-Arms Erected for the Purpose on Trolley-Line Poles Give Complete Satisfaction

In flood-lighting the municipal auditorium of Oakland, Cal., to advertise the "ad masque" given by the advertising bureau of the Oakland Chamber of Commerce it was found that there was no available source of



MOUNTING THE PROJECTORS ON TEMPORARY CROSS-ARMS ON TROLLEY-LINE POLE

energy supply at the points where projectors should have been placed. A way out, however, was found by the San Francisco & Oakland Terminal Railways, which installed a double cross-arm, as shown in the accompanying illustration, on five trolley-line poles parallel with the auditorium. The projectors were mounted in the cross-arms, receiving energy from the wires above. In all thirty projectors were used, with excellent effect. The distance of the projectors from the building was about 500 ft. (152.4 m.).

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

TEMPERATURE RISE OF TRANSFORMER WINDINGS

Measurement by Resistance Method—Error Due to Cooling of Windings After Shutdown—Compensation for Error

IT IS standard practice to-day to rate electrical apparatus at its maximum continuous capacity. When the rating is limited by temperature (as is the case with most transformers) the insulation or some part of it is operating close to the danger point. For this reason it is more important to know accurately the average temperature of the windings than it has been in the past, when it was the practice to make the temperature guarantee for two different loads—namely, full load followed by a short-time overload. While there are three general methods of determining temperature of electrical apparatus—the thermometer method, the resistance method and the embedded temperature detector method—the A. I. E. E. rules specify that the temperature of the windings of transformers is always to be ascertained by the resistance method, although it should be supplemented by careful thermometer measurements.

In observing the temperature of transformers by means of change in resistance there usually is a sufficient lapse of time to permit an appreciable drop in temperature. In practice this drop ranges from a fraction of a degree to several degrees per minute, hence it becomes highly important to know the extent of it. The problems involved in this matter are subjected to a very careful and complete analysis in a paper by V. M. Montsinger in the A. I. E. E. *Proceedings*, April, 1917.

There are three general methods of determining the temperature at shutdown. These are as follows:

(1) To take a cooling curve and extrapolate back to the instant of shutdown. Practice has shown that generally this method is fairly reliable. In some cases, however, it is liable to error, owing to the difficulty of being able to extrapolate back correctly. This is true when considerable time is required in obtaining the initial readings or when these first readings are influenced by inductance in the windings. At any rate, commercially, this method is not always practicable, because of the increased time required.

(2) To use an arbitrary correction. The advantages of this method are simplicity and ease of application. The disadvantage is that it is liable to error. Generally speaking, for maximum rated water-cooled transformers the copper loss will vary from about 6 to 25 watts per pound. If an arbitrary correction of, say, 2 deg. C. per minute is adopted, errors of 4 or 4.5 deg. are introduced for a lapse of two to four minutes after shutdown respectively. In cases where machines operate on short-time overloads or on duty-cycle operation the error would naturally be greater than the above. Again, this method might put a premium on using high current densities.

Provided that the time does not exceed four minutes after the instant of shutdown, the following, however, seems to be about the general average rate of cooling for:

	Deg. C. per Minute
(a) Air blast transformers (air shut off)	0.5
(b) Distributing transformers (100 kva. and less)	0.5
(c) Self-cooled transformers, except (b)	1.5
(d) Water-cooled transformers	2.0

(3) To calculate the rate of cooling. The usual theoretical formula for calculating the cooling of a body is not in a convenient form for practical use. Furthermore, the conditions in a transformer are generally such that it would be difficult to apply. However, it is shown in the paper that the cooling of oil-immersed transformer windings for a limited time (four or five minutes) after shutdown is approximately a function of the watts per pound of copper, and that when it is necessary to make calculations more accurate results can be obtained by this partly empirical method than by attempting to use the theoretical formula. The author's method depends on the use of the formula

$$\theta = 1.95 W_c^{0.7} (1 - \varepsilon^{-0.106 W_c^{0.3} t})$$

in which

θ = cooling in deg. cent.

W_c = watts per pound of bare copper.

The advantage of this method is that it is fairly reliable and simple in application. In order to apply the formula, it is necessary only to know the watts (RI^2 + eddy-current loss) per pound of copper. The disadvantage is that in order to apply the method the current density and eddy-current loss must be known, which cannot be determined by test.

Generators, Motors and Transformers

Pressure Harmonics in Polyphase Systems and Windings.—B. HAGUE.—The first part of a mathematical article in which the properties of pressure harmonics in a polyphase system are first discussed by the use of the well-known theory, after which the effect of the distribution of the armature winding of the alternator (from which the system is derived) on the magnitude of the harmonics is considered. Tables of distribution factors are given for single-layer windings and for double-layer lap windings, forming an extension to similar tables published by S. P. Smith and R. S. H. Boulding. In the present installment the introduction is given and polyphase systems and windings (both symmetrical and hemi-symmetrical) are discussed. The equations of the power are given for both systems. The article is to be continued.—London *Electrician*, March 16, 1917.

Sudden Short-Circuiting of Three-Phase Generators.—J. BIERMANNS.—The physical processes that appear

on sudden short-circuiting of a three-phase alternator are explained, and then the differential equations are written down and solved for the case of a Y-connected generator short-circuited across one pair of its terminals and leaving one phase open-circuited. This enables the wave shapes of the stator and rotor currents and of the voltage of the open-circuited phase to be determined. These curves are drawn for generators with varying amounts of leakage. Good agreement has been observed between the theoretical curves and oscillograms taken under operating conditions. Similar investigations are extended to the case of a simultaneous short circuit of all three phases. In this case the oscillograms are the same at whatever instant the short circuit takes place, and the current rushes can reach values 15 per cent greater than in the previous case. The destructive effects of short circuits can be moderated by increasing the leakage reactance of the machines, and the most effective method of doing this is by the insertion of protective choking coils in series with the windings.—Abstracted from *Elek. Zeit.*, Oct. 26, 1916, and Nov. 2, in *Science Abstracts*, Feb. 26, 1917.

Lamps and Lighting

Mine Lamps.—F. T. FORSTER.—An illustrated description of two new types of portable electric mine lamps equipped with porcelain reflectors and ironclad Exide batteries. In one type the metal container for the battery has a steel case and a cast-aluminum cover; the other type has a cast-aluminum case and cover. Charging the battery and various details of design are discussed.—*Gen. Elec. Review*, April, 1917.

Generation, Transmission and Distribution

Irish Water Powers.—An editorial note on an opinion recently expressed by Lord Northcliffe that the Irish problem is an economic one and that the solution will be found in the development of the water powers available in Ireland. While at certain seasons there is a great deal of energy running to waste, the minimum flow of the Irish rivers is only about one-sixth of the ordinary maximum, and for industrial purposes, unless the hydraulic plant is supplemented (at great additional cost) with steam-driven or gas-driven plant, it is the minimum flow that fixes the capacity of the undertaking. There are certain sites at which power could be obtained close to the sea, and therefore under highly favorable conditions; and on the Shannon, which Lord Northcliffe describes as the greatest river of the British Isles, water carriage to the sea is available. At other places transmission lines would be necessary to carry the power to suitable sites for factories. A valuable feature is the fact that in many cases the rivers are fed from large lakes which could be utilized for the storage of water, greatly improving the possibilities. On the other hand, there are vested interests to be dealt with, such as navigation and fishing rights, compensation for the disturbance of which would involve heavy outlay; moreover, in many cases the hydraulic work would be very costly.—London *Elec. Review*, March 23, 1917.

Regulating Water Powers.—PAUL LEVY SALVADOR.—A long discussion of the importance of the problem of regulating the flow of rivers utilized for power production. Storage lakes and reservoirs are discussed and details are given of a special example. Notes are added on legislation desirable in France in connection with this problem.—*Rev. Gen. d'Elec.*, Feb. 17, 1917.

Installations, Systems and Appliances

Frequency Changers.—In the discussion of R. Townend's recent paper Miles Walker emphasized that the coupling of two power stations by means of synchronous frequency changers was analogous to a solid coupling connecting two machines driven by independent prime movers. He discussed the use of induction motors, and emphasized the point that if a commutating machine were introduced into the rotor circuit of the induction motor there would be all sorts of possibili-

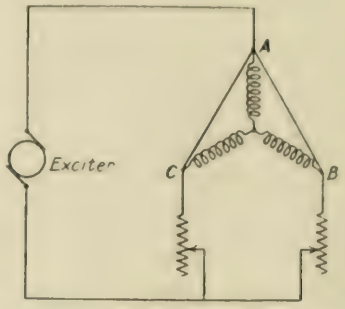


FIG. 1—CONNECTIONS OF THREE-PHASE GENERATOR TO AN EXCITER AND TWO RHEOSTATS

ties. For instance, a frequency changer from 50 to 40 cycles might consist of a twelve-pole, 50-cycle synchronous generator (in the 50-cycle supply) directly connected to a ten-pole induction motor belonging to the 40-cycle supply. The set would run at 500 r.p.m., so that the induction motor would be running at 4 per cent above synchronous speed and would tend to deliver power to the 40-cycle circuit. If now the rotor circuit of the induction motor was connected to a phase advancer whose excitation was so arranged that it boosted against the emf. generated in the rotor conductors, the asynchronous machine could be made to operate as a motor, notwithstanding the fact that it was running above synchronous speed; and at the same time, by suitable arrangement of the field coils, the power factor could be kept near unity or leading. Moreover, when the asynchronous machine was required to supply a generator load, the phase advancer could be used to supply the wattless component of the load. With respect to the comparative advantages and disadvantages of the induction type and the synchronous type of frequency changers, it would be found that the addition of a phase advancer to the induction type completely changed the situation, since all the advantages possessed by the synchronous type would now be found in the induction type, and at the same time the great objection to the rigidity of the coupling incident to the synchronous frequency changer be entirely removed. In cases where the synchronous frequency changer was employed there was another method of changing the load between sets run in parallel other than that of rocking the stator. If the field magnet of one of the synchronous machines be wound with a polyphase winding, say as a three-phase machine, it is possible to shift the position of the poles of the magnet relatively to the iron, and in this way secure the same effect as by rocking the stator. Fig. 1 shows how a three-phase generator can be connected to an exciter and two rheostats so as to obtain a shifting of the pole through an angle of 60 deg. If all the exciting current is passed through phases *A* and *B*, the resultant field will be *AB*. If the current after passing through *A* be equally divided be-

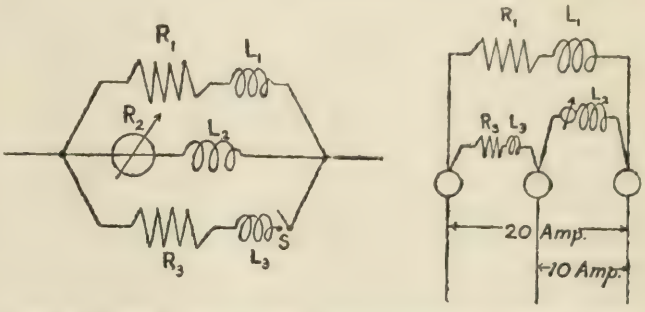
tween *B* and *C*, the line of the poles will be in phase with *A*. If all the current be passed through phases *A* and *C*, the line of the poles will take a position *AC*. It is also possible to build a special exciter which will give any required phase position of the excitation on the rotor, and in cases where perfectly synchronous running is required the exciter operates as a continuous-current generator. In his final reply the author (Townend) said that there was no doubt that the use of a phase advancer in conjunction with an induction frequency changer would give operating characteristics which are on an equality with, and in some respects better than, those of the synchronous set, but in the majority of cases the cost of the former would be higher than the latter; also attention and maintenance would be slightly greater. The arrangement shown in Fig. 1 gives a simple way of obtaining a displacement of the poles, but no doubt a standard type of machine with salient poles and a movable stator is more desirable and less expensive.—London *Electrician*, March 23, 1917.

Electrochemistry and Batteries

Electrolytic Equivalents of Gases.—CARL HERING.—An article in which the author points out that in the case of elements which are gases Faraday's law becomes much simpler if the amounts set free are stated by volume instead of by weight. The author restricts the discussion to the six gases—bromine, chlorine, fluorine, hydrogen, nitrogen and oxygen—which are diatomic at ordinary temperatures. The quantities of any of these gases set free by electrolysis at 0 deg. and 760 mm. are by volume and for a change of valence of unity equal to 0.11602 cu. cm. per coulomb, 0.41767 liter per ampere-hour, 14.750 cu. ft. per 1000 amp.-hr. The reciprocals of these standard values are 8.6193 coulombs per cu. cm., 2.3943 amp.-hr. per liter, 67.798 amp.-hr. per cubic foot. "The equivalence between the quantity of electricity and the volume of the elements when in the form of gases or vapors, instead of their weights, may be termed the electrophysical equivalent as distinguished from the more usual electrochemical equivalents, as it is independent of the atomic weights. It may be said to be the fundamental or basic law, and that Faraday's law as usually stated is a deduction from it or a corollary. It applies strictly, however, only to perfect or ideal gases; it seems that the gaseous elements do not all behave like perfect gases, but the differences are slight, being apparently of the order of fractions of a per cent, and hence can be neglected for all practical purposes."—*Metallurgical and Chemical Engineering*, April 1, 1917.

Units, Measurements and Instruments

Measurement of Large High-Frequency Currents.—G. KEINATH.—There is no difficulty in measuring high-frequency currents of 5 amp. or 10 amp. by means of ordinary hot-wire instruments with subdivided hot wires. For larger currents up to about 50 amp. instruments have been designed with systems of such wires connected in parallel. They have been found to give errors of 30 per cent on short wave lengths and to have variable zero readings. Similar instruments have been made with thin and short platinum-iridium strips connected in parallel between heavy copper blocks giving improved accuracy but still having errors of 10 per cent and changeability of the zero readings due to the considerable heating at high currents. A new instrument of the induction-dynamometer type is described, consisting of a fixed coil and a coaxial pivoted short-circuited coil. The reading of such an instrument is independent of the supply frequency if the resistance of the moving coil is small compared with its reactance. However, the full deflection would be only 90 deg., of which only about two-thirds can be used for measurements. The scale may be lengthened to 180 deg., according to a suggestion of Papalexi, by constructing both the fixed and moving systems as two coils in series,



FIGS. 2 AND 3—METHOD OF CONNECTING MULTIPLE-RANGE INSTRUMENTS

the two coils being in planes at right angles like equatorial and meridian planes. The equatorial coils maintain a magnetic coupling between the two systems even in the case when the meridian coils are at right angles. This type of instrument has a fairly evenly divided scale and is used directly for currents up to 5 amp. and with inductive shunts for higher currents. These shunts are adjusted by alteration of the pitch of the spirally wound coils of which they are composed. The objection to this instrument lies in the fact that with the 5-amp. size about 50 amp.-turns are required, which corresponds to an inductance of 7000 cm. This involves the danger of the induction of very high voltages in the windings. The author tested normal hot-wire ammeters with shunts specially designed so as to have the same time constant as the instrument with an external inductance in its circuit. This type of instrument is practically unaffected by the supply frequency, giving an accuracy of about 5 per cent on waves as short as 135 m. (443 ft.). The variation of the zero with temperature is completely compensated by an ingenious device consisting of a second wire actuating the spring keeping the hot wire in tension. The 500-amp. size has a hot wire carrying 10 amp. and a volt drop of 0.25 volt on direct current. It has no appreciable error between 1000 and 10,000 cycles per second. Multiple-range instruments are connected according to the methods shown in Figs. 2 and 3.—Abstracted from *Jahrb. d. Drahtl. Tele*, August, 1916, in *Science Abstracts*, Feb. 26, 1917.

Telegraphy, Telephony and Signals

Machine-Switching Telephone Gear.—F. R. MCBERTY.—The first part of a long illustrated abstract of a paper read before the (British) Institution of Electrical Engineers. The author reviews comprehensively the subject of automatic telephony. After some general considerations, computation of traffic is dealt with and a comparison is made between observed results and computed chances. The advantages of automatic telephony are shown, and in conclusion results are given for the maintenance of machine switches.—London *Electrician*, March 23, 1917.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

DENIAL OF INJUNCTION IN FUSE CASE TO BE APPEALED

Formal Appeal from Decision of Justice Pendleton Is Entered and Argument Set for May 4 Before Appellate Division

Roger L. Foote, general counsel for the Economy Fuse & Manufacturing Company, in an interview with a representative of the ELECTRICAL WORLD in New York, said that the company had appealed the order entered by Justice Pendleton on April 14 denying the motion for a preliminary injunction against the electrical committee of the National Fire Protection Association, and that the appeal would come up for argument on May 4 in the Appellate Division of the Supreme Court.

Mr. Foote stated further that the case of the company would be pushed to a hearing as vigorously as possible as soon as the Appellate Division of the Supreme Court had decided the motion.

GREATER NEW YORK JOBBERS ORGANIZE ELECTRICAL CLUB

Forty Concerns Join in Organization to Consider Problems in Metropolitan District and Ways of Bettering Conditions

A meeting of various concerns in the electrical jobbing business in Greater New York was held at Mouquin's restaurant on the evening of April 17. The problems of the electrical jobbing business in Greater New York territory and ways of bettering conditions were discussed. The meeting was enthusiastic and was attended by fifty-one representatives of forty-two electrical jobbing concerns.

It was decided unanimously to form the Electrical Club of Greater New York. The following concerns have been enrolled as charter members of the new organization:

Manhattan Electrical Supply Company, E. Whitmore.
Weber Supply Company, Fred W. Weber and William Smart.
P. H. Addison, Mr. Sternberg.
E. B. Latham & Co., E. B. Latham.
David Killoch Company, David Killoch.
Madison Electrical Supply Company, M. R. Greason.
W. R. Ostrander & Co., C. P. LaShelle.
Royal-Eastern Electrical Supply Company, Charles P. Scott and J. D. Sweeney.
A. Shemel & Co., A. Shemel and Meyer Zuckr.
Stanley & Patterson, George L. Patterson, Arthur F. Stanley and George H. Hopper.
J. A. Pizzini.
J. H. Bunnell & Co., Mr. Johnson.
Eclipse Light Company, Mr. Rothenstein.
Burnet Company, W. S. Jones.
J. J. Leahy.
Alpha Electric Company, Inc., A. T. Thacher, J. H. Hughes and Walter Williamson.
Baily Electrical Supply Company, Louis D. Baily.
Bronx Electrical Supply Company, William J. Courtney.
Brooklyn Electrical Supply Company, H. T. Hochhausen.
Crannell, Nugent & Kranzer, Inc., W. J. Kranzer.
H. Cohn.
Central Electrical Supply Company, George M. Beatty.
Charles F. Campbell.
Samuel Frost.
Fullerton Electric Company, Fred W. L. Fullerton.
Fletcher Electric Company, P. M. Fletcher.
G & G Electric Company, G. Soffer.
Greeley Electric Company, W. John Killoch.
Hartt & Morison, Charles T. Morison and James J. Hartt.
H. Heller.
H. Hirschfeld Electrical Supply Company, M. Hirschfeld.
Holloway, Bentz & Co., Charles Bentz and John T. Koehler.
Independent Electrical Supply Company, H. H. Habst.
Metropolitan Electrical Supply Company, Leon Portnow.
Northwestern Electric Equipment Company, J. E. McClernon and W. Jockers.
Charles G. Robin, Inc., Charles G. Robin.
Starobin Electrical Supply Company, Joseph Starobin.
Sibley-Pitman Electric Corporation, H. Q. Foreman and F. S. Gardner.
Silk City Electric Supply Company, I. I. Jaffe.
Tri-City Electric Company, Joseph R. Spurr.
Walsh Electrical Supply Company, John F. Walsh.

Charles P. Scott of the Royal-Eastern Electrical Supply Company was elected chairman and W. J. Kranzer of Crannell, Nugent & Kranzer secretary.

The following executive committee was elected: J. E. McClernon, Northwestern Electric Equipment Company; Charles B. Bentz, Holloway, Bentz & Company; James J. Hartt, Hartt & Morison; C. P. La Shelle, W. R. Ostrander & Company; H. H. Kabat, Independent Electrical Supply Company.

Meetings will be held each Tuesday evening for the first month until the organization can be perfected, after which they will be held bimonthly, and later monthly.

OUTLET BOX SECTION MEETING OF ASSOCIATED MANUFACTURERS

F. W. Hall Elected Chairman for Coming Year—Standard Packages and Methods of Packing, Shipping, Etc., Under Consideration

The outlet box section of the Associated Manufacturers of Electrical Supplies met at the association offices, 62 Cedar Street, New York City, on April 24. The meeting was large and enthusiastic, practically all members of the section being present. The standardization committee submitted a memorandum covering a number of important subjects for consideration, and these were taken up by the meeting and discussed at length.

New officers of the section for the coming year were elected, as follows: F. W. Hall, chairman, Sprague Electric Works, New York City; H. G. Knoderer, secretary, National Metal Molding Company, Pittsburgh, Pa.; Hobart D. Betts, treasurer, Thomas & Betts Company, New York City. New committees have not yet been named.

Among various subjects, the section has taken under consideration standard packages and methods of packing, shipping, etc., and a committee has been appointed to make a study and to report at the next meeting. This is one of the activities which have been taken up by the association lately, and committees have been appointed in a number of the sections to make an extensive study of the matter with a view to uniform standardization so far as it is possible to carry it out.

Removal of the general offices of the Associated Manufacturers to the new offices, 30 East Forty-second Street, is to take place on May 1.

ALTERED PLANS FOR THE N. E. L. A. ANNUAL CONVENTION

Leaders of the Industry Approve the Action of President Wagner in Making National Service Paramount

As forecast in last week's issue of the ELECTRICAL WORLD, the plans for the 1917 convention of the National Electric Light Association have been altered materially.

President Herbert A. Wagner has issued a letter reviewing the circumstances and reasons why, in the public interest, it has been decided to forego the usual large convention and substitute a conference at the headquarters in New York on May 9 and 10. Mr. Wagner's letter in part is as follows:

"Until the last moment it had been hoped and believed that the annual convention of the association could be held as usual, but in these days of national crisis events march swiftly, and decisions with reference to the aspect of affairs, changing from day to day, with equal promptitude have to be made. The opinion now prevails that the date for holding the convention should be advanced and that the meeting itself should be materially changed in character.

"Perhaps never before have we been confronted with conditions affecting our members which make it more desirable and necessary to get together and discuss ways and means for the conduct of our affairs within the next year.

"We are compelled by every dictate of citizenship and patriotism to do all in our power to uphold and assist the government in the prodigious task before it and to lead in encouraging patriotic service and sacrifice, while at the same time we must continue to serve the community in which we operate and to furnish power to industries upon which the government will be dependent for supplies and lighting for the protection of property and citizens.

"We must assist the government particularly in the organization on the most efficient basis of the industries of the country, that they may not be seriously interfered with by the draft of men for military service.

"It is necessary to find means through organization and government co-operation to use our highly trained men for the most useful service, which will in many cases be in continuing work which they have at present in hand. We need to consult with each other and to consider these matters, and the convention called for May should present unequaled opportunity for this.

"In order that these most important matters should have first and full consideration, it is now deemed advisable to curtail as far as possible our proposed program, leaving this to be presented merely in the formal way of receiving printed reports and papers with discussions to be presented in writing at a later date. This radical change in the program will probably result in the natural limitation of attendance largely to the direct representatives of member companies.

"Therefore, with the highest welfare and interests of the association at heart, and in view of the power invested in me as president by the executive committee to decide the time and place of the annual meeting, and after receiving the benefit of a full discussion of the matter by the public policy committee, I have issued instructions to the association staff and its committees to cease all preparations for Atlantic City and to abandon all work in connection therewith.

"The regular continuance of association functions, under the constitution, requires an annual meeting in May or June. In the confidence that the executive committee will ratify my action I call an annual convention to be held at the United Engineering Society Building, New York, on Wednesday and Thursday, May 9 and 10, of Class A and D member companies and such of their member officers and member employees as may be delegated to attend, for the discharge of regular business and the consideration of such other matters as may be deemed necessary to dispose of at that time. Admission to meetings will be limited to those presenting credentials from Class A and D members. Executive sessions will be limited as usual to delegates, one each, of Class A members.

"It is realized that this is very short notice, but we must yield to the necessities of the situation and shape our affairs with the aim of insuring the welfare of our country and the highest efficiency of the industry. To these ends I invite and request the fullest co-operation of all member companies."

A meeting of the executive committee of the N. E. L. A. was scheduled for April 27.

NATIONAL SERVICE PARAMOUNT

FROM SAMUEL INSULL

To the Electrical World:

Telegram received. My belief is that the national crisis demands that we should do everything possible to increase efficiency in our business, and any time we have to spare should be devoted to the nation and not to the convention.

SAMUEL INSULL,
President Commonwealth Edison Company.
Chicago, Ill., April 23, 1917.

FROM JOSEPH B. McCALL

To the Electrical World:

The postponement of the N. E. L. A. convention meets with my hearty approval, as it is highly important that the trained men of the public utility corporations should be "on their jobs" at this time.

JOSEPH B. McCALL,
President Philadelphia Electric Company.
Philadelphia, Pa., April 23, 1917.

FROM C. L. EDGAR

To the Electrical World:

I heartily favor the proposal of postponing the coming convention of the National Electric Light Association. I think that this association can during the coming year more than ever justify its existence by doing big things, and it can well afford to set aside for the moment the very valuable routine work which it has been doing in past years, confining its attention almost entirely to the questions arising out of the national crisis and calling an immediate meeting of the executives of its member companies.

C. L. EDGAR,
President Edison Electric Illuminating Company of Boston.
Boston, Mass., April 23, 1917.

PATRIOTIC SERVICE OF THE ENGINEERING PROFESSION

Gano Dunn, as Chairman of the Engineering Committee, National Research Council, Shows Work of National Society Members

Gano Dunn, chairman of the engineering committee, National Research Council, has written a letter describing the relations of the engineering societies to the agencies of national defense. Mr. Dunn says in part:

"The engineering profession, which has been so prompt to volunteer its professional and military services to the government in support of national defense, is now in contact with the various government agencies, as follows:

"First, through the Naval Consulting Board and its formerly existing committee on industrial preparedness.

"Second, in a more or less informal way, through the joint committee on Engineers' Reserve Corps and the military engineering committee of New York, the military services of engineers are being organized and offered to the government, and an engineers' regiment is recruiting in New York. The constitutions of the national engineering societies were found to contain such limitations that these societies could not take formal action in military matters. A little over a year ago the military engineering committee organized itself through the spontaneous action of a group of leading engineers.

"Third, through the National Research Council created by the National Academy of Sciences.

"To the committee on engineering of the National Research Council each of the National Engineering Socities has contributed two representatives and stands ready to contribute others as called for. With the engineers who are members of the National Research Council, these constitute the engineering committee.

"The representatives so far named from the American Society of Civil Engineers are George F. Swain, Edgar C. Marburg and Clemens Herschel; American Institute of Mining Engineers, Pope Yeatman, Albert Sauveur, Charles F. Rand and George K. Burgess; American Society of Mechanical Engineers, W. F. M. Goss, John N. Freeman, C. D. Young, William F. Durand, John A. Brashear, Hollis Godfrey, Howard E. Coffin and Ambrose Swasey; American Institute of Electrical Engineers, Frank B. Jewett, Clayton H. Sharp, Gano Dunn, C. E. Skinner, Michael I. Pupin, S. W. Stratton, Elihu Thomson and John J. Carty; American Institute of Consulting Engineers, Lewis B. Stillwell.

"In addition to supporting the government in engineering research this committee also brings to the aid of the government through the National Research Council such general engineering services as are auxiliary to research.

"The national engineering societies have a further relation to the National Research Council through the Engineering Foundation. Through the action of the engineers the whole available income from the gift of Ambrose Swasey is devoted to organization and operation expenses but not research expenses of the council.

"Fourth, through an engineering section of that committee of the Advisory Commission of the Council of National Defense which is under the direction of Dr. Hollis Godfrey, to whom the Defense Council has assigned supervision of general engineering matters, including education."

GREAT DEMANDS FOR POWER

FROM JACOB GOULD SCHURMAN, PRESIDENT CORNELL UNIVERSITY

To the ELECTRICAL WORLD:

The entrance of the United States into the war will require a more intensive manufacture of war materials. There will therefore be great demands for power from the central station industry, and there is some doubt as to its ability to supply more than its present output. There will also be a call for all kinds of electrical apparatus for the equipment of factories and for the extension of central stations.

During the last two years expansion in plant has not kept pace with the increase in demand for equipment, so that prices are high and deliveries are low. The electrical manufacturers already have orders on their books for months ahead, so that with the rush of work now in prospect there will be an exaggeration of the present conditions where factories are refusing orders and wages are higher than they have been for many years.

Ithaca, N. Y. JACOB GOULD SCHURMAN.

OTHER DEVELOPMENTS OF WAR

Reports received by the ELECTRICAL WORLD from many points throughout the country show that protection of plants by flood-lighting is extending rapidly.

The engineering department of the National Lamp Works has issued a valuable timely booklet on "Protective Lighting for Industrial Plants."

The National Lamp Works has allotted ground to employees for gardens at Cleveland and the General Electric Company has taken similar action at Schenectady.

The Denver Gas & Electric Light Company will plant potatoes to be sold to employees at cost.

The Louisville Gas & Electric Company will supply seeds and instructions and give prizes for employees' gardens.

The American Institute of Electrical Engineers has decided definitely to hold its annual convention, as planned before the announcement of war, at Hot Springs, Va., on June 26 to 29.

At its meeting last week the Pacific Coast Section of the National Electric Light Association passed resolutions pledging service to the government.



FLOOD-LIGHTING FOR INDUSTRIAL PROTECTION INCREASING IN FAVOR

Pacific Coast Section Has First Convention

Members of the N. E. L. A. in Far Western States Have Successful Meeting with Attendance of Over 500—Services Offered to the Government

THE first annual convention of the Pacific Coast Section of the National Electric Light Association, including the States of California, Nevada, Arizona and New Mexico, was held at Glenwood Mission Inn, Riverside, Cal., on April 19, 20 and 21. In three months this new section, which now represents fifty-one central stations, has enrolled 1419 members, making it the largest geographical section in point of numbers, although the density of population in the territory covered is less than in any other section. The registration at the convention was over 500.

R. H. Ballard, Southern California Edison Company, president of the new section, presided at the opening session on Thursday afternoon, April 19. The Mayor of Riverside welcomed the delegates, and in response John A. Britton, Pacific Gas & Electric Company, paid a warm tribute to southern California hospitality.

Address of President Ballard

Mr. Ballard, in a presidential address, called for "an unconventional convention," and outlined the advantages of close co-operation among the interests represented. It was pointed out that of Class A members small central stations outnumbered the larger companies three to one and that special attention should be given to the problems of the smaller company.

An exchange of information was much desired on rate problems, Mr. Ballard said, and an agreement on matters involving Railroad Commission action. Two considerations must be borne in mind—the securing of a fair rate of return and the protection of investment. Bearing on this is the fact that the central station turns its capital over only once in four or five years as against the four to eight turnovers per year in other lines of business.

The alarming increase in the price of fuel oil was pointed out as a new and most serious problem.

Reports were received from the secretary, the treasurer and the membership committee.

George B. Muldaur, representing the national association, conveyed a welcome to the new section from New York headquarters.

The meeting was then turned over to S. V. Walton, Pacific Gas & Electric Company, chairman of the commercial committee, and the remainder of the afternoon was devoted to commercial questions.

Simpler Rate Schedules

The paper on rate making by W. G. Vincent, Jr., Pacific Gas & Electric Company, provoked a general discussion. It was agreed that the urgent need is for simpler rates which the consumer can understand. Those who favored a straight meter rate presented views in opposition to the differential rate. The former can be explained satisfactorily to the small consumer, and the latter encourages the greatest use of electric service.

It was apparent that there are two points of view on the rate question, *i.e.*, the theory of rate making and the application of rates. The ideal way would be to have an expert study the conditions in each case and assign a rate that suited. The danger in this that makes it impracticable is the charge of discrimination. So the compromise method has been for the company to lay down the principles on which rates will be charged and then let the consumer select his own rate by the class in which he places himself.

An appeal was made to the commission to recognize the difference between classification and discrimination. Irrigation pumping installations were cited as instances of connected load that might be on the lines without using energy for several years and then in a season of drought, when the hydroelectric company least wanted it, there would come on the load curve sudden heavy demands for pumping. Some companies have as high as 70 or 80 per cent of such load. It was agreed that a fixed charge on the connected load basis was essential.

Among those who discussed the paper were H. F. Jackson, Sierra & San Francisco Power Company; L. S.

STRONG POINTS IN PRESIDENT BALLARD'S ADDRESS

In our organization particular attention has been given to the manufacturing, jobbing and contracting interests to develop a unity of effort within our area of operation, and the response in membership from these interests has been quite gratifying. Hereafter they will be represented on the executive committee. Conditions in our section of the country demand a close relation between all branches of the industry and it devolves upon us to lead the way.

This organization stands emphatically and unequivocally for closer relations and broader understanding between the utility companies and the public and will work unceasingly to that end.

A utility which through wise, skillful and diligent management has reached a point of such efficiency that it is enabled to improve its service, to operate at lower cost and to more advantageously finance its requirements should . . . receive a recognition which would tend to put a premium upon careful, economical and efficient operation.

With the modern doctrine of concentration of production and unified system of distribution serving large areas with diversified demands, the solution of the much-mooted question of municipal ownership will be worked out solely along sane and logical lines.

Costs of materials, supplies and commodities of all sorts have jumped amazingly in the past two or three years, but a review over a longer period reveals the fact that there has been a constantly increasing level of prices, aside from the abnormal development in the immediate past. . . . Yet in the face of this electric rates have been falling steadily.

Ready, California Railroad Commission; H. L. Aller, Pacific Gas & Electric Company, Phoenix, Ariz.; O. B. Coldwell, Portland Railway, Light & Power Company; A. E. Wishon, South San Joaquin Power Company; Edward Whaley, Northern California Power Company; C. F. Butte, Butte Engineering Company, San Francisco, and Frank Somers, Century Electric Company, San José.

Electric Cooking and Water Heating

The paper on electric cooking and water heating by J. B. Black brought out discussion covering a wide range of experience. Practically all of the companies whose representatives spoke had rates for water heating of 2 cents or less, 1.1 cents per kilowatt-hour being the lowest.

A plea was made by H. S. Batchelder, Western States Gas & Electric Company, for the electric heater to warm kitchens where electric ranges were in use. He had been able to show consumers how a rate of 1.5 cents per kilowatt-hour would do this as cheaply as it could be done with other fuels in rural districts.

Glenn D. Smith, Ontario Power Company, discussed his company, serving only two small towns, as typical of smaller central stations. His men had placed 140 ranges and, since no large industrial load could be expected, they looked to the electrification of the kitchen for their chief revenue. He strongly favored the electric heater for kitchen use. One dealer present had sold 150 electric heaters for use on a 7-cent basis and had had only one complaint about high bills. Of course with electric range rates in effect the cost would be correspondingly less.

Work of Engineering Committee

The first engineering session on Friday morning was presided over by J. S. Woodbridge, Sierra & San Francisco Power Company, who reviewed the work on which the engineering committee has been engaged. Co-operation with the railroad commission in deciding upon overhead construction and on inductive interference was included, as well as work on insulator failures and the standardization of various equipment.

Transformer Standards

S. J. Lisberger, Pacific Gas & Electric Company, in discussing the paper on transformer standardization, reported that the co-operation of many companies through the new section had facilitated agreement on design to which the manufacturers had responded quickly. Representatives of manufacturers and jobbers pointed out that this standardization would reduce cost, would make for quicker deliveries, and would enable the jobber to protect customers without too burdensome stock.

Mr. Jackson urged study of distributing conditions before final decision on transformer standards was adopted. Peculiarities of Western distributing systems were discussed, such as No. 4 wire lines 20 miles (32.2 km.) long serving irrigation pumps, and it was agreed that sacrifices would be made where necessary to secure some standard that all could use

Overhead-Construction Rules

An outline of the California Railroad Commission safety orders on overhead construction was presented by A. F. Bridge of the commission.

Discussion indicated the general belief that standardization of light but safe construction was preferable to much special provision for certain conditions and locations.

Others who discussed the paper were A. H. Babcock and Fred Geible, Southern Pacific Company; L. R. Brown, General Electric Company; W. P. L'Hommedieu, Westinghouse Electric & Manufacturing Company; E. R. Northmore, Los Angeles Gas & Electric Company; P. M. Downing, Pacific Gas & Electric Company, and C. O. Poole, Southern Sierras Power Company.

In discussing the paper on porcelain line insulators P. M. Lincoln, Westinghouse Electric & Manufacturing Company, announced that he had brought an expert on ceramics to the coast to study Western requirements. To find out what is the matter with insulators and how they can be improved is the undertaking of his company, he said.

Prof. R. W. Sorensen, Throop College of Technology, described an oscillator for testing line insulators. Tests on a number of Pacific Light & Power Corporation lines had shown that leaky insulators were found most often in groups. The average of defectives removed from the 150,000-volt line is about 2½ per cent per annum.

Joint Committee on Inductive Interference

Mr. Bridge announced that the joint committee on inductive interference was almost ready to report to the Railroad Commission, bringing up to date the previous orders and clearing up certain new phases of the situation. He said that effort had been made particularly toward a definition of a parallel so that power companies might know just what they were expected to avoid.

In discussing the paper on high-head Francis turbines, John A. Koontz, Great Western Power Company, cited the case of runners in the Big Bend plant on the Feather River. These runners have given satisfactory service and have not been renewed since 1908, although operating at 400 r.p.m. under a head of 420 ft. (128 m.). These wheels often operate two years without having the casings removed.

In opposition to this Mr. Poole cited the case of Francis runners under 400-ft. (121.9 m.) head on his system in which the efficiency dropped to 60 per cent in six months. After replacement the units were used another four months and were then found to have an efficiency of only 40 per cent and were removed and replaced by impulse wheels.

It was agreed that the sediment in the water limited the extent to which Francis runners could be used.

Joint Pole Construction

A discussion of joint pole construction at the engineering session on Friday afternoon, April 20, showed a belief that joint pole contracts should be drawn up by attorneys but that specifications should be left open to change.

The Los Angeles Gas & Electric Company believed that the joint pole committee had reduced its city line troubles 50 per cent. The Los Angeles joint pole committee now attends to 23,000 poles.

In discussing the question of fuse protection of transformers and branch lines there was agreement on the need of an automatic switch. The fuse was considered as now at its zenith.

One company, finding fuse trouble traceable largely to improper fusing, made up standard fuse kits which linemen are required to use. These are tin cylinders with brass tag labels.

Steam Turbine Standby Stations

The paper on steam turbine standby stations was followed by discussion of various methods of synchronous condenser operation. Opinion was divided on the question of whether auxiliary apparatus should be driven by steam or electricity, but it was agreed that there should always be some steam in the turbine when it is turning over at full speed.

Insulating brick boiler settings received some attention. A steam reserve pumping station in San Francisco was said to keep up steam constantly in a 250-hp. lagged boiler with only one barrel of fuel oil per day.

Industrial Electric Heating

The paper on industrial electric heating at the commercial session on Friday morning developed a number of suggestions for new markets. W. S. Leffler, Great Western Power Company, described an electric humidity-controlling device using 36 kw. on an 80 per cent load factor, which could be used in a wide variety of industries.

Samuel Kahn, Western States Gas & Electric Company, described crucible steel electric furnaces on his lines which, at 1 cent per kilowatt-hour, were operated at half the cost of fuel oil needed to do the same work. These had an 80 per cent power factor during regular operation.

Merchandising a Popular Subject

More discussion was brought out by the paper on merchandising than by any other paper of the commercial section.

S. M. Kennedy, Southern California Edison Company, made it clear that the central station's first duty was to its stockholders—that it must adopt that merchandising method which will develop the load desired in the most advantageous way.

Mr. Walton reported that the Pacific Gas & Electric Company had put out in a co-operative campaign last year 45,000 pieces of apparatus with a total rating of 27,000 kw.

P. H. Booth, Hotpoint Electric Heating Company, urged more activity on general publicity campaigns and intensive study of the merchandising problems of each central station.

Mr. Britton said the central station should and would help the dealer in merchandising appliances wherever the conditions were such that co-operation could be effected.

Several representatives of jobbers and dealers pointed out that co-operative plans put at the service of the central station the long experience in merchandising which dealer and jobber have acquired.

Commercial Organization

The paper on commercial organization led to a suggestion from Mr. Aller which met very general approval. He pointed out that the small central station needs specialists just as do the larger companies, but that it cannot keep them busy. He therefore proposed that the N. E. L. A. establish a school for training such men, who could then be assigned to the companies as they were needed. The school could probably be made self-supporting or nearly so if a large central station would foster it and break in the men under the supervision of its experts.

Mr. Britton replied to this by pledging the support of his company in carrying out such a scheme.

Highway Lighting

The paper on highway lighting was discussed by W. D'A. Ryan, General Electric Company, and S. J. Lisberger, Pacific Gas & Electric Company.

Mr. Ryan objected to short terms on contracts for highway lighting. Highest grade equipment could be put in, he said, only on long-term contracts. He predicted rapid advance in the lighting of highways between towns and cited several recent advances in the art which promise to facilitate this.

Rural districts could not afford high intensity of highway illumination, Mr. Lisberger said. He described a plan of silhouette lighting which could be made effective at low cost.

Accounting and Public Policy Committees

At a final joint session on Friday afternoon the report of the accounting committee was presented by B. T. Story, chairman, Southern California Edison Company.

The public policy committee presented a resolution, which was carried unanimously, to further water-power development on equitable terms. Another resolution, carried unanimously, tendered to the government the use of the systems and service of member companies in such manner as might be desired.

New Officers and Entertainments

Officers elected for the ensuing year were as follows: President, H. F. Jackson, Sierra & San Francisco Power Company; first vice-president, Samuel Kahn, Western States Gas & Electric Company; second vice-president, E. R. Davis, Pacific Light & Power Corporation; secretary, A. H. Halloran, *Journal of Electricity;* treasurer, A. N. Kemp, Pacific Light & Power Corporation.

Additional members on the executive committee were appointed as follows: Representing manufacturers, K. E. Van Kuren, Westinghouse Electric & Manufacturing Company; representing jobbers, Dave Harris, Pacific States Electric Company; representing contractors, H. C. Reid, Pacific Fire Extinguisher Company.

Automobile trips and card tournaments were provided for the ladies while the sessions were being held.

On Thursday evening an illustrated lecture was given by C. O. Poole on the Southern Sierra's system.

At a banquet on Friday evening talks were made by Max Thelen, president California Railroad Commission; Johnathan S. Mitchell, Los Angeles Chamber of Commerce, and O. B. Coldwell, Northwest Electric Light & Power Association.

Delegates were taken by automobiles on Saturday over the "rim-of-the-world" road to the crest of the San Bernardino mountains, where a "mile-high luncheon" was served at Pine Crest by the Southern Sierras Power Company. Returning via Colton and San Bernardino, stops were made at the steam substations in these two towns and at the plant of the Riverside Portland Cement Company. The convention was closed with a ball on Saturday night.

HIGH-SPEED TELEGRAPHY APPROVED IN ENGLAND

Multiplex Apparatus Developed in American Practice Recommended by Committee in Report to Post Office Department

A report has been made by a committee appointed by the Postmaster General of Great Britain to consider the position of high-speed telegraphy.

After reviewing the automatic high-speed systems the committee announces that for ordinary commercial telegraph work between the main centers of the British post office service the inventions based on the multiplex method are superior. Multiplex systems conduce to economy in staff and in office equipment; they are subject to less serious stoppages and delays than automatic systems, necessitate less spare plant and less costly maintenance, and are economical in respect of lines and of paper tape for transmission. The report adds:

"The Western Electric multiplex apparatus is the most generally satisfactory system for busy lines which we have examined. A quadruple duplex installation of the system has been working since March last between London and Manchester. The average number of telegrams per operator per hour is consistently well over forty, and has reached forty-nine. The apparatus has dealt with about two-thirds of the whole traffic between London and Manchester on a single circuit. There are not many circuits in the kingdom capable of keeping the apparatus fully fed, but we think that the question of extending the use of the system should be proceeded with without delay."

LOS ANGELES AGREES TO BUY DISTRIBUTING SYSTEMS

Beginning May 1, Power Companies Will Be Distributing Agents of City Until Details of Purchase Are Settled

The City Council of Los Angeles has approved the revised draft of the contract covering the city's purchase of the distributing systems of the Southern California Edison and Pacific Light & Power companies. The plan carries an agreement whereby the companies will distribute power from municipal plants in conjunction with that from their own sources until the city takes over the properties.

The city will buy the desired portions of the two distributing systems for $8,270,000 plus $1,145,000 for severance damage. The temporary agreement provides that in addition to the city's power the companies will furnish such additional power as may be required by the territory served, to be, however, not less than 25,000 hp.

The companies agree to maintain the systems, make extensions and improvements, collect from consumers as the city's agents, and appoint two members of a board of supervision, two other members of which are to be appointed by the city. This board shall determine policy and decide questions governing maintenance and extension of systems and management of the business in general.

Under the temporary agreement the companies will retain from consumers' collections 8 per cent per annum on the $8,270,000 purchase price and 6 per cent on $130,000 as part of severance damage effected by the contract. The actual cost of power furnished by the companies is to be held as a trust fund, to be turned over to the city when the properties are taken. The remainder of the collections from consumers is to go to the city as its share of the business. The agreement is to go into effect subject to approval of the State Railroad Commission.

ALLIS-CHALMERS COMPANY LARGE GAIN IN BUSINESS

Sales Billed in 1916 Amount to $19,400,000, a Gain of 66 Per Cent Over 1915—$16,000,000 Unfilled Orders on March 31, 1917

Sales billed by the Allis-Chalmers Manufacturing Company during the calendar year 1916 amounted to $19,440,509, a gain of 66.6 per cent over the previous year. The profit and loss account follows:

Year ended Dec. 31	1916	1915	1914
Sales billed	$19,440,509	$11,666,412	$10,323,150
Cost, including depreciation and development expenditures	14,699,744	9,582,264	9,221,174
Factory profit	$4,740,765	$2,084,148	$1,101,976
Selling, publicity, administrative and general expenses	1,838,454	1,353,054	1,379,685
Net manufacturing profit	$2,902,311	$731,094	*$277,709
Other income—Interest, discounts, royalties, commissions, etc.	262,709	347,258	252,641
Net profit for the year	$3,165,020	$1,078,352	*$25,068

*Loss.

Otto H. Falk, the president, says in the annual report:

"During 1916, in accordance with the policy of the company, liberal reserves were set aside out of earnings before arriving at the results above reported. The reserve for depreciation of machinery and plants amounted to $393,999 (all special machinery considered of no benefit for future operations being charged direct against contracts as part of the cost). There was also expended and charged off during the year the sum of $1,098,479 for maintenance, renewals and general upkeep of machinery and plants. Inventories were carefully reviewed prior to closing the books and items contained therein of finished and semi-finished stock considered obsolete or superseded in design were written down to estimated realizable values, and, as a further protection on account of high prices obtaining for raw materials and supplies, substantial allowances have been made in valuations.

"In order to provide for new lines of apparatus and to expand the present lines of manufacture, there was expended during the year for standard development, consisting of drawings, patterns and tools, the sum of $243,423, which has also been charged off.

"The company's cash investment in sundry marketable securities as at Dec. 31, 1916, amounted to $1,995,640.

"Following the initial preferred dividend of 3 per cent declared by the directors, payable Jan. 15, 1916, there have since been declared during 1916 dividends on preferred stock aggregating 9 per cent, of which 6 per cent were regular and 3 per cent on account of accumulated dividends. After payment of the above there remained 10 per cent in arrears on the preferred stock. The preferred stock is on a 7 per cent basis commencing with 1917.

"The unfilled orders on hand Dec. 31, 1916, made up entirely of the company's regular lines of manufacture, amounted to $13,292,178 and on March 31, 1917, they amounted to $16,000,000."

WESTERN RED CEDAR MEN IN ANNUAL MEETING

Comparative Strength Tests of Various Kinds of Poles, Including Different Makes of Steel, to Be Held in Spokane

The annual meeting of the Western Red Cedar Association was held in the Davenport Hotel, Spokane, Wash., on April 3.

In his address E. T. Chapin, Spokane, the president, said that out of the 567,000 Western red cedar poles used in 1915, 422,000 went to electric railway, light and power companies. He described the new method of creosote treatment and predicted that soon such treatment would be almost universal.

In accordance with a suggestion of President Chapin, a resolution was passed providing that a committee of three, consisting of W. M. Leavitt (chairman), E. T. Chapin and E. A. Lindsley, be authorized to arrange a series of comparative strength tests in Spokane within the next sixty to ninety days, of Western red cedar and various other kinds of poles, including the different kinds of steel; that the services of some competent engineer to outline and conduct the experiments be secured, and that a representative of the United States Forestry Department and prominent engineers from all over the country be invited.

F. C. Culver of the Sandpoint (Idaho) Lumber & Pole Company is the new president.

MONTANA POWER EARNINGS SHOW GREAT BUSINESS GROWTH

Gains of 44 Per Cent in Gross and 51 Per Cent in Net Accompany New Construction Plans to Meet Heavy Demands

Gross earnings of the Montana Power Company in 1916 increased 44.37 per cent over 1915, and net earnings increased 51.71 per cent.

In the annual report President John D. Ryan says that the gains are due to marked growth in general business, including new business from extensions to towns not previously served, and to earnings from the Chicago, Milwaukee & St. Paul Railway and sale of energy to the Anaconda Copper Mining Company's new electrolytic zinc reduction plant.

Total rated generating capacity in 1916 was 150,000 kw., as compared with 120,000 kw. in 1915; 867,940,326 kw.-hr. were generated, as compared with 488,517,672 kw.-hr. in 1915; the maximum demand was 150,000 kw., against 89,000 in 1915; at the end of the year the connected load was 275,000 kw., as compared with 200,000 kw. in 1915. During the latter part of the year the maximum demand reached the full rated plant capacity on many occasions.

In 1916 $3,400,000 was expended on new construction, transmission lines, additions and betterments.

Regarding the Holter development Mr. Ryan says: "Construction work was started in the spring of 1916 on the new 40,000-kw. development at Holter, on the Missouri River, about 30 miles (48.3 km.) north of Helena. The dam is to be 1350 ft. (411.5 m.) long and 110 ft. (33.5 m.) high and will create another large storage reservoir, which will assist materially in regulating the flow of the river for the plants lower down stream. The generating plant will consist of four vertical single-runner turbine units of 15,000-hp. capacity each. Power from this development will be delivered to the Great Falls-Morel-Anaconda transmission line, which passes over this site. It is expected that this plant will be in operation the latter part of 1917 and provide for the increased business, which will come on during the year. About $1,300,000 was expended



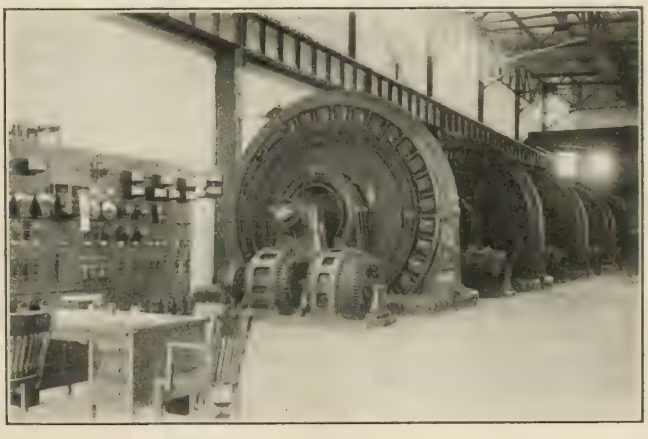
HOLTER DEVELOPMENT ON THE MISSOURI RIVER

on this construction during 1916, and it is estimated that $1,523,000 will complete this development."

Earnings of the Montana Power Company, Great Falls Power Company, Thompson Falls Power Company, Montana Reservoir & Irrigation Company and Great Falls Water Power & Town Site Company follow:

	1916	1915	1914
Gross earnings	$6,244,905	$4,359,408	$3,778,285
Operating expenses and taxes	1,491,623	1,191,904	1,139,046
Net earnings	$4,753,282	$3,167,504	$2,639,239
Interest charges	1,319,735	1,189,162	1,063,614
Surplus over charges	$3,433,547	$1,978,342	$1,575,625
Reserve for depreciation	350,000	300,000	.....
Balance to surplus	$3,083,547	$1,678,342	.....

In speaking of the substantial additions to the equipment of many mining and smelting industries, Mr. Ryan says that "the most important of these is the new electrolytic zinc plant of the Anaconda Copper Mining Company at Great Falls, requiring 30,000 kw. All of these



ANACONDA COPPER COMPANY SUBSTATION, GREAT FALLS

additions are permanent in character and provide for more economical operations, this being especially true of those applied to metallurgy and the reduction of ores, in which arts marked advances have been made in the past two years. No important decrease in earnings from these sources is anticipated upon the return of metals to normal prices."

Co-operation for Vehicle Promotion

Manufacturers Discuss Problems of Marketing and Present Concrete Proposal for Co-operation Between the Separate Interests

As A beginning to a broader co-operation between the many different interests engaged in the promotion of the electric vehicle, both commercial and passenger, representatives of vehicle, battery and accessory manufacturers gathered on Thursday of last week at the instigation of the Electric Vehicle Section of the National Electric Light Association in New York City for a general discussion of the problems involved in the successful marketing of the electric vehicle in the expectation of taking a definite step in the direction of co-operation with one another and with the central stations.

A program of four papers was arranged. The papers took up the problem of marketing the electric vehicle in all of its essential phases. "Advertising" was the title of the first paper, which was read by E. P. Chalfant, in the absence of the author, G. D. Fairgrieve, vice-president of the Anderson Electric Car Company.

Concrete Proposal for Co-operation Between Central Station Interests and Electric Vehicle, Battery and Accessory Manufacturers for Promotion and Development of the Electric Vehicle Business in Its Various Departments

WHEREAS the representatives of the central station interests at a special meeting held at the N. E. L. A. headquarters, New York, Feb. 14, 1917, were unanimous in expressing their confidence in the future of the electric vehicle business, comprising passenger cars, trucks, industrial trucks and storage batteries, the manufacturers, gathered together in this meeting, held at N. E. L. A. headquarters, New York, April 19, 1917, have unanimously agreed upon the recommendation of the following procedure to further promote the sale and use of electric vehicles:

First—Owing to the difficulty of making the central station companies in various localities familiar with the community interests of the manufacturers, due to no manufacturing company having special representatives devoting their time to this purpose, and the further fact that a representative of this grade would necessarily be a partisan, it is recommended that the combined manufacturers' and central stations' interests unite in raising a fund for the purpose of employing and defraying the expenses of an experienced and competent man, operating under the jurisdiction of the N. E. L. A. headquarters, whose duties will be to visit central stations in the cities throughout the country where electric vehicles are, or should be, in general use, for the purpose of meeting the officials of the central stations and "selling" them to a belief in the utility, efficiency and economy of electric vehicle transportation. His further mission will be to aid in the inauguration and operation of electric vehicle bureaus in central stations. It is understood that the man selected for this work will first familiarize himself with the essential details of the business from both the manufacturers' and central stations' viewpoints, and will secure the unanimous indorsement of the manufacturers of the proposals and recommendations which he will take to the central stations, in order that the manufacturers, in following up his work, shall all operate along parallel channels and talk in the same language.

It is estimated that the expense of conducting this department, including salary, traveling expenses and printed matter, will be approximately, but not to exceed, $20,000 per annum. It is recommended that the manufacturing interests that are parties to this proposition shall each contribute $1,000 per annum toward the total expenses, the balance (amounting to probably 25 per cent) to be supplied by central station interests through the N. E. L. A.

This man's duties will be under the direction of the executive committee of the Electric Vehicle Section of the N. E. L. A., and he will make reports to the officials of this section, who will in turn keep the contributing members informed of his activities.

Assuming the principles of this plan to be sound, the contributing members will be expected to commit themselves for a period of two years, it being estimated that it requires this period of time to give the plan a thorough trial.

Second—It is recommended that a booklet be prepared for distribution to central stations which shall set forth a brief history of the electric vehicle business, its potentialities and its possibilities, the same to be supported by existing statistics; also that this booklet be prepared by the joint co-operation of the advertising departments of manufacturing members and the N. E. L. A. headquarters staff. This booklet should set forth the following:

(A) Methods now being successfully employed by central stations for the local development of the electric vehicle industry, classified as to population; also composite recommendations by manufacturers for the local development of the vehicle business by central stations not already organized for that work.

(B) Plans which might be adopted by central stations in establishing electric vehicle bureaus; also recommendations as to how this work, in a preliminary way, could be handled by a man, the whole or a portion of whose time could be devoted to this development, co-operating in both sales and mechanical matters with local dealers and garage men.

(C) Specimen advertisements of a neutral nature to be used by central stations for local purposes, with or without modifications, intended for newspapers, theater programs, billboards, street cars and electrical signs.

(D) Complete information regarding charging apparatus, comprising rotary sets, mercury-arc rectifiers and rheostats and their methods of installation and use; also suggestions in regard to supplying these outfits to public and private garages on deferred payment.

(E) Information to aid central stations in co-operating with local dealers and garages for the installation of electric garages and their equipment.

(F) Information for central stations as to appliances for emergency charging at their substations, with particular reference to boosting facilities at country clubs, public parks, amusement resorts and suburban points.

(G) Recommendations to central stations for the creation of electric vehicle departments within their local organizations for the proper instructions to garage employees and to private owners for the charging and care of batteries.

(H) Information to central stations as to what has already been done in large cities regarding parking facilities and recommendations for use in cities where these facilities do not already exist.

(I) Recommendations to central stations to chart their respective localities and suburban towns, showing where the electric garaging and boosting could be obtained, and that the central stations make this information available in booklet form to owners.

(J) Cite battery exchange methods now successfully employed by central stations, with information regarding the installations, operation and co-operation available from vehicle and battery manufacturers.

(K) Recommendations to central stations, acting as neutrals, to get local garage men together for uniform methods, examples to be given of successful methods employed in different cities, showing both the flat rate and the measured service plans.

Third—Recommendation that central stations be made familiar with the value of electric vehicle charging as an off-peak, long-hour, low-demand department of their business with a possible view to rate revision.

Mr. Fairgrieve, after describing in general terms some of the conditions that exist to-day in the market for electric vehicles, made the following recommendations:

First—That the central stations run at their expense a series of advertisements in their local newspaper, copy to be educational and impartial.

Second—That the central stations inclose with their monthly statements to clients printed or novelty inserts advising the purchase of electric cars.

Third—That each central station in localities where electric vehicles are used employ in its new-business department a capable man to devote his time exclusively to building up the use of the electric vehicle.

Fourth—That a money appropriation from the N. E. L. A. be prorated among the electric vehicle manufacturers in proportion to the amount that each manufacturer will himself agree to spend for his season's national advertising, with the agreement that each manufacturer so benefiting will devote at least two-thirds of his copy to the general merits of the electric vehicle.

"What Co-operation Means," by E. P. Chalfant, presented in a clear-cut manner the necessity for a rational program of constructive co-operation, financial, physical and educational, between the manufacturers and the central stations. He said:

"The manufacture and sale of electric vehicles represents 100 per cent of our business, and the sale of electric energy for charging these vehicles represents probably less than 5 per cent of the business of the central station; nevertheless, a partnership arrangement for educating the public as to the potentiality of the electric vehicle, and making it easy to own and operate that vehicle, will develop for the industry a volume of business that will return handsome profits to both partners."

The problems of local distribution regarding the respective value of dealers, branch offices and central stations were analyzed minutely by P. D. Wagoner, president of the General Vehicle Company, Inc. Mr. Wagoner was emphatic in stating that the manufacturers should not look to the central stations for actually promoting the sale of vehicles, but rather that it would be to the "best interests of all manufacturers to secure active independent dealers and then for both the manufacturer and the dealer to secure such co-operation from the central station as may be obtainable."

"Charging Problems in Vehicle Selling" was the subject assigned to C. A. Street, but he stated that so far as he was able to find out there was "no such animal."

Following the papers there was a small amount of discussion which paved the way for a resolution by Mr. Chalfant, which is printed here in full, setting forth in definite terms a plan for co-operation between the different interests involved. In discussing the resolution, which was finally unanimously adopted, all who spoke made it clear that it was the consensus of opinion that one man must have charge of whatever plan is actually put in force, that the details of the plan must be clearly and definitely worked out, and that the thing to be sold is, first, electric transportation. It seemed also to be the opinion of the majority that the time was not ripe for a national advertising campaign.

The resolution upon adoption was referred to the Electric Vehicle Section of the N. E. L. A., with the understanding that should that body adopt it in essence a committee should be appointed to crystallize the plan still further and present it to the separate interests.

ELECTRIC STORAGE BATTERY EMPLOYEES RAISE FLAGS

Workers in Every Manufacturing and Office Department of the Works of the Company at Philadelphia Purchase Flags

In every manufacturing and office department of the Electric Storage Battery Company, Philadelphia, the employees, on their own volition, contributed to a fund for the purchase of flags and bunting to decorate their workroom or department.

Addresses were made at several of the flag raisings by an officer of the United States Navy, stationed at the works, who expressed himself as highly gratified at the patriotic spirit shown in every department. At two of the flag-raising exercises a parade with a band formed part of the ceremony.



THE EMPLOYEES FURNISHED THE FLAGS

SPRINGFIELD (MASS.) RAILWAY MAKES POWER CONTRACT

Turners Falls Power & Electric Company Will Furnish Energy to Operate Cars and Will Spend $3,000,000 on Plants

A power contract has been signed by the Springfield (Mass.) Street Railway and the Turners Falls Power & Electric Company, operating an extensive system in the central Connecticut Valley. The Springfield company will purchase the entire input required to operate its cars, and the Turners Falls company will expend, within two or three years, about $3,000,000 for extensions in the Springfield-Greenfield region.

The Turners Falls company plans include the erection of a large modern steam turbine station to supplement the hydroelectric plant built recently at Montague City and other smaller generating stations tied into the system. Supply of power to the Springfield railway will require construction of various motor-generator substations, which will be supplied from the 66,000-volt lines of the Turners Falls company. These are already connected with the steam plant of the United Electric Light Company, Springfield, and when energy is provided according to contract, the engine-driven steam plant of the railway at Springfield will be shut down.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Rate Schedule Approved in Indiana.—The Public Service Commission of Indiana has approved a supplemental rate schedule of the Public Utilities Company of Evansville for energy supplied to Winslow, Ind. The new rates are reductions and grade from 12 cents to 6 cents per kilowatt-hour, the latter charge being for all energy used in any one month over 100 kw.

Electric Rate Proceedings in New York.—The New York Public Service Commission, First District, has decided to continue the proceedings which it started some time ago to investigate the electric rates of the Bronx Gas & Electric Company and of the Westchester Lighting Company in portions of the Bronx which are not served by the New York Edison Company.

Enlarged Jurisdiction for Colorado Commission.—Governor Gunter of Colorado has signed a bill amending the law which gives the commission power to refuse permits for competitive utilities in any district where proper service at reasonable rates is being rendered by an existing utility. It also provides that where a municipality desires to acquire any privately owned public utility it must make application to the commission, which will fix the value of the utility and submit the question of purchase at such price at a special election.

Regulation for Meter and Service Connections in Colorado.—Rules and regulations for gas, electric and water service of private and municipal utilities were adopted by the Public Utilities Commission of Colorado, effective on Jan. 1, 1917. Upon application by the city of Colorado Springs for a rehearing as to the reasonableness of Rule 14, "Meter and Service Connections," the commission suspended this rule until April 1. At a hearing F. J. Rankin, engineer for the commission, recommended that the application of this rule to private and municipal water utilities be suspended indefinitely. The commission was "convinced that rule 14 in so far as it applies to municipally owned and privately owned water utilities should be suspended. In the event the commission shall be called upon in the future to value water utilities, whether privately or municipally owned, for the purpose of establishing reasonable rates, the commission will be free to require the utility to install and maintain service connections in the event the commission makes allowance in the rate structure for this practice."

Deciding Between Two Corporations.—In the matter of the petition of the Colliers Light, Heat & Power Company under Section 68 of the public service commission law for permission to construct in the town of Oneonta an electric plant, poles, wires and appurtenances for transmitting and furnishing to the public electricity for light, heat or power, and for approval of the exercise of rights and privileges under a franchise therefor received from said town, the New York Public Service Commission, Second District, holds: "(1) A corporation should not be encouraged to make extensions of its transmission and distribution lines into a territory which another corporation, by making a much smaller investment of capital for line extensions, can serve equally well, because every reasonable effort should be made to relieve the public from all unnecessary burdens. (2) The making of extensions by one corporation should not be encouraged when they are apparently for the sole purpose of handicapping the operations of another corporation doing business in an adjacent territory. (3) The wishes of the public which is to be served should be taken into consideration in considering the question as to which of two corporations should be permitted to operate in a new territory into which each of them wishes to extend its lines."

Commission Consent Necessary in New York.—In the matter of the complaint of the Colliers Light, Heat & Power Company against the Oneonta Light & Power Company, alleging that the last-named company is unlawfully furnishing to the public electricity in a lighting district at Oneonta Plains, the New York Public Service Commission, Second District, held "(1) An electrical corporation which has no franchise in a municipality cannot begin construction of its plant therein for the sale and distribution of electricity without the consent and approval of the commission notwithstanding that no portion of its plant or distribution system is placed upon, along, or across the public highways of the municipality. (2) An electrical corporation cannot, without the consent of the commission, extend its lines into a municipality in which it has no franchise to carry on its business even though such extensions are entirely upon private property."

Are Gas and Electrical Utilities "Similar"?—Whether the "certificate of public necessity" clause in the law applies to a gas utility entering a field served by an electrical utility is the question that has been raised before the Oregon Public Service Commission by the North Coast Power Company of Portland. According to the North Coast Power Company, the Portland Gas & Coke Company is now laying mains into Washington County from the Multnomah line, and its representatives are canvassing Garden Home and Beaverton for heating and lighting customers. The North Coast company declares that it is now adequately serving this field with electricity, and inquires if the gas company must not secure a certificate of necessity before entering the field. The law provides that before "a similar utility enters a field already served it must obtain a certificate of necessity," and the question arises whether or not a gas and an electrical utility come within the term "similar."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public-utility companies.

Liability of Telephone Company the Wires of Which Are in Close Proximity to High-Tension Lines.—In action to recover damages for loss by fire alleged to have been caused by a telephone company's negligence in failing to maintain a cable at a proper distance from plaintiff's building and properly to insulate the cable, plaintiff had the burden of proving that the fire was not only caused by the electric current from the telephone company's cable, but that it was due to that company's negligence, the Supreme Court of Errors of Connecticut held (100 A.358). A telephone company in carrying its wires through a city and placing them on poles carrying high-tension wires was chargeable with knowledge that currents of high potential might be brought upon its cables by branches of trees or other conductors coming in contact with such high-tension wires and its own cables, and a very high duty was thus imposed upon it to prevent its wires from carrying such currents into places where injury might result.

Compliance With Ordinance Requiring Underground Distribution.—The Common Council of the city of Albany had power, under the authority conferred upon it by statute and under the conditions incorporated in the municipal gas company's contract with the city, to pass an ordinance requiring that all wires within a prescribed district, with the exception of trolley wires and telephone wires, be put under ground, the limitation of territory and exceptions of wires being within the proper discretion of the Common Council, it was held by the Court of Appeals of New York in the case of Porter vs. Municipal Gas Company of City of Albany (115 N. E. 457). Where an ordinance of a city requiring electric wires to be placed under ground provided that the plans for the conduits should be submitted to and approved by the Commissioner of Public Works before the work was undertaken and the location of the conduits should be determined by him, and where a company, upon application to the commissioner for instructions as to the location of conduits, was told that the commissioner could not approve any location until definite plans had been decided upon for the improvement of the section, the company was not negligent in failing to place its wires under ground as for a failure to comply with the ordinance, the commissioner's refusal to give instructions for the location of conduits being an excuse for failure to obey the ordinance, and the company, in a suit against it for injuries, was entitled to have the jury thus instructed.

May List Cities Service Stock.—President Henry L. Doherty of the Cities Service Company has appointed Warren W. Foster, F. S. Terry and Frank W. Frueauff a committee to take up the matter of changing the par value of the stock and consider the advisability of making application for listing the securities on the New York Stock Exchange.

Outlook for Water-Power Legislation.—One of the recent callers upon President Wilson has been Senator Husting of Wisconsin, who took a leading part in the water-power fight in his State a few years ago. Senator Husting has allowed it to become known that when the water-power bills are introduced at the extra session he will press for a national hydroelectric commission similar to the Ontario commission.

Company at Mount Vernon, Ill., Sold to Frey Interests.—The Citizens' Gas, Electric & Heating Company at Mount Vernon, Ill., operated by Henry L. Doherty & Company, has been sold to the Southern Illinois Light & Power Company, which is controlled by the Frey syndicate of St. Louis. This property was sold because of its isolation from other Doherty operations, being the only one in Illinois, whereas the purchasers control several plants in the vicinity.

Rates Affect Income in New Orleans.—Operating revenue of the New Orleans (La.) Railway & Light Company in 1916 amounted to $7,200,741, an increase of 3.58 per cent over 1915. Net operating income was $2,815,040, a decrease of 8.71 per cent. D. D. Curran, the president, says that the decrease in net income is due mainly to the reduction in electric rates, which became effective on Dec. 1, 1915, and the increase in cost of materials and wages.

Westfield (Mass.) Municipal Plant Investigated.—Whether electricity shall be purchased from an outside company or continue to be generated in the local municipal plant is to be considered by a special committee of the town of Westfield, Mass., following recent investigations brought before a town meeting. Three reports on the administration of the lighting department were presented at the recent meeting, two being by members of a special committee appointed to investigate conditions in the plant, and the third by William Plattner, consulting engineer and manager of the North Attleboro (Mass.) municipal electric department. The committee of investigation consisted of J. D. Cadle, D. F. Doherty and F. Grant. The two first named concluded that as the result of low rates the electrical department of the town has been conducted for several years at a loss; that the gas department has been operated at a profit, and that the latter is accountable for the good showing made by the combined departments. Mr. Plattner's report includes an extended analysis of plant conditions and service. Both the Plattner and the committee reports point out that the town's policy in merchandising appliances, both gas and electric, has been a losing one.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Pacific Gas & Electric Customers.—The Pacific Gas & Electric Company reports that during the year ending Feb. 28 13,342 new consumers of electricity were added to the system; 6646 new gas customers were also added. The totals are now: Gas, 233,736; electricity, 180,626.

Sale of Tidewater Power Company.—William J. Norton of Norton, Bird & Whitman, engineers, Chicago and Baltimore, has concluded the transfer of the utility property of the Tidewater Power Company, Wilmington, N. C., from Hugh McRae, the president, who owned the control of the stock, to Brooks & Company, Scranton, Pa.

Niagara Water Diversion Extended.—The United States Senate adopted on April 18 a resolution extending for another year, or until July 1, 1918, the authority for additional diversions of water in the Niagara River, New York. The resolution was presented by Senator Hitchcock. It had been reported from the foreign relations committee by request of Senator Wadsworth of New York.

Engineering Regulation in Florida.—A bill prepared by the Florida Engineering Society has been received from J. R. Benton, the secretary. It has been introduced in the Legislature and will, it is expected, be passed after unimportant modifications. It is modeled on similar laws enacted in some other States. It provides for the creation and establishment of a Florida State Board of Engineering Examiners, grants certain powers to and prescribes the duties of the board, provides for the examination and registration of professional engineers, regulates the practice of engineering in the State, and provides penalties for the violation of the act.

Reduction in Rates by the Louisville Company.—Beginning May 1, the Louisville (Ky.) Gas & Electric Company will put into effect a two-step reduction in rates for residence service. Consumers who contract on a minimum basis of 3 kw.-hr. per room at the prevailing rate of 8 cents will be entitled to energy in excess of 6 kw.-hr. per room per month at 3 cents net. This applies to city consumers. Outside residence consumers will be given the same terms, except that their initial rate for the first 3 and 6 kw.-hr. is the prevailing suburban rate of 9 cents. Excess energy will be billed at 3.157 cents, but the 5 per cent discount for payment within ten days will reduce it to 3 cents net. It is the belief that this proposal will stimulate the use of home electrical appliances.

New York Civil Service Positions.—Examinations to be held on June 2 by the New York State Civil Service Commission include those for junior assistant in engineering departments, junior electrical engineer of the Public Service Commission of the First District, electrical draftsman and assistant electrical engineer, state hospitals, departments and institutions. All except the last named are open to non-residents. For application forms address the State Civil Service Commission, Albany, N. Y.

Testing Transformer Oils.—The United States Bureau of Standards is co-operating with the American Society for Testing Materials in a study of methods of testing transformer oils for dielectric strength, with the object of obtaining uniformity throughout the industry. Results obtained from various instruments now in use are interpreted differently. An experimental research has been agreed upon, to be conducted by electrical manufacturers and oil producers jointly. Already progress has been made in the experiments.

Generating Stations for South Russia.—Moscow capitalists are organizing a stock company to provide electrical energy for the operation of the coal and other mines and the metallurgical and miscellaneous manufacturing industries of South Russia. A capital of 150,000,000 rubles is proposed. The plan embraces the erection in the Donets coal basin of three stations of 75,000 hp. rating each. It is proposed to transmit power from these stations not only to the mines, but also to the industrial towns and villages and to separate industrial plants. It is not expected that ground will be broken during the war.

Beneficent Patent Laws Aid Progress.—Frederick P. Fish, formerly president of the American Telephone & Telegraph Company, was introduced at a recent meeting of the Boston (Mass.) City Club as the present leader of the patent bar of the United States. In an address Mr. Fish emphasized the cost of developing inventions, many of which have required the expenditure of millions of dollars to carry to commercial form. There have been cases where the whole seventeen years' term of a patent has expired before the arts have advanced to a point where they were ready to accept and absorb the good ideas that were in the patent. A vast majority of the inventions made in this country have been absolutely useless except when employed in connection with other inventions. A man makes an improvement in a steam turbine, and whether he is rich or poor, whether he has a factory or not, he cannot use that improvement except in a steam turbine, and any steam turbine that is useful may have in it 100 inventions. The invention may be useless unless combined with others. The result is that in the development of inventions business capacity, engineering skill and skill of the designer, administrative ability and large capital must co-operate in order that useful results may be produced.

Joint Convention of Iowa Electrical Associations.—May 22 to 25 is the date set for the joint meeting of the Iowa Electrical Association and the Iowa Electric Railway Association to be held in Des Moines.

Cleveland Electrical League.—Attorney John Garfield addressed the members of the Cleveland Electrical League on April 19 on "Who's Who and Why." Morris A. Black, chairman of the Cleveland City Planning Commission, is scheduled to speak on April 26 on the subject of "City Planning."

Handling of Supplies for Central Stations.—F. L. Leitner, storekeeper of the Brooklyn Edison company, addressed the Brooklyn Polytechnic Institute branch of the A. I. E. E. on April 20 on the subject of "Handling Supplies for Central Stations." A. H. Bernhard spoke on "Three-Phase, Four-Wire Distribution."

St. Louis Jovian League.—Asserting that the "personal equation" is the greatest business factor to-day, A. L. Wilson, president of the St. Louis Farm Mortgage Company, delivered an interesting address before the St. Louis Jovian League at the Mercantile Club on April 17, comparing the value of personal efficiency with that of capital and equipment.

Synchronous Club of Los Angeles.—At the annual meeting held in Los Angeles on April 5 thirty-five new members were "synchronized." The table around which the banqueters gathered was arranged in U-shape, and twelve poles arranged along the center line of the tables carried a transmission and distributing system constructed according to state laws for 10,000-volt primary and 2300-volt secondary circuits. Single-phase and three-phase transformers were provided, and current was actually delivered by the system throughout the evening to miniature lamps attached to the poles with standard goose-neck brackets and reflectors. Current was also supplied for lighting three miniature houses along the transmission line. The system was built about one-twenty-fourth actual size.

Station Operating Committee Meeting of the O. E. L. A.—The following papers were presented and discussed at the station-operating committee meeting of the Ohio Electric Light Association, held April 24 at Cincinnati, Ohio. F. R. Brosius of the Union Gas & Electric Company presented a paper on "Some Economies Effected in Power Stations, and Savings Possible." H. L. Lawrence, test engineer for the American Engineering Company of Philadelphia, read a paper on "Stoker Operation as Found in the Ordinary Plant and as It Ought to Be." A paper on "Pressure Drops of Superheaters and Dry Pipes" was read by George Coghlin of the Toledo Railways & Electric Company; "Fire Bricks" were discussed by W. A. Heisel of Charles Taylor Sons Company, and Mr. Pickett of the Dayton Light & Power Company read a paper on "The Effect of Operating Boilers at High Ratings."

Associations and Societies

A complete Directory of Electrical Associations is regularly printed in the first issue of each month on the next to-last text page.

Schenectady Section, A. I. E. E.—"A New Basis for Engineering Education" was the subject of the April 20 meeting of the Schenectady Section of the American Institute of Electrical Engineers. Dr. C. R. Mann of the Carnegie Foundation for the Advancement of Teaching was the speaker.

Oklahoma Gas, Electric & Street Railway Convention.—The sixth annual convention of the Gas, Electric & Street Railway Association of Oklahoma will be held on May 10, 11 and 12 at Oklahoma City, Okla. The following papers will be presented: "Small Plant Operation," "Street Railway Plants and Outdoor Substations," "Ice and Electric Plant Operation," "Oklahoma Fuels," and "Meters and Services." There will also be a question-box session which will afford a clearing house for troubles of utility operators as well as give time for a definite outline of future association policies. A large entertainment program has been planned. L. W. W. Morrow of Norman, Okla., is secretary of the association.

Ohio Electric Light Association.—Developments in insulation and frame-steel towers were the subjects discussed at the first spring meeting of the transmission and distribution committee of the Ohio Electric Light Association, held at Canton, Ohio, April 17. The design of insulators and its importance to transmission were the subjects treated by A. O. Austin, chief engineer of the Ohio Insulator Company, Barberton, Ohio. In this paper special emphasis was laid upon the problem of maintenance of insulators and their importance to a given system. "One point of improvement in the design of an insulator means ten points of improvement or vantage in the transmission system. The problems of insulators on the larger systems are different from those on the small systems, in that the equipment used on a small system would be wrecked if used on a large system. Chances of hazard increase directly with the number of parts of insulator," said Mr. Austin. "A direct decrease in the number of parts of the insulator means a direct decrease in the number of hazards and further means a reduction in internal stresses developed in the insulators. The insulator field has been given to fads, and this has meant trouble in many cases. Operating logs furnish a good means of studying liabilities." R. L. Allen, engineer of the Archbold-Brady Company, Syracuse, N. Y., presented a paper on "Design and Structural Advantages of the A-Frame Steel Tower." Mr. Allen first discussed wind pressure as a factor of line design and gave 15 lb. per square foot (73.2 kg. per sq. m.) as a basis for design. This figure represents a compromise between what would be sufficient to take care of all conditions and what would probably take care of the average condition. Installations made under this specification seem to have been successful from an operating standpoint. The speaker pointed out that while provision for 0.5 in. (1.27 cm.) of sleet has been specified by many engineers in the past, sleet loads have been many times this figure in some cases.

Louisiana Engineering Society.—Preparedness for the defense of the nation was the subject discussed at a joint meeting of the local sections of the American Society of Civil Engineers and the American Society of Mechanical Engineers, held at New Orleans on April 2. This meeting was also attended by many electrical and chemical engineers and army and navy officers. A resolution was adopted to use the Louisiana Engineering Society as a medium through which the services of the large number of technically trained men living in this district could be tendered to the government. A. M. Lockett is chairman of the preparedness committee.

Cleveland Alumni, Massachusetts Institute of Technology.—At the annual banquet of the 300 alumni of the Massachusetts Institute of Technology at the Hotel Statler, Cleveland, Ohio, on the evening of April 21, members of the Technology Clubs, Associated, heard addresses by Frank A. Scott of Cleveland, chairman of the Federal General Munitions Board, and Dr. Charles S. Howe, president of Case School of Applied Science, Cleveland, on the aid that may be given the country by technical men. Mr. Scott said that war is one of the most complex of sciences and that trained brains are the country's greatest resource if they are utilized. Civil experience and ability count for much in time of war, he said. Dr. Howe spoke on military preparation in its broadest sense. He said the man who does conscientious work at home in the production of the things that are used in war is giving his country a service just as much as the one who goes to the front. It requires the work of seven or eight men at home, he said, to support one soldier in the field. Dr. Howe suggested that the government may obtain men of trained minds from the engineering schools. Dr. Hollis Godfrey of Philadelphia, chairman of the Council for National Defense and the newly elected president of the Technology Clubs; Dr. Henry Churchill King, president of Oberlin College, and Dr. Richard Cockburn Maclaurin, president of the Massachusetts Institute of Technology, were other speakers. At a meeting of the executive committee in the afternoon a resolution was adopted providing for the establishment of headquarters at Washington at once. A permanent representative, with a staff, will be located there to carry out the organization's plans for co-operation with the government in the mobilization of technical forces.

Tom Edwards has been chosen to succeed L. C. Hulse as engineer of the Arkansas Light & Power Company at Malvern, Ark.

L. C. Hulse, engineer of the power station at Malvern for the Arkansas Light & Power Company, has been transferred by the company to Magnolia.

Lauren C. Gay has been appointed assistant superintendent of the Bureau of Gas and Electricity of the city of Syracuse, N. Y., succeeding R. W. Grower, who resigned on Feb. 1 to go to Akron, Ohio.

L. A. Wright has been appointed local manager of the San Diego Consolidated Gas & Electric Company at Escondido, Cal., to have charge of the gas and electric utilities in that district recently taken over by the company for operation.

George A. Murch has been appointed manager of the Public Electric Light Company, St. Albans, Vt., and director and superintendent of the St. Albans & Swanton Traction Company, succeeding F. C. Wilkinson, who resigned. Mr. Murch, who is a pioneer in the electric railway field, has built a large number of railways in the East and Middle West.

R. E. Flower, for several years manager of the electric shop of the Union Gas & Electric Company, Cincinnati, has resigned to become manager of the household appliance department of the Erner Electric Company, Cleveland. Mr. Flower was at one time contract agent for the Mobile (Ala.) Electric Company and later assistant commercial manager of the Louisville (Ky.) Gas & Electric Company.

O. C. Roos, who for two years had charge of the radio service of the Philippines, is now in the consulting engineering field in Manila. Mr. Roos has made many contributions to the advancement of radio-engineering, most of which were worked out between 1905 and 1911. One of his best-known contributions to electrical science is the circular diagram for unity power factor in a transformer.

R. J. S. Pigott, formerly construction engineer of the Interborough Rapid Transit Company, motive power department, and for the last two years power superintendent of the Remington Arms Union Metallic Cartridge Company of Bridgeport, Conn., has resigned to become associated with the Sanford Riley Stoker Company. He is retained by the Remington company in a consulting capacity on power and service.

R. J. Busey, formerly a member of the Southwest Engineering Company of Joplin, is now with the Missouri Metals Corporation as electrical engineer at the Mines La Motte, Madison County, Mo. The Mines La Motte are among the oldest lead mines in the country, being operated by the French before the Louisiana Purchase. It has been said that they had some influence in bringing about the acquisition of this territory by the United States.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

N. E. Smith has been appointed to succeed Joseph Pratt as superintendent of outside distribution at the Woonsocket (R. I.) branch of the Blackstone Valley Gas & Electric Company. Mr. Smith, who is a graduate of the Electrical Engineering School of the University of Maine, was formerly employed by Stone & Webster in Boston. He has been with the Blackstone company for five years, starting in the commercial department. Later he was transferred to the engineering department as electrical engineer.



W. F. M. GOSS

Dr. W. F. M. Goss has resigned as dean of the College of Engineering, University of Illinois, to take up the duties of president of the Railway Car Manufacturers' Association. Temporarily he will be at the office of the association, 1120 Frick Building, Pittsburgh, Pa. Dr. Goss is probably best known to the electrical industry in connection with smoke abatement and electrification of railroad terminals in Chicago, he having been chief engineer for the Chicago Association of Commerce committee dealing with these matters. Dr. Goss was born in Massachusetts in 1858 and received his technical education at the Massachusetts Institute of Technology. Upon graduation he became a member of the faculty of Purdue University, where during a large part of the time he was connected with the university he was dean of the engineering school. In 1907 he became dean of the College of Engineering of the University of Illinois. He has a wide association with many of the national engineering societies and is one of the past-presidents of the American Society of Mechanical Engineers. In 1893 he was a member of the jury of awards of the Columbian Exposition at Chicago.

J. J. Flynn has become associated with the department of publicity of the Society for Electrical Development, New York. He was formerly connected with the typographical department of Conde Nast and important agencies.

Carroll H. Shaw, electrical engineer for the Eastern Wisconsin Electric Company, with headquarters at Sheboygan, Wis., has resigned to accept the position of chief engineer of the Minnesota Utilities Company at Chisholm, Minn. Mr. Shaw is a graduate of the Massachusetts Institute of Technology and previous to locating in Sheboygan he was with the engineering department of the National Lamp Works of the General Electric Company at Cleveland, Ohio.

C. R. Richards, professor of mechanical engineering and head of the department since 1911, has been appointed dean of the College of Engineering and director of the Engineering Experiment Station of the University of Illinois, to succeed Dr. W. F. M. Goss, who has resigned to become president of the Railway Car Manufacturers' Association. Dean Richards is a graduate of Purdue University, 1890, and has been successively instructor in mechanical engineering, Colorado Agricultural College, and professor of practical mechanics, professor of mechanical engineering and dean of the College of Engineering, University of Nebraska. Since entering the University of Illinois he has served for two years as acting dean of the College of Engineering during an absence of Dean Goss.

Byron C. Fowles, secretary-treasurer and general superintendent of the Pine Bluff (Ark.) Company, has resigned to take up on May 1 the duties of general manager of the public utilities of Kingsport, Tenn., which include a 200,000-kw. power house and electric distribution, water and sewerage systems, while the erection of gas works is now being contemplated. Kingsport, which is a second Gary, Ind., is being made to order by the Equitable Securities Company of New York, which owns the utilities. Mr. Fowles was graduated from the Spring Garden and Drexel Institutes of Philadelphia and worked on the original Edison plant that was installed in Philadelphia on Sansom Street and connected with the Brush Electric. In 1900 he went to Bay City, Mich., where he rebuilt the Bay City Gas & Electric Company, later going to Richmond, Ind., for rebuilding the Richmond Light, Heat & Power Company. In 1904 he was appointed manager of the Pine Bluff Electric Light, Water & Gas Company. Since Mr. Fowles took over the management of this property it has grown until there are but seventy-nine unwired houses in the corporate limits of Pine Bluff, which had a population in 1910 of 15,102. No successor to Mr. Fowles has yet been appointed. Mr. Fowles was one of the Arkansas Association of Public Utility Operators and its president during 1909 and 1910. He has always taken a very active part in the association's work.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

SHIPBUILDING IN NORTHWEST BOOM TO ELECTRICAL TRADE

Although Greatly Overestimated, the Trade of Shipyards Is Very Much Appreciated by Dealers in Electrical Supplies

A canvass of electrical supply houses in the Northwest as to the effect of the shipbuilding industry on their business brings out some interesting facts. The amount of building shown by the building permits in 1916 was very low, and the first three months of 1917 are even lower than in 1916, but the loss of business in electrical supplies due to the small amount of ordinary normal building has been made up by the electrical material purchased by shipbuilders and boiler works and by machine shops which are by-products of the shipbuilding industry.

There are five shipbuilding plants in Seattle, two yards building wooden ships in Tacoma, and ground is being prepared for a yard to build steel ships in Tacoma for the Todd interests. In Olympia there is one yard building wooden boats. There are two yards starting at Aberdeen with the idea of building wooden boats, and there is one starting in Everett and another in Bellingham with the intention of building wooden boats. It is the opinion of the conservative banking elements that the present boom will be over in from two to three years, at which time there will not be more than two plants able to operate at a profit. Electrical supply houses are hoping that building will become normal at that time.

The amount of electrical material used in steel and wooden boats is greatly overestimated. It consists mostly of conduit, wire, sockets, lamps, marine fittings, etc. A great many of these items are of such size that they are difficult to secure promptly from the factory and have necessitated a rearrangement and readjustment of the jobbers' stocks. Under the present circumstances the shipbuilding companies constitute a class of trade that is very highly appreciated by the electrical supply houses.

DEMAND FOR INDUSTRIAL TRUCKS IS INCREASING

Labor Shortage and Necessity for Increased Production the Important Factors in Creating This Market

Labor shortage and the demand for increased production have united in creating a steadily increasing market for electric industrial trucks. Already this market has assumed considerable proportions and manufacturers are getting behind with their orders.

Last year was a good year for industrial trucks, but this year so far is much better. With the present prospect of a large labor shortage it becomes evident that more machinery of a labor-saving nature must be employed by industrial establishments in order to keep up with production. Labor now is very scarce, although somewhat easier than it was a few months ago; but it is anticipated that when farming operations begin on a larger scale and when the government calls for a large body of men for the army industrial establishments will be greatly handicapped unless some means is provided for taking care of the work formerly handled by a larger force.

Terminals, freight yards, shipping centers and docks, in addition to industrial establishments, are calling for large numbers of trucks. Increased transportation, both domestic and export, has called for greater facilities for handling goods in transit at terminal points. Battery and motor manufacturers report a large increase in business for this class of trade.

The value of the industrial truck can well be appreciated when it is understood that for handling bulk goods one truck easily displaces a number of men. The electric truck has no competition, and the demand has come from the customer largely without solicitation.

The delivery of trucks is being held up somewhat, owing in a degree to the large increase in business, but more especially to the condition of the market for raw materials and for parts. Motor manufacturers and battery manufacturers are working at capacity limit, and truck producers therefore must take their turn with the rest of the buyers of this class of equipment. Besides, steel shapes and castings are particularly difficult to obtain.

BIDDING FOR BUSINESS OF TWO YEARS HENCE

Part That Advertising Plays in Establishing a Permanent Background for the Future When Competition Will Again Be Keen

Comparatively few manufacturers at the present time have developed any far-sighted policy in connection with their advertising. In spite of the fact that practically all manufacturers of electrical goods—and the same can be said of other manufacturers—have now more business than they can conveniently turn out, little attention by means of advertising is being paid to the business of years to come. For the most part what advertising is now being done is of the same general nature as advertising in normal times.

Economists all agree and it is logical to believe that the present volume of business activity cannot be maintained, and that after the war, in a period variously estimated from a few months to two or three years, business will again have reached a level that is below the total capacity of the plants and where competition will again be keen. As an insurance against this condition, manufacturers have been urged time and time again to adopt a far-sighted policy and advertise in a way that will impress the name of their product upon the minds of the buying public. That such a policy has been so little followed is almost unexplainable in this day of national preparedness. Manufacturers, however, who have been interviewed on this subject have almost all stated that they have been too busy to pay any attention to advertising. They had all the business they could conveniently take care of at the present date, and so far as the future was concerned there was plenty of time to think about that. Such ideas, while exceedingly short-sighted, are nevertheless very prevalent to-day.

Some manufacturers, of course, have realized that the future will depend largely upon the degree to which buyers know their goods, and for that reason have directed their advertising of late into channels designed not to influence the buyers of to-day but those of a few years from now. Prominent among these has been one of the largest electrical manufacturing concerns, which for some time has been conducting an educational campaign the results of which are expected to appear months and years from now. In announcing this policy to its different officers this company made the following statement:

"When we are loaded up with business we nevertheless understand that additional business will be needed eventually. We advertise, therefore, to interest others in coming to us with their future plans, so that we will be making our future plans accordingly."

SECOND-HAND MARKET IS STRONG ON LARGE APPARATUS

Available Equipment in Excellent Condition Generally, the Poorer Stuff Finding Its Way to the Metal Scrap Pile

Although deliveries on most manufactured products have been set back a month or two months, because of the government's demands on the industries of the nation, no appreciable effect has been felt by the second-hand merchants of electrical goods except for very large apparatus, the demand for which has been enhanced to an appreciable extent. Second-hand dealers continue to experience a large demand for practically all classes of equipment. There is no shortage at the present time of second-hand electrical apparatus except for large equipment, such as large induction motors, rotary converters, transformers and turbines.

Steam engines, it is understood, are a drug on the market, there being no demand for this class of equipment.

The demand for direct-current motors continues large, and it has been noticed that manufacturers are no longer particular regarding the type of equipment they obtain so long as it will do the work and can be had quickly. For this reason there are many direct-current motors on the market that had previously been taken off central-station lines in the country-wide endeavor to increase alternating-current and decrease direct-current distribution.

The available machinery is for the most part in excellent shape. There is, of course, some poor stuff coming out, but, owing to the price of copper, it has been found to be more profitable to break the machines up for old metal than to attempt to rewind them or otherwise repair them to put them in good operating condition.

The second-hand market in the future, in all probability, will depend largely on the copper market. If the price of copper continues high it is the belief of those engaged in the trade that second-hand dealers should experience an excellent business. On the other hand, should a readjustment of the copper market bring prices down nearer their former level in normal times, the indications then point to a poor second-hand market.

Dealers, it is found, are now hesitating about laying in large stocks of second-hand equipment owing to the uncertainty of the copper market. Should stocks be laid in at the high prices of to-day and the copper market fall off considerably, the loss to second-hand men would, according to the degree of speculation, wipe off profits otherwise earned.

EFFECTS OF SUBMARINES SEEN IN FEBRUARY EXPORTS

Trade for the Month Totals Up to Only $3,526,269 as Compared with $4,912,924 for the Month of January

Exports of electrical goods were less in value in February than in any month since last July. The February exports amounted to $3,526,269, or about $1,400,000 less than in January. In comparison with February, 1916, however, there was an increase of $1,000,000.

Exports of fans and meters were both record-breaking in February, the former reaching a value of $66,243 and the latter of $105,943. The items which, in comparison with the previous half year, showed the largest decreases were insulated wire and cable, motors and miscellaneous merchandise. Exports of the latter were over half a million dollars less in February than in January.

For the eight months ended February, 1917, the exports of electrical goods totaled $31,744,237, in comparison with $18,151,223 for the corresponding period ended February, 1916, and $12,205,421 for that a year previous.

The total exports for the first two months of the current year amounted to $8,439,193, as compared with $5,163,433 for the first two months of 1916. Should the exports for the remainder of the year keep up at this rate, the 1917 figures will total over $50,000,000.

Evidences are seen in the February figures of the activities of the German U-boats. In February, it will be remembered, the German government threw all restraint to the winds in the prosecution of its intention to destroy shipping bound for Europe. Besides deterring many American manufacturers from shipping their goods, there grew up on the Atlantic coastboard a very serious congestion of freight, resulting in embargoes being placed on goods of a certain nature destined for export. The result, as seen in the accompanying figures, was an appreciable contraction in the foreign trade of the United States. That February is a short month may of course account for some of the decrease, but only a small part.

In the accompanying table are shown detailed figures of electrical exports as compiled by the Bureau of Foreign and Domestic Commerce:

Articles	February 1916	February 1917	Eight Months Ended February 1916	Eight Months Ended February 1917
Batteries	$104,712	$227,105	$926,924	$1,769,158
Dynamos or generators	112,965	277,953	965,713	1,744,064
Fans	30,637	66,243	234,466	254,764
Insulated wire and cables	217,764	526,879	1,919,157	4,557,567
Interior wiring supplies, etc., including fixtures	133,500	72,524	628,971	696,196
Arc lamps	1,761	842	12,168	7,793
Carbon-filament lamps	12,898	13,248	115,893	96,950
Metal-filament lamps	107,715	153,475	792,079	1,048,174
Meters and other measuring instruments	59,170	105,943	508,121	681,977
Motors	439,769	335,093	2,722,811	3,602,232
Telegraph instruments, including wireless apparatus	2,542	18,324	96,117	191,712
Telephones	105,176	157,796	554,108	1,155,108
Transformers	86,414	84,105	606,949	740,446
All other	1,097,631	1,486,739	8,067,746	15,198,096
Total	$2,512,654	$3,526,269	$18,151,223	$31,744,237

COPPER QUOTATIONS CONTINUE TO FALL OFF

Traders Are Awaiting the Readjustment of the Market—Consumers Are Disposing of Surplus Stock at a Profit

With but little business being done, and that mostly in spot copper, nominal market quotations continue to fall off. In fact, it is known that many sales have been made under the market. A readjustment of the copper market is anticipated, and when this occurs buyers and sellers will have a more definite idea of existing conditions.

Little activity has been manifest in the market. Some manufacturers with an over-supply of copper are taking a profit on their surplus. The amounts that change hands, however, are not large. Until the market becomes readjusted it is doubtful if there will be much purchasing on long deliveries.

Nominal market prices on Tuesday of this week for electrolytic were as follows: April, 30.5 cents; May, 29.75 cents; June, 28.75 cents; third quarter, 25.5 cents; fourth quarter, 24.5 cents.

NEW YORK METAL MARKET PRICES

	April 17 Selling Prices Bid	April 17 Selling Prices Asked	April 24 Selling Prices Bid	April 24 Selling Prices Asked
Copper:	£ s d		£ s d	
London, standard spot	135 0 0		130 0 0	
Prime Lake	32.00 to 32.50†		30.50	to 31.00
Electrolytic	31.50 to 32.00†		30.00	to 31.00
Casting	29.00 to 29.50†		26.75	to 27.25
Copper wire base	38.00 to 38.50†		37.50	to 38.00
Lead	9.00		9.00	
Nickel	50.00		50.00	
Sheet zinc, f.o.b. smelter	21.00		21.00	
Spelter, spot	9.55 to 9.80		8.92½	to 9.17½
Tin, straits	55.37½†		57.50†	
Aluminum, 98 to 99 per cent.	56.00 to 58.00		56.00	to 58.00

OLD METALS

Heavy copper and wire	27.50 to 28.00	25.50	to 26.50
Brass, heavy	16.50 to 17.00	16.00	to 16.50
Brass, light	12.50 to 13.00	12.00	to 12.50
Lead, heavy	7.50 to 7.75	7.50	to 7.75
Zinc, scrap	7.50 to 7.75	6.25	to 6.50

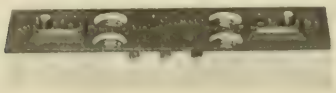
†Nominal.

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Dead-Front Panels

Dead-front distributing panels with push-button switches are being marketed by the Bryant Electric Company of Bridgeport, Conn. In general the switches have a porcelain base recessed to accommodate the standard two-button switch mechanism, of which two are



DEAD-FRONT DISTRIBUTING PANEL

provided for each unit. Provision is also made for fuse plugs for each line to the switch. All connections and conductors are concealed and separated from the front of the panel by a continuous sheet of insulating material, hence no live parts can be exposed. Moreover, the sheet-metal front of each unit has an overhanging edge which engages with the front of the adjoining unit, thereby effectively preventing accidental contact with any live parts. In case the switch mechanism requires adjustment the cover of the particular unit can be readily removed and the switch mechanism lifted from its socket. The switch mechanism can be replaced or a new one substituted just as readily and quickly, it is said. These dead-front panels with push-button switches can be furnished in double-pole, single-branch, double-pole, double-branch and triple-to-double pole, double-branch types.

Over-Voltage Protective Device for Regulators

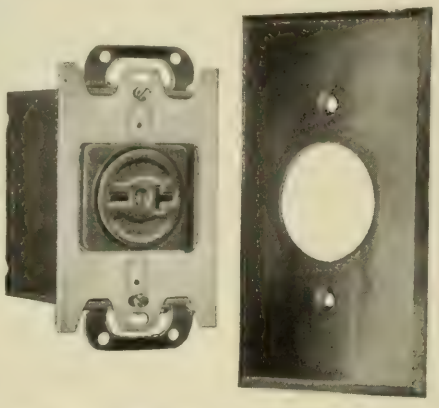
To prevent excessively high voltages caused by voltage regulators overboosting when a short circuit is removed from a system the Westinghouse Electric & Manufacturing Company has developed a device which is applicable to any contact-making type of alternating-current generator voltage regulator.

The device consists of an under-voltage relay in combination with a direct-current magnetic vibrator connected in the main contact circuit of the alternating-current generator voltage regulator, as shown. The contacts of the direct-current vibrator and the relay are connected in parallel, the pair being in series with the main contacts of the regulator. The vibrator magnet is energized from the exciter bus, and the relay from the potential transformer supplying the regulator.

When a short circuit occurs on a system equipped with this protective device, the main contacts of the regulator immediately close, and the under-voltage relay contacts open, owing to the drop in alternating-current voltage. As soon as the exciter voltage builds up to the point for which the direct-current vibrator is adjusted the vibrator contacts operate and regulate the exciter voltage in the same manner that the regulator contacts normally do. Thus the exciter voltage under short-circuit conditions can never rise above the predetermined point, which is usually set a little above the no-load excitation value required by the alternating-current generators. When the short circuit is relieved, therefore, no excessive field current exists to produce a dangerous increase in the alternating-current voltage. The moment the alternating current rises above the setting of the under-voltage relay, the contacts of this relay close and bring the regulator back into service.

Receptacle Aligning Plate

Harvey Hubbell, Inc., of Bridgeport, Conn., has developed a receptacle of the standard interchangeable type equipped



LEFT — STANDARD INTERCHANGEABLE-TYPE RECEPTACLE AND ALIGNING PLATE ATTACHED. RIGHT—BRASS FLUSH PLATE

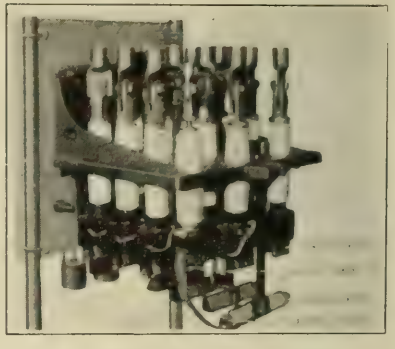
with a special aligning plate as shown in the accompanying illustration. The use of this combination, it is claimed, makes it possible to secure positive alignment before attaching the brass flush plate. Elliptical slots in the aligning plate, through which the screws pass to the outlet box, allow free movement for aligning and adjusting to wall variations. This plate overhangs the edges of the outlet box and fits flat against the wall, giving greater security to the receptacle and increased rigidity to the "struck-up" flush plate shown herewith. This plate affords protection from dust and dirt to the outlet box and receptacle plate while the building is under construction.

Wire and Cable Grip

Wire and cable grips made of cast-steel wire of coarse strand are offered to the trade by the Norris Electric Specialties Company, Inc., of New York City. The flaring ends of the device form a funnel-shape entrance for the cable ends. The wire grip is not limited to use with a single wire or lead-covered cable. It can be used to pull in a three-wire feeder or a number of wires such as would be required in a signal system. It is claimed by the manufacturer that this grip will not destroy lead-covered cable in the pulling operation. The device is made in single-eye, double-eye and double-eye split-grip styles.

Auto Starters

Three types of auto starters have been developed by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., for use in connection with the operation of large squirrel-cage induction motors up to 650 hp. Resistance can be furnished in connection with these starters to prevent opening of the circuit when changing from starting to running position, an operation which oftentimes causes disturbances that may be injurious to both motor and starter. The effect of arcing has been reduced to a minimum, the manufacturer claims, by immersing all contacts in oil and by using either auxiliary arcing tips or large-contact surfaces on the main contacts. For service where arcing occurs the contacts are provided with removable tips which may be renewed readily with a pair of pliers. The starting current may be adjusted by taps on an auto-transformer, which provides either three or eight



ONE TYPE OF AUTO STARTER

starting voltages, according to the capacity of the transformer. Safety to the operator is assured by excellent insulation in the switch and by a very liberal margin of safety above actual requirements. Safety to the apparatus

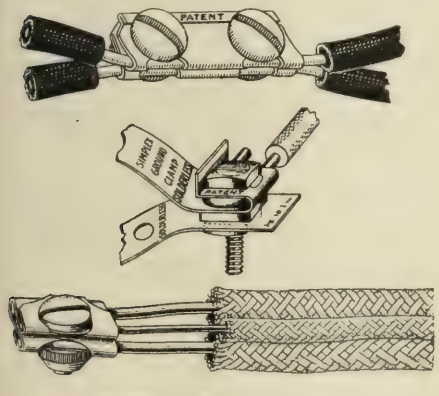
is assured by overload relays, which cause the switch to open at a predetermined overload, and by a low-voltage relay which opens the switch when the service is interrupted.

The three types of starters meet the requirements of a wide range of operative conditions. The type Q starter is for use on two-phase and three-phase circuits operating at 220 to 2200 volts and 25 to 60 cycles. The types QF and QF-1 are for use with motors of larger capacity or higher voltage than can be started by the type Q starters. They differ from the latter mainly in their ability to handle larger currents and in having larger kva. breaking capacity, and, in certain sizes, a preventive resistance. They also have two handles, one for starting and the other for running.

In starting a motor with the type Q auto starter, the switch handle is moved from the "off" to the "full" position, and held there until the motor has ceased to gain speed. It is then moved downward as far as it will go, to the "running" position, where it will remain. The handle will not remain in the starting position unless held, and it is impossible to move the handle directly from the "off" to the "running" position without first passing to the starting position. Where a type QF or QF-1 auto-starter is employed, having no preventive resistance, it is necessary to move the starting handle down as far as it will go and hold it there until the motor has ceased to gain speed. That handle is then released, and before it has fully returned to the "off" position the running handle is moved down as far as it will go, where it will remain latched. If a preventive resistance is used, the starting handle is held down until the motor no longer gains speed; then the running switch is closed and the starting switch released.

Solderless Wire Clamp

Wire-clamp connectors for circuits, fixtures and grounding purposes which are designed to connect four wires or



THREE TYPES OF CLAMPS

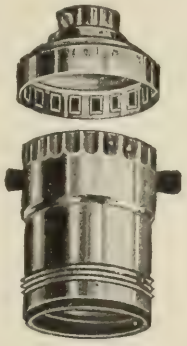
less of different sizes without the use of heat are being offered to the trade by Alexander B. Simpson of New York City. To connect the wires the screws of the device are loosened slightly and each wire is inserted in one of the four loops and securely connected by tightening the screws. A knurled surface is provided on the nut threaded on each screw so it will grip the wire and not turn when the screw is drawn up. These connectors are also made for grounding work.

Bicycle Headlamp

Bicycle headlamps equipped with tungsten units accurately focused have been developed by the Metal Specialties Manufacturing Company of Chicago. A bayonet type of switch is provided at the back of the lamp, where the lamp can be controlled at the will of the rider. The battery container is made of steel of waterproof construction and held in place by three leather straps. The lamp-head bracket is made adjustable so that it will fit any handle bar. This line of lamps includes eight different styles.

Push-Through Socket

Push-through sockets manufactured by the Arrow Electric Company of Hartford, Conn., have a quick make-and-break switch mechanism and a rating of 660 watts at 250 volts, which is usual with that type of socket. This type belongs to the Arrow E 20 socket



INTERCHANGEABLE PUSH-THROUGH SOCKETS

line and is therefore interchangeable with fourteen different body parts and fifteen different caps. These sockets have threaded beads for "Uno" shade holders and can be equipped with the Arrolock attachment to prevent the removal or theft of lamps.

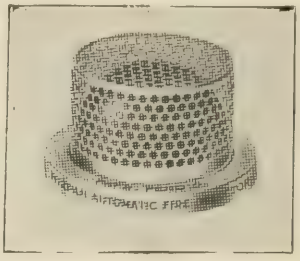
Electric Kitchenette

A compact combination electric range for small apartments, kitchenettes and buffets has been developed by the National Electric Utilities Corporation of New York City. This range consists of two compartments, a broiler and an oven. A grid is permanently placed in the upper section of the broiler. The heat is confined and thrown downward by means of a baffle plate or reflector placed on top. For convenience the latter is fitted with a handle.

When used for building, the baffle plate is placed in a slide underneath the heat unit, inside the broiling compartment, thereby deflecting the heat upward to a circular plate on top. For baking and roasting, the baffle plate remains in place inside the broiler, and the oven is substituted for the top plate and lid. The temperature may be adjusted by means of a three-heat snap switch conveniently placed on the lower panel of the broiler. The power demand at high heat is 2000 watts; at medium heat, 1000 watts, and at low heat, 500 watts.

Automatic Fire Detector

A device for announcing fire danger, which closes an electric circuit upon a sudden rise of temperature, is being



EXPANSION OF AIR CAUSES FIRE DETECTOR TO CLOSE CIRCUIT

made by the Automatic Fire Detector Company of 1834 Broadway, New York City. The instrument consists of a brass shell incased in a metal guard and base which is provided with electrical connections and contact point. The shell contains 1.5 cu. in. (24 cu. cm.) of air, and with normal atmospheric changes the expansion of air is provided for by means of an adjustable vent.

Heat waves from a fire cause the air in the brass chamber to expand rapidly, forcing a taut diaphragm to bend out and close an electric contact. The detector is designed for mounting in any position, and the makers state that neither vibration nor jar will affect its operation. In connection with an annunciator and bells (or lamps) the instruments may be arranged to register at a central point the exact location of a fire.

Portable Electric Drill

A line of fan-cooled electric portable drills has been brought out by the James Clark, Jr., Electric Company of Louisville, Ky. These drills are made in seven sizes, ranging from ¼ in. to 1½ in. (0.63 cm. to 3.8 cm.). Drills for direct current may be had only in sizes up to 1¾ in. (4.4 cm.). The drill spindles are made of high-grade, heat-treated steel, which is turned and ground. Heat-treated nickel-steel grease-incased gears are provided. The three largest universal drills embody all the general features of construction of the large direct-current drills, having aluminum frames and ball thrust, while all electrical parts are completely inclosed and protected from injury.

Trade Notes

THE ST. LOUIS (MO.) ELECTRICAL WORKS have changed their address to 1060 Forest Park Building.

THE RAILWAY CAR MANUFACTURERS ASSOCIATION has established an office at 61 Broadway, New York City, room 2216.

THE A. D. GRANGER COMPANY announces the removal of its offices to 1608-1611 Park Row Building, 15 Park Row, New York City.

C. H. ROBERTS has been appointed comptroller of the Hess Bright Manufacturing Company, Philadelphia, Pa. He was formerly factory accountant.

THE SAFETY-ARMORITE CONDUIT COMPANY has removed its New York office to 511 West Twenty-seventh Street, where it will be in connection with the company's new warehouse.

A. HALL BERRY is removing his office to 71-73 Murray Street, New York City. Owing to increase in business and having taken on additional lines Mr. Berry found it necessary to take larger quarters.

THE ROBBINS & MYERS COMPANY, Springfield, Ohio, has just issued the first number of a semi-monthly factory organ published for its employees and customers. Temporarily, at least, this new publication will be known as "The R. & M. Breeze."

POOLE ENGINEERING & MACHINE COMPANY, BALTIMORE, MD., recently acquired the exclusive manufacturing and selling rights of the turbo-gear formerly manufactured by the Turbo-Gear Company, Inc., also of Baltimore, through consolidation.

THE ELECTRIC MOTOR EXCHANGE has opened offices at Miami, Fla., and will engage in selling new and second-hand electrical machinery, fans, lamps and electric fixtures. The company would like to receive catalogs from electrical manufacturers.

THE JEFFERSON ELECTRIC MANUFACTURING COMPANY has moved into larger quarters at 426-430 South Green Street, Chicago. The company announces that T. C. Hawkins has recently joined its sales department with headquarters at the home office.

CHARLES M. CROFOOT has been transferred from the post of district sales manager for the Cincinnati district office of the Federal Sign System (Electric) company to the New York City office. A farewell dinner was given to Mr. Crofoot on March 30 by F. D. Lawrence, president of the F. D. Lawrence Company.

C. H. HOLDEN has been made central district manager for Edwards & Company, Inc., of New York City, and has established a sales office at 9 South Clinton Street, Chicago, Ill. Mr. Holden was formerly sales manager for the P R Manufacturing Company of Detroit, Mich., and has had long experience in the sale of electrical specialties.

THE YOUNGSTOWN SHEET & TUBE COMPANY has given notice that the Andrews & Hitchcock Iron Company of Hubbard, Ohio, and the Western Conduit Company of Struthers, Ohio, heretofore known as subsidiaries to the Youngstown Sheet & Tube Company, have now been dissolved and will be known as the Youngstown Sheet & Tube Company.

C. W. FORBRICH and J. H. Burton announce the formation of the Forbrich-Burton Advertising Service, Inc., Monadnock Block, Chicago, for the purpose of serving advertisers, particularly those catering to electrical, mechanical and allied fields. Both Mr. Forbrich and Mr. Burton have been connected with trade and technical papers in these fields for many years.

ROBERT GRIMSHAW, special agent of the Bureau of Foreign and Domestic Commerce, will visit early in June the principal South American countries to investigate the markets there for certain lines of American manufacturers; also to report on the methods adopted in the various countries for getting bids and awarding contracts for government and municipal supplies, especially electrical. Before departing he would like to learn from electrical and other manufacturers the principal difficulties that they have experienced in bidding on supplies in South America. His address is Room 409, Custom House, New York City.

THE CUTLER-HAMMER MANUFACTURING COMPANY, Milwaukee, Wis., calls attention to the fact that there seems to be some misunderstanding in relation to the operation of the plants of the company because of news items that have appeared in different publications announcing the enlistment of employees in the Naval Coast Defense Reserve. It is pointed out that the condition in the Milwaukee plant at the present time is that out of some 2000 people approximately 100 shopmen and some 10 in the testing room, engineering department and office force are enlisted in the Naval Reserve. There has been absolutely no interference with the progress of the work in the shop by the navy officials, it is stated, nor is any anticipated, since this number of men would be ample to meet even emergency requirements of the navy.

THE HOTPOINT CLUBHOUSE.—The new Hotpoint Club headquarters at the factory of the Hotpoint Electric Heating Company in Ontario, Cal., will be opened formally in the special spring festival on May 1. The Hotpoint Club is composed of every member on the payroll of the Hotpoint company at the Ontario office. No dues are required; all persons entering the employ of the company automatically become members of the club. The club operates a cafeteria where lunch is served at the noon hour and where the midnight lunch is served to the night shift. The club also operates a grocery store on a co-operative basis, thus enabling employees to purchase their staple groceries at from 10 to 15 per cent below regular retail store prices. The grocery store also handles fruits and vegetables which are raised by the employees and which can be marketed through the store without any expense except the nominal charge necessary to maintain the employee in charge of the store. The company takes no part in the management and operation of either the cafeteria or the store, except to assist where necessary in financing, and to supply suitable quarters and equipment at a very nominal charge. The new clubhouse will contain both the cafeteria and the store, as well as the large assembly room, caretaker's quarters, and a ladies' rest room. The clubhouse is so arranged that meals can be served on the porch during the summer time.

Trade Publications

SOCKETS.—The Arrow Electric Company of Hartford, Conn., is distributing a leaflet descriptive of its interchangeable push-through socket.

SWITCH PLATES. — The Chattanooga (Tenn.) Stamping & Enameling Company is distributing a leaflet descriptive of its porcelain enamel switch plates.

ELECTRIC APPLIANCES. — Landers, Frary & Clark of New Britain, Conn., are distributing an illustrated folder descriptive of their Universal heating devices.

LIGHTING.—The National Lamp Works of the General Electric Company, Nela Park, Cleveland, have prepared bulletin 28, descriptive of show window lighting.

WASHING MACHINES. — The Northwestern Electric Equipment Company of New York City is distributing a leaflet descriptive of its Baby Geyser electric washer.

FAULT-FINDING INSTRUMENTS. — The type F Matthews Woodpecker Telefault is illustrated and described in a folder recently issued by W. N. Matthews & Brother of St. Louis, Mo.

REFLECTORS. — The National X-ray Reflector Company of Chicago is distributing a bulletin entitled "How to Know and Have Good Lighting." Illustrations of well-known places which use X-ray reflectors are given.

SWITCHES.—The South Bend (Ind.) Current Control Company is distributing a folder descriptive of its R. C. O. C. switch, a remote-control oil-circuit switch for control at the power house of multiple or series ornamental street-lighting systems, etc.

INSULATING MATERIAL.—The Dielectric Manufacturing Company, St. Louis, Mo., has issued a catalog on insulations, technical paints and varnishes, which, in addition to listing its products, contains useful curves showing the electrical characteristics of various insulating materials.

STEAM JET CONVEYOR SYSTEM.—The American Steam Conveyor Corporation, 326 West Madison Street, Chicago, has issued a thirty-two-page booklet giving a general description of American steam jet conveyors, showing detailed views of the fittings used in this system, blueprints illustrating the system installed in different types of power plants, and photographs of numerous central station and industrial plant installations of the system. The booklet also states that the cost of handling ashes by this system varies from 4 cents to 10 cents as the cost of coal per ton varies from $1 to $3.10.

New Incorporations

THE ECONOMY POWER APPLIANCE COMPANY of Tomah, Wis., has been incorporated with a capital stock of $10,000 by W. A. Lee, E. H. Manning and William B. Naylor.

THE SWARTZ ELECTRIC COMPANY OF THE PACIFIC COAST of Spokane, Wash., has been incorporated with a capital stock of $50,000 by John H. Morgan and M. L. Morgan.

THE NORTH ELECTRIC MANUFACTURING COMPANY of Galion, Ohio, has been incorporated by C. H. North, Carl J. Gugler, C. H. Steele, and others. The company is capitalized at $1,000,000.

THE E. G. LIGHT COMPANY of Allendale, Ill., has been incorporated with a capital stock of $8,000 to supply electricity in Allendale. The incorporators are: Elijah Greathouse, A. Greathouse and E. Campbell.

THE A. T. VICK COMPANY of Houston, Tex., has been incorporated with a capital stock of $10,000 by A. T. Vick, P. S. Grogan and R. W. Franklin. The company proposes to deal in electrical and heating apparatus.

THE CHILHOWIE (VA.) LIGHT & POWER COMPANY has been chartered with a capital stock of $5,000 to supply light and power in Chilhowie. J. D. Tate is president and W. P. Vaughan is secretary and treasurer.

THE STAROBIN ELECTRICAL SUPPLY COMPANY of New York, N. Y., has been chartered by Joseph Starobin, Samuel Levine and M. Levine. The company is capitalized at $30,000 and proposes to deal in electrical fixtures and supplies.

THE HUNTLEY ELECTRIC COMPANY of Brooklyn, N. Y., has been incorporated with a capital stock of $2,500 to do a general contracting and electrical business. The incorporators are: Julia R. Roth, Samuel Randel and M. A. Franklin.

THE FRANK NASON ELECTRIC COMPANY of Boston, Mass., has been incorporated with a capital stock of $50,000. The officers are: Frank W. Nason, president; John W. Nason, treasurer, and Gladys M. Nason, clerk, all of Dorchester, Mass.

THE ONEONTA (ALA.) UTILITIES COMPANY has been incorporated with a capital stock of $4,000 by J. D. Harvey, W. A. Weaver, P. B. Hale and A. A. Fendley. The company proposes to operate an electric plant and ice factory in Oneonta.

THE HAMLIN (TEX.) LIGHT, POWER & ICE COMPANY has been incorporated by A. V. Wainwright, R. F. Price and F. A. Matthes. The company is capitalized at $60,000 and proposes to construct and operate an electric-light and power plant and ice factory in Hamlin.

THE PORT REPUBLIC (VA.) ELECTRIC LIGHT & POWER COMPANY has been incorporated with a capital stock of $5,000 to supply electricity for lamps and motors in Port Republic. J. H. Lamb is president and W. L. Dinsmore is secretary, both of Port Republic.

THE FERMANAGH (PA.) TOWNSHIP ELECTRIC COMPANY has been chartered with a capital stock of $5,000 to supply electricity in the township of Fermanagh. The incorporators are: A. J. Musser, M. S. Mitchell and P. T. Davis, of Clearfield. The offices of the company are located in Bellefonte, Pa.

THE WHEATFIELD (PA.) TOWNSHIP ELECTRIC COMPANY has been incorporated with a capital stock of $5,000 by A. J. Musser, M. S. Mitchell and P. T. Davis, of Clearfield. The company proposes to supply electricity in the township of Wheatfield. The head office of the company will be located in Bellefonte, Pa.

THE RAILWAY ELECTRIC SWITCH & SUPPLY COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $1,500,000 to manufacture and sell electrical railway switches, etc. The incorporators are: Wilber A. McCoy, of Pittsburgh, Pa.; Charles H. Jones and W. I. N. Lofland, of Dover, Del.

THE GREENE COMPANY of Corning, Cal., has been incorporated with a capital stock of $10,000 to do a general construction, electrical and mechanical contracting business and also to deal in electrical supplies and fixtures of all kinds. The incorporators are: A. E. Greene, William Dale, H. R. Salisbury, C. B. Fergus, C. G. Sutton and Marshall DeMotte, all of Corning.

New England States

CLAREMONT, N. H.—Preparations are being made by the Claremont Power Company for the erection of a new high-tension (44,000 volts) transmission line from Claremont to Charlestown, for which most of the right of way has been secured. This line will connect with the transmission system of the Connecticut River Power Company.

NORWOOD, MASS.—Work has begun on the foundation for the addition to the municipal electric-light plant, 25 ft. by 42 ft., to cost about $5,000.

SPRINGFIELD, MASS. — Negotiations are under way by the Springfield Street Railway Company for the purchase of energy from the Turners Falls (Mass.) Power & Electric Company. The proposed changes will involve an expenditure of more than $1,000,000. Under the proposed arrangement it is understood that the Turners Falls Company will take over the Margaret Street power station, now the chief source of supply for the street railway system, and equip and operate it as the main substation. Large substations will be established on the west side of the Connecticut River, on the company's property near Main and Carew streets, in Chicopee and in Ludlow.

WESTFIELD, MASS.—Franchises over various properties in the town of Westfield have been secured by the Turners Falls (Mass.) Power Company.

DIAMOND HILL, R. I.—Plans are being considered for the installation of an electric-lighting system in Diamond Hill. It is proposed to tap the transmission line which the Blackstone Valley Gas & Electric Company of Woonsocket is erecting from Woonsocket to Plainville, Mass., which will pass through the town.

Middle Atlantic States

BRONXVILLE, N. Y.—The Lawrence Park Heat, Light & Power Company of Bronxville has applied to the Public Service Commission for permission to construct and operate an electric light and power plant and steam plant under franchises granted by the village of Bronxville.

BROOKLYN, N. Y.—The chief of the Bureau of Yards and Docks, Navy Department, Washington, D. C., is having plans drawn for a shop building, 300 ft. by 600 ft., one and two stories, for the Brooklyn Navy Yard, to cost approximately $1,000,000.

BROOKLYN, N. Y.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until May 1 for furnishing coaling bags, blades for Curtis turbines, blowers, lamp and telephone cord, crucibles, coal tar, etc., oil lamps, dough-mixing and kitchen and cake machines, and electric wire and cable, etc., at the navy yard, Brooklyn.

BUFFALO, N. Y.—The City Council is considering an ordinance which would compel all steam railroads to equip their roads for electrical operation within the city limits.

BUFFALO, N. Y.—Thirty of the largest real estate dealers in Buffalo have adopted resolutions and have petitioned the State Legislature and Congress for the enactment of legislation that would give the city authority to own and operate a municipal electric-light and power plant. The Real Estate Association asks for the construction of the plant at Niagara Falls.

FAR ROCKAWAY, N. Y.—Steps have been taken by the Business Men's Association and the Property Owners' Association for the installation of an ornamental lighting system on Central Avenue.

FREDONIA, N. Y.—The Niagara & Erie Power Company has submitted a proposal to the Village Council for lighting the streets, which, it is asserted, would mean an annual saving of over $3,000.

GUILFORD, N. Y.—The Standard Light, Heat & Power Company of Unadilla has applied to the Public Service Commission for permission to erect an electric transmission line in the town of Guilford.

HORNELL, N. Y.—The Hornell Electric Company is contemplating the installation of a new street-lighting system to replace the arc lamps now in use.

NEW YORK, N. Y.—The Long Island Railroad Company is planning to equip its Evergreen branch in Brooklyn and Queens Boroughs, about 1½ miles, for electrical operation.

NEW YORK, N. Y.—Permit has been taken out by the New York Telephone Company for the erection of a new five-story exchange building, 100 ft. by 170 ft., on West Thirty-sixth Street, to cost about $500,000. Plans have also been filed for the construction of a new six-story exchange and office building on East 150th Street, to cost about $100,000. A site on Thirtieth and Thirty-first Streets, between Second and Third avenues, has been purchased for a new exchange and office building.

NUNDA, N. Y.—The capital stock of the Nunda Electric Light Company has been increased from $10,000 to $24,000.

PORT JERVIS, N. Y.—The Public Service Commission has authorized the Orange County Public Service Company to take over the Murray Electric Light & Power Company of Monticello, the Port Jervis (N. Y.) Light & Power Company, the Orange County Power Company of Port Jervis, and the Orange County Lighting Company of Middletown, for a consideration of $1,600,000. The new company will issue $600,000 in capital stock and $1,200,000 in bonds.

ROCKWOOD, N. Y.—Plans are being prepared by the Rockwood Manufacturing Company for the construction of a hydroelectric power plant, to cost about $300,000. Donald W. Hyde of Gloversville is president. Rockwood has not a post office.

TOTTENVILLE, N. Y.—Permission has been granted by the War Department to the Richmond Light & Railroad Company for the installation of a submarine cable line in Fresh Kills Creek, from Linoleumville to Rossville, Lake Island. The line will supply electricity to the proposed garbage plant.

UTICA, N. Y.—The Utica Gas & Electric Company has awarded the contract for construction of its hydroelectric power plant, to cost about $700,000, to the Structural Concrete Company of Dayton, Ohio; the contract for water wheels and other electrical equipment was awarded to the Platt Iron Works of Dayton, Ohio.

ENGLEWOOD, N. J.—Bids will be received by the Board of Education until May 15 for construction of the new Lincoln School, on Englewood Avenue, including electrical work, heating and ventilating, etc. Guilbert & Betelle, 665 Broad Street, Newark, are architects.

JERSEY CITY, N. J.—The Board of City Commissioners is contemplating the installation of a new street-lighting system on West Side Avenue, from Montgomery Street to Grant Avenue. The Public Service Electric Company has been asked to submit estimate of cost.

LIVINGSTON, N. J.—An ordinance has been passed providing for creating a lighting district in the township of Livingston.

NEWARK, N. J.—Upon the refusal of the United Supply & Construction Company, 61 Broadway, New York, N. Y., to accept the contract for new boilers and boiler equipment at the Overbrook Hospital, the Board of Freeholders has awarded the contract to Henderson & Company, 835 Springfield Avenue, Irvington, at $63,600.

NEWARK, N. J.—Contract has been awarded by the Higrade Belting & Weaving Company for the construction of a new belting plant, 100 ft. by 200 ft., one story, with engine house and boiler plant, 30 ft. by 50 ft., at 60-76 Frankfort Street, to cost about $25,000. The company has established temporary heaquarters at 671 Broad Street.

PATERSON, N. J.—The Board of Public Works has approved the contract with the Public Service Electric Company for the installation of a new ornamental lighting system on Main Street.

PATERSON, N. J.—Bids will be received by the Board of Education, City Hall, Paterson, until May 14, for construction of Public School 6 on Broadway, including electrical work, heating and ventilating. Henry B. Crosby, First National Bank Building, is architect.

POMPTON, N. J.—Bids will be received by the Board of Education of Pompton Township until May 9 for construction of School No. 6, Bloomingdale, including electrical work and equipment. Van Vlandren & Culver, 140 Market Street, Paterson, are architects.

WEEHAWKEN, N. J.—The Town Council of Union Hill is planning to install a new fire and police signal alarm system, to cost about $23,000. Emil Bautz is town clerk.

ALLENTOWN, PA.—Plans have been prepared for the erection of a power plant at the new leather plant of the Victor Leather Company. Samuel J. Kister is treasurer.

CARLISLE, PA.—Plans are being prepared by E. B. Beetem for the construction of a new power plant to be used in connection with his factory. A. J. Sauer & Company are architects.

EASTON, PA.—The Bell Telephone Company has acquired a site adjoining its local exchange, on which it proposes to erect a seven-story repair and service plant, to be equipped to handle all classes of repair and construction work.

HARRISBURG, PA.—Bids will be received by the Board of Commissioners of Public Grounds and Buildings, Harrisburg, until May 8 for power plant, engineering and laboratory supplies, as well as other equipment for the ensuing year. L. W. Mitchell is secretary.

LEMOYNE, PA. — Extensive improvements are contemplated by the United Electric Company, including the installation of a new turbine, rotary converter and transformer equipment. An addition will be built to the power house. A large part of the machinery, it is understood, has been purchased.

MEADVILLE, PA.—The Northwestern Pennsylvania Railway Company, it is reported, contemplates the construction of an extension from Titusville to Cambridge Springs during the coming summer.

PHILADELPHIA, PA.—The Bell Telephone Company is contemplating the erection of a new telephone building at Fifty-seventh and Chestnut Streets. The cost of the building with equipment is estimated at $400,000.

PHILADELPHIA, PA. — The Electric Service Supplies Company is planning to erect a three-story addition to its plant on Seventeenth Street, to cost about $60,000. Contract for building, it is understood, has been awarded.

PHILADELPHIA, PA.—Plans have been filed by the Schuylkill Forge Company for the erection of a new boiler plant, 35 ft. by 41 ft.

PHILADELPHIA, PA.—Bids, it is reported, are being asked by the Philadelphia Electric Company for the erection of a new substation, 134 ft. by 145 ft., one story, on property recently acquired on Hunting Park Avenue.

QUAKERTOWN, PA.—The Borough Council has approved an ordinance providing for an issue of $45,000 in bonds for the reconstruction of the municipal electric-light plant. A special election will be called to submit the proposal to the voters.

SCRANTON, PA.—Notice has been filed that application will soon be made to Governor Brumbaugh for charters for the following corporations: Sandy Township Electric Company, Brady Township Electric Company, Washington Township Electric Company, Gaskill Township Electric Company, Snyder Township Electric Company, Young Township Electric Company and the Henderson Township Electric Company, each to be located in the township from which it takes its name. Jacob L. Fisher of Punxsutawney is solicitor.

STEELTON, PA.—The Harrisburg Light & Power Company is planning to install a new street-lighting system in Steelton, to replace the lamps now in use.

BALTIMORE, MD.—A permit has been taken out by the Consolidated Gas, Electric Light & Power Company for the erection of its proposed new power plant on Race Street, to cost about $55,000.

INDIANHEAD, MD.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until May 7, for construction of sulphur storehouse and elevator house, and also a bucket elevator, of the continuous bucket type with buckets secure to single or double sprocket chains, to be driven by an electric motor, at the naval proving grounds at Indianhead, Md. Drawings and specifications (2359) may be obtained on application to the above bureau.

FAIRMONT, W. VA.—Work has begun on the erection of the high-tension transmission line of the Monongahela Valley Traction Company down the Monongahela River to the mines of the Lehigh Coal Company.

SHENANDOAH, VA.—At an election to be held May 8 the proposal to issue $60,000 in bonds for the construction of a dam and hydroelectric plant to supply water, and electricity for lamps and motors in Shenandoah, will be submitted to the voters. The plans provide for a concrete dam and power plant with entire new equipment to develop 350 hp. The present plant is to be held as an auxiliary. E. V. Dunston of Washington, D. C., is engineer.

URBANNA, VA. — The local electric-light plant, owned by J. E. Richwine, was

Construction

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recently destroyed by fire, causing a loss of about $5,000.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, War Department, Washington, D. C., until May 1, under proposal 971 for one electric windlass hoisting engine for captive observation balloon. For further information address Charles S. Wallace, major Signal Corps, U. S. A.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until May 1, for a 75-ton floating crane. Amount available, $50,000. Drawings and specifications (7366) can be obtained on application to the above bureau or commandant of the naval station at New Orleans.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until May 14, for dry dock pumping plants at the navy yards at Norfolk, Va., and Philadelphia, Pa. Drawings and specifications (7365) can be obtained on application to the above bureau or to the commandants of the navy yards named.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, War Department, Washington, D. C., until May 1, under proposal 969, for furnishing one 40-hp. induction motor, one 25-kw. motor-generator set, one 25-kw. generator, one starting compensator and one two-panel switchboard. For further information address Charles S. Wallace, major Signal Corps, U. S. A.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C. for furnishing at the various navy yards and naval stations supplies as follows: Mare Island, Cal., Schedule 950—one motor-driven wood planer; Schedule 973—miscellaneous steam and water iron pipe fittings. Newport, R. I., Schedule 951—five turbine bulkheads, tail cones, yokes, etc., miscellaneous after bulkhead, valve bodies, etc. Norfolk, Va., Schedule 967—miscellaneous wire steel rope. Washington, D. C., Schedule 990—32,000 ft. plow steel wire. Philadelphia, Pa., Schedule 962—800 lb. soft composition wire, 1000 spiral tube boiler brushes, 20,000 ft. galvanized sheet conduit pipe. Puget Sound, Wash., Schedule 980—miscellaneous bronze phosphor wire, miscellaneous steel crucible wire; Schedule 949—one motor-driven horizontal punch, one motor-driven joggling plate rolls. Portsmouth, N. H., Schedule 998—one motor-driven vertical 10½-in. shaper. Brooklyn, N. Y., Schedule 989—twenty-seven 600 and 1000-cu. ft. open type, motor, blowers; Schedule 958—thirty portable electric drills, 100 portable electric drills; Schedule 954—sixty-three electric heaters. Charleston, S. C., Schedule 962—nine ¼-hp. portable ventilating sets. Norfolk, Va., Schedule 962—twenty-four ¼-hp. portable ventilating sets. Applications for proposal blanks should designate the schedule by number.

North Central States

GRAND RAPIDS, MICH.—A proposal has been submitted by City Engineer Schriver to provide $75,000 in the budget this year to place the municipal wires underground.

NORTH MUSKOGEE, MICH.—The Council has granted the Consumers' Power Company of Jackson a franchise to supply electricity in North Muskogee. A distribution system will be installed this summer.

DAYTON, OHIO.—Property owners and residents on East Second Street, from Jefferson to Madison Street, have petitioned the City Council for the installation of an ornamental lighting system on that thoroughfare. Similar action has been taken by property owners and residents on St. Clair Street and on Fifth Street, from Wilkinson to Perry Street. It is expected that a petition will be presented by the residents on West Fifth Street from Perry Street to the river bridge.

DELPHOS, OHIO.—Plans have been completed for the erection of a power house and substation in Delphos for the Northwestern Ohio Light & Power Company to cost about $20,000. W. P. Hurd of Van Wert is district manager.

LAKEWOOD, OHIO.—The city of Lakewood, a suburb of Cleveland, has rejected a bid submitted by the Cleveland Electric Illuminating Company for street lighting. The old contract expired on April 1. The city must now invite new bids or install its own plant.

MECHANICSBURG, OHIO.—The Northwestern Ohio Light Company has purchased a site in Mechanicsburg on which it proposes to erect a substation. Energy will be transmitted from the company's plant at Urbana and stepped down for distribution.

SPRINGFIELD, OHIO.—The city officials are considering the extension of the cluster lamp lighting system on Fountain Avenue to the bridge.

SPRINGFIELD, OHIO.—Preparations are being made by the Elwood Myers Company for the construction of an addition to its plant, 60 ft. by 100 ft., four stories, which will house the electric sign department. Most of the equipment, it is understood, has been purchased.

HICKMAN, KY.—The local electric light plant, owned by the Public Service Company of Western Kentucky, is reported to have been purchased by the Kentucky Utilities Company of Louisville.

BRAZIL, IND.—Arrangements are being made by the Crawford McCrimmon Company for increasing the output of its plant in the near future.

FRANKFORT, IND.—Bids will be received at the office of Charles M. Cohee, city clerk, Frankfort, for the city of Frankfort until May 17 for one second-hand turbo-generator set of about 1250-kva. rating, 2300 volts, two-phase, 60 cycles, with condensing outfit, consisting of surface condenser, steam-driven circulating and air pump, etc. For details see proposal columns.

GARY, IND.—Improvements are contemplated by the Gary & Interurban Railroad Company in Gary, including a new substation, additional cars and loops, etc. Charles D. Davidson is receiver.

BELLEVILLE, ILL.—The Modern Auto & Garage Company is planning to erect and equip a garage and machine shop, to cost about $75,000.

CHICAGO, ILL.—Bids will be received by John McGillen, clerk of the Sanitary District of Chicago, 700 South Michigan Avenue, Chicago, until May 17 for furnishing a hydraulic turbine and an alternating-current generator, to be installed in the power house at Lockport. For details see proposal columns.

ROCK ISLAND, ILL.—Plans are being drawn for a central heating plant, to cost about $150,000, for the Rock Island Arsenal. Col. George W. Burr is commandant.

GREEN BAY, WIS.—The Railroad Commission has granted a certificate of convenience to the Green Bay & Eastern Railway Company, which proposes to construct an electric railway from Green Bay through Manitowoc to Sheboygan.

LA CROSSE, WIS.—Plans are being prepared by the Wisconsin-Minnesota Light & Power Company for the construction of a high-tension transmission line from the Wissota hydroelectric plant above Chippewa Falls to La Crosse.

POTOSI, WIS.—The installation of an electric-lighting system in Potosi is under consideration.

ST. PAUL, MINN.—The installation of an ornamental lighting system on University Avenue, from Lexington Avenue to the city limits, a distance of about 3 miles, is under consideration.

DES MOINES, IOWA.—Preliminary plans are being prepared by the Des Moines Electric Company for the erection of a central heating plant.

DYERSVILLE, IOWA.—Plans are being considered by the Eastern Iowa Electric Company for the erection of an electric transmission line, 9 miles long, into the rural district, known as Hickory Valley, to supply electrical service to farmers along the line.

LITTLE ROCK, IOWA.—The City Council is considering the question of establishing a municipal electric-light plant.

NEW VIENNA, IOWA.—The Eastern Iowa Electric Company of Dubuque has been granted a franchise to supply electricity in New Vienna. The company will extend its transmission line from Dyersville to this town.

TINGLEY, IOWA.—The Council is considering a proposal submitted by the Mount Ayr (Iowa) Light & Power Company for furnishing electrical service in Tingley.

DUDLEY, MO.—The installation of an electric-lighting system in Dudley is under consideration. It is proposed to secure energy from Poplar Bluff.

RICH HILL, MO.—The installation of new generating equipment in the municipal electric-light plant is under consideration.

ST. JOSEPH, MO.—An election will soon be called to submit to the voters the proposal to issue $172,000 in bonds for extensions and improvements to the municipal electric-light plant.

SPRINGFIELD, MO.—A petition has been filed with the City Council asking that a special election be called to vote on the proposal to issue $400,000 in bonds to establish a municipal electric-light plant.

TURTLE LAKE, N. D.—The Central Power Company has been granted a franchise to supply electricity in Turtle Lake. The power plant will be located at the John Satterlund Mine and will furnish electricity in Washburn, Turtle Lake, Mercer, McClusky, Denhoff and Goodrich.

WHITE LAKE, S. D.—The proposal to issue $10,000 in bonds for the installation of a municipal electric-light plant will soon be submitted to the voters.

WESSINGTON SPRINGS, S. D.—The municipal electric-light plant was recently destroyed by fire.

BEAVER CITY, NEB.—The City Council is considering the question of issuing $7,000 in bonds for increasing the output of the municipal electric-light plant with a view of establishing a 24-hour service.

GUIDE ROCK, NEB.—Plans are being considered by E. Brogg of Guide Rock for the erection of an electric transmission line from Guide Rock to the city limits of Superior, a distance of 18 miles, and there to connect with the transmission system of the Southern Nebraska Power Company. Mr. Brogg proposes to supply electricity in Guide Rock.

HOLDREDGE, NEB.—Contracts have been secured by the Intermountain Railway, Light & Power Company for supplying electricity in the villages of Loomis and Upland. The company will extend its transmission line from Hildreth to Upland, a distance of 11 miles, and will also erect a line from Holdredge to Loomis, 11 miles long, to supply the service. Electricity will be transmitted at 11,000 volts.

INDIANOLA, NEB.—Bonds to the amount of $11,000 have been voted for the installation of a municipal electric-lighting plant. The present plans provide for the erection of an electric transmission line to McCook to secure energy to operate the system. The town, it is expected, will take over the local plant, operated by F. Plound.

LOOMIS, NEB.—Bonds to the amount of $3,600 have been voted for the installation of an electric-lighting system in Loomis. Energy will be obtained from the plant of the Intermountain Railway, Light & Power Company at Holredge.

SUPERIOR, NEB.—The Southern Nebraska Power Company is planning to build a reinforced concrete dam across the Republican River, about 1½ miles from Superior. A new generator will be installed, which will be connected to the present prime movers, but probably a new turbine will be installed later on. The work, it is expected, will be done this fall. The cost is estimated at about $15,000.

UPLAND, NEB.—At an election held recently the proposal to issue $6,500 in bonds for the installation of a municipal electric-light plant was carried. Energy to operate the system will be purchased from the Intermountain Railway, Light & Power Company of Holdredge.

BAXTER SPRINGS, KAN.—The Council has granted authority to the Empire District Electric Company of Joplin, Mo., to supply electrical service in Baxter Springs.

BISON, KAN.—At an election held recently the proposal to issue $9,000 in bonds to erect an electric transmission line to La Crosse to supply electricity in Bison was defeated.

CANEY, KAN.—The power plant of the Caney Electric Light & Railway was recently damaged by fire, causing a loss of about $25,000. The plant, it is understood, will be rebuilt.

DENTON, KAN.—The City Council is considering the installation of an electrical distributing system in Denton. Energy to operate the system will be obtained over an electric transmission line from Severance.

ELLIS, KAN.—At an election held recently the proposal to issue bonds for improvements to the municipal electric-light plant was carried.

INDEPENDENCE, KAN.—At an election held recently the proposal to issue $75,000 in bonds to establish a municipal electric-light plant was defeated.

IOLA, KAN.—Plans are being considered to extend the municipal electric-lighting service to Colony and Neosha Falls.

IRVING, KAN.—Bonds to the amount of $7,000 have been authorized to erect an electric transmission line to Blue Rapids and to install an electric distribution and lighting system in Irving.

KANSAS CITY, KAN.—The City Commission has decided to replace 500 gas lamps on streets and boulevards with electric lamps.

PRESCOTT, KAN.—The installation of an electric-lighting system in Prescott is under consideration.

STAFFORD, KAN.—The City Council is considering the purchase of a new steam engine for the municipal electric-light plant.

Southern States

BELHAVEN, N. C.—Preparations are being made for the construction of an electric-light plant and water-works system, bids for which have been received. The J. B. McCrary Company of Atlanta, Ga., is engineer and contractor.

CHARLOTTE, N. C.—The Charlotte Knitting Company, recently organized with a capital stock of $125,000, is planning to install 100 knitting machines, to be operated by electricity. The cost of the plant is estimated at $40,000. R. J. Walker is president.

CHAUNCEY, GA.—The town of Chauncey has granted the Georgia & Southern Utilities Company of Eastman a franchise to supply electricity here.

CRAWFORD, GA.—The Crawford Cotton Mills, recently incorporated by B. T. Comer of Crawford, J. W. Ingles of Athens, Ga., and others, have purchased the Edwards Cotton Mill, including the hydroelectric plant at Watson Shoals on Broad River. The new owners contemplate enlarging the mill and expect to erect transmission lines to supply electricity for lamps and motors in Crawford, Comer, Carlton and Lexington.

EASTMAN, GA.—The Georgia & Southern Utilities Company is making extensions to its power plant in Eastman, and, it is reported, contemplates extending its electric transmission line to Chauncey, where it was recently granted a franchise. From Chauncey the line will be extended to Milan.

FOLKSTON, GA.—J. W. Buchanan, who recently built a dam across a creek near the city limits, is planning to erect a power plant for the purpose of supplying electricity in Folkston for lighting the city and for manufacturing purposes.

VALDOSTA, GA.—The South Georgia Power Company, recently organized, is planning to construct a hydroelectric power plant on the Withlacoochee River, 4 miles from Valdosta. Electricity generated at the plant will be transmitted to Valdosta, Quitman, Boston, Thomasville, Pelham, Moultrie and other towns and cities in this section of the State. The company will also supply energy to the Valdosta Street Railway.

JACKSONVILLE, FLA. — The electrical committee of the Board of Bond Trustees is considering a proposition to install a lighting system on the river front.

ONEONTA, ALA.—The Oneonta Utilities Company, recently organized, contemplates the installation of public utility plants in Oneonta.

GULFPORT, MISS.—The contract to supply wire, cables and lamps for the Mississippi Centennial at Gulfport, it is reported, has been awarded to the Electric Supply Company of Memphis, at $35,000. The contract includes 150 lamps and 11 miles of cable, etc.

GREENWOOD, ARK.—The Fort Smith (Ark.) Light & Power Company is contemplating extending its transmission line to Greenwood.

PINE BLUFF, ARK.—The directors of the Pine Bluff school district have awarded the contract for conduit system for electric wiring, including Western Electric interphone system, wiring for fire gongs and class periods in connection with Time System Company's program clocks to the Pine Bluff Electric Company, at $4,800.

OAK GROVE, LA.—Plans are being considered for the installation of a municipal electric-light plant in Oak Grove.

SLIDELL, LA.—A bond issue of $100,000 will be recommended by Mayor Badon, the proceeds to be used for water-works, electric lighting, drainage and another public school building.

BUFFALO, OKLA.—Bonds to the amount of $15,000 have been authorized for extension to the electric-lighting system.

KAW CITY, OKLA.—Contract for construction of the municipal electric-light plant and water-works system has been awarded to Cudgel & McVay of Stillwater. The cost is estimated at about $25,000. The Benham Engineering Company, Colcord Building, Oklahoma City, has charge of the engineering work.

McALESTER, OKLA. — The Pittsburg County Electric Railway Company will install a new engine in its plant to replace the one wrecked by an explosion recently.

OKLAHOMA CITY, OKLA.—Steps have been taken for the installation of an ornamental lighting system on North Broadway, between Grand Avenue and Fourth Street. LeRoy M. Gibbs, secretary of Chamber of Commerce, is interested.

RINGLING, OKLA.—The Consumers' Light & Power Company is contemplating the installation of an electric-light plant in Ringling. C. B. Owens of Chicago, Ill., is engineer.

BEAUMONT, TEX.—Unless more satisfactory rates for electrical service can be obtained from the Beaumont Electric Light & Power Company the Commissioners of Jefferson County may install an electric-light plant to supply electricity for the court house, jail and hospital building.

BOWIE, TEX.—The Wichita Falls (Tex.) Electric Company is contemplating extending its electric transmission lines to Bowie. The company will also supply electricity in Electra, Burkburnett, Iowa Park and Henrietta.

BROWNFIELD, TEX.—Eugene Wood & Company, it is reported, are in the market for equipment for an electric plant for lighting a small town.

CELINA, TEX.—The municipal electric-light and water-works station was recently destroyed by fire, causing a loss of about $20,000. The plant, it is understood, will be rebuilt.

CORPUS CHRISTI, TEX.—The Corpus Christi Railway & Light Company is contemplating the installation of additional equipment in its plant and other improvements to the property.

DALLAS, TEX.—Steps have been taken by property owners on South Ervay Street, from Commerce to Gano Street, for the installation of ornamental lamps. The Park Board, it is said, has authorized the installation of ornamental lamps along the west side of the park, which faces South Avery Street.

HAMLIN, TEX.—The Hamlin Light, Power & Ice Company, recently incorporated with a capital stock og $60,000, is planning to install an electric-light and power plant and ice factory. A. V. Wainwright, R. F. Price and F. A. Matthes are interested.

SAN ANGELO, TEX.—The Interstate Electric Corporation, which was granted a franchise some time ago to construct an electric railway system in San Angelo, will erect its power plant as soon as the necessary machinery and equipment can be obtained.

Pacific and Mountain States

ARLINGTON, WASH.—The Washington Coast Utilities Company of Arlington has petitioned the County Commissioners for a franchise to erect and operate electric transmission lines over certain roads, highways and streets in Snohomish County.

HARRINGTON, WASH.—The Washington Water Power Company of Spokane is planning to install a new electrical distribution system for power and lighting purposes in Harrington.

OLYMPIA, WASH.—The Puget Sound Traction, Light & Power Company of Seattle, it is reported, will begin work immediately on the erection of a 55,000-volt transmission line from Fern Hill to Olympia to connect with the service lines of the Olympia Light & Power Company. The cost is estimated at $53,000. The Olympia company will expend about $15,000 for the installation of new transformers.

SEATTLE, WASH.—The Chicago, Milwaukee & St. Paul Railway Company has announced its intention of equipping its railroad between Othello and Seattle, Wash., for electrical operation, at a cost of about $6,000,000. Substations will be erected at Taunton, Doris, Kittitas, Cle Elum, Hyak, the east portal of the Snoqualmie tunnel, Cedar Falls, Black River Junction and the Tacoma shops, at a cost of $175,000 each. Energy for the main line west of the Cascades will be furnished by the Puget Sound Traction, Light & Power Company, and will be generated at the Snoqualmie Falls plant; from Othello west, power will be purchased from the Washington Water Power Company of Spokane. Energy will also be purchased from the Intermountain Power Company, which will deliver 7500 hp. at Taunton from the Long Lake plant of the Washington Water Power Company, 15 miles west of Spokane.

SPOKANE, WASH. — The Washington Water Power Company is contemplating the erection of a high-tension transmission line from its power plant at Long Lake to Northport, a distance of about 90 miles, to supply electricity to the mines and other industries in that vicinity.

SPOKANE, WASH.—Improvements involving an expenditure of about $100,000 are contemplated by the Jack Waite Mining Company of Spokane. The proposed work will include the installation of a hydroelectric plant to supply energy for milling, mining and transportation operations.

SPOKANE, WASH.—Application has been made to the County Commissioners by the Pacific Power & Light Company of Portland, Ore., for a franchise to erect a high-tension transmission line through Franklin County to connect with the transmission line of the Washington Water Power Company at Lind.

TOUCHET, WASH.—The Pacific Power & Light Company of Portland, Ore., is planning to extend its electric transmission lines from Priest River power plant to Touchet, a distance of 16 miles.

HALFWAY, ORE.—The County Court has granted the Baker Mines Company a franchise to erect an electric transmission line from Halfway to Cornucopia to furnish electricity to operate the machinery at its mines.

MOUNT PLEASANT, ORE.—Arrangements are being made by the Mount Pleasant Community Club for the installation of a street-lighting system in the town.

OSWEGO, ORE.—The contract for the installation of an electric-light plant in Oswego has been awarded to C. O. Knight of Glasgow, Mont., at $7,800.

PORTLAND, ORE.—The City Council is considering a plan of W. H. Daly, commissioner of public utilities, for a steam-driven electric plant to cost about $350,000, preliminary to the development of the proposed hydroelectric development in the Bull Run Reserve.

BLYTHE, CAL.—Application has been made to the State Railroad Commission by the Southern Sierras Power Company of Riverside to extend its electric transmission lines to Blythe, a distance of 90 miles. It is proposed temporarily to generate electricity in Blythe for local consumption, later tying the city in with the company's main line.

CROCKETT, CAL.—The contract for construction of a large water barge for the California & Hawaiian Sugar Refining Company has been awarded to Barney Lanteri of Pittsburgh. A complete electric plant will be installed on the barge. The pumps for handling this cargo will be operated by electricity.

DARWIN, CAL.—Plans are being considered by the Darwin Development Company to build an electric railway along the south shore of Owens Lake, to connect with the Southern Pacific Company at Olancha.

ESCONDIDO, CAL.—Important improvements are contemplated to the local system, recently taken over by the San Diego Consolidated Gas & Electric Company. Arrangements have been made for taking energy from the Escondido Mutual Water Company. The present street-lighting system will be replaced with a modern series system.

FOLSOM, CAL.—Plans have been prepared by the Pacific Gas & Electric Company for the reconstruction of its entire system in Folsom.

OROVILLE, CAL.—Work will soon begin on the reconstruction of the plant of the Pacific Gas & Electric Company at the foot of Huntoon Street. The company will also begin work on the installation of a new street-lighting system in the business district. It is proposed to replace the arc lamps now in use with incandescent lamps.

PASADENA, CAL.—The city of Pasadena is considering building a municipal railway system, to cost about $2,500,000.

ROCKLAND, IDAHO.—Application has been made to the Council by the Idaho Power Company for a franchise to light the streets of the town.

SALT LAKE CITY, UTAH.—The Utah Power & Light Company has extended its electric transmission line from the Wheeler Schoolhouse at Lewiston, a distance of 3½ miles, and will make further extensions to the line to supply electrical service to the residents of Cornish, and will also continue the line to Weston, Idaho, 4 miles distant.

GLOBE, ARIZ.—Surveys are being made for the construction of the proposed railway between Globe and Miami, a distance of 11 miles, to be built by the Globe-Miami Electric Railway Company.

EUREKA, MONT.—A special election will soon be called to submit to the voters the proposal to grant a franchise to supply electricity in Eureka to J. J. Tetrault and associates, who contemplate a hydroelectric development on Grave Creek, to cost about $60,000.

LOVELAND, COL.—Bonds to the amount of $83,000 have been voted for the installation of a municipal electric-light plant.

PUEBLO, COL.—The Arkansas Valley Railway, Light & Power Company is installing a new 2500-kw. motor generator set in its Pueblo power station to facilitate the interchange of current between the Canyon City and Cripple Creek divisions and the Pueblo station.

SANTA FE, N. M.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 18 for repairs to heating, plumbing, conduit and wiring, lighting fixtures, etc., in the United States Court House, etc., at Santa Fe, N. M. For details see proposal columns.

Canada

AYLMER, ONT.—The by-law to authorize $7,000 for remodeling the electrical distribution system and $7,000 for the installation of an electrically-driven fire pump will be submitted to the ratepayers on April 30.

FORT ERIE, ONT.—The Council is considering the installation of an electric-light plant. George Ross of Welland is engineer.

HAMILTON, ONT.—The Standard Underground Cable Company of Canada is erecting an addition to its plant, 120 ft. by 125 ft., to cost about $50,000, for the wire drawing department. Machinery capable of drawing wire, from No. 40 B and S. gage, to the largest size of trolley wire will be installed. All machinery in the new plant will be driven by three-phase, 25-cycle, 550-volt, alternating-current motors. Frack & Perrine of Hamilton are architects.

HILLSDALE, ONT.—A by-law providing $2,500 for the purchase of a gasoline engine and other equipment for an electric plant to light the village of Hillsdale has been approved by the ratepayers.

LONDON, ONT.—The Utilities Commission is considering the installation of an ornamental lighting system on Erie Avenue.

OTTAWA, ONT.—The overland pipe system will soon be ready for operation, but it may be allowed to stand idle until the city builds a power plant to operate the same. The Hydro-Electric Power Commission of Ontario recommends the construction of a 2,600-hp. plant by the city, which could be increased to 4000 hp. at any time. The commission offers to build the plant and turn it over to the city when completed in one year. The city will endeavor to secure a temporary supply of energy to operate the overland system during the construction of the city plant.

YARMOUTH, ONT.—The Township Council has adopted a resolution authorizing the Hydro-Electric Power Commission of Ontario to submit an estimate of cost of installing an electrical service in the township of Yarmouth between the city of St. Thomas and the village of Belmont.

YORKTON, SASK.—Bids will be received by the town of Yorkton until April 30 for one 350-hp. to 400-hp. combined Diesel engine-driven electric generating unit. Specifications may be obtained at the office of F. J. Pilkington, town clerk.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until May 12, for steel doors, galvanized steel, spring bronze, sheet brass, chain, cable clips, electric cable, magnet wire, compensators, lighting fixtures, electric meters, electric motors, smoothing planer, machine brass couplings, etc. Blanks and further information relating to this circular (No. 1139) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y., 614 Whitney-Central Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

14,284. SWITCH BOX; Jerome Z. Bayliss and Charles Raus, Cleveland, Ohio. App. filed Sept. 13, 1916. (Reissue.) May be used either as a single unit or as one of a plurality or gang.

14,286. ELECTRIC HEATING PAD; Nelson E. Mann, New Britain, Conn. App. filed Feb. 23, 1917. (Reissue.) Regulating device.

1,222,593. ART OF PRODUCING ALUMINUM CARBIDE; Maurice Barnett and Louis Burgess, New York, N. Y. App. filed Jan. 26, 1917. Carbon is present in an amount in excess of that theoretically necessary to reduce the alumina to metal.

1,222,633. CENTRIFUGAL SWITCH; Carlton L. Kennedy, South Braintree, Mass. App. filed Aug. 1, 1914. For split-phase induction motors.

1,122,637. ELECTROCHEMICAL TREATMENT OF LIQUIDS; Clarence P. Landreth, Philadelphia, Pa. App. filed Aug. 6, 1915. For removing incrustating salts, for softening, for removal of colloidal and suspended matter.

1,222,658. ADVERTISING OR SIGNALING APPARATUS; James P. Naylor, Dulwich, Eng. App. filed April 14, 1914. Capable of reproducing devices, words, phrases, letters or signs in a larger variety and in a larger number of methods.

1,222,669. ELECTRIC BATHTUB HEATER; John W. Purnell, Morristown, Tenn. App. filed May 3, 1916. Carried in a dress-suit case.

1,222,676. ELECTRIC CANDLESTICK; Andrew J. Sanford, Newark, Ohio. App. filed June 24, 1913. Adapted to be used as the standard of an electrolier.

1,222,692. REVERSE-PHASE SAFETY RELAY FOR MOTOR CIRCUITS; Charles H. Spangler, Reading, Pa. App. filed Oct. 5, 1914. For protecting multiphase motor-driven mechanism.

1,222,714. ELECTRIC SWITCH; George Baehr, McKeesport, Pa. App. filed Oct. 29, 1913. Improvements.

1,222,720. AUTOMATIC SWITCH; Joseph Bijur, New York, N. Y. App. filed Nov. 17, 1911. Reversing.

1,222,721. ELECTRICAL CONNECTION; Carl H. Bissell and Elda G. Smith, Syracuse, N. Y. App. filed Jan. 8, 1914. Socket.

1,222,761. OSCILLATOR; Charles D. Herrold, San Jose, Cal. App. filed Oct. 20, 1915. Comprises the necessary number of gaps in a single unit.

1,222,803. RECTIFYING DEVICE; Charles C. Ruprecht, Midway, Fla. App. filed Nov. 25, 1914. Simplified type of vibrating armature rectifier.

1,222,805. GAS GENERATOR; Leo P. Sebille, Providence, R. I. App. filed June 16, 1916. For generating oxygen and hydrogen gas.

1,222,837. PORTABLE ELECTRICAL DEVICE; Elbert R. Winslow and Clyde A. Jones, Kearney, Neb. App. filed March 20, 1916. Electric fan and an electric incandescent light mounted on the same frame.

1,222,852. CONTROLLER FOR AND METHOD OF REGULATING ELECTRIC MOTORS; Harry E. Dey, Jersey City, N. J. App. filed Sept. 29, 1914. For use on electrically propelled vehicles.

1,222,869. MAGNETO; Francis R. Hoyt, East Orange, N. J. App. filed Feb. 15, 1916. Improvements.

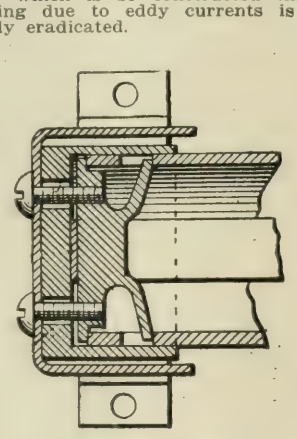
Record of Electrical Patents

Notes on United States Patents issued on April 17, 1917

1,222,885. INDUCTION-COIL CONTROLLER; Mary P. Mitchell, Eaton, Ohio. App. filed Dec. 31, 1915. Prevents an overcharge in the current induced in the secondary.

1,222,886. ELECTRIC SWITCH FOR LAMP SOCKETS, ETC.; Shiras Morris and Monroe Guett, Hartford, Conn. App. filed April 14, 1915. Improvements.

1,222,900. ALTERNATING-CURRENT MAGNET; William S. Smith, Cambridge, Mass. App. filed Sept. 10, 1915. Guide tube for the core, which is so constructed that the heating due to eddy currents is practically eradicated.



1,222,937.—Fuse

1,222,916. IONIZED-CHAMBER DEVICE; Clifford D. Babcock, New York, N. Y. App. filed Oct. 24, 1916. For use as detectors, indicators, amplifiers, repeaters, relays.

1,222,937. FUSE; Albert F. Daum, Pittsburgh, Pa. App. filed May 10, 1913. Refillable fuses.

1,222,945. MEDICAL APPARATUS; Oscar Hammerstein, New York, N. Y. App. filed June 14, 1916. Improvements.

1,222,947. ELECTRIC SWITCH; George H. Hart, West Hartford, Conn. App. filed June 17, 1916. Snap switch which can be operated to make and break a circuit by an oscillating movement of the actuating member.

1,222,952. FUSE DEVICE; Alfred Herz, Chicago, Ill. App. filed Jan. 26, 1911. For operation on overloaded current.

1,222,982. BRUSH AND HOLDER FOR GENERATORS AND MOTORS; John B. Peters, Toledo, Ohio. App. filed Nov. 14, 1913. Embodied in different forms of construction.

1,222,999. COMMUTATOR BRUSH; Henry K. Scandell, Chicago, Ill. App. filed March 20, 1916. Lightens the construction of the brush.

1,223,000. MEANS FOR RECTIFYING ALTERNATING CURRENT FOR EDISON THREE-WIRE DISTRIBUTION SYSTEM; Henry K. Sandell, Chicago, Ill. App. filed April 8, 1916. Accomplished by the use of a rotary rectifier comprising a synchronous motor which drives a rectifying commutator.

1,223,091. METHOD OF MAKING HOLLOW METAL OBJECTS BY ELECTRICAL WELDING; Thomas E. Murray and Harry R. Woodrow, New York, N. Y. App. filed Jan. 24, 1917. Improvement.

1,223,092. ELECTRIC WELDING APPARATUS; Thomas E. Murray, New York, N. Y. App. filed Jan. 29, 1917. Consists of a welding electrode made in sections.

1,223,094. DYNAMO-ELECTRIC MACHINE; Alfons H. Neuland, Bergenfield, N. J. App. filed Feb. 20, 1914. Commutating type.

1,223,095. INDUCTION POWER-TRANSMITTING DEVICE; Alfons H. Neuland, Bergenfield, N. J. App. filed April 16, 1914. Electromagnetic or induction type.

1,223,096. DYNAMO-ELECTRIC MACHINE; Alfons H. Neuland, New York, N. Y. App. filed March 30, 1915. Means for properly spacing and rigidly supporting the field parts.

1,223,111. CONNECTION BOX AND PLUGGING JACK; Henry F. Richardson, New York, N. Y. App. filed Sept. 11, 1914. Safe from short-circuiting and grounding.

1,223,114. ELECTROLYTIC RECTIFIER; Charles C. Ruprecht, Midway, Fla. App. filed April 22, 1916. Improved.

1,223,117. ELECTROTHERMOSTATIC CONTROLLER; Joseph C. Schaf, Jr., and William E. Muck, Indianapolis, Ind. App. filed Sept. 16, 1916. Dial-indicating means.

1,223,169. REMOTE-CONTROL SYSTEM; Charles J. Henschel, Bloomfield, N. J. App. filed March 9, 1914. An operator at one station may exercise positive and accurate control over movable mechanism at another station.

1,223,180. IGNITION SYSTEM; Charles F. Kettering, Dayton, Ohio. App. filed Aug. 11, 1911. Prevents the waste of current.

1,223,224. APPARATUS FOR THE ELECTRICAL TRANSMISSION OF POWER; Herman B. van Daalen and Hugo P. Schreiber, London, England. App. filed Oct. 23, 1912. Dynamo-electric machine having two armatures capable of independent rotation and a single stationary field the intensity of which can be varied as desired.

1,223,278. MULTIPLE-HEARTH ELECTRIC FURNACE; Alois Helfenstein, Vienna, Austria. App. filed June 5, 1914. Allows of an ample charging of the furnace.

1,223,306. ELECTRICAL MEASURING INSTRUMENT; William Anthony, Clyde, Ohio. App. filed Jan. 20, 1916. Pocket voltmeters and ammeters.

1,223,313. ELECTRIC REGULATION; John L. Creveling, New York, N. Y. App. filed June 23, 1910. Improvements.

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The N. E. L. A. in the Service

NO PAST National Electric Light Association convention voiced the powerful purpose for national service which will dominate the brief proceedings at next week's patriotic gathering. Smaller in number, less vital to other industries, totaling much lower values in invested capital, the association was in a very different position during the relatively unimportant Spanish-American War. Now one of the greatest industrial forces, capably designed, efficiently managed, it is ready and willing to do the utmost in large human and machine accomplishment. Its work and the broad scope of its committees and sections were preparation for the conditions of to-day. They are training which better fits the whole industry to step into its necessary place, to enter the war machine which is to be driven hard to bring peace. No happening could reveal more clearly the true usefulness of the association as a central agency for mobilization. Current affairs will wait; the industry is in the government service for the duration of the war.

Lighting Contracts and Present Prices

CENTRAL station companies which are about to renew city street-lighting contracts find new factors in the problem. The cost of electrical energy having steadily decreased because of improved apparatus and larger production, a company was justified in assuming that a long-term street-lighting contract would likely become more profitable as time went on. The present uncertainty of coal prices, however, as well as the price of everything else used by utilities, naturally causes companies to be cautious about making street-lighting rates—or for that matter any long-term power contracts—at very close margins. On the other hand, if a street-lighting contract which formerly yielded little or no profit is to be renewed to advantage and provide for some future increase, the price is likely to be so high as to cause unfavorable comment. The possibility of referring such matters to a public service commission somewhat relieves the situation, but it is well for all concerned to remember that whatever contract is entered into there should be sufficient flexibility in its terms to provide for changes in production costs during its life. While commission regulation permits of such changes in some states, a definite understanding that the question of price can be brought up for readjustment at various times by either party is likely to save friction later on. The indeterminate form of street-lighting contract which has been advocated by some central station men in quarters where municipal ownership sentiment has been strong offers one solution. Such a form of contract has the advantage of recognizing the necessity for readjustments and also provides the means for changing apparatus with advances in the art without loss or injustice to either party.

A Word to Manufacturers

IT IS becoming increasingly evident that if American manufacturers of electrical goods expect to develop the South American markets they must be prepared at once to co-ordinate many of their endeavors for a common purpose. To prevent overlapping, smaller firms must group themselves into an association having a carefully organized financial system and proceed to restrict competition and to encourage specialization among its members. They can gain export trade rapidly and surely only in so far as each ceases to exploit in foreign markets certain lines of merchandise made by some other firm in the group. Joint selling organizations manned by experts and adequately equipped are necessary with joint sales departments and warehouses in all large cities. A joint catalog issued in Spanish and in Portuguese is also a prerequisite. While the necessary legislation permitting such export associations has not yet been passed, it is the part of wisdom to be prepared to carry out the scheme as soon as Congress stamps it with its approval. With such an association of specialized firms the maximum appeal can be made and the quickest results obtained. England and Germany have managed to conquer foreign markets partly by such means, and we should profit from their experience or offer something better. We have the goods, but lack the organization.

Enlistment of Central Station Employees

TO A certain extent the central stations of the country are placed between the devil and the deep sea by the war. On the one hand, they must, for the public welfare and for the manufacturing industries, maintain undisturbed their full supply of energy and probably increase it. On the other hand, they cannot and do not discourage the enlistment of employees for actual service. It is a difficult situation. Trained men with electrical experience are needed in large numbers for the engineer regiments which will have to be formed, and yet they cannot be well spared without cutting down the working efficiency of the plants. How shall the situation be handled so as to keep the central stations at high efficiency without in any way discouraging patriotic men in their desire to serve their country? As time goes on there will have to be a vast overhauling of the general situation so as to keep up industrial

activity commensurate with the needs of military operations. It requires from three to four men behind a firing line to supply with material one man upon it. All this will have to be taken into consideration when the selective draft is put in operation, but every industry will be pleading for exemption on the ground of national necessity, and the just distribution of the burdens will be a most serious problem for the government.

It seems to us that, considering the situation broadly, the wisest policy for central station companies in conserving their own efficiency and the efficiency of their men would be to say to their employees: "You are technically trained men who can be of the greatest service to your country in doing specialized work, and are no better than others in the common duties of the soldier. If you feel that you ought to enlist, enlist in an engineer regiment or in some other body where your training will make you particularly valuable. Good fortune go with you! We will stand by you, first, last and always."

When the draft comes strong representation should be made on this subject so that men should only be drafted from the ranks of technical workers in so far as their services will be of more use to the specialized branches of the army in active service than to the task of supplying its needs behind the lines. It would be a pity to waste a first-class man for the engineers, the signal corps or the quartermaster's department in order to make merely an average infantryman or cavalryman.

The loss of a large number of valuable men to the service of the electric lighting companies even with this rational method of selection will be inevitable, and the industry must make the best of it, taking in and training up technical recruits as best it may. But if there is a definite effort to call men from highly specialized industries necessary to public service only in so far as their skill and experience are needed in technical functions, a principle of selection will be established which will tend toward the greatest efficiency of the whole military establishment both at the front and in the not less necessary operations far in the rear.

Exploiting the Electric Truck

THE Hartford Electric Light Company, which for a good many years has been pretty near the advance guard of central station practice, has worked out a plan of dealing with the electric vehicle which deserves more extensive trial. The account which we published last week shows how in the last four or five years a considerable electric vehicle load has been taken on to the advantage both of the station and the consumers. Though it has a splendid record for usefulness when properly handled, the ordinary man is a little cautious about taking up the electric vehicle on account of the charging difficulty and the possibility that the truck may be out of service just when it is most needed. To meet this situation the Hartford company evolved a very ingenious and skillful battery exchange plan.

The company buys and charges the batteries and makes the change whenever required, for which service a flat sum is paid plus a mileage charge. It takes ordinarily less than three minutes to change batteries—in fact, less time than would be necessary to fill up the gasoline tank of a gas truck—and the "electric" can start out for a day's work in prime condition. The changing of batteries is commonly done during the early morning, and the batteries themselves are charged during the off-peak hours. By working in this way the user of an electric truck can be relieved of nearly all the bother connected with its operation, and consequently finds it regularly in service with very small delay on account of necessary repairs. The Hartford experience indicates that by means of battery exchange an electric truck is actually in service a good many more days a year than any gasoline truck and that its operating costs all told are distinctly light. Were the battery exchange system more widely adopted the use of electric trucks would be vastly greater than it is now, and the same would be true of other electric vehicles. If war-time conditions have anything like the effect here which they have had elsewhere, increasing prices for gasoline will put the electric vehicle emphatically on the right side of the balance sheet, and the extension of its use will become chiefly a question of providing exchange stations enough to obviate the delays due to charging.

Serving Small Communities

WE HAVE over and over referred to the admirable results which can be obtained on a small scale, provided that service projects are not unduly expanded but carried out strictly with reference to the needs of the situation. A brief paper in the current issue lends emphasis to what we have already discussed. The work carried out in this case is exceptional even in this minor class of operations. The place to be served was a village of only 600 inhabitants, and the local generation of electricity in such a case did not seem feasible. The town wanted light and the only available source was eleven miles away. Consequently the citizens got together and provided for a bond issue as a municipal undertaking, buying the energy, erecting the transmission and distribution system, and retailing to the consumers. The bond issue was arranged also to cover a ten-dollar installation charge for each house and business establishment in the town.

The interesting part of the construction is the transmission line. Plans were first laid for an ordinary wooden-pole line, but the cost seemed to run high and a change was made to a combination somewhat unusual. Steel A-frames were used for the transmission and strung with a steel-cored aluminum wire, chiefly on account of its comparatively low cost and large tensile strength. The town went into the house-wiring business to insure low cost and good construction, with the result that at the present time 90 per cent of the buildings in the town are wired for service. Energy is metered at 12 cents per kilowatt-hour, by no means a high price for a small community, and as the town buys its energy for transmission at 3 cents per unit the excess was enough to meet interest on the bonds, depre-

ciation and operating charges from the very beginning of the service. It is interesting to note that the total cost of providing the service facilities by the town was only slightly over $12,000, which sounds like a record low figure for work involving so long a transmission for so small an amount of power. It is an excellent example of the way in which by general interest on the part of the public and careful management service can be secured on reasonable terms even in a very small community.

Reliability of Porcelain Insulators

SO RAPID have been the strides made in the electric transmission of power that engineers and others are apt to forget how short is the space of time between what was and what is and how great has been the change in practice in the interim. This is especially true of the developments in porcelain insulator design, without which the vast high-tension networks which have sprung up in this country in recent years would be impossible. True, there have been troubles, as there must be in all new development work, but these troubles have been speedily surmounted. When one recalls how insulators stood up five years ago under what was then thought to be a very severe test and considers how they behave to-day, there is no escaping the conclusion that porcelain manufacturers have made great improvements in the quality of the porcelain they have produced, and that they now turn out something which will serve the purpose.

Electric service interruptions due to insulator failures are now about one-eighth as frequent as they were five years ago, and with closer co-operation between transmission-line engineers and porcelain-insulator manufacturers this will be still more reduced. The line insulator to-day is no longer the weakest link in the system, and such difficulties as manifest themselves are more mechanical than electrical in their origin.

The real problem of manufacture at the present time is not so much the question of electrical design to meet abnormal conditions as one of keeping down depreciation to an exceedingly small value for a period of years. Great advances have been made by the manufacturers in vitrification, and the care now given to small details in design and assembly so as to keep down internal stresses and thereby reduce the danger of cracking with time has shown its advantages in operation. Definite air bubbles or laminations due to defective pugging, folds in the porcelain while it is being jiggered, excessive pressure due to tools squeezing out moisture around sharp corners which subsequently may cause a partial fault in drying or prevent the insulator vitrifying later in the kiln, the underfiring of the kiln itself —all these preventable causes of failure in the finished insulator have been carefully guarded against. Well-made insulators of good design are as lightning-proof and puncture-proof as human skill probably can make them. The credit for most of the work belongs in large measure to the engineers of the manufacturing companies, who have combined their knowledge of electricity with the painstaking and scientific study of ceramics. While insulator reliability becomes increasingly important as transmission distances increase and the requirements of the service become more exacting, these conditions can be best met by a free and frank exchange of experience with the manufacturers of porcelain insulators, to whom the industry must look for the product that is requisite.

Current Prices of Electrical Supplies

IN KEEPING with its established policy of rendering to its readers complete and unexcelled service, the ELECTRICAL WORLD begins this week the publication of prevailing prices of electrical supplies in Eastern and Middle Western markets. These prices, which will be a regular feature of the ELECTRICAL WORLD, apply to standard apparatus and appliances in broken and standard package lots intended for resale by contractors, central stations, dealers and others. Coupled with the regular weekly review of trade and market conditions, the prompt and uncolored description of all new apparatus brought out by manufacturers and the well-known authoritative news service of the ELECTRICAL WORLD, by which its readers are the first to be put in possession of all the important news of the industry, this one section of the ELECTRICAL WORLD should be of inestimable value to the jobbers, dealers and contractors of the country. The publication of the prices should also have an excellent influence on the market. This added service does not curtail one iota the technical, operating and managerial features which are characteristic of the ELECTRICAL WORLD and on which its reputation as the great American electrical technical journal is founded.

The Coming Issues

WHILE the National Electric Light Association will not hold its great annual convention as usual, the representatives of operating companies who have looked forward to this event for a new fund of information will not be disappointed, since the ELECTRICAL WORLD has arranged to publish abstracts of all of the papers and committee reports intended for the Atlantic City meeting. These summaries, as well as accounts of the proceedings of the N. E. L. A. meeting which will be held in New York City on May 9 and 10, will be presented in the next issue of the ELECTRICAL WORLD. The subsequent number, which is the engineering issue, will contain an article on the causes of underground-cable failures and suggestions for their remedy. A paper on measuring reflection factor and the final installment of the article by Walter Arthur on the characteristics of standard inclosed fuses, the first part of which was published on March 10, will also appear in the May 19 issue. The fourth issue of the month, that for May 26, will contain, in addition to the regular departments, special articles on commercial and management topics and illumination.

Small-Town Electric Service Problems

Steel Poles Used in Distribution System—Steel-Cored Aluminum Wire Employed in Both Transmission and Distribution Lines—Bond Issue Provides for House Wiring

PRECEDENT and general practice were both very largely disregarded in bringing electric service to Pomona, Kan., a town with 600 inhabitants. The load available was so small (15 kw.) that the installation and operation of a generating plant did not seem feasible when compared with the possibility of securing energy by transmission line from a generating station at Ottawa, Kan., 11 miles (17.7 km.) distant. The latter plan was adopted and the contract for building the line and the Pomona distributing system was let on a cost-plus-a-fixed-profit basis to the Bushong Electrical Works of Ottawa.



FIGS. 1, 2 AND 3—THREE-WIRE SECONDARY AND STREET-LIGHTING CIRCUITS ON BRACKET FIXTURES; REINFORCED ALUMINUM-WIRE TRANSMISSION LINE, AND GUYED-POLE CONSTRUCTION AT RAILROAD CROSSING

The original estimate which this firm made, basing its figures on the proposed use of wood poles and copper wire, was $13,600. This figure covered the total cost including the bond election, a provision for house wiring in Pomona, meters and line work complete. A desire for more sturdy construction, however, led to the making of another estimate and the decision to build both the transmission line and the distribution line on steel poles of the type made by the Carbo Corporation of South Chicago. It was also decided to use bare steel-cored aluminum wire on the transmission line and weatherproof steel-cored aluminum wire in the distribution system, instead of copper, as specified in the original estimate, because of saving in first cost.

In carrying out these plans 25-ft. (7.6-m.) A-frame earth-anchored line towers were used except at road crossings and in low places, where 30-ft. (9.1-m.) towers were used to increase clearance and to grade the line. The poles are placed 250 ft. (76.2 m.) apart and are equipped with Hubbard 36-in. (90-cm.) steel cross-arms and No. 86 pins. At corners four-legged earth-anchored towers set 5 ft. (1.5 m.) deep, were used. On these towers the line was dead-ended on strain insulators fastened one above the other directly to the center of the pole. This arrangement avoided using heavy corner cross-arms and gave added strength. No. 4 B. & S. steel-cored, stranded-aluminum wire was used because its tensile strength is greater than copper and because it permits the use of longer spans and less sag with resulting reduced first cost on the line. The cross-sectional area selected gives a conductivity equal to that of copper considered in the first estimate. The wire was strung to give a 17-in. (42.7-cm.) sag at 70 deg. Fahr. (21.1 deg. C.) and has caused no trouble.

The transmission circuit receives 60-cycle, single-phase energy from a 15-kw. transformer tower at Ottawa, where the pressure is increased from 1100 volts to 6600 volts. At the Pomona end of the line the potential is reduced to 220-110 volts in three distributing transformers, which are rated at 7.5 kw., 5 kw. and 3 kw. respectively. They are situated near the load centers and are banked on the three-wire secondary system. The secondary mains in Pomona, which are of No. 0, No. 2, No. 4 and No. 6 steel-cored, weatherproof aluminum, are also supported on A-frame towers ranging in height from 20 ft. to 40 ft. (6.1 m. to 12.2 m.). In town the pole spacing varies from 120 ft. to 165 ft. (36.6 m. to 50.3 m.). The distribution network, including the street-lighting circuit, involved the

TABLE I—TOTAL COST OF PROVIDING SERVICE FACILITIES

Transmission and distribution line material	$7,305.15
Meters	680.20
House-wiring material	787.40
Labor and engineering fee (including work on house wiring and on lines)	3,192.25
Bond election, expense of printing bonds, etc.	287.00
Total	$12,252.00

rection of about 6 miles (about 9.7 km.) of pole line.

For town work the steel poles were found to have several advantages over wood. They will, it is believed, give longer life; they stand the side strain from service connections better; they provide more convenient mounting space for brackets; they are neat in appearance, and they can be erected with less labor expense

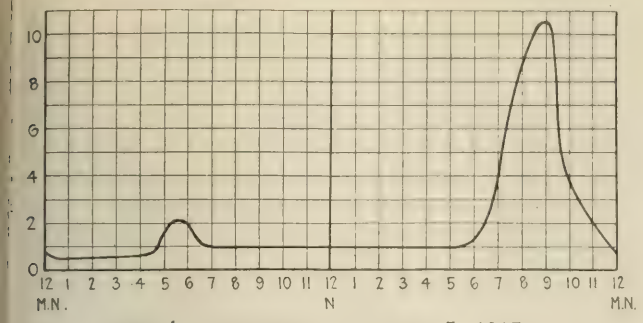


FIG. 4—LOAD CURVE ON APRIL 5, 1917

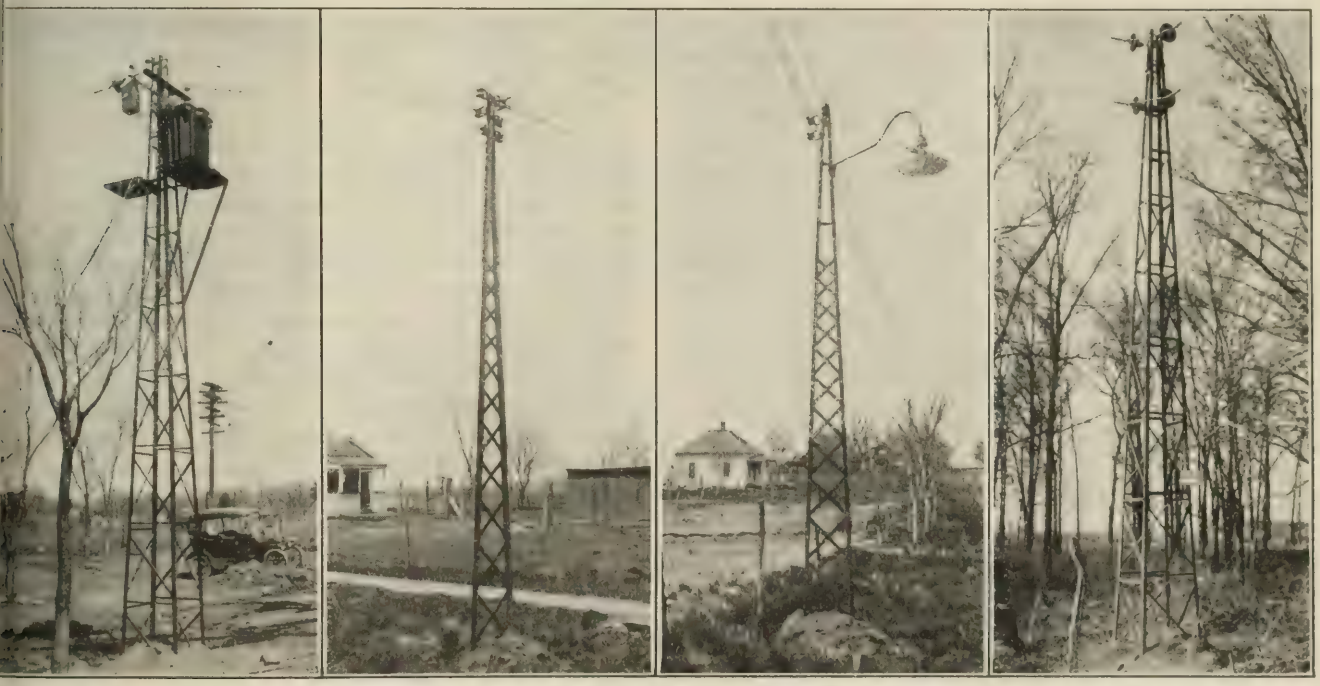
than wood. Cross-arms are used on no poles in town, except those carrying the 6600-volt circuit. All secondary lines are supported on Hubbard No. 561 bracket fittings bolted to the top of the tower, the spacing of which is sufficient to accommodate a 0.5-in. (1.27-cm.) bolt. At corners and at dead ends it was possible to use this fitting by properly staggering the units and by attaching them so they would take the strain. Avoiding buck arms also helped reduce the initial investment.

The street-lighting system, which consists of Westinghouse adjuster-socket units, takes energy from the 6600-volt line through a transformer controlled by a time switch in the secondary leads. The system consists of thirty-six lamps, of which thirty-one are 100 cp. type C bracket type and five are 250-cp. type C Cutter suspension type. The street-lighting circuit also consists of No. 6 steel-cored aluminum wire.

While the original estimate for the completed job was $13,600, the system was actually installed complete for $12,252, including the fixed charge for engineering and supervision made by the contracting company. A detailed statement of the total cost of providing service facilities is given in Table I. To produce immediate revenue which would cover interest and depreciation charges as well as service bills, the bond issue was arranged to pay $10 of the cost of wiring each home and business house in Pomona. The city went into the wiring business and did all work at cost under the direction of its engineers to be sure that all wiring was up to Code requirements. The result was that the system started with 80 per cent of the buildings in town using, or about to use, electric service. Since then an additional 10 per cent has been gained, making the total number of customers 110 out of a population of 600. Furthermore, by charging 12 cents per kilowatt-hour retail for energy the city, Dr. J. F. Vigor, city clerk, declares, has been able to meet interest, depreciation and energy charges from the very first, the city crediting the lighting fund $40 per month for street lighting. Pomona pays 3 cents per kilowatt-hour for energy at the Ottawa switchboard, with a fifty-dollar monthly minimum charge. From Table II it is interesting to observe that the average cost of energy is less than the probable cost of the services of one power-plant operator.

TABLE II—COST OF ELECTRICITY FURNISHED TO POMONA

	Kw.-hr.	Cost
From Dec. 8, 1915, to Dec. 29, 1915	1421	$42.63
January, 1916	2860	85.80
February	1955	58.65
March	1926	57.75
April	1510	43.50
May	1940	58.20
June	1532	45.96
July	1676	50.28
August	1922	57.66
September	1943	58.29
October	2340	70.20
November	2489	74.67
December	2772	83.16
January, 1917	2396	71.88
February	2069	62.07
March	2012	60.36
Average excluding December, 1915	2089	$62.68



FIGS. 5, 6, 7 AND 8—TRANSFORMER FEEDING OTTAWA-POMONA LINE; STAGGERED INSULATORS ON CORNER POLE; USE OF BRACKET FIXTURES FOR DEAD-ENDING SERVICE AND STREET-LIGHTING CIRCUIT, AND CORNER-POLE CONSTRUCTION

What Would You Do as General Manager?

A Lifetime Worker and Executive in the Industry Tells How He Would Develop the Business if He Were in Charge of the Average Small Central Station Company To-day

AN UNSIGNED INTERVIEW

THE ELECTRICAL WORLD has asked me to discuss the opportunities for commercial expansion which are before the industry and to state specifically what I would do if I were a general manager of an average small central station company and wanted to develop the territory.

It is my opinion that the general manager of such a company should first join the National Electric Light Association in order to receive the benefit of the information and assistance which it gives through its commercial work. This assumes, of course, that the general manager has a good knowledge of efficient operating methods and is applying it to good advantage.

Upon the understanding that the company has a well-developed lighting load the general manager should endeavor next to get the power load in the industries in his city or town. Then he can direct his effort toward development in the field of utilitarian devices for the home. These campaigns will lead along successive lines of least resistance, and the company will need to progress in each of these directions in order to attain the most economical average cost of production possible in the community served.

Pulling the Doorbell Won't Do It

In following these broad principles of commercial management no plan will be found so productive of necessary information as that of blocking the territory and making a survey of every house and customer, actual and possible. This will reduce the actual possibilities to definite data.

The work of studying the territory cannot be done successfully by men who lack imagination. Any one who is content to pull the front doorbell and ask the number of people in the house instead of studying each case as an individual problem will not get the results required for systematic development. If the work is well done—and it is not worth doing in any way but well—it will be expensive.

In making the survey the manager will have in mind the question of whether or not the gross revenues of the company show the right average number of dollars per capita. This record of results from the territory will be one of the best tests of the efficiency of the accomplishments of the organization.

The general manager will find it profitable to devote his personal time to the study of commercial possibilities and to the study of not only ordinary salesmanship, but also efficiency salesmanship and how he can build men to sell. He ought to train himself to become a salesman or commercial engineer. The need to-day is for not only operating knowledge, but also to combine that with commercial knowledge.

Concentration Still Progressing

In all plans it is advisable to look to the future. Concentration of central station units and concentration within the industry generally are still progressing. Betterment of quality and reduction of cost are still the aim. Barring the possibility that present high costs will be permanent, future development will be along the lines of better quality and reduced cost, and therefore will be largely a continuation of the character of the work in which the industry has been engaged for the last fifteen years.

Central stations have large markets before them for power in the vast and ever-widening scope of industries which they serve. In all of these industries the tendency will be more and more toward the use of labor-saving machinery. Industries which heretofore have not felt the urgent necessity of introducing scientific methods of efficiency will find it desirable in the future to develop such methods so as to promote economy. For if this country is to go far in the new competition which it will face when the war is over it will do so only by the recognition and introduction of the most efficient and economical means of production.

Increased costs of materials, higher wages and shorter hours of labor are very serious factors in the competition which the industries of this country will find from producers. To meet these conditions our industries will have to undergo certain readjustments in their operations.

Give Individual Study to Cases

Much more will be done by electrically driven machines than in the past. The opportunities in this direction, however, will have to be studied individually in each industry. Some factories, for instance, will get increased production from the use of electrically driven machines operating at uniform speed, and in others increased output will be developed by the use of motors which will permit changes of speed.

Then there are the various avenues for the use of electrical energy which may be classified roughly as semi-industrial. A large number of utilitarian devices are being built which are motor-driven. At first the use of these was considered more or less of a luxury. Then these came to be regarded more and more as necessities. The causes of the change in the attitude of the public are somewhat similar to those which are producing revolution in the purely industrial conditions. They go back generally to the higher cost of living. Many people cannot afford servants as in the past, and housewives do a good deal of their own work. They want motor-driven devices which lessen work and reduce costs.

Outside of the large group of devices of this sort which are finding an ever-widening market there is the electric range. Intelligent housewives are able to handle this labor-saving apparatus so that in many instances the cost of operation is no greater than that of the old-time coal or gas range.

For the full realization of the large possibilities in

these directions co-operation and co-ordination of effort are essential. We discuss in general terms the opportunities for enlargement of markets, but we cannot appreciate what they mean in any given territory without following a plan of study and analysis especially adapted to the conditions found in a particular case. That a study be made of the total possibilities is certainly vital to the industry. In the last few years some of the central station companies have done wonders in analyzing and classifying the markets open to ultimate capture.

For the central station industry as a whole the large avenue for future commercial development is in the industrial plant load. Because of the diversity in the various classes of industries in the United States a great deal of development work and study is necessary in order that electricity may be applied to meet the specific requirements in various plants.

In dealing with the question of steam railroad electrification we have only one industry to study. And in street railway development only one industry is concerned. In the problem of lighting, also, only one method of study is needed; but in the application of power to cotton mills, rolling mills, textile mills and the multitude of other classes of great industries each line of activity means an individual study.

What the General Manager of a Small Central Station Company Should Do

He should join the N. E. L. A. and use its commercial information.

Assuming a well-developed lighting load, he should get the power load.

Then the effort may be directed to utilitarian devices for the home.

Make a survey of every house and customer, actual and possible. It will be expensive, but it will pay.

Devote personal time to the study of commercial possibilities and of efficiency salesmanship.

Build men to sell. The need to-day is for operating knowledge and for combination of that knowledge with commercial knowledge.

Continue to aim at better quality and reduced cost. Barring the possibility that present abnormal costs will remain, high quality of service and low cost will be the lines of future development.

Look for the ever-growing opportunities in electrically driven machines. Industrial needs and competition will give more force to the demand for labor-saving machinery.

Remember that the high cost of living means that motor-driven devices for the home are being regarded more and more as necessities.

Prove the case to every manufacturer. Classify the possibilities and study intensively the requirements of every line of industry.

Watch for the opportunities everywhere.

Prove Your Statements

Conditions surrounding the markets in each case have to be taken into separate consideration. We cannot argue regarding power applications as we can with lighting. That electricity is used universally for lighting, that it is the best source of energy for artificial lighting and that people have come to accept that as fact simplifies the argument there. But we have to prove the statement that electrical energy is the best source of power for an individual manufacturer, we have to classify the possibilities and give the most intensive study to the requirements of a special line of industry before we can be sure of securing the load which it offers.

Central stations are properly looking for enormous power loads in the future. They will profit most from these loads if they study in acquiring them the influence of the factors of volume and diversity.

New Conditions Will Increase Demand

While development in the last few years has been on an enormous scale, it has not nearly reached the point of saturation of markets because new methods of distribution and new study and conditions will increase the demand for energy. Still greater increases in central station output and in the market for lamps will follow. We shall see a still wider application of flood-lighting and also better methods of lighting both indoors and outdoors. Only in very small communities will dark streets be found.

Before the saturation point can be reached in the application of energy to industrial power requirements great development will take place. We shall get away from the past practice of indiscriminately furnishing motors of given sizes without making careful studies of the uses to which motors are to be applied. Better co-operation in the industry at large will help in the realization of all of these possibilities. More commercialism and less engineering will promote commercial possibilities in all sections.

Opportunities Always Present

Present prosperity affords splendid opportunities for central stations. In such good business times as the country is now enjoying central stations often get a portion of the business of established industries. Conditions in those industries make it necessary that they shall provide for rapid increases in the demand for their products which they believe are only temporary. By installing motors these industries are enabled to avoid or postpone the introduction of new prime movers.

By getting part of the load under these conditions central stations have the chance to demonstrate in the best way the reliability and other advantages of their service and in many cases develop connections which they continue to hold permanently. Finding that the conditions are all that the central stations claim for them, such industries are likely to continue to be customers.

In periods of hard times also the central stations find opportunities. In such periods some industries operate only a part of their plants with central station energy at a lower expenditure than would be required for the operation of their entire plant through their own power and they are likely to remain permanently as customers.

In reality all conditions afford opportunities for the increase of the industrial power load, but they require the most intensive and careful individual study.

Such study can be given only with trained men, those who understand that the customer has his own point of view and are determined to approach that point of view sympathetically. Such men can be found and developed. While they are working to develop business they will incidentally present the point of view of the utility and will strengthen public relations.

BENEFIT FROM A BLOW AFTER ELECTRIC SHOCK

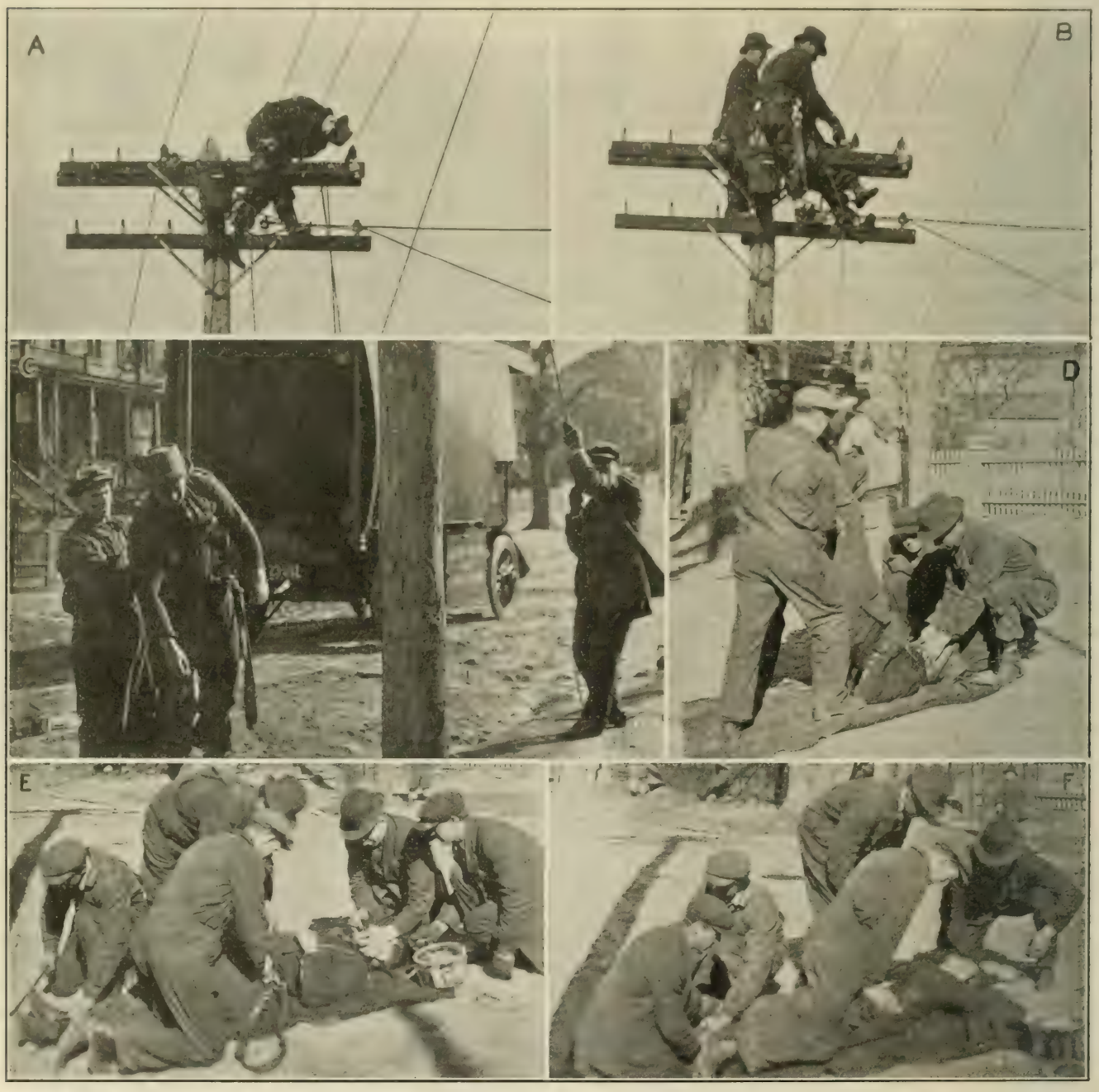
Another Case Where Man Rendered Unconscious by Electricity Was Resuscitated Without Special Apparatus

BY W. P. STRICKLAND

General Inspector New York & Queens Electric Light & Power Company

Recently the writer's attention was called to another case where a man rendered unconscious by contact with a 2200-volt circuit was resuscitated by the method outlined in the explanatory caption under the accompanying illustration. Although the man suffered the loss of a thumb on one hand and a little finger on the other, he is alive and well to-day. Just two days before this accident a man in a nearby district was fatally shocked by the same voltage. It is the writer's belief that his life could have been saved by the method pictured on this page.

In the other cases mentioned in the writer's last contribution on this subject it appeared that blows given to the patients were chiefly responsible for their reviving. In one case the man was restored to consciousness by falling from the pole he was on, and others were revived by striking the soles of their feet or allowing their body to drop on the ground.



RESCUING AND RESUSCITATING SHOCKED LINEMAN

A—Through carelessness or accident the lineman shown has received a shock. B—Rescuers have cut the live lines and are preparing to lower the injured lineman to the ground. C—The shocked lineman has been lowered from the cross-arm on which he was working by a line slung around his chest and has been allowed to drop the last three feet to the ground, the jar helping in restoring him to consciousness. D—The injured lineman has been lifted by the heels with his head resting on the ground so that his body may be dropped, the shock thus inflicted aiding in resuscitation. E—The patient's clothes are being loosened and his mouth has been wedged open preparatory to clearing his throat and withdrawing his tongue to facilitate respiration. Throughout these operations the injured man's soles are struck vigorously with anything at hand—connectors, chisel or club. A medicine kit, tongue forceps and mouth wedge were brought by the rescuers answering the emergency call. F—Awaiting means for producing respiration by mechanical apparatus, the Schaeffer prone method of artificial respiration is applied. Striking of the feet is also continued.

Trend of Regulation in California

Policies of the Past, Under Which $200,000,000 New Money Has Been Invested in Three Years, Will Be Continued — Questions Involved in San Francisco Rate Investigations

BY MAX THELEN

President National Association of Railway Commissioners and President Railroad Commission of California

DURING 1917 the Railroad Commission of California hopes to continue to be of service to the patrons of all the public utilities of that State, as well as to the utilities themselves, in matters great and small.

The commission will pursue the same policy, whereby more than $200,000,000 of new money has been invested in additions, betterments, extensions and new construction of the facilities of California public service companies during the last three years, and by which the securities issued by these utility corporations have come to command a ready sale in the financial markets of the world.

The functions of this commission were materially broadened by the legislative act approved Dec. 23, 1911, and effective March 23, 1912, which extended its jurisdiction to cover all gas, electric, telephone, telegraph and water utilities operating in unincorporated territory, and which was amended to cover the same classes of public service corporations within incorporated territory when it was re-enacted April 23, 1915, effective Aug. 8, 1915, so that the title "Railroad Commission," which remains unchanged, no longer signifies fully its duties and scope.

Among its various and numerous duties not the least is the exercise of complete jurisdiction over the public service companies engaged in the distribution and sale of electric energy. In this field it covers rates, service, facilities, extensions, safety of construction and operation, accounts, transfers and encumbrances of property and issues of securities.

No electric, gas, street railroad, telephone or water utility may enter a field already being served by a utility of like character unless the Railroad Commission's consent has first been secured.

The commission has power, upon petition of any municipality or other public authority, to determine the just compensation to be paid by such public authority for the whole or any part of the property of any public utility. Such finding is conclusive in eminent domain proceedings.

In all respects necessary for the protection of the consuming and investing public as well as the utility itself and its employees the commission has jurisdiction.

Work Affecting Electrical Companies

Among the specific objects affecting electric, telephone and telegraph companies which the California Railroad Commission hopes to accomplish during 1917 are the following:

The completion of its State-wide investigation into the rates, rules and regulations of each of the 400 local exchanges of the Pacific Telephone & Telegraph Company in California.

The establishment of just and reasonable rates for all electrical energy supplied in the cities of San Francisco, Sacramento, Turlock, Oakdale, Tracy and Santa Barbara. The determination of these rates will involve some very nice problems. For instance, there are three competing companies at present in the San Francisco field. From the standpoint of the cost of service, it is unlikely that any two of these will show the same results, and yet in many places all three are doing business on the same street.

A number of the large electric and gas companies have asked the commission to fix all of their rates, rules and regulations, and proceedings of this nature have been disposed of recently or are now pending in connection with the applications of the San Diego Consolidated Gas & Electric Company, the Western States Gas & Electric Company (Eureka Division), the Southern California Gas Company and the Los Angeles Gas & Electric Corporation.

Valuation in Los Angeles

In the valuation of utility properties in connection with condemnation proceedings instituted by public authorities, the commission rendered a decision only recently in the case of the City of Los Angeles against the Southern California Edison Company. The commission found $6,328,000 to be a just and reasonable compensation for property rights and lands, including an allowance of $1,578,000 for severance damages, which were defined as the reduction, caused by severance, in the value of the property not to be taken.

The attitude of the California Railroad Commission toward capital invested in utility property is clearly shown by the following quotation from this decision:

"More is involved in this proceeding than a determination of the issue between the city of Los Angeles and the Edison company. California is a young and growing State. We shall require millions of additional capital for the development of public utility enterprises. If the investor is assured that he will continue to receive fair treatment in California, he will continue to invest generously in our public utilities, even though he realizes that our cities have the prower to condemn existing public utility properties, for he will know that on such condemnation he will receive compensation which in law and in fact is a 'just compensation.' But if the State tribunals in such eminent domain proceedings make awards which are unfairly and unjustly low, so that the property is taken from its owner and given to a municipality for a sum which is less than a 'just compensation,' the investor will, of course, seek other states for his investments. On the other hand, we fully recognize the legal right of the municipalities of this State to condemn the properties of existing public utilities for compensation which shall not be unduly or unfairly high, and we deeply appreciate the tremendously important governmental policies involved in such proceedings."

In the recent decisions fixing the electric rates for the San Joaquin Light & Power Corporation, the Mount

Whitney Power & Electric Company and the Northern California Power Company, Consolidated, the commission has recognized the logic of the demand and energy form of such rates as apply to the use of electrical energy for power purposes.

The utilities involved in these cases serve the San Joaquin Valley and a part of the Sacramento Valley. These are two of the largest and most fertile districts in California. The farms therein depend for their success upon an adequate supply of water for irrigation purposes. This water is furnished partly by canal systems and partly by electrically driven pumps. In each of these three cases a rate in the following form was established for agricultural pumping service:

DEMAND CHARGE FOR VARIED MONTHS' SERVICE PER YEAR PER HORSEPOWER

One month	$4.50	Seven months	$16.40
Two months	7.50	Eight months	17.70
Three months	9.80	Nine months	18.90
Four months	11.75	Ten months	20.00
Five months	13.45	Eleven months	21.05
Six months	15.00	Twelve months	22.05

To these demand charges, which are payable in equal monthly installments, is added an energy charge of ½ cent per kilowatt-hour.

This rate, which was established for the San Joaquin Light & Power Corporation in the San Joaquin Valley, has been varied as to the amount of the charges but not as to the form in its application to the other companies, the cost of service and local conditions being different in each individual case.

The rates which were in effect at the time this investigation was instituted were nearly all on the flat-rate basis, and it was therefore necessary, for the purpose of avoiding a too abrupt change, to establish an optional flat rate for this business also, but as the consumers become educated to the advantages of the demand and energy rate it is probable that the latter will become very popular and will eventually entirely displace the former. Demand and energy rates were also established in each of these cases for industrial service, with optional schedules on a straight kilowatt-hour basis. Wherever this form of rate was put into effect a demand meter is maintained by the company which registers the average demand for the maximum fifteen-minute period during each month.

Informal Adjustment Increases Confidence

A very important department of the Railroad Commission's activities, which it hopes to develop even more in the future, is that dealing with the informal complaints which come to it by letter or orally from public utility patrons and from the utilities themselves. During the year ended June 30, 1916, more than 3000 such informal complaints were settled by the commission.

In each such instance the complainant's allegations are taken up informally with the proper officers of the utility involved, and the utility's answer is submitted with the commission's recommendations to the complainant, and, after a more or less extended discussion of this nature, in the vast majority of the cases an amicable adjustment, agreeable to all parties, is reached without the necessity of formal proceedings.

In this way the commission is able to assist in inspiring increased confidence and security in the relationship between public utilities and the public in California resulting to the benefit of the State as a whole.

RIGHTS OF HOLDING COMPANY IN A SUBSIDIARY COMPANY

Lower Court Decision in American Telephone & Telegraph Case Affecting the Controlled Central Union Telephone Company

As announced briefly in a recent issue, Judge William E. Dever of the Superior Court of Cook County, Illinois, has rendered an important opinion in the case of William A. Read and other minority stockholders against the Central Union Telephone Company, the American Telephone & Telegraph Company, the Chicago Telephone Company, the Western Electric Company, Theodore N. Vail, Union N. Bethel, B. E. Sunny, L. G. Richardson and the other directors of the Central Union Company. The Central Union Company was organized in 1883 in Illinois as a Bell subsidiary and has operated throughout Illinois, Indiana and Ohio with the exception of certain territories occupied by the Chicago, Cleveland and Cincinnati companies.

The allegations of the bill of complaint filed by the minority stockholders early in 1913 were reviewed in our issue of May 3 of that year, page 924. The immediate cause of the suit was an attempted sale of the assets and business of the Central Union Company to other subsidiaries of the Bell system at a price, which, after redeeming the indebtedness alleged to be due to the American company, would have left nothing for stockholders.

Upon the filing of the bill of complaint a temporary injunction was issued by Judge Dever restraining the proposed special meeting of stockholders of the Central Union Company and the sale of the property. Subsequently a motion for a receiver was made by the complainants. This motion was resisted by the defendants. Finally, in January, 1914, all parties consenting, the court appointed, to take over the management and control of the corporation, David R. Forgan, Frank F. Fowle and Edgar S. Bloom as receivers for Illinois. The Court of Common Pleas of Franklin County, Ohio, named the same receivers for Ohio, and the Superior Court of Marion County, Indiana, named the same receivers and also John A. Moriarity in Indiana.

Complainants contended that the stock ownership of the American company in the Union company was *per se* illegal under Illinois laws, whereas the defendants contended that it was not. The court found: "My conclusion . . . is that the purchase of the stock control of the Union company by the American company was illegal *per se* . . . first, because it violated Section 26 of the incorporation act of Illinois, and, second, because its inevitable tendency was to stifle competition and to create a monopoly."

The court next considered whether the American company acquired the stock control to promote monopoly and suppress competition. The decision goes on:

"From almost the very beginning of telephone history in this country the promoters and managers of the Bell system conceived the idea of a telephone organization doing a countrywide telephone business.

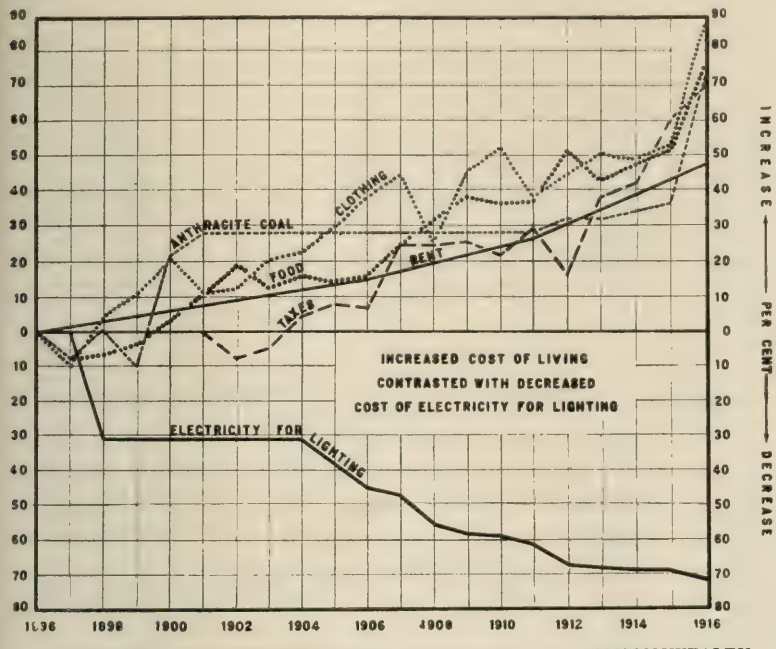
"There is no doubt that in the early history of the Bell System much of its control of the telephone business of the country was acquired by reason of its ownership of the fundamental patents, but as time passed its stock controls and sub-licensee arrangements became more and more effective and the patent right less important in maintaining its dominant position."

Mounting Costs Halt Rate Reductions

Central Station Companies Trying to Determine the Permanent Result of Higher Expenses and Taxes—European Properties Have Raised Rates

WHERE does the price of electric service stand in these strenuous times of inevitable advances in the cost of commodities and service?

Is it as a matter of business pride that the electrical industry at large continues to keep electric rates down when all other costs are creeping up day by day? Are the old low rates justified when the economical low operating costs upon which those rates were based can no longer be attained?



HOW THE CONSUMER BENEFITS—DIAGRAM OF THE COMMONWEALTH EDISON COMPANY, CHICAGO, TELLS THE STORY

Central stations are founded on the economic theory of the largest possible volume of production at the lowest possible average cost. They are the most sparing, careful users of fuel in the community, measured by the results which they obtain. Coal or oil consumption under their efficiently operated boilers yields the greatest return in applied energy to the community and is distributed by methods which assure the lowest level of cost. In short, these companies are the most important conservers of energy on an immense scale that the country holds.

Under conditions of the past, the central station companies strained every commercial resource to develop volume of business and diversity of demand. The rate was not disregarded, but it was great output at which the selling organization aimed. For output spelled lower average cost per kilowatt-hour. With the lowering of production cost there was simultaneously a decrease in the rates charged to the public users. In addition there is the tremendous influence of the tungsten lamp development and evolution, giving the public three times the amount of light without increase in rate. The full benefit of this has gone to the public.

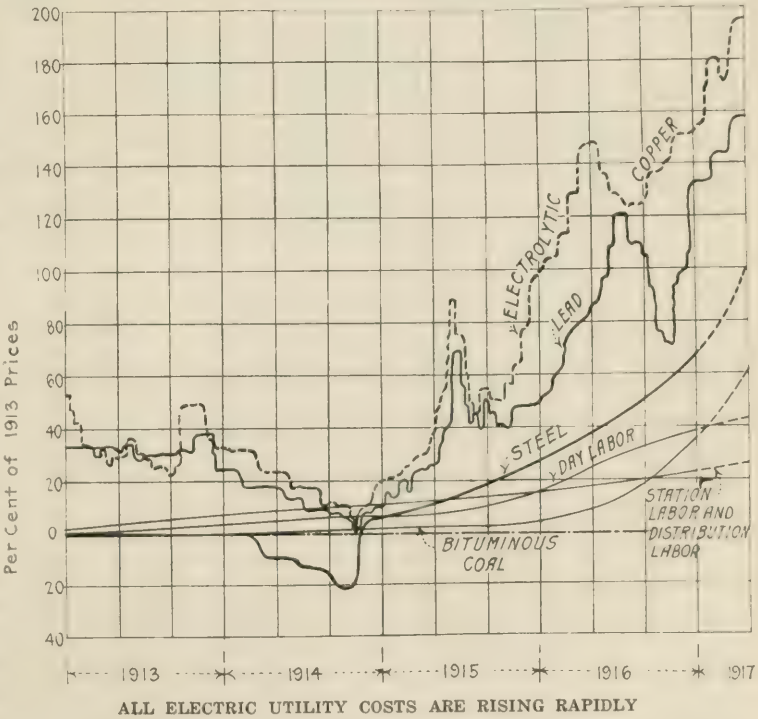
Into the steady progress in increasing production and lowering cost the 1916-17 conditions of shortage and advanced prices in material and labor have come with an explosive shock.

If the price of coal should prove to be high only for a brief abnormal period, probably the excessive operating costs of the last few months would be written down by most of the companies to experience. With a new decision to be forehanded with ample fuel supply, they would put renewed vigor into the contest for lower average operating costs.

Coal, however, only followed other commodities. Copper, steel, lead and other metals which are the raw material for apparatus and supplies antedated the coal advance in the upward price movement. Furthermore, the expenses of labor have risen so rapidly that they loom as a more and more serious factor in total cost. Taxes will be lifted by the heavier governmental outlay due to actual war.

The manufacturer who is caught by similar conditions raises his price. Unfortunately, the public utility, subject to close regulation, cannot easily do that.

In the meanwhile the tendency to reduce rates can be arrested sharply. In ending the movement for free-and-easy reductions the companies have as examples the European central station systems, which are known to have increased their rates generally. The public is reasonable. Electrical companies are entitled to a period of waiting until they can see how permanent or transient are the factors now affecting their cost accounts heavily.



ALL ELECTRIC UTILITY COSTS ARE RISING RAPIDLY

February Central Station Statistics

Earnings Total $38,900,000, an Increase of 13.4 per Cent Over February, 1916, While the Output Amounts to 1,570,000,000 Kw.-Hr., an Increase of 21.5 per Cent

THE results of central station operation, according to the regular reports received and compiled by the ELECTRICAL WORLD, continue to show the gratifying increases both in income and output which have marked the electric light and power industry now for many months. The returns from central stations having 56 per cent of the generating capacity of the entire country indicate that earnings for February last totaled $38,900,000, an increase over the previous February of 13.4 per cent, while the output amounted to 1,570,000,000 kw.-hr., an increase of 21.5 per cent. Earnings include only that revenue received from the sale of energy, while output includes only that energy from which an income was received. So far as possible intercompany activities are eliminated.

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE-MONTH PERIOD

	Percentage of Industry Represented	Income from the Sale of Energy			Kw.-Hr. Output		
		1916	1915	Per Cent Increase	1916	1915	Per Cent Increase
March	65	22,027,000	18,722,000	17.8	1,212,363,000	969,888,000	25.2
April	64	21,206,000	18,375,000	15.5	1,137,602,000	920,464,000	23.1
May	64	20,345,000	17,559,000	16.0	1,170,143,000	944,681,000	24.0
June	64	20,254,000	17,551,000	15.4	1,170,679,000	968,724,000	21.0
July	64	19,760,000	17,301,000	14.2	1,174,374,000	976,704,000	24.4
Aug	64	20,502,000	17,861,000	15.0	1,262,575,000	1,015,805,000	22.4
Sept	64	21,432,000	18,600,000	15.2	1,268,339,000	1,037,976,000	21.2
Oct	64	22,882,000	20,164,000	13.5	1,347,502,000	1,125,132,000	19.9
Nov	64	24,819,000	21,744,000	14.4	1,396,537,000	1,148,221,000	21.7
Dec	61	25,199,000	21,931,000	15.0	1,339,805,000	1,106,827,000	21.2
1917		1917	1916		1917	1916	
Jan	63	27,090,000	23,691,000	14.4	1,480,253,000	1,167,774,000	27.0
Feb	56	21,800,000	19,228,000	13.4	1,024,174,000	843,826,000	21.5

TABLE III—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR UNITED STATES—CITIES GROUPED BY SIZE

	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.
INCOME:										
Group 1	14.4	14.9	13.8	13.9	15.0	11.6	13.0	15.0	13.1	12.7
Group 2	17.5	17.7	16.8	15.7	20.4	19.2	17.7	16.9	19.4	20.0
Group 3	26.2	21.8	19.5	20.9	18.4	18.5	18.2	15.2	15.2	12.5
Group 4	15.1	11.0	9.0	9.5	11.3	13.5	12.8	12.3	15.5	10.1
Group 5	24.0	15.3	12.2	14.9	13.3	16.0	12.8	9.5	20.2	15.8
OUTPUT:										
Group 1	21.3	18.7	18.1	21.4	18.5	16.6	18.2	18.7	23.9	20.9
Group 2	18.0	17.5	22.9	33.0	32.9	31.1	27.2	21.9	36.2	24.0
Group 3	40.0	21.8	27.8	31.1	19.3	24.0	32.0	28.8	34.4	19.8
Group 4	23.0	19.3	16.1	23.0	26.0	20.4	19.7	21.0	30.5	21.8
Group 5	33.2	19.0	11.6	16.8	15.3	18.3	33.0	25.4	21.3	21.2

TABLE IV—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR NEW ENGLAND STATES—CITIES GROUPED ACCORDING TO SIZE

	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.
INCOME:										
Group 1	17.0	16.4	12.6	9.6	16.5	12.1	13.5	12.5	12.5	12.3
Group 2	19.5	19.8	20.6	15.1	25.5	21.3	20.0	30.2	16.1	19.9
Group 3	24.0	18.2	21.2	15.0	20.5	18.0	19.4	16.5	17.8	15.7
Group 4	13.5	7.2	6.2	11.1	10.5	15.4	16.0	16.0	22.0	13.0
Group 5	27.0	21.7	14.9	17.5	18.3	18.2	18.6	12.2	24.0	15.1
OUTPUT:										
Group 1	28.2	30.0	19.2	31.3	34.0	17.5	18.0	10.8	20.7	19.6
Group 2	33.2	26.3	14.1	32.0	37.7	35.0	24.7	18.2	24.8	19.4
Group 3	43.0	15.0	31.4	45.5	32.4	42.6	35.9	22.0	20.9	35.7
Group 4	30.0	21.0	26.6	39.4	32.9	48.9	40.0	55.2	73.8	41.5
Group 5	54.4	31.7	13.5	21.3	27.4	22.0	17.0	35.7	29.2	26.8

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	Percentage of Industry Represented	New England States			Percentage of Industry Represented	Atlantic States			Percentage of Industry Represented	Central States (Illinois Excluded)			Percentage of Industry Represented	Pacific and Mountain States		
			1916	1915	Per Cent Increase		1916	1915	Per Cent Increase		1916	1915	Per Cent Increase		1916	1915	Per Cent Increase
INCOME	March	66	2,595,000	2,122,000	22.0	67	8,998,000	7,660,000	17.5	57	6,470,000	5,394,000	20.1	88	3,787,000	3,386,000	11.9
	April	64	2,221,000	1,898,000	17.0	67	8,794,000	7,596,000	15.8	56	6,289,000	5,292,000	19.0	88	3,825,000	3,520,000	8.8
	May	65	2,103,000	1,788,000	17.0	67	8,226,000	7,131,000	15.4	56	6,085,000	5,123,000	18.7	88	3,874,000	3,469,000	11.6
	June	65	2,208,000	1,906,000	16.0	67	8,045,000	6,905,000	16.5	56	6,007,000	5,143,000	16.9	88	4,017,000	3,539,000	13.5
	July	65	2,130,000	1,875,000	13.7	67	7,832,000	6,621,000	16.4	56	5,926,000	5,095,000	16.3	88	3,755,000	3,493,000	7.6
	August	65	2,203,000	1,935,000	13.7	66	8,000,000	6,875,000	16.4	56	6,195,000	5,266,000	17.7	88	3,883,000	3,582,000	8.4
	September	65	2,315,000	1,982,000	16.8	66	8,631,000	7,445,000	16.0	56	6,505,000	5,537,000	17.8	88	3,979,000	3,644,000	9.2
	October	65	2,684,000	2,331,000	15.2	65	8,887,000	7,930,000	12.1	56	6,968,000	5,895,000	18.2	87	4,213,000	3,889,000	8.3
	November	65	2,912,000	2,516,000	15.7	65	10,061,000	8,859,000	13.5	56	7,410,000	6,313,000	17.4	87	4,246,000	3,947,000	7.5
	December	65	3,203,000	2,814,000	14.0	66	11,059,000	9,348,000	19.6	56	7,791,000	6,899,000	12.9	75	2,987,000	2,735,000	9.3
	1917		1917	1916			1917	1916			1917	1916			1917	1916	
	January	64	3,181,000	2,762,000	15.1	66	11,400,000	9,874,000	15.6	55	7,763,000	6,735,000	15.3	86	4,602,000	4,208,000	9.5
	February	63	2,932,000	2,587,000	13.3	65	10,200,000	8,979,000	13.7	40	5,156,000	4,517,000	14.3	74	3,351,000	3,012,000	11.4
KW.-HR. OUTPUT			1916	1915			1916	1915			1916	1915			1916	1915	
	March	66	97,321,000	74,958,000	29.9	67	439,660,000	349,347,000	26.0	57	360,872,000	282,179,000	28.0	88	304,327,000	255,450,000	19.3
	April	64	84,769,000	64,816,000	30.8	67	403,223,000	326,574,000	23.4	56	344,866,000	273,367,000	26.4	88	302,386,000	255,778,000	19.2
	May	65	84,719,000	64,318,000	31.8	67	409,529,000	333,585,000	22.0	56	345,860,000	275,328,000	25.6	88	328,793,000	266,599,000	23.2
	June	65	87,829,000	69,506,000	27.6	67	396,630,000	327,541,000	21.2	56	350,015,000	288,982,000	21.2	88	328,996,000	277,915,000	18.6
	July	65	85,317,000	71,160,000	19.8	67	401,179,000	333,771,000	20.3	56	350,708,000	287,407,000	22.2	88	325,647,000	279,285,000	17.4
	August	65	97,197,000	72,900,000	33.4	66	433,129,000	344,730,000	25.7	56	374,327,000	295,866,000	26.5	88	333,468,000	279,976,000	19.1
	September	65	98,350,000	73,343,000	34.2	66	446,534,000	369,815,000	20.8	56	387,626,000	307,485,000	26.2	88	335,817,000	288,332,000	16.4
	October	65	107,756,000	83,705,000	28.8	65	426,151,000	373,705,000	14.2	56	408,364,000	324,509,000	25.9	87	355,014,000	306,828,000	15.8
	November	65	111,873,000	89,015,000	25.7	65	533,252,000	424,746,000	25.6	56	415,491,000	334,044,000	24.4	87	346,847,000	293,518,000	18.2
	December	65	117,763,000	97,387,000	21.0	66	535,410,000	444,923,000	20.4	56	419,532,000	348,815,000	20.2	75	256,006,000	206,838,000	23.8
	1917		1917	1916			1917	1916			1917	1916			1917	1916	
	January	64	120,211,000	93,163,000	29.1	66	564,699,000	429,432,000	31.5	55	422,347,000	338,225,000	25.0	86	363,094,000	298,990,000	21.4
	February	63	106,328,000	84,992,000	25.3	65	416,714,000	240,724,000	22.0	40	225,318,000	194,125,000	16.1	74	264,319,000	215,399,000	22.9

With the exception of the Pacific Coast and Mountain States, the results from operation did not show up so well in February last compared with February, 1916, as they did in January last compared with January, 1916. Especially is this true for output, the increase in which, while large, was not so large as the January increase. However, the output for February, 1916, was especially large, and for that reason the comparison with February last would not make such a favorable showing. In addition, there was a slowing down in February of some of the major industries of the country which in previous months had been working at capacity rate. Many munition factories had completed contracts and had shut down temporarily. It is further noticed that in the zinc-mining region the output in February fell off considerably. In the copper-mining region there was a similar falling off, but here it was undoubtedly due to a large extent to weather conditions, which caused mining operations to be curtailed to a considerable extent.

Industrial operations had slowed down to a much greater extent than is evidenced by the figures for February. Besides those industries already mentioned other industries were affected by the labor situation, but principally by raw materials, the scarcity of which caused a lessening in production. That this condition is not more evidenced in the accompanying figures is undoubtedly due to the increased or new load that many plants have taken on. A shortage in coal brought to the central stations a large industrial load that otherwise would not have been on the lines, at least for some time.

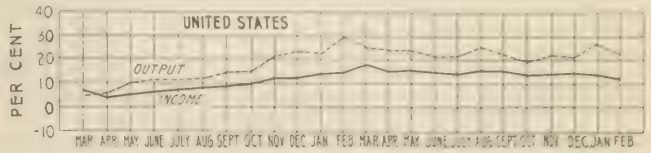


FIG. 1—CENTRAL STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT FOR UNITED STATES

Generally speaking, cities in the group having a population between 50,000 and 100,000 inhabitants showed the greatest increases in operations for February last over February, 1916. In the remainder of the country the increases from operations were approximately the same.

Decreases in rates which were put into effect in a number of cities at the beginning of the new year, of course, have tended to make the increase in February, 1917, over February, 1916, somewhat less in income than it would have been had rates remained the same.

Graphic Representation of Growth

The accompanying curves show graphically the percentages of increase in income and output as contained in Tables I and II. The remaining tables show the increases in per cent in income and output grouped in companies according to the size of the community served. Group 1 includes those companies operating in cities with a population of over 100,000 inhabitants; group 2 includes those companies operating in cities with a population between 50,000 and 100,000; group 3 in cities between 25,000 and 50,000; group 4 between 10,000 and 25,000, and group 5 between 5000 and 10,000 inhabitants.

TABLE V—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR ATLANTIC STATES—CITIES GROUPED BY SIZE

	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan	Feb.
INCOME:										
Group 1	14.5	16.4	16.8	16.1	16.2	10.7	13.7	18.8	15.0	13.0
Group 2	21.7	21.9	18.5	21.6	19.0	21.0	22.5	21.7	28.3	27.3
Group 3	17.7	12.0	14.2	15.0	14.0	14.6	13.0	13.4	12.5	10.4
Group 4	14.0	15.4	10.0	14.4	9.8	13.5	13.1	14.4	14.0	11.0
Group 5	13.0	15.2	13.0	19.4	8.9	14.3	16.0	14.3	11.1	11.8
OUTPUT:										
Group 1	25.5	13.1	23.4	28.5	23.6	19.2	20.8	21.5	32.5	22.0
Group 2	11.3	31.8	27.4	32.5	26.7	33.0	31.9	28.2	42.6	31.2
Group 3	18.0	13.2	11.5	16.0	24.7	4.5	19.0	15.9	27.2	21.2
Group 4	12.6	19.7	16.3	29.5	18.6	17.5	14.6	16.0	25.4	17.0
Group 5	35.0	11.1	13.5	20.4	1.3	1.5	5.8	6.9	9.4	17.0

TABLE VI—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR CENTRAL STATES—CITIES GROUPED BY SIZE

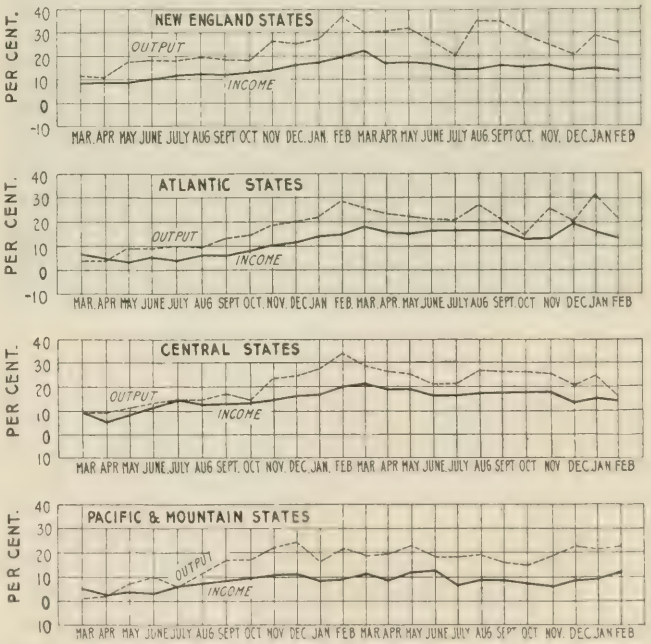
	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.
INCOME:										
Group 1	18.0	16.4	15.8	16.5	16.6	18.0	16.5	13.0	15.5	14.0
Group 2	17.4	17.5	17.3	21.8	21.5	21.0	17.0	16.4	18.0	18.7
Group 3	27.2	20.5	18.6	18.4	13.4	10.9	13.0	1.8	6.0	0.5
Group 4	24.1	17.5	17.5	10.7	20.0	19.7	16.8	15.5	19.8	19.6
Group 5	21.3	12.6	6.1	11.8	11.0	18.4	14.3	†	19.3	16.7
OUTPUT:										
Group 1	25.0	23.8	21.0	24.3	22.3	24.9	24.8	22.3	25.3	22.7
Group 2	19.5	12.3	25.7	36.4	40.0	31.7	29.7	21.0	31.0	23.6
Group 3	41.0	31.8	26.0	25.7	20.7	17.3	19.7	1.2	5.8	30.0*
Group 4	38.5	34.3	21.1	23.0	33.8	26.1	21.2	21.4	24.5	23.2
Group 5	14.7	4.0	8.6	6.1	13.7	28.2	16.8	9.9	15.5	17.1

*Decrease.
†Results omitted owing to insufficient returns.

TABLE VII—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR PACIFIC AND MOUNTAIN STATES—CITIES GROUPED ACCORDING TO SIZE

	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan	Feb.
INCOME:										
Group 1	7.2	7.5	4.7	5.5	6.2	4.2	4.5	4.0	5.4	10.0
Group 2	2.3	1.2	0.6*	0.7	4.9	1.3	3.0	3.6	7.5	5.5
Group 3	39.0	39.5	28.3	32.5	28.5	32.4	31.0	30.0	27.6	23.5
Group 4	13.8	3.6	1.0	0.5	11.5	7.2	0.4	0.6*	8.6	1.8
Group 5	19.1	12.8	13.2	13.0	11.7	13.5	17.1	11.1	20.3	13.0
OUTPUT:										
Group 1	12.0	8.0	10.0	6.3	7.1	5.2	8.0	8.6	11.0	17.8
Group 2	2.2	1.0	2.0	6.5	7.8	9.7	11.4	8.7	11.8	16.2
Group 3	79.0	74.5	56.1	57.5	60.0	63.7	61.3	48.0	59.5	36.8
Group 4	21.8	10.0	4.0	7.5	12.0	*0.5	4.2	2.6	15.2	14.0
Group 5	17.5	16.0	10.8	16.5	7.0	14.7	42.3	5.4	19.1	8.0

*Decrease.



FIGS. 2 TO 5—CENTRAL STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT SECTIONALLY

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

COMPACT OUTDOOR SUBSTATION

Transforming, Switching, Metering and Protective Equipment Serving Ohio Industrial Plant

Shown in the accompanying illustration is an outdoor transformer station which is particularly well equipped, arranged and protected for an industrial plant station. It serves the Godman Shoe Company, Lancaster, Ohio,



TWO 500-KW. THREE-PHASE TRANSFORMERS AND METERING AND PROTECTIVE EQUIPMENT FOR SMALL FACTORY SUBSTATION

and is on the lines of the Ohio Light & Power Company. The station consists of two General Electric Company 500-kw., three-phase, 60-cycle, 2300/440-volt, oil-cooled transformers on concrete foundations, and two 50-kw. and one 75-kw. unit behind the units in the foreground of the picture. These units, with the poles which support the wiring, the metering devices and protective equipment, are located outside the plant of the shoe company in a 14-ft. by 30-ft. (4.3-m. by 9.1-m.) space between the buildings. This outside location was chosen because it was not valuable for other purposes and because it was considered safer not to take the higher potential into the factory building.

The primary leads to the station are taken from an adjacent power circuit. These leads are supported on strain insulators rather than pin-type insulators, because it is the practice of this company to dead-end primary lines on strain insulators rather than on wood pins, owing to the fact that pins as a rule rot out in a short time and this method makes a safer and more lasting installation. The leads then pass through a type P-7 General Electric oil switch, by means of which the entire installation can be disconnected from the lines. From this switch the primary leads drop to a three-wire bus stretched between the top arm of the short pole and the third arm of the high pole. Connections between the primary leads of each 500-kw. transformer and this bus are made through two P-7 oil switches, so that either unit can be "killed" under load without affecting the operation of the other. Expulsion-type fuses are also installed in the primary leads just ahead of these two oil switches to afford protection against lightning and short-circuits on the lines. The secondary leads are arranged in a sightly fashion by placing two secondary cable buses between the wall and a stub pole and then dropping from these buses to the conduit entrance with the heavy secondary lines.

This installation is metered both on the high-tension and low-tension side. The customer pays for energy metered on the secondary side. But in order to secure accurate comparative data on high-tension and low-tension metering, the company has installed potential and current transformers in the roofed box near the top of the high pole and meters the energy also on the high-tension side. A watt-hour meter and a maximum-demand meter used for this service are installed in a box just behind the transformers at a height which makes it convenient for a man to look into the box. The leads from the current transformers to the meters are inclosed in conduit.

DUSTING OF CONCRETE

Objection in Power Plants—Contributing Causes and How Floors in Service May Be Treated

Freedom from dust, especially dust of a coarse, gritty nature, is desirable around any air-cooled apparatus, but is almost imperative where rotating machines are installed. Dusting of concrete floors is frequently a great source of trouble. Usually it is caused by too fine, dirty or otherwise unsuitable sand in the concrete; by too little cement in the mixture; by too much time being allowed to elapse between mixing and finishing; by troweling to finish while too wet or troweling at several intervals after hardening has commenced, and thus breaking up the process of crystallization of the cement in setting; by the use of dryers; and finally, by permitting the surface to dry out too rapidly after completion.

Floors that are already in service and are giving trouble from dusting can be treated by one of several methods to remove the defect, although such treatments, being in the nature of surface applications, may require renewing from time to time as a result of wear. One palliative treatment that has been used with consid-

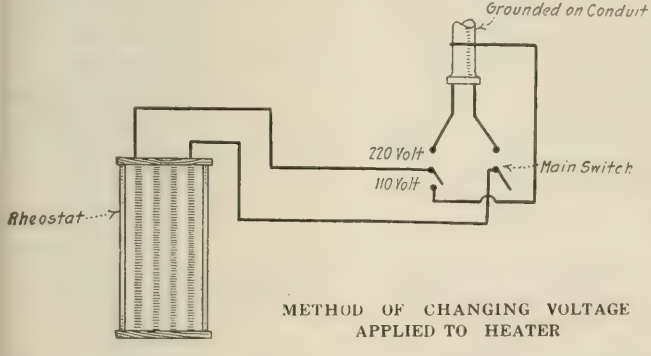
erable success consists of a mixture of turpentine and boiled linseed oil, combined in such proportions as readily to be absorbed by the floor surface. This preparation, however, is suited only to old or thoroughly cured concrete, and will somewhat darken the color of the floor. Several paint manufacturers have brought out, under such names as "floor surfacers" and "floor fillers," paints that temporarily suppress dusting, but such applications also will need renewal from time to time as the surface wears off.

CONSTRUCTION OF HEATER FOR SUBSTATION OFFICE

Heater Made from Telegraph Wire and Switching Arrangements for Operating It at Either of Two Voltages

Electrical energy has superseded steam heating at the Plum Street substation of the Cumberland County Power & Light Company, Portland, Me. A home-made heater is used in the office. It consists of helicos of No. 13 galvanized-iron telegraph wire stretched between two 8-in. (20.3-cm.) by 12-in. (30.5-cm.) slate slabs held 30 in. (91.4 cm.) apart by ½-in. (12.7-mm.) pipe spacers mounted on ¼-in. (6.4-mm.) rods. At 220 volts the heater requires 25 amp.,* but in mild weather it is operated at 110 volts, changes in the connections being permitted by the switching arrangements shown in the accompanying sketch. A double-throw, single-pole switch enables the transfer from one voltage to the other to be made readily.

The heater, it has been ascertained, effectively warms



METHOD OF CHANGING VOLTAGE APPLIED TO HEATER

an office 20 ft. 6 in. (6.25 m.) long, 12 ft. 6 in. (3.81 m.) wide and 14 ft. (4.27 m.) high, with three windows and a northeasterly exposure.

Method of Fusing Transformers

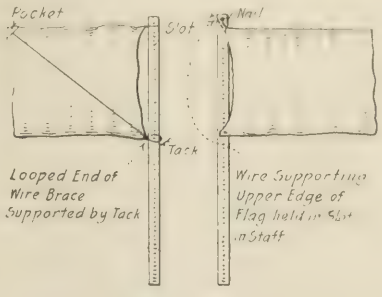
An unusual method of fusing 2300-volt pole-type transformers has been devised by W. T. Wells, superintendent of the Kingsport (Tenn.) Light & Power Company. In the fuse block which is at the lineman's right hand when he climbs the pole on the side opposite the transformer is placed a fuse which is slightly smaller than the other or others, as the case may be. As most fuses are blown by small overloads, only the lower-rated fuse is ruptured with this arrangement. Thus it is unnecessary for a lineman to test both fuses where restoring service, and considerable time is saved.

*Safe carrying capacity of No. 13 iron wire is 12.5 amp.

DANGER SIGNALS

Two Methods of Making Warning Flags Conspicuous —Both Methods Involve Wire Brace

Instead of tacking red flags to staffs, one large Middle West central station company attaches each flag to a wire and then attaches the wire to the staff. The method of fastening the wire to the flagstaff is shown on the left of the accompanying illustration. A slit is sawn longitudinally in the top of the staff and an eye in the wire is held in the slit by means of a stove bolt. The wire is then bent so that it forms a self-supporting arm when extended in one direction from the staff and lies longitudinally along the staff when it is thrown over in the other direction. With this arrangement a flag can be made to remain fully extended when in use and for transportation can be packed into practically as small space as an ordinary flag.



METHODS OF HOLDING WARNING FLAGS EXTENDED

A different method of extending warning flags, used by an Eastern company, is also illustrated herewith. In this case the flag is tacked to the staff, but is held extended by a wire looped around the staff near the lower fixed corner of the flag and projecting diagonally across the flag to the outer upper corner where it fits into a pocket in the flag. The lower end of the wire brace is prevented from sliding down the staff by a tack. This flag can also be rolled up when desired by folding the wire brace up against the staff.

HIGH-TENSION OUTDOOR METERING

Method of Protecting Apparatus Used for This Service from Weather and Temperature Changes

BY ADRIAN TOBIAS

Superintendent Meter Department, Mahoning & Shenango Railway & Light Company, Youngstown, Ohio.

During the past few years distribution of electrical energy to large power users at high voltages and over long distances has become the rule. The greater portion of this energy is measured on the high-tension side of distributing transformers and on a demand basis. Furthermore, the drift of modern distribution engineering is decidedly toward completely operated outdoor substations. This arrangement presumes the location of necessary current and potential transformers, including demand apparatus and possibly a power-factor meter in an outdoor location. But simply to make use of instrument transformers designed for outdoor use and then house the demand meter in an ordinary weatherproof box will not accomplish the results desired under extreme weather conditions. This is particularly true just now when there are from six to ten torsion springs, several contact surfaces and a complicated gear mechanism evident in demand devices in use. All of these parts are susceptible to variations in temperature, which will seriously affect the indications of demand.

In Youngstown, Ohio, we are attempting, therefore, to solve the problem of protecting demand meters and controlling temperature variation by providing specially constructed outdoor boxes. They are made of 1-in. (2.54-cm.) lumber in the rough, then covered with heavy tarred felt paper. Over the paper is laid 3-in. (7.62-cm.) straight-grained, yellow-pine flooring. The door is made like a refrigerator or cold-storage door, by extending the flooring for about 1 in. (2.54 cm.) over the dimensions of the rough door. For installations up to 400 kw. inside measurements should be about 30 in. by 36 in. (76.2 cm. by 91.4 cm.) with a depth of 10 in. (25.4 cm.).

Inside the box current transformers are mounted at the top and on each side with the two potential transformers between them. Porcelain tubes are used for the lead-in wires. The demand meter is mounted at the bottom of the box. To provide ventilation, two holes, 2.5 in. (6.35 cm.) in diameter, are made in both sides of the box near the top; two holes of the same dimensions are also made in the bottom of the box on either side of the demand meter. These holes are covered with screen cloth on the outside. Two-inch (5.08-cm.) galvanized sheet-iron louvers keep the rain out of the ventilating holes at the top.

In cold weather all or part of the openings are closed, thus making use of the heat given off by the transformers in keeping up the temperature on the inside of the box. Heat given off from transformers is not sufficient for this purpose, however, when the outside temperature falls much below freezing. For extreme weather conditions a 25-watt frosted lamp is inserted on the secondary of each potential transformer. One or both of these lamps are backed out of sockets as weather moderates. By increasing the size of the box to 30 in. by 48 in. by 10 in. (76.2 cm. by 121.9 cm. by 25.4 cm.) sufficient equipment to take care of a 2000-kw. load, including a power-factor meter, can be easily provided for.

COST OF OPERATING PRODUCER-GAS PLANT

Output Amounting to 133,314 Kw.-hr. Yearly Produced at Cost of 4.6 Cents per Kw.-hr. in South Dakota Plant

As an example of the cost of furnishing electric service from a producer-gas-engine plant in a town of 1500 people, the following data were recently submitted by Earl D. Jackson, consulting engineer, St. Paul, Minn. The installation, which is at Elk Point, S. D., consists of two Smith gas producers and two 50-kw. Foos gas engines. For the year 1916 the total output of the plant was 133,314 kw.-hr. The station expenses were as follows:

COST OF OPERATION IN PRODUCER-GAS PLANT

Coal	$1,131.07
Salaries, two operators and one-half superintendent's time	2,200.00
Insurance	73.00
Lubricating oil	121.60
Gasoline	65.10
Repairs, tools, waste, etc.	349.66
Interest at 5 per cent on station investment	1,000.00
Depreciation at 6 per cent	1,200.00
Total	$6,140.43
Cost per kilowatt hour (cents)	4.6

COST OF TREATING POLES

Data on Butt Treatment of Wooden Poles by Open-Tank Process and Added Life Gained Thereby

According to A. B. Campbell of Ames, Iowa, open-tank treatments of wooden poles have been found more expensive than the brush methods, but it should be kept in mind that a deeper penetration is secured when poles receive these treatments. One operating company reports the cost of treating by the open-tank process with semi-portable equipment at 75 cents per pole. In this case the butts are submerged in hot carbolineum twenty to thirty minutes and then dipped in cold carbolineum for two minutes. The tank in which the hot treatment is given is 5 ft. (1.5 m.) in diameter and 9 ft. (2.7 m.) high. Ten poles are treated at one time. The cold treatment is given in a tank 3 ft (0.9 m.) in diameter and 9 ft. (2.7 m.) high. Each pole is given the cold treatment separately. The poles are distributed by the use of auto trucks.

TABLE I—COST OF BUTT-TREATING WOODEN POLES WITH OPEN-TANK METHOD

	Size of Pole						
Top (in.)	4	5	6	6	7	6	7
Length (ft.)	20	25	25	30	30	35	35
Price of pole f.o.b. common points in Iowa and Illinois rate of freight	$0.90	$1.28	$2.25	$3.90	$5.35	$5.85	$9.15
Cost of putting in line including shaving, but exclusive of painting and stepping	0.72	1.54	1.54	2.17	2.17	3.38	3.38
Total cost in line	$1.62	$2.82	$3.79	$6.07	$7.52	$9.23	$12.53
Using U. S. average twelve years' life. Per annum cost of pole in line	0.135	0.235	0.315	0.505	0.626	0.769	1.04
Cost of butt treatment according to specification A	0.45	0.55	0.90	1.10	1.25	1.35	1.50
Cost of butt treatment according to specification AA	0.35	0.40	0.70	0.85	1.00	1.05	1.20
Cost of butt treatment according to specification B	...	...	1.30	1.85	1.95	2.05	2.35
	Number of years added life necessary to pay entire cost of treatment						
Specification A	3.30	2.34	2.85	2.17	2.00	1.75	1.44
Specification AA	2.59	1.70	2.27	1.68	1.60	1.36	1.15
Specification B	...	...	4.12	3.70	3.12	2.66	2.26

Table I, issued by the Page & Hill Company of Minneapolis, shows the cost of Northern white cedar poles, cost of butt treatment by open-tank process, annual maintenance expense of poles in line, and number of years added life necessary to pay entire cost of treatment. The prices given are f.o.b. Iowa and Illinois common points. No specific data are available as to the number of years which may be added to the life of poles through treating, but reports on inspections made on the Warren-Buffalo and Newton-Poughkeepsie lines of the American Telephone & Telegraph Company are summarized in Table II.

TABLE II—EFFECT OF BUTT TREATMENT ON LIFE OF POLES*

Method of Treatment	Reduction in Circumference at Ground Line After Five Years of Service	Average Percentage of Poles Showing Decay After Eight Years of Service
Tank treated with creosote	Not noticeable	1.5
Tank treated with zinc chloride	.....	59
Brush treated with creosote	0.06 inch	45
Brush treated with carbolineum	0.09 inch	47
Untreated	1.03 inch	100

*Information obtained from the Page & Hill Company, Minneapolis.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

JUSTIFICATION FOR THE ELECTRIC COOKING RATE

Why Electric Range Customers Can Obtain Energy at a Lower Unit Price Than Small Power Users

The question "How shall we justify an electric range rate that gives residence customers energy at a lower unit price than small power users?" was asked at the recent Minnesota Electrical Association's convention. The manager who asked the question stated that he had plenty of plant capacity available and that he was able to produce energy at a cost which would justify a 3-cent cooking rate, but that he hesitated to inaugurate such a rate for fear of its effect on the small power customers in view of his own inability to explain the justice of it.

The reply to the query was made by H. E. Young, sales manager of the Minneapolis General Electric Company, who said: "The reason the electric range load can be served at a lower unit cost than the small power load is that it costs the producer less for the former service. Under the conditions specified the generating capacity, a large part of the distribution system and perhaps even the meter necessary for serving the range installation are already a part of the existing permanent investment. The chances are also that the prospective range customer is now a lighting customer, and the addition of the range in the home will not increase the existing consumer costs. This is not true of the small power customer as a rule. Moreover, the load produced by the small power customer is probably an on-peak load, whereas it has been demonstrated that the electric range load is coincident with the system peak only 10 per cent of the time."

THE COMMONWEALTH EDISON CONTEMPLATES SALES SCHOOL

To Instruct Salespeople in Manufacture and Operation of Appliances, in Sales Methods, and General Company Policies

In a discussion presented by Ernest A. Edkins, general manager of the Electric Shops, before the new-business co-operation committee of the Illinois State Electric Association at Peoria, Ill., April 27, it was pointed out that, contingent upon the authorization of the plan by the company's executives, the Commonwealth Edison Company would inaugurate a school for its sales staff. This course of study will include lessons in construction and operation of appliances, in sales methods, in decorative periods and styles as applied to portable lamps, shades, etc., in interdepartmental relations and in general company policies.

The course will probably be carried on with daily classes, and every one in the sales department will be obliged to spend approximately one hour each day in these classes, which will be conducted along the same general lines as a regular school, with prescribed lessons and periodic examinations to determine the progress of the students. A similar plan is now about to be put into effect in the Baltimore (Md.) company, and both of these plans are directly in line with the other developments in commercial engineering and salesmanship courses now being carried on in the National Electric Light Association under the supervision of the Commercial Section.

"I firmly believe," said Mr. Edkins, "that such courses of study intelligently directed will very soon result in doubling the efficiency of the sales force and will pay big dividends on the modest investment required to carry on the course."

POOR UPKEEP THE PRACTICE AS REGARDS ELECTRIC SIGNS

Investigation Shows That Only 10 Per Cent of Signs Operated in One of the Larger Cities Had Every Socket Equipped with a Good Lamp

Electric signs all alight and with every lamp burning look well and speak for progress; but when a sign every here and there shows a few lamps not burning, then the effect is one of shabbiness and backwardness. Signs that by night look as though the mice had got into them and chewed out a part of a letter here and a chunk somewhere else are not assets to the owner and certainly do not help the central station in increasing its sign load.

An investigation recently conducted showed that of 200-odd electric signs which were investigated one-third were not being burned at all, and only about 10 per cent of those which were in operation had every socket equipped with a good lamp. A surprisingly large percentage of the owners apparently knew nothing about the poor condition of their signs.

The investigation covered a survey of practically all of the electric signs in one of the larger cities of the country, except those signs of large hotels, department stores, etc., whose lamp requirements were known to be covered by a lamp contract. In a total of 229 signs, over 30 per cent were entirely unlighted at night and about 47 per cent had six or more burned-out lamps. The owners in this last-named class were interviewed in an effort to have the necessary lamp renewals made, with the result that practically all decided to put in new lamps and many decided to repaint their signs at the same time. The renewals averaged sixteen lamps per sign. The results of this investigation may be taken generally as representative of conditions obtaining in the large cities; in smaller cities and towns it is doubtful if conditions are much better.

On one of the largest department stores in the East a few nights ago every sign—and this store has about ten electric signs—had one or more lamps out, and the

largest sign of all had one of its five letters entirely out. The largest sign in one of the oldest suburban cities outside of New York City, a sign that meets the eye of every person entering that town, never has all of its lamps burning. The effect of that sign on a prospective sign purchaser is certainly not encouraging.

There is an opportunity for much co-operation between central stations and sign owners. Electric signs are advertisements—if they are not good advertisements their use cannot be justified—and their value to their owners is dependent upon the impression they give to the passerby. The average store manager is very willing to take steps to renew lamps and have his sign put in order if his attention is called to the advantages and necessity for so doing—the investigation strongly confirms this statement. The trouble most often lies in the fact that few owners or managers view their signs at night. The revenue of the central station would be increased on a very desirable class of long-hour business were an effort made to have every socket in every sign equipped with a good lamp and the sign used consistently.

Besides, there is another point of view that the central station should not lose sight of. Operating expenses have reached such a point that it is absolutely necessary to increase output. The sign load is by no means insignificant, and as a matter of good economy it would seem advisable to get the maximum output from this load. The loss in revenue from signs that are not burning, or burning in part only, amounts to a considerable sum in the course of a year. As a means therefore of increasing revenue without increasing generating capacity it would be to the best interests of central stations to see that all signs burn every night and that every socket is in nightly operation.

THE PUBLIC SERVICE MAN IN CIVIC LIFE

What One Ohio Sales Manager Thinks About the Advantages That Accrue to the Utility Which Has Its Executives in Prominent Local Circles

At one of the meetings of the new-business men of the Ohio Electric Light Association O. A. Acuff, sales manager of the Massillon (Ohio) Electric & Gas Company, presented a brief discussion expressing his belief that every salesman should interest himself in the civic life of his city. At the request of a representative of the ELECTRICAL WORLD, Mr. Acuff elaborated on that idea more fully in a letter setting forth what has been accomplished along this line at Massillon. This letter contains so much food for thought on the part of the utility manager who is inactive locally that it is published practically in full herewith.

"Without wishing to appear egotistical," writes Mr. Acuff, "I may point out that the writer is president of the Massillon Advertising Club, vice-president of the Rotary Club of Massillon, chairman of the advertising committee of the Chamber of Commerce, and a member of the executive committee of Massillon's annual industrial show. T. O. Kennedy, general manager of the Massillon Electric & Gas Company, is a director of the Chamber of Commerce, a member of the industrial show's executive committee, secretary of the Massillon Club and chairman of the new industries committee of the Chamber of Commerce. This shows to what extent we believe it is necessary to be leaders in an active community.

"The Massillon Advertising Club is composed mostly of retail merchants. The president of this club necessarily represents a retail establishment. The average central station organization is considered a soulless body of men whose sole object is to extract dollars from a community. The general public does not recognize it as a retailer, or a business institution doing a legitimate retail business, unless it is proved to them that it is such. The general public is 'from Missouri.' We have succeeded here in proving to the majority of Massillon citizens that the Massillon Electric & Gas Company is an Ohio corporation, a Massillon taxpayer, a necessity to the community, and a retail establishment to which are due the respect and confidence of the people. We have made our public feel that our employees are folks with souls and folks who are Massillon boosters.

"The Massillon Rotary Club is a representative body of live business men who are doing things. It is, I believe, quite an honor to be an executive in this club. The Massillon Club is the manufacturers' club. This also is a select club and is too expensive for other than manufacturers who are at the top.

BUSINESS AND CIVIC CONNECTIONS COMPEL RECOGNITION

"The business and civic connections of our executives, therefore, compel recognition in the event that we who are active in this work conduct ourselves properly. The positions in these clubs or organizations have come unsolicited. The individuals with this company have been elected by the members of these different organizations as their representatives. It has been said here that a man from the electric light company on the board of control of these clubs is a necessity, as it affords the club corporation ideas or viewpoints. The business men feel that the corporation view is the broader view.

"As the result of the efforts of the company's executives in these civic organizations, a condition has been created wherein a new industry locating in Massillon cannot do otherwise than buy power from the company. The industries here have had it drilled into them through contact that they cannot afford to operate a power plant.

PUBLIC ACTIVITY VALUABLE IN SECURING LIGHTING CONTRACT

"Our merchants have placed great confidence in us. They depend on us for support, and when we asked the city for a new ten-year street-lighting contract not a word was said against its being granted. In fact, our friends in the business section of the city petitioned the Council to grant us the contract without the consideration of other bids than our own.

"The citizens in general have come to know from acquaintance with us that we are human. They have learned to recognize that we have souls and have brains which produce constructive ideas. I believe our association with the civic and commercial bodies of Massillon should be credited with the company's wonderful increase in revenue last year, which amounted to 50 per cent.

"In addition to this it is certainly a pleasure to be able to walk the streets of this city as a representative of a two-million-dollar corporation and be called by

your first name and to receive a friendly slap on the back from the best people in the city—those who are really doing things."

FOUR AND A HALF YEARS OF BATTERY EXCHANGE

Detailed Figures Showing Monthly Operation of System at Hartford Since It Was First Started

Detailed figures showing the monthly operation since its beginning of the battery exchange system of the Hartford Electric Light Company are shown in the accompanying table. Further information concerning this system will be found in the April 28 issue of the ELECTRICAL WORLD, where it is fully described. The battery exchange system in Hartford began, it will be noted in the table, with eighteen cars in June, 1912, and in January, 1917, the latest month for which operating figures are obtainable, there were eighty-six cars using the exchange service. Since that time other cars have been added.

A careful study of the table will reveal that on the average 1.4 batteries are needed per car. It will also be noticed that the average of car miles per month was in the neighborhood of 6700. The lighter cars, however, had a better mileage record than the heavier cars. On the total mileage of the system, the highest month was October of last year, when 56,402 miles were run off. The energy consumption, however, was highest in December last, when this figure reached the total of 83,258 kw.-hr.

The energy consumption per car mile was between 1 kw.-hr. and 2 kw.-hr., while the energy consumption per rated ton-mile was on an average 1.3 kw.-hr. Early figures for energy consumption appear to present a discrepancy, but the reason for this was that some of the cars were formerly on a different system and it took some time to change over all the cars to the battery exchange system. For this time the records are not sufficiently clear.

MONTHLY OPERATING DETAILS OF HARTFORD BATTERY EXCHANGE SYSTEM

	Total Cars	Total Batteries	750-Lb.		1000-Lb.		2000-Lb.		2-Ton		3½-Ton		Car Miles per Month						Total Miles	Kw.-hr. per Month	Kw.-hr. per Car Mile	Kw.-hr. per Rated Ton Mile
			Trucks	Batteries	Trucks	Batteries	Trucks	Batteries	Trucks	Batteries	Trucks	Batteries	Total	750-Lb.	1000-Lb.	2000-Lb.	2-Ton	3½-Ton				
June 12	18	4	7	2	6	....	5	2	....	....	....	....	655	817	582	509		....	11,757	668	0.058	0.098
July 12	18	5	7	2	6	....	5	3	....	....	....	....	587	664	588	471	....	....	10,530	818	0.078	0.134
August 12	19	5	7	2	6	....	6	3	....	....	....	....	653	720	681	542	....	....	12,381	1,630	0.132	0.215
September 12	19	5	7	2	6	....	6	3	....	....	....	....	645	679	584	662	....	....	12,224	2,610	0.213	0.349
October 12	21	7	8	3	6	1	7	3	....	....	....	....	707	799	676	627	....	....	14,839	4,084	0.275	0.445
November 12	25	8	8	3	9	1	8	4	....	....	....	....	592	685	545	550	....	....	14,778	5,652	0.383	0.619
December 12	30	23	8	4	14	13	8	6	....	....	....	....	507	518	455	588	....	....	15,207	8,022	0.528	0.880
January 13	30	30	8	9	14	15	8	6	....	....	....	....	642	545	719	603	....	....	19,237	11,574	0.602	1.000
February 13	31	34	8	9	14	17	9	8	....	....	....	....	503	371	619	437	....	....	15,559	11,274	0.726	1.182
March 13	31	36	8	10	14	18	9	8	....	....	....	....	678	565	785	645	....	....	21,322	13,552	0.637	1.039
April 13	32	42	8	12	14	19	10	11	....	....	....	....	698	650	767	637	....	....	22,310	22,654	1.015	1.659
May 13	32	47	8	14	14	19	10	12	....	2	....	....	796	801	816	762	....	....	25,441	21,662	0.853	1.390
June 13	32	47	8	14	14	19	10	12	....	2	....	....	778	819	786	722	....	....	24,873	23,026	0.925	1.448
July 13	38	55	8	14	18	24	11	15	1	2	....	....	738	886	673	750	571	....	28,024	26,040	0.930	1.413
August 13	41	60	8	14	18	27	14	17	1	2	....	....	784	885	802	718	500	....	32,074	44,328	1.380	2.023
September 13	43	63	8	14	19	27	15	20	1	2	....	....	783	865	806	721	569	....	33,620	31,178	0.928	1.350
October 13	45	66	8	14	20	30	15	20	2	2	....	....	781	867	889	655	298	....	35,137	32,874	0.938	1.335
November 13	46	66	8	14	20	30	16	20	2	2	....	....	694	759	836	526	313	....	31,839	32,346	1.015	1.439
December 13	46	69	8	14	20	30	16	22	2	3	....	....	736	710	909	556	529	....	33,819	34,700	1.025	1.451
January 14	46	69	8	14	20	30	16	22	2	3	....	....	713	775	865	513	523	....	32,751	39,370	1.220	1.703
February 14	46	69	8	14	20	30	16	22	2	3	....	....	309	315	373	236	213	....	14,179	21,602	1.524	2.154
March 14	46	69	8	14	20	30	16	22	2	3	....	....	604	629	722	462	435	....	27,736	38,802	1.420	1.980
April 14	46	70	8	14	20	30	16	23	2	3	....	....	755	825	858	615	544	....	34,687	35,162	1.014	1.434
May 14	46	73	8	14	20	31	16	25	2	3	....	....	810	832	861	751	661	....	37,229	41,538	1.116	1.642
June 14	50	74	8	14	20	31	20	26	2	3	....	....	773	822	847	695	598	....	38,614	43,978	1.137	1.539
July 14	54	81	9	17	21	31	22	30	2	3	....	....	759	771	780	758	456	....	40,907	39,808	0.974	1.321
August 14	56	81	11	17	21	31	22	30	2	3	....	....	756	737	815	725	597	....	42,359	40,780	0.965	1.328
September 14	56	81	11	17	21	31	22	30	2	3	....	....	780	751	848	743	599	....	43,618	40,450	0.929	1.280
October 14	56	81	11	17	21	31	22	30	2	3	....	....	796	802	890	713	675	....	44,541	44,616	1.002	1.373
November 14	58	86	11	17	22	34	22	30	3	5	....	....	674	550	801	628	493	....	38,969	41,488	1.066	1.435
December 14	58	86	11	17	22	34	22	30	3	5	....	....	704	611	842	615	669	....	40,785	57,856	1.419	1.910
January 15	58	86	11	17	22	34	22	30	3	5	....	....	690	608	835	589	674	....	40,039	56,816	1.420	1.913
February 15	59	86	11	17	22	34	23	30	3	5	....	....	545	574	654	476	532	....	32,160	49,942	1.554	2.080
March 15	60	86	11	17	22	34	24	30	3	5	....	....	736	658	880	646	673	....	44,111	52,360	1.187	1.580
April 15	60	86	11	17	22	34	24	30	3	5	....	....	754	645	863	711	672	....	45,161	49,806	1.103	1.469
May 15	62	89	11	17	22	34	26	33	3	5	....	....	731	620	838	690	697	....	45,355	48,774	1.077	1.417
June 15	64	89	11	17	22	34	28	33	3	5	....	....	745	652	818	723	733	....	47,615	50,414	1.059	1.381
July 15	64	89	11	17	22	34	28	33	3	5	....	....	740	618	757	780	684	....	47,356	50,312	1.063	1.385
August 15	64	92	11	17	22	34	28	36	3	5	....	....	757	632	778	795	711	....	48,462	50,180	1.036	1.350
September 15	65	92	11	17	22	34	28	36	4	5	....	....	792	686	850	799	715	....	51,477	56,446	1.096	1.430
October 15	65	92	11	17	22	34	28	36	4	5	....	....	784	685	890	747	735	....	50,965	56,592	1.100	1.444
November 15	66	94	11	17	22	34	29	36	4	7	....	....	731	628	835	715	657	....	48,282	55,464	1.150	1.446
December 15	66	94	11	17	22	34	29	36	4	7	....	....	523	445	577	519	531	....	34,515	50,398	1.540	1.425
January 16	67	98	11	17	22	34	30	40	4	7	....	....	595	530	698	555	496	....	39,820	52,448	1.317	1.660
February 16	70	100	11	17	22	34	31	40	6	9	....	....	401	327	450	403	346	....	28,055	54,708	1.953	2.350
March 16	74	100	11	17	22	34	34	40	7	9	....	....	506	405	637	462	471	....	37,475	65,220	1.740	2.034
April 16	74	102	11	17	22	34	34	40	7	11	....	....	615	524	704	610	501	....	45,523	59,238	1.302	1.487
May 16	75	105	11	17	22	34	34	42	8	12	....	....	653	625	749	715	527	....	51,854	62,852	1.211	1.394
June 16	77	105	11	17	22	34	36	42	8	12	....	....	678	602	734	697	541	....	52,155	62,684	1.200	1.380
July 16	77	105	11	17	22	34	36	42	8	12	....	....	685	556	714	726	594	....	52,705	49,510	0.940	1.077
August 16	78	105	11	17	22	34	36	42	9	12	....	....	720	716	697	766	627	....	56,052	55,836	0.996	1.125
September 16	78	106	11	17	22	34	36	42	9	13	....	....	695	634	715	696	724	....	54,255	55,526	1.025	1.154
October 16	82	112	11	17	22	34	36	42	9	13	4	6	688	592	735	735	669	316	56,402	63,294	1.123	1.107
November 16	84	112	11	17	22	34	36	42	11	13	4	6	625	578	685	649	495	581	52,498	68,752	1.310	1.261
December 16	84	119	11	17	22	34	36	45	11	16	4	7	573	535	630	592	459	493	48,044	83,258	1.735	1.673
January 17	86	119	11	17	22	34	38	45	11	16	4	7	560	529	625	566	460	491	48,135	74,490	1.549	1.490

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

IMPEDANCE OF STEEL RAILS

A Summary of Recent Research Work in Electrical Engineering at the Massachusetts Institute of Technology

IN THE design and operation of alternating-current traction systems in which rails are used as electrical conductors, accurate knowledge of rail impedance is of no little importance. In order to add to this knowledge, the research division of the electrical engineering department of the Massachusetts Institute of Technology has conducted a research to determine, by direct measurement, the impedance offered to alternating currents by standard steel rails of various shapes and sizes, and also to ascertain how this impedance varies with frequency and with current strength. Furthermore, it was desired to find, if possible, a simple theory by means of which the rail impedance can be calculated from physical data concerning the steel used in the rails and from the dimensions of the rails.

The rails employed in the tests were furnished through the courtesy of two steel rail manufacturing companies. The samples tested were of standard length, 33 ft. (10.07 m.), and ranged in weight from 60 lb. to 100 lb. per yd. (30 kg. to 50 kg. per m.). Of the thirteen rails tested, eleven were track rails, while two were contact rails. Frequencies of 25 and 60 cycles per second were used in testing each rail sample. A few tests were also made at 45 cycles per second. The rail current strengths employed varied from 10 amp. to 800 amp. r.m.s.

In order to obtain the results desired, it was necessary to measure, in addition to the direct-current resistance, the alternating-current voltage drop and current in the rail and the phase angle between them. Four test methods were tried: (1) by astatic electro-dynamometer, (2) by oscillograph, (3) by alternating-current potentiometer, and (4) by a special form of laminated iron-core electro-dynamometer. Method (4) was found most satisfactory for these particular tests, method (3) also being employed in a few tests to check the results obtained by method (4). The direct-current resistance of the rails was measured, in the usual way, by direct-current potentiometer. During the tests special efforts were made (1) to duplicate practical railway conditions as nearly as possible in regard to positions of rail and return conductor, (2) to have an approximately sinusoidal current in the rail, (3) to eliminate errors of measurement arising from the change of rail temperature with change of current, and (4) to correct for the voltage induced in the potential leads by reason of the mutual inductance between potential circuit and rail circuit.

Some of the results obtained and conclusions reached are as follows:

The ratio of alternating-current resistance to direct-current resistance, called "resistance ratio," was found in practically all cases tested to reach a maximum value within the limits of rail current from 10 amp. to 800 amp. r.m.s. This maximum value of resistance ratio, at 25 cycles per second, was observed to vary between 5.3 and 10.1 for ten track rails and between 10.9 and 13.4 for two contact rails. For most rails the lowest observed value of resistance ratio of a sample was from 40 to 60 per cent lower than the maximum value for that sample at constant frequency, the reason for this large

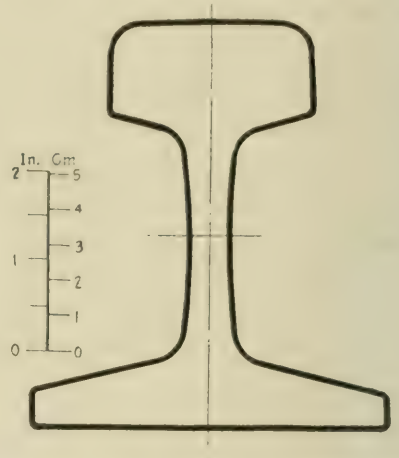


FIG. 1—EQUIVALENT SKIN DEPTH OF ALTERNATING-CURRENT PENETRATION OF STEEL RAIL

range of resistance ratio being the variation in the permeability of the steel at the various flux densities corresponding to different strengths of rail current.

The equivalent skin depth of alternating-current penetration—defined as the thickness of uniform rail skin which would offer the same resistance to a direct current as the entire section offers to an alternating current—was found, by calculation from the experimental results, to be 1.5 mm. (1.16 in.) for a typical rail, at 25.5 cycles per second and at maximum permeability. (See Fig. 1.)

The maximum observed skin-effect resistance ratio was found to vary substantially as the square root of the impressed frequency between the limits of 25 and 60 cycles per second.

The self-inductance of the rails was also found to increase, with increasing current, to reach and pass a maximum value, for current strengths up to 800 amp., the total change of inductance varying, for the different rail samples, from 15 to 30 per cent, approximately.

The rail inductance is greater at 25 cycles per second than at 60 cycles per second, but the rail reactance at 60 cycles per second is greater than that at 25 cycles per second.

From the experiments conducted, it would seem that the skin-effect resistance ratio of a rail to a given alternating-current frequency and current strength can be approximately calculated by a simple formula involving measured values of direct-current conductivity and permeability of the steel, the area of cross-section of the rail, the rail perimeter, and an experimentally deter-

mined factor to cover certain discrepancies. This factor appeared to be not more than 1.3 at the maximum skin-effect ratio.

The complete report on the investigation, entitled "Experimental Researches on the Skin Effect in Steel Rails," by A. E. Kennelly, F. H. Achard and A. S. Dana, is available as Research Bulletin No. 12 of the Electrical Engineering Department, Research Division of the Massachusetts Institute of Technology.

Generators, Motors and Transformers

Pressure Harmonics in Polyphase Systems and Windings.—B. HAGUE.—The continuation of this highly mathematical article. In the present installment the author discusses interlinking polyphase systems, dealing both with star-connected and mesh-connected systems. He then discusses the harmonics in symmetrical polyphase systems and the effect of interlinking on the harmonics.—London *Electrician*, March 23, 1917.

Efficiency of Electric Generators.—W. KUMMER.—In giving guarantees of electric generators the Swiss manufacturers generally adopt the method laid down by the Association of German Engineers for the determination of the "conventional efficiency" from a no-load test. This method has the defect of failing in the two important cases: (1) when the generators are to act as loading machines for the determination of the efficiency of prime movers, and (2) when the manufacturer of prime movers is in the position of having to guarantee the consumption of a prime mover per kilowatt-hour of electrical energy generated. The "conventional efficiency" may differ from the actual efficiency by as much as 8 per cent through changes of the losses in the machine with variation of load. These changes are particularly to be found in the iron losses. The article describes how these losses may be determined for three-phase alternators. If the resistance drop per phase is $E_r = Ir$ and the reactive drop per phase is $E_s = Ix$, it

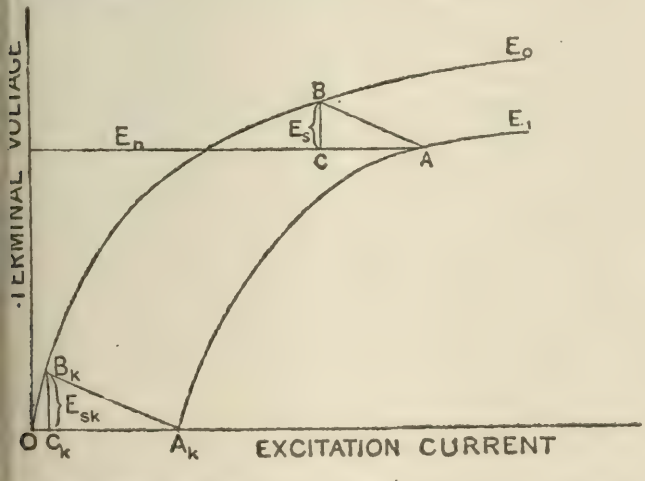


FIG. 2—CURVES SHOWING NO-LOAD AND LOAD TEST AT NORMAL CURRENT

necessary to note that r and x are not really constants, but vary with the load. If a no-load, short-circuit test at normal current and a load test at normal current and cos $\phi = 0$ are taken, the curves in Fig. 2 may be drawn. The no-load curve E_o may be obtained by driving the machine as a generator or by running as a synchronous motor at various voltages and excitation for minimum armature current. The short-circuit test gives the point A_k, and the point B_k may, in the case of Y-connected machines, be measured between the neutral point and one phase. The load curve E_l is obtainable by driving the machine at cos $\phi = 0$ as an over-excited synchronous motor. $E_{sk} = B_kC_k$ is the value of E_s at short-circuit, and A_kC_k represents the armature back-ampere-turns at normal current. At normal voltage E_r we have $AC = A_kC_k$ and $BC = E_s$, which differs for each voltage. To determine E_r and r the machine must be driven at short-circuit by a calibrated motor to determine the mechanical output; this is equal to E_rI per phase. For the load points the machine is run as a synchronous motor at cost $\phi = 0$, the input being measured by wattmeter and being taken as equal to E_rI per phase. The values obtained for under-excitation and over-excitation will not agree exactly with each other or with the short-circuit value, but the differences will not be great, and variations will also be found at different currents owing to the skin effect. It will generally suffice to take r as a constant as determined from the short-circuit test at normal current. Having determined E_s and E_r for different voltages, the corresponding internal voltage E_a may be deduced. For each value of E_a the iron losses may be determined by driving the unloaded machine by a calibrated motor and taking E_a = open-circuit voltage. In this manner a series of curves is obtained for the iron losses at various voltages and various currents. In some cases B_kC_k is not able to be directly determined, and then it is necessary to calculate A_kC_k as the armature back-ampere-turns. If the necessary data for this calculation are not available, but if the point A is known, AC may be obtained by the method given by Fischer-Hinnen.—From *Schweiz. Elektrot. Verein Bulletin*, Vol. VII, p. 273, October, 1916; abstracted in *Science Abstracts*, Section B, Feb. 26, 1917.

Traction

Booster Transformers in Single-Phase Lines.—CH. DACHARY.—The French railway company "du Midi" has carried out for several years an investigation of the influence of single-phase traction current on telegraph and telephone lines in the neighborhood. The author, who has been specially connected with this investigation, describes the use of booster transformers or sucking transformers ("transformateurs suceurs") on the line from Perpignan to Villefranche. The principle of the action of these booster transformers in forcing the return current into the rail or into the special return conductor is discussed with the aid of diagrams.—*Rev. Gen. d'Elec.*, March 3, 1917.

Electric Automobiles.—An account of part of the discussion which followed L. Broekman's recent paper on self-propelled electric vehicles and their applications in Great Britain, which was abstracted at some length recently in the Digest. T. B. Murray referred to experiments made twenty years ago in which the useful life of the batteries then available was less than three months, so that the electric automobile then proved a failure. The speaker said that "while the electrical vehicle would no doubt have a certain amount of scope in fairly level cities with decently paved streets, and for some purposes had undoubtedly outstanding merits, he was afraid that its sphere of action, in the meantime at least, was necessarily limited, even if one recognized the fact that it was bound to have influential sponsors and backers in the various electric light and power companies which had energy to sell." He claimed that electric automobiles have difficulty in climbing hills, and

he thought that until there was a prodigious improvement in the energy-weight equivalent of storage batteries the scope of the electrically driven motor car was bound to be limited. *Transactions*, Institute of Engineers and Shipbuilders in Scotland, Vol. IX, Part 4, February, 1917

Wires, Wiring and Conduits

Effect of Heat on Cotton and Paper.—L. SCHUELER.—A report of the "Testing Bureau of the German Government" on a new series of tests on the effect of temperature upon the mechanical strength of paper and yarn. If yarn is heated in oil to which air has access it gradually becomes disintegrated, probably owing to the formation of acids, which tend gradually to become asphalts. The yarn was therefore heated in oil contained in glass-stoppered vessels. Curves are given showing the way in which the mechanical strength falls off in the case of (1) cotton heated in air, (2) cotton heated in oil, and (3) cable paper heated in oil. At the end of a lengthened period, say of 100 days, the mechanical strength tends to reach a steady value. Curves are also given showing the value of this steady mechanical strength (expressed as a percentage of its initial value) as a variable dependent on the temperature. The main demand is made on the mechanical strength of the insulation during the act of winding; if the winding is successfully carried out, a lower mechanical strength will thereafter suffice. If this lower mechanical strength is taken as 40 per cent of its initial value, then the curves show that cotton heated in air can be subjected to a steady temperature of 102 deg. C., cotton heated in oil to 114 deg. C., and paper heated in oil to 125 deg. These temperatures are higher than those usually prescribed.—From *Elek. Zeit.*, Oct. 5, 1916, abstracted in *Science Abstracts*, Feb. 26, 1917.

Installations, Systems and Appliances

Small British Power Station.—E. M. LACEY.—An illustrated abstract of a paper read before the (British) Institution of Civil Engineers describing the new electric power station at Birchills, Walsall. It contains three generating sets, each of 4000 kw. The capital cost of the station comes out as low as $33 per kilowatt installed. This is thought to make out a strong case for the small station. "One of the objects of this paper is to show that a power station of 2000-kw. to 16,000-kw. rating can be so designed as to produce electricity at such a low cost that economy in production due to further increase of capacity is not as considerable as has frequently been assumed. While it may be admitted that the costs of production will decrease to a limited extent as the plant capacity of a station increases from, say, 12,000 kw. to 50,000 kw., yet in many cases which necessitate the transmission of electricity over more extensive areas in order to secure a larger demand such decrease in the costs of production would not be sufficient to balance the additional costs of the longer transmission system." In a long editorial on the subject this argument is contradicted, although it is admitted that the capital cost of $33 per kilowatt installed is very low. This compares with $55 per kilowatt for the large new power station of Manchester and the figures of $35 to $37.50 per kilowatt estimated by Klingenberg for very large power stations. The reasons of the low power cost at the Walsall station are discussed. "One item which undoubtedly leads to such a saving is the use of the combined boiler unit, consisting of a Babcock & Wilcox boiler with superheater, and its own economizer mounted on top, each such unit having its own small chimney shaft with induced draft. This arrangement not only leads to a saving in this part of the equipment, but it also means a considerable narrowing down of the width of the boiler house, with corresponding less cost. There is also a shortening of steam pipes. Further, there is no duplicate coal conveyor, which seems a doubtful economy where the bunker capacity is small, and one not leading to any great saving. The only other item making for cheapness in the present instance is the Reyrolle switchgear, which avoids the necessity of special buildings and the extensive work that becomes a necessity in the case of cellular construction. Lastly there seems to have been no large expenditure on the site." The author's "heresy" in favor of the small station is deprecated at a time in which there is such a tendency toward centralization of electricity supply. It is pointed out especially that the possible great improvement of the load factor due to enlarging a station is overlooked. Further, if anything is to be done in the carbonization of coal before it is used for power purposes, this will only become practicable with large power plants.—London *Electrician*, March 30, 1917.

Electrophysics and Magnetism

Magnetic Properties of Iron, Nickel and Cobalt Above the Curie Point, and Keesom's Theory of Magnetization.—EARLE M. TERRY.—An abstract of a paper read before the American Physical Society giving the final results of an investigation of the magnetic properties of iron, nickel and cobalt from the temperature at which ferro-magnetism disappears up through the melting point. The work has been carried out in a good vacuum, the high temperatures being obtained by means of a special tungsten furnace. The results show that Curie's law, $xT = \text{const}$, where x is the susceptibility and T the absolute temperature, holds in the case of nickel only, and here in but a restricted region. For beta iron, beta cobalt and beta nickel in the lower temperature region, the $1/xT$ curves all show a distinct concavity upward instead of being straight lines, as demanded by Curie's law. For gamma iron, the susceptibility varies only slightly with temperature, but the concavity of the xT curve is downward instead of upward, as required by the law. At the gamma-delta transformation point an increase in x of approximately 50 per cent occurs above which the xT curve is a straight line with a large negative slope. In passing through the melting point the susceptibility for iron decreases rapidly, while for nickel there is no change whatever, but for cobalt the xT curve shows a slight depression. These results are in marked contrast to those of Weiss and Foëx, who found Curie's law to hold in all cases. Keesom's quantum theory of magnetization, including the assumption of a zero-point energy, gives xT curves of the same general character as those obtained by the author, but they depart from the asymptote less rapidly than required by experiment. An attempt has been made to obtain a better fit by modifying the theory by the assumption of a larger zero-point energy, but it has been found that even when the latter is taken twenty times that of the theory the agreement with experiment is still unsatisfactory.—*Phys. Review*, March, 1917.

Readers' Views and Comments

Part-Slot Fractional-Pitch Windings

To the Editor of ELECTRICAL WORLD:

Sir: I read with much interest the article under this heading by Theodore Schou which appeared in your issues of March 17 and April 21, and should like to contribute a little information which may be of assistance to those interested in this subject.

On page 500 Mr. Schou states: "As mentioned before, 'chording,' or applying a fractional pitch winding, may tend to improve the wave form, and a winding having a throw of about 83 per cent of the pitch or a chord factor of 0.966 seems to have the tendency, in case of star connection, to reduce the larger higher harmonic to a minimum."

As a matter of fact, the use of any reasonable fractional pitch winding not only may but *does* improve the wave form in every case although the particular harmonics effected depend upon the degree of pitch reduction. The amount by which any particular pitch reduction reduces any particular harmonic may be very simply computed. This has been done and the results published first in a paper by the writer, entitled "Split Pole Synchronous Converters," in the *Transactions* of the A. I. E. E., June, 1908, and later in a paper entitled, "Electromotive Force Wave Shape in Alternators." A. I. E. E., July, 1909, and also in the fourth edition of the Standard Handbook for Electrical Engineers, Section 7, page 453. The method is explained in both of the above-mentioned papers.

A glance at the curves referred to in the Standard Handbook will show that the 83 per cent pitch mentioned in Mr. Schou's article reduces the fifth and seventh harmonics to about 26 per cent of the value which they would have in the full-pitch winding, but that it does not affect the eleventh and thirteenth harmonics. From these same pitch-differential-factor curves and Mr. Schou's harmonic analysis of the field form given in Fig. 11 of his article, the amount by which any of the harmonics are reduced by any one of the pitch reductions given may be readily obtained; also whether or not the harmonics are reversed is clearly shown. In other words, it is quite unnecessary to go through the very tedious process indicated in Mr. Schou's paper to determine the effect of any particular pitch reduction upon the emf. wave.

A very important advantage of "chording" in high-speed machines, (not mentioned by Mr. Schou) is the reduction in over-all length of the machine. This is particularly the case in two-pole machines, where a full pitch winding is practically out of the question.

Coming now to the question of the fractional number of slots per pole per phase, it is a very simple matter to state the effect of this change upon the wave shape, in terms of an equivalent integral number of slots per pole per phase. For example: one and a quarter slots per pole per phase, with a normal balanced winding, is, as far as wave shape is concerned, exactly equivalent to five slots per pole per phase; or, in general, if the fractional number be expressed in the form, $a + (b \div c)$ where b and c have no common divisor greater than unity, the equivalent number of slots per belt is $ac + b$. With this understanding, the belt differential factor, or, as Mr. Schou calls it, the spread factor, may be readily computed for both the fundamental and the harmonics. This is given in the tables of the two above-mentioned articles as well as in the Standard Handbook for Electrical Engineers. These latter tables show the exact percentage to which the various harmonics are reduced in the emf. wave by the belt differential action.

By multiplying together the belt differential factor and the pitch differential factor for any particular harmonic the total differential factor for this harmonic is obtained. It is thus quite unnecessary even to plot the resulting emf. curve, since it is completely described in its most useful form when the harmonics are stated in terms of the fundamental.

It should be noted in connection with part-slot windings for polyphase machines that that scheme of connections which gives an exact balance in magnitude, wave shape and phase difference is not always so obvious as it might seem, and considerable care must be employed in laying it out.

About two years ago A. A. Prior—at that time one of the writer's assistants—designed a double inductor alternator with ninety slots in each stator, with seventeen pairs of poles on one side and nineteen pairs of poles on the other side of the rotor, giving at 3600 r.p.m. frequencies corresponding to the seventeenth and nineteenth harmonics of a sixty-cycle system. It will be observed that this machine has less than one slot per pole per phase in both stators. It has a capacity of about 30 kva. and has now been in use for some time in connection with a research on core-loss analysis. Its wave shape at no load is practically sinusoidal as far as can be detected by ordinary means.

It will be noted that in each stator the winding is equivalent to fifteen slots per pole per phase. The coil pitch or throw in each stator is two slots, which corresponds to a pitch of 0.755 in one and 0.843 in the other. By applying the belt differential factor corresponding to a three-phase machine with fifteen slots per pole per phase, and the pitch differential factors corresponding to the above given pitches, the percentages by which the various harmonics are reduced from their values in the field form are readily obtained from the tables and curves above mentioned, and it will be found that the total reduction or differential factors for practically all of the harmonics are such that with any reasonable field form, the emf. wave form, with Y connection of the phases, will be practically sinusoidal, even under considerable distortion of the field form by armature reaction.

At the time the above alternator was designed a systematic scheme was developed by Mr. Prior for the laying out of the connections for the three phases in such a way as to insure balance in magnitude and wave shape and symmetry in phase displacement. This scheme will probably be published by Mr. Prior.

C. A. ADAMS.

Massachusetts Institute of Technology, Cambridge, Mass.

Clearing Up a Possible Misapprehension

To the Editor of ELECTRICAL WORLD:

SIR: In your issue of April 7, 1917, there appeared an article prepared by the writer under the title "Poor Lighting Promotes Public Ownership" that had for its object to point out the necessity for greater care on the part of central stations generally to see to it that their customers are educated up to the proper use of light, so that poor lighting shall not serve as an argument for replacing central station service with municipal service.

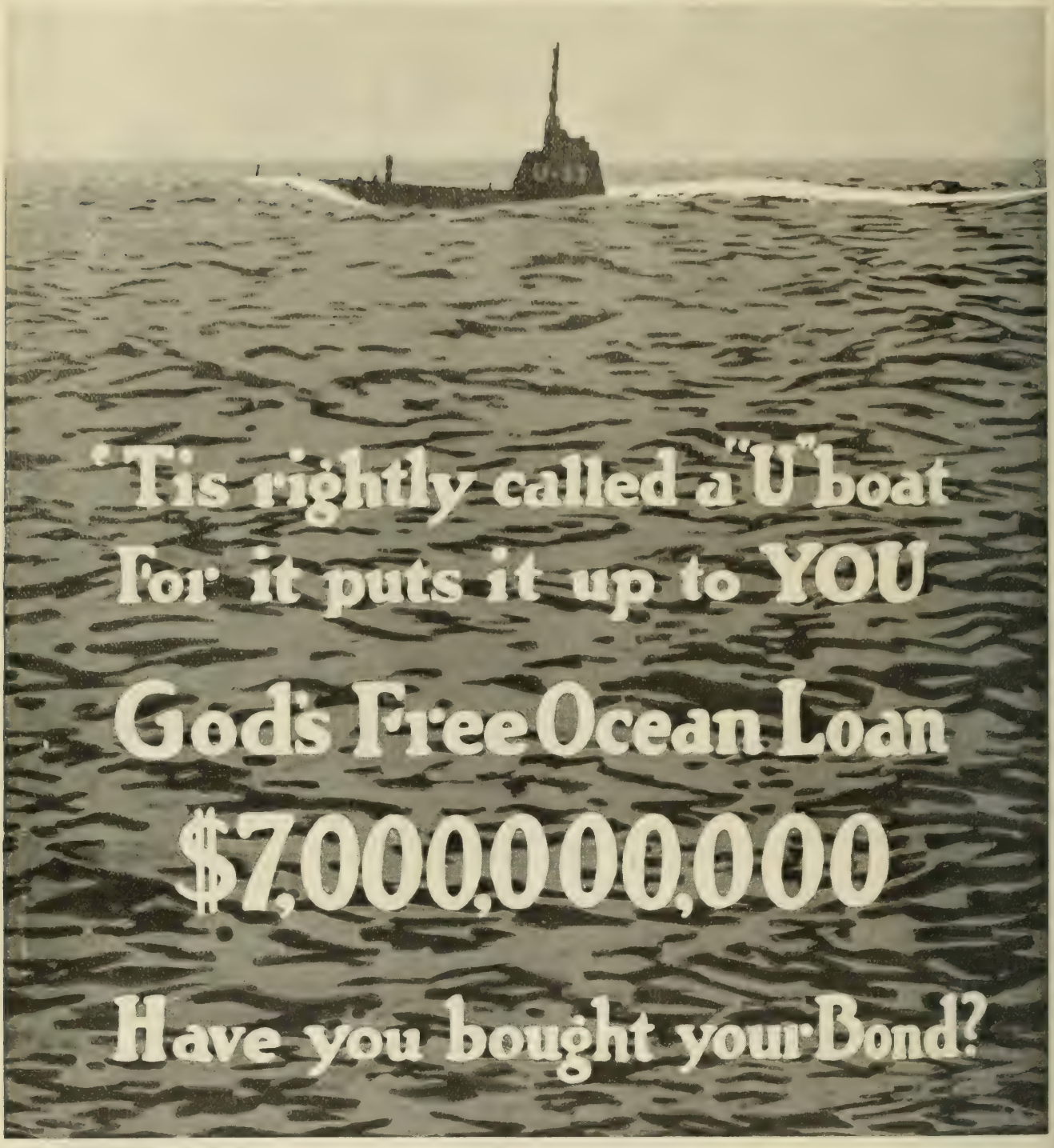
To illustrate this matter, the case of the borough of Catasauqua, Pa., was used, where application was recently made to the Pennsylvania State Public Service Commission for permission to install a municipal plant to compete with service of the Lehigh Valley Light & Power Company. Inasmuch as the article seems to have led some to think that the author accused this company of being constantly neglectful of its opportunities along this line, and also that some feeling of antagonism between him and the company in question must have prompted the use of this case to illustrate the point brought out, the writer takes this early opportunity to state forcibly that the use of the Catasauqua case and the reference to the Lehigh Valley Light & Power Company were solely for the purpose of illustrating the point forming the basis of the article, and furthermore that there was not the slightest cause on the part of the author for other than the most cordial and friendly attitude toward the company in question.

As a matter of record the company had experts in Catasauqua for more than a year for the specific purpose of improving conditions there, and the writer hoped that a reference to such a small portion of a large territory would not in any sense seem to detract from the good service being rendered to 98 per cent of the company's customers. He is sure that this statement will remove any misunderstanding as to his motives, and that any reader who may have noted the article will look upon it merely as illustrating the principle maintained.

C. E. CLEWELL.

Philadelphia, April 27, 1917.

Liberty's War Loan for the World



Mobilization of capital is one of the strongest weapons in the war against the German government.

The first issue of the "liberty loan of 1917" will be $2,000,000,000. Secretary of the Treasury McAdoo announces that subscriptions may be made now at par to the great loan. They will be received until June 15. The bonds will bear 3½ per cent interest and will be dated July 1, 1917, with interest payable Jan. 1 and July 1. In every sense the loan will be a popular one, for the bonds will be issued in denominations as low as $20. If any subsequent series shall be issued at a higher interest rate before termination of the war between the United States and the German government the bonds of this series will be convertible into bonds bearing such higher rate. Mr. McAdoo says:

"Since the great bulk of the credits to be established for the foreign governments is required for purchases made in this country, the operation will be largely a transfer, or exchange, of credits and should have a stimulating and helpful effect upon the general business and financial situation."

It is the largest single piece of financing the United States government has ever attempted.

To uphold the government, to provide abundant means for the mighty forces of the nation, the editors of the ELECTRICAL WORLD urge every one to do his mite.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

UTILITIES PLANNING TO GIVE MAXIMUM NATIONAL SERVICE

It Is Understood That Heads of Important Interests Are Studying Arrangements to Secure Most Efficient Results

The ELECTRICAL WORLD understands arrangements are being studied by the heads of important utility interests as to how to secure to the government the most efficient utilization of the resources of the utilities engaged in public service in men and facilities which they command and at the same time provide for the continued and uninterrupted operation of the plants which are so necessary to the maximum output that is an essential part of the industries contributory to the manufacture of the munitions and supplies of all kinds vital to the proper conduct of war.

Advantage will no doubt be taken of the experience had in Great Britain along similar lines so as to avoid duplication of effort and some of the mistakes which were made early in the war by the British government in its relation to the utilities and which in the early stages of the war seriously crippled the conduct of the utilities and the intensive co-operation which they were later able to afford in the general co-ordination of industrial activities.

ELECTRIC RATES RISE WITH COAL IN FALL RIVER, MASS.

Electric Company Advances Power Rates to Conform to Higher Cost of Fuel—Graduated Scale for Future

The Fall River (Mass.) Electric Light Company has made an increase in power rates based on the high cost of coal and graduated on the basis of 1 mill increase per kilowatt-hour for every dollar of coal cost to the company above $4 per ton.

In introducing the new schedule the company pointed out that its policy consistently has been to base power rates upon a small margin of profit and that rates have been reduced from time to time as conditions have warranted.

Since Jan. 1, 1916, the cost of coal to the company has increased nearly 100 per cent, and it has been obliged to contract on this basis for the coming year's supply. A notice to customers states that in the manufacturing cost of electricity coal is the principal item and last year represented 70 per cent of the cost of generation.

"Every dollar of increase in the cost of coal over $4 per ton," the company says, "represents an increased cost to the company of approximately 1 mill on every kilowatt-hour generated or sold. Our present power rates were figured and adopted when coal was $3.50 per ton, and we have assumed a coal cost of $4 per ton before increasing our present rate. Owing to the abnormal prevailing conditions, which include not only the high cost of coal but also material, apparatus and labor, we feel that it is necessary and justified to increase our present power rate on the basis of 1 mill per kilowatt-hour per dollar increase in the cost of coal above $4 per ton.

"We believe and sincerely hope that these extreme prices are temporary, and wish to assure you that we will restore our present rates immediately on the return of coal prices to their original normal figures. Based on the price of coal for the coming year the increased cost will be between 2.75 and 3 mills per kilowatt-hour. This increase will go into effect and be figured on all bills rendered on and after July 1 next."

NIKOLA TESLA IS AWARDED THE EDISON MEDAL BY A. I. E. E.

"Meritorious Achievements in His Early Original Work in Polyphase and High-Frequency Currents" to Be Honored on May 18

The seventh Edison medal, which was awarded to Nikola Tesla on Dec. 13, 1916, "for meritorious achievements in his early original work in polyphase and high-frequency electric currents," will be presented to Mr. Tesla at the annual meeting of the American Institute of Electrical Engineers in the auditorium of the Engineering Societies Building, 29 West Thirty-ninth Street, New York, on Friday evening, May 18, 1917, at 8.30 p. m. Ladies are invited to attend this meeting.

President H. W. Buck will preside, and addresses will be made by Dr. A. E. Kennelly, chairman of the Edison medal committee; Charles A. Terry, New York, and B. A. Behrend, Boston.

HISTORY OF THE EDISON MEDAL

The Edison medal was established upon the initiative of a group of friends and associates of Thomas A. Edison for the purpose of recounting and celebrating the achievements of a quarter of a century in the art of electric lighting, with which the name of Edison is imperishably identified. It was decided that the most effective means of accomplishing this object would be by the establishment of a gold medal which during the centuries to come should serve as an honorable incentive to scientists, engineers and artisans to maintain by their works a high standard of accomplishment.

The Edison medal was therefore established and endowed with a trust fund, under an indenture dated Feb. 11, 1904, whereby the A. I. E. E. agreed to award the medal annually. The medal is awarded each year by a committee consisting of twenty-four members of the Institute to a resident of the United States of America or its dependencies, or of Canada, "for meritorious achievement in electrical science or electrical engineering or the electrical arts."

NATIONAL PREPAREDNESS IN THE N. E. L. A. PROGRAM

Large Part of the Industry in Military and Industrial Mobilization the Conspicuous Feature for Next Week's Convention

A letter of President Herbert A. Wagner of the National Electric Light Association, sending the tentative program for next week's convention to members, says:

PRESIDENT WAGNER'S LETTER

"This program may be departed from in some particulars, but you will note that the first day at least is to be devoted to a general conference on national preparedness and the consideration of the part which our association and member companies can take in the general scheme of military and industrial mobilization.

"As yet we have been unable definitely to obtain acceptances from the prominent speakers whom we hope to have to address the meeting. The name of Howard E. Coffin is used without his authorization, merely in the strong hope that he can arrange to be with us.

"This tentative program is being sent you in order that you will get some idea of the general character of the proposed meeting so that you may be able to determine upon the personnel of your representation. The matters for general discussion are so important to public service corporations that they demand the presence of those who can fully represent the policies and aims of member companies and speak with authority for them.

"It should also be borne in mind that while it is not expected that the attendance will be nearly so large as heretofore at usual annual conventions, the representation should be sufficiently general and complete to assure the general support of the association in the election of officers and executive committee men both in the national organization and in our four national special sections, and for the consideration of other executive matters necessary at annual executive meetings."

The annual meeting of Class "D" members of the N. E. L. A. will be held at the association offices at 12 o'clock noon on Thursday, May 10. It is earnestly requested that all members in attendance at the convention attend this meeting as matters of importance will be brought up for attention.

As is indicated by the program published herewith, the arrangements for the convention are extremely flexible, and provide for either curtailment or expansion as necessities or desires develop at the time. It is made obligatory by the constitution to hold a formal meeting for the election of officers, and the opportunity for executive conference on war matters is invaluable.

TENTATIVE PROGRAM OF N.E.L.A. SPECIAL MEETING

in lieu of usual form of annual convention, Wednesday and Thursday, May 9 and 10, 1917, Engineering Societies Building, 29 West Thirty-ninth Street, New York City.

WEDNESDAY, MAY 9, 10 A.M

President's address.
Appointment of committee on president's address
Secretary's report.
Report of public policy committee.
Address by Howard E. Coffin.
Addresses by four to six prominent association members.
Adjournment at 1 p.m.

WEDNESDAY, MAY 9, 2.30 P.M.

General discussion on morning's addresses and formulation of definite recommendations to member companies for the conduct of their affairs in relation to the government's plans for raising military forces and mobilizing the nation's industries.

THURSDAY, MAY 10, 10 A.M.

Treasurer's report.
Appointment or election of special committees
Election of nominating committee.
Committee on constitution and bylaws.
Committee on Doherty and Billings prizes.
Committee on memorials.
Committee on resolutions.
Committee on nominations for national sections.
Reports of all national general committees received by title only.

THURSDAY, MAY 10, NOON

Class D members.

THURSDAY, MAY 10, 2:30 P.M.

General and executive session.
Report of committee on constitution and bylaws.
Report of national nominating committee.
Elections.
Report of membership committee.
Report of committee on safety rules.
Report of exhibition committee, etc.
Any other reports.
Adjournment.

THURSDAY, MAY 10, 2:30 P.M.

Parallel executive and general meetings of all national sections for nominations, elections and reading of reports by title only.

FRIDAY, MAY 11, 10 A.M.

Parallel national section meetings for unfinished business if desired by section chairmen.

THURSDAY AFTERNOON AND FRIDAY

Section meetings may be conducted as desired by their respective chairmen. Papers may be read by title if desired and time permits.

As to possible exercises on Friday, if the national section members are present in sufficient numbers and enough interest is shown, it is regarded as quite likely that the various sections may discuss such important reports and papers as may be called for.

Edison Association

The convention of the Association of Edison Illuminating Companies, scheduled for September, has been postponed. Peter Junkersfeld, the president, has issued the following notice to members:

"In view of the existing state of war and after consultation with a majority of the executive committee, it has been decided to postpone the next convention of the Association of Edison Illuminating Companies, scheduled to be held next September at Spring Lake, N. J.

"It will probably be desirable to hold a short meeting the second week in September for the purpose of transacting necessary business as prescribed by the by-laws of the association. The time and place of such meeting will be announced later."

Westinghouse Agent-Jobbers

On account of the war situation and the fact that the National Electric Light Association and other associations, as well as various clubs, have abandoned conventions and meetings which have been scheduled for the next two or three months, it has been decided to postpone the May meeting of the Westinghouse Agent-Jobbers' Association to the annual meeting in November, 1917. The executive committee will meet May 18 to 21, and it is expected that several of the agent-jobbers will attend this meeting and will also go to the next meeting of the Electrical Supply Jobbers Association, May 22 to 24 inclusive, at Hot Springs, Va

Magazine Section PUBLIC LEDGER—PHILADELPHIA, SUNDAY MORNING, APRIL 29, 1917 5

"LIGHT UP PHILADELPHIA!" Slogan of Chamber of Commerce Campaign

City's Industrial Leaders Will Exploit "World's Greatest Workshop" by Unique Illumination Plan



Light conquers the "dark forces" of night in Philadelphia when the City Hall statue of William Penn is thus illumined

By Charles W. Duke

"RETURN on the light!"

America has always been at it. As a robust infant the young, free country turned the light of freedom upon the despotic sway of kings. Filled with power at the vision, the young colonists arose in their might and their answer was recorded at Lexington, Valley Forge and Yorktown.

Shortly after American independence it became necessary for the youthful America to switch the headlight of democracy again on the same kings. They were revealed playing the role of highwaymen with American ships and sailors on the free seas. The people spoke at Lakes Erie and Champlain and the kings ceased their practices.

Later it became necessary for America to turn the light on herself. That light disclosed thousands of human souls burdened under the yoke of slavery. So brightly burned the light that the bands of slavery were dissolved and the shackles fell away from the limbs of the black man.

Again in recent years, the light was flashed on a little neighboring island and revealed it helplessly squirming under the cruel lash of a tyrant. Again the people spoke, the aggressor was taken to task and his victim not only freed but granted perpetual immunity from persecution.

Now, again the light of democracy has been turned on centuries-old Europe where the kings and emperors of a long line of kings and emperors are locked in the embrace of a titanic warfare. It has illumined the whole field of action and revealed again the people battling against the kings in the age-old struggle of democracy vs autocracy. America follows along the pathway of light to answer with the sword the challenge to democracy.

It has ever been thus with America. "Turning on the light" has been a part of America from the beginning of the young republic. Light and civilization have been synonymous. The longer the light has burned the greater the progress. Truth has been the beckoning beacon. Under the limelight the rascals have turned and run to cover. Disease has shrunk away before the light of research. Ignorance has been routed by the pitiless shafts of education. Democracy triumphs because of the light of humanity.



Giant projectors hurl their beams against the tower so that it is visible by night in four counties of Pennsylvania and in New Jersey

If this has been figuratively true of the progress of America, it has been also literally so. The world knew not electricity until Benjamin Franklin snatched it out of the sky one day on a kite string raised from the American soil. Since then democracy has attained its highest development under the influence of marvelous scientific achievements affecting mind and matter for the glorification of the human race in general.

Light today reveals the freedom and the purpose of America. In the harbor of New York, silhouetted against the inky darkness of night by the twinkle of twenty million candles, stands Liberty enlightening the world. The national Capitol at Washington is swathed in an aurora of electrical beauty that proclaims to all civilization the Truth and the Humanity of America. The statue of William Penn in the city where the young republic was born is illumined by long lines of light that bespeak the fearless principles of government laid down by Penn many years ago. So on throughout America.

The tenderfoot is to flood-lighted America more than ever. Zeppelins or no Zeppelins, America turns on the light today in greater measure than ever. There are no Zeppelins that can turn out the light of America. The country's answer to the will-o'-wisp nightfulness has been to turn on the lights a little higher. When some one counseled turning down the lights for fear the Zeppelins would get us America's answer was to turn to a report published recently in the Electrician, from London, which related how in the period from August 1, 1914, to January 31, of last year, the number of fatal street accidents in London due to the lack of light was 954, as against 137 persons killed by Zeppelins during the same period. If any Zeppelins are coming to the United States there will be plenty of light to spot them out.

It has been considered most expedient to turn the light full and free on America at this juncture in order to thwart any who might be conniving in dark corners to overthrow liberty. The foes within have been considered equally as dangerous as, if not more so, than the foes without. So the light has been streaming forth, figuratively and literally since America was ushered into the world war, and with efficacious results. Public safety today is promoted by shafts of light from giant projectors that flood railroad properties, docks and wharves, shipbuilding plants, navy yards, munition plants, arsenals and storehouses.

Ten cents is saving $10,000,000. Ten cents' worth of electricity turned nightly on a huge industrial plant bathes it in a glow that forbids the approach of a bomb-thrower or a firebrand. It is a dime's worth of energy turned into $1,000,000 worth of protection, and it is a new kind of public safety that in these turbulent times is proving its worth in kilowatts.

Starting with the marvels accomplished with flood lighting by the illumination of the Panama-Pacific International Exposition, this country has turned to electric lighting on a comprehensive scale. The industrial world first took it up as a wonderful advertising medium. Art approves it as a means of setting off to full value the architectural beauties of the nation. The church utilizes it on an elaborate scale. The pleasure-loving employ it for night skating, tennis, motor racing and other outdoor activities. England is tilling the soil now at night. America is campaigning for recruits and warding off plotters by electricity. The searchlights of American warships are seeking out U-boats that American guns may drive them from the seas.

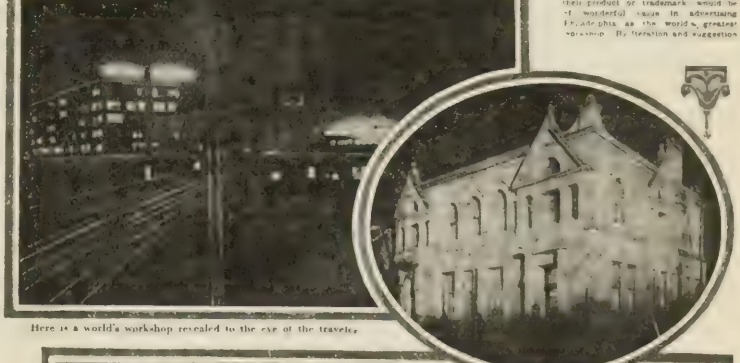
Everywhere one goes in the United States he finds wonderful illuminations. You have seen the State House in Boston, the Steeplechase Pier in Atlantic City, the Soldiers' and Sailors' Monument on Riverside drive, New York, the aviation field at Hempstead, Long Island; the new speedway at Sheepshead Bay, the new municipal pier in Chicago and many other notable examples of modern electric illumination everywhere you travel. Charles A. Steinmetz, the electrical wizard, in his new book on "American Ideals and the New Epoch," declares the marvels of modern electrical development are beyond all description and afford rich field for the exploitation of romance by a Jack London or a Rudyard Kipling.

Down in Columbia, South America, they gather wood at night by electric light. In Montana electric projectors are used for spotting logs and other material that come down the river and interfere with the dams. Coal is mined at night by the aid of electric illumination, steam shovels and dredges work at night, construction goes on in the New York and Philadelphia subways, the vast industrial resources of the country work twenty-four hours a day, building up the nation's defenses. On every hand you see science turning night into day.

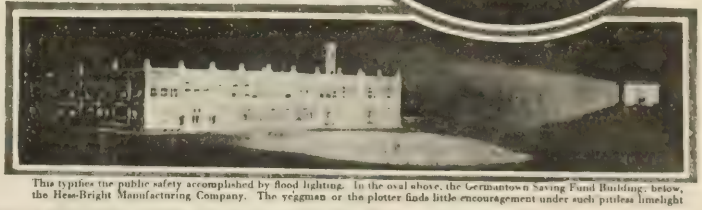
Such is the background that has given birth to a campaign about to be launched in Philadelphia to visualize before all the world the fact that Philadelphia is the world's greatest shop. New York has its Great White Way. A grand canyon of lurid lights that proclaims the nation's central pleasure palaces. The campaign now to be initiated in that city under the auspices of the Philadelphia Chamber of Commerce proposes to make Philadelphia the world's greatest workshop. More than a billion dollars' worth of materials are turned out annually.

War has not deterred great utilitarian projects in Europe, nor will it retard development in the United States. It is proposed to make the railroad arteries leading in and out of Philadelphia great avenues of light that will proclaim to all the traveling public the fact that Philadelphia is the world's greatest workshop. This city stands at a strategic point in transcontinental travel. It is the gateway to the South from the North and the gateway to the North from the South. Much of the travel from the Atlantic to the Pacific coast lines is through Philadelphia. It has been said that one-fifth of the traveling public in the United States [illegible] Philadelphia.

The new Parkway will be a marvel of art indeed if all its new temples are lighted as is the Bell Telephone Building at Seventeenth and Arch streets



Here is a world's workshop revealed to the eye of the traveler



This typifies the public safety accomplished by flood lighting. In the oval above, the Germantown Saving Fund Building; below, the Hess-Bright Manufacturing Company. The yeggman or the plotter finds little encouragement under such pitiless limelight

[illegible] comprehends a publicity campaign on an elaborate scale, not heretofore attempted anywhere in the world. It was inspired by Charles S. Calwell, president of the Corn Exchange National Bank and chairman of the Chamber of Commerce publicity committee, who was greatly impressed by the extraordinary manner in which Philadelphia was illuminated February 1 [illegible] darkness gave [illegible] at noon.

[illegible] has long been heralded as a world's greatest workshop. Here is the midst of the world's greatest catastrophe at a time when the resources of the earth are being taxed to feed and clothe this nation as well as the great nations of Europe, Philadelphia is the greatest center from which these supplies are being obtained. From this district are obtained wonderful supplies of ships, ice, [illegible], carpets, leather goods, carpets, foodstuffs, cotton goods, chemicals, metals, petroleum, furniture, shoes, electrical supplies, paper and textiles. More than a billion dollars' worth of materials are turned out annually.

War has not deterred great utilitarian projects in Europe, nor will it retard development in the United States. It is proposed to make the railroad arteries leading in and out of Philadelphia great avenues of light that will proclaim to all the traveling public the fact that Philadelphia is the world's greatest workshop. This city stands at a strategic point in transcontinental travel. It is the gateway to the South from the North and the gateway to the North from the South. Much of the travel from the Atlantic to the Pacific coast lines is through Philadelphia. It has been said that one-fifth of the traveling public in the United States [illegible] Philadelphia.

[illegible] proposes [illegible] manufacturer and capitalist in the Philadelphia district in a huge publicity campaign of this character. As you ride into the city today from New York or Pittsburgh or Washington you see sporadic outbursts of this kind of illuminative advertising. Scores of mills, factories, [illegible] and industrial plants have erected signs over their roofings. The idea is to have every single observation concern enlisted in the campaign so that the avenues of travel to and from the city will be one continuous line of light.

"I believe that if our large manufacturers would cooperate in the liberal use of electric signs or would illuminate their buildings in the new flood lighting method, it would do more to advertise Philadelphia to the outside world than any other means of publicity that we could use," said Mr. Calwell.

"We have a wonderful manufacturing plants in Philadelphia, but the through traveler is not sufficiently impressed with this fact, nor with the names and trademarks of the diversified products in this district."

The promoters of this campaign say that the impression on the millions of people that pass through Philadelphia every year if every building within a mile of the great trunk lines would either be floodlighted or have a large electric sign on the roof, stating the name of the corporation or firm and their product or trademark, would be of wonderful value in advertising Philadelphia as the world's greatest workshop. By iteration and suggestion it would show the immense industrial development of the Philadelphia district. It would embody a continual panorama of light-pictures that would unfold before the traveler like an industrial kaleidoscope.

Such is the plan. It has greater possibilities for there are a number of public-spirited leaders who are so interested in Philadelphia and in the proposition that they are in favor of illuminating all the great public buildings and in particular the historic shrines that are a part of Philadelphia, including Independence Hall, the Betsy Ross House and other notable places.

"Advertise Your City by Night Illuminations"

By Charles S. Calwell

Chairman Publicity Committee, Philadelphia Chamber of Commerce

THE Publicity Committee of the Philadelphia Chamber of Commerce has become very much interested in the subject of factory illumination and electric signs, especially along the through lines of travel.

Among the hundreds of great industrial plants which are known throughout the country, located in this city, there are only few which advertise themselves at night. Electric signs or electric flood lighting would identify these national names with Philadelphia. This would be a gift to the city and at the same time a byproduct through good advertising of the industrial plants themselves. These signs would be read not only by the traveling public going through the city, but also by the residents of Philadelphia, who are customers of virtually all these great industries.

If every manufacturing plant within the sight of the railroads could be illuminated at night it would make a greater impression on the visitors and the local citizens than could be obtained by any other means of publicity.

"LIGHT UP PHILADELPHIA" TO SHOW ITS POSITION AS "WORLD'S GREATEST WORKSHOP"

Successful lighting of Philadelphia during a period of "daylight darkness" suggested the great advertising and protective possibilities of electric light to Charles S. Calwell, president of the Corn Exchange National Bank in that city and chairman of the publicity committee in its Chamber of Commerce.

The result is that a great campaign for bright electric illumination at night is under way. In his statement in this article in the *Public Ledger*, Mr. Calwell says that electric signs or electric flood-lighting would identify the nationally known names of hundreds of industrial plants.

ILLINOIS COMMERCIAL MEN HOLD NEW-BUSINESS MEETING

Fundamentals of Selling Include Perpetual Service and Satisfaction with Every Transaction—Lighting, Wiring, Appliances and Cooking

The prearranged program of the Peoria meeting of the new-business co-operation committee of the Illinois State Electric Association on April 27 was of such length that the attempt at its completion prevented extended open discussion. The feature of the meeting was the luncheon address on "Salesmanship" by A. F. Siebert of the Dayton (Ohio) Insulating Die Company. It dealt with the fundamentals of selling without attempting specific application to the electrical business. It was considered by the delegates, however, an excellent analysis. It emphasized the necessity of perpetual service and satisfaction with every sale.

The paper on window lighting, by Norman B. Hickox of Chicago, discussed good show-window lighting and the methods of getting it.

The discussion brought out that central stations do not work out methods of securing window-lighting business with the same care which they give to residence lighting and power. Considerable interest was shown in daylight lamps. The best experience seemed to indicate that the combined use of daylight lamps and ordinary gas-filled lamps in alternate outlets gives the best results. This retains the advertising and daylight values of the colored lamp but eliminates the cold, lifeless effect.

In the paper on house-wiring by F. H. Scheel of Joliet, Ill., particular mention was made of the plan of the Public Service Company of Northern Illinois for promoting the sale and use of wall and floor outlets. The company has so changed its method of paying salesmen as to encourage the sale of extra outlets with house-wiring jobs, decreasing the commission on ordinary outlets and increasing it on wall and floor outlets. This made the average commission about the same as before, but promoted the sale of extra outlets.

The discussion showed great interest in the salary and commission plan of paying salesmen. It was estimated that $1.60 per wiring contract was the average commission paid by one company.

John G. Learned said that if prices of construction material maintained their present level companies might be forced to put more intensive effort on prospective business in the territory already served.

Electrification of Coal Mines

The paper on electrification of coal mines by Orlie Rue of Mattoon stated that complete electric service was feasible in any mine producing more than 200,000 tons of coal a year and electric hoisting in smaller mines producing 100,000 tons or more a year. The cost of electricity per ton of coal mined varies widely, but 2.5 cents per ton for complete electric service and 1 cent for electric hoisting can be taken as fair averages. This is a small part of cost when compared with 74 cents per ton paid miners.

The symposium on sale and upkeep of electrical merchandise was shortened for lack of time. E. C. Forest of Rockford discussed policies that a central station may follow in opening an appliance department.

Several speakers emphasized the necessity of appliance salesmen using devices in their own homes. It was urged that a liberal appliance repair policy be adopted.

Electric store arrangements were discussed by George E. Dunn of Oak Park.

Electric Heating and Cooking

In the symposium on electric heating L. H. Knapp of Chicago described low-temperature oven equipment.

B. G. Tarkington of Jackson, Mich., also took up heat treatment, brass melting and steel melting, and gave methods of getting this business and data on a few installations.

J. Paul Clayton of Mattoon said that in Illinois cities which now have no gas service there is a possible electric-cooking revenue of $3,600,000 annually, figuring $36 per family per year. In three years he expects to see $1,000,000 of that revenue accruing to central stations. He emphasized the necessity of having all employees use ranges. Mr. Clayton said that the best promotion work was that of providing ranges for church and lodge social functions and installing cooking equipment in high schools. The company has sixteen high schools equipped for electric cooking.

LARGE STEAM PLANT FOR CHICOPEE, MASS.

Turners Falls Power & Electric Company Will Erect Immediately Turbine Station of 120,000 Hp. Ultimate Rating

The Turners Falls Power & Electric Company has purchased 40 acres at Chicopee Junction, Mass., and will erect immediately a steam-turbine plant of about 120,000 hp. ultimate rating and a present rating of 40,000 hp.

The station will be a reinforced-concrete and brick structure, 350 ft. long by 250 ft. wide, and will be between the Boston & Maine Railroad and the Chicopee and Connecticut Rivers, assuring ample facilities for fuel and condensing-water supply. The plant will raise the total generating capacity of the Turners Falls company to 200,000 hp.

The system now operates plants of 20,000 hp. combined rating at Turners Falls, Greenfield and Mount Tom, besides a 40,000-hp. hydroelectric plant at Montague City, Mass., which was described in the Electrical World of April 21, 1917, page 740. Two additional units of 10,000 hp. each are now on order and will be installed at the earliest possible moment. The new steam plant will serve as a relay station for the central Connecticut Valley.

At present the company has two steel tower lines, each carrying two 66,000-volt, three-phase circuits, extending from Turners Falls to Amherst, and one two-circuit tower line from Amherst to Springfield, Mass. An additional two-circuit line will be built at once from Amherst to Springfield, and the company has purchased the right of way for a double tower line from the site of the new Chicopee station to the main transmission lines near the point where they cross the Connecticut River at Chicopee.

The demand for power has increased so rapidly that it has been found necessary to build the new plant eight years in advance of the time anticipated. The contract for building the station has been awarded to Fred T. Ley & Company of Springfield, Mass. Philip Cabot of Boston is president of the company. Offices have been opened in the Third National Bank Building in Springfield.

DALLAS CONVENTION OF THE SOUTHWESTERN ASSOCIATION

Attendance of 300 and Many Topics Affecting Central Stations Are Discussed—Loyalty to the President in War

The thirteenth annual convention of the Southwestern Electrical and Gas Association, held at the Adolphus Hotel, Dallas, Tex., on April 26 to 28, was attended by 300 persons.

At the opening meeting H. S. Slater, president of the association and general manager Texas Power & Light Company, Dallas, spoke on the need of efficiency and intelligent thought in utility management, now more imperative than before owing to the war crisis and the probability that a part of the central station employees would be called for military service. The education of the public as to its rights and to the utility's rights he considered to be of the greatest importance to the association members; for all business is based on confidence.

SUPPORT THE NATION

The following telegram was sent to the President:

> The members of the Southwestern Electrical and Gas Association, representing the street and interurban electric railway companies, gas companies, electric light and power companies and water-works companies of the Southwest, in full convention assembled, have unanimously pledged their support to the national administration in all its war measures and especially the selective conscription, and tender their services and the use of their properties to the end of the defense of the country.

A buffet dance was given to the visiting ladies, members and guests in the palm garden of the hotel by the Suppliers' Section.

FIRST ELECTRIC LIGHT AND POWER SESSION

The first electric light and power session, on the afternoon of Friday, April 27, was opened by an address on "Water Softening, the Free Work of the University on This Subject," by E. P. Schoch, professor of chemistry, Texas State University. He offered to co-operate with any central station in solving water-softening problems by testing water and designing softening plants. A study of Texas lignite beds will be made soon to see if they may be utilized as central station fuel.

In a talk on "Internal-Combustion Engines" J. C. Kennedy, manager electric department Benham (Tex.) Compress Oil & Manufacturing Company, gave his experience with steam-turbine and oil-engine power. He found the most efficient arrangement was to use the steam unit in the five months of heavy load when the mill was operated and the oil engines in the remaining time of light load.

"The Fallacy of the Comparison of Rates of Separate Public Utilities as a Basis for the Fixing of New Rates of Any One of Those Compared," by H. S. Cooper, secretary of the association, pointed out the mistake that is often made in trying to fix rates by comparison with those of similar companies.

Mr. Cooper has received many inquiries from central stations and outside municipal representatives for schedules of rates in cities about the same size as their own. He emphasized the fact that "local plants are strictly home products and subject to all the variations and increase in costs which local conditions will cause, and that once a community is made fully to understand and appreciate this point, a large amount of the utility's rate troubles have been brushed away. Also, if a community is made to understand and appreciate fully what these local conditions are and how they affect the cost of operation a still further amount of rate troubles will be eliminated. This presupposes, however, that the rates of the utility have been made on some equitable basis and give only a reasonable return to the utility."

A similar paper on the "Justice and Equity of Wholesale Rates," by H. O. Clarke, commercial agent Houston Lighting & Power Company, 1905, closed this meeting.

In the evening a Jovian rejuvenation followed by a cabaret was held at the Scottish Rite Cathedral.

SECOND ELECTRIC LIGHT AND POWER SESSION

In the Saturday morning session R. J. Irvine, general manager San Angelo Light, Water & Power Company, spoke on "Extension of Service by Public Utilities."

Among the "Economies in Central Station Operation," F. N. Lawton, manager Wichita Falls Electric Company, urged the installation of CO_2 recorders and draft gages on all boilers, stopping of air leaks in boiler settings, and the employment of high-class men for firemen. The fuel item is 75 per cent of the operation cost, and hence this should be guarded most carefully.

C. B. Roberts, betterment engineer Stone & Webster Engineering Corporation, said that CO_2 recorders were being used in its Texas properties on both oil-fired and coal-fired boilers with excellent results. He recommended the use of mechanical soot cleaners for boilers to prevent those heat losses estimated at 3 to 4 per cent from coal soot and 5 to 8 per cent from oil soot.

In discussing "Raw Light Versus Illumination," J. G. Barrett, illuminating engineer Texas Power & Light Company, stated that lighting was primarily a problem of two factors—light and eye. Sunlight being the perfect illumination, a good lighting system to approach this must have the characteristics of eye protection above all, then color value, efficiency, uniformity, diffusion and appearance. He believed that the great majority of central stations ignored the lighting problem entirely, and to the public a live new-business manager was more important than the manager, as the former was in reality a city builder. The empty socket, the unused porch light and the unshaded lamp were the signs of a "kilowatt peddler," not a salesman of service.

NEW OFFICERS

In the afternoon the nominating committee reported and the following were elected for the coming year: President, H. C. Morris, general manager Dallas Gas Company; first vice-president, D. A. Hegarty, president Texas Gas & Electric Company, Houston; second vice-president, W. A. Sullivan, manager Shreveport (La.) Railway; chairman executive committee, F. R. Slater, general manager Texas Power & Light Company, Dallas.

Industrial Heating as a Station Load

"Industrial Heating as a Central Station Load" is a booklet published by the Society for Electrical Development. Part 1, which has just been issued, deals with electric furnaces. Part 2, which is to be mailed on May 10, will give data as to various uses and applications of commercial electric heating, applying more particularly to the smaller cities.



DELEGATES TO THE CONVENTION OF THE PACIFIC COAST SECTION, N. E. L. A.

ENLARGED PUBLIC-POLICY PLAN FOR N. E. L. A. IS SUSPENDED

Success Assured by Contributions Well in Excess of the Figure Set, but National Service Comes First

The public-policy committee of the National Electric Light Association has decided that the efforts to raise funds for enlarging the public-policy work of the organization should be suspended on account of the national situation.

Money which has been received from members to be used in this work will be returned. Up to the present time the money received and pledged on this account amounts to approximately $75,000 per annum. The minimum sum which the committee felt would be necessary in order to assure the success of the plan on a satisfactory scale was $50,000 per annum. It is felt, therefore, that the members have responded in sufficient degree to indicate their hearty approval of the work.

In giving notice to members of the suspension of the plan, the committee emphasizes the fact that it is not because of lack of support that this action is taken but solely on account of the national situation. A letter addressed by the committee to members says:

"The public-policy committee met in New York on April 18 and, after thorough discussion, unanimously concluded that, in view of the present national situation, it is desirable that member companies concentrate all of their energies and resources upon the maintenance of reliable and efficient service in the public interest and upon the furtherance of co-operative plans with federal and local authorities for the successful consummation of our national war program.

"In furtherance of these ideas the committee recommended to the executive committee of the association the abandoning of the usual annual convention and the substitution of a meeting in New York of the company members for exchange of views and the formulation of action relative to the present situation.

"It was also determined to be advisable to indefinitely postpone further action with regard to the proposed program of enlarged activities of the association, as outlined in the letter of the public-policy committee addressed to the executives of the larger Class A companies under date of Feb. 14. In announcing this determination the members of the committee desire to express their very sincere appreciation of the prompt and favorable response received from a large proportion of such companies, whose definite subscriptions were more than sufficient to guarantee the carrying out of the plan had new conditions not arisen to render such action inadvisable in the opinion of your committee.

"For the reasons above outlined no call will be made for the present on the subscriptions received, and the payments already made will be returned by the treasurer of the association.

"We trust that the action of the committee in the above matters will meet the approval of the company members."

PATRIOTISM AND WATER POWER IN PACIFIC COAST MEETING

Use of Systems and Service Tendered to the Government—Legislative Conditions to Aid Water Power Development

In last week's issue the ELECTRICAL WORLD gave an account of the successful first convention of the Pacific Coast Section of the National Electric Light Association, held at Glenwood Mission Inn, Riverside, Cal., on April 19 to 21. The accompanying photograph of the members is convincing evidence of the support given by the Western coast members to their own organization and its work.

In addition to the full program of reports and papers the convention gave time to the consideration of patriotic and public measures. One resolution, showing that utilities are large factors in furnishing energy particularly for industrial establishments and for irrigation, tendered the use of the systems and service to the government "in protecting it in necessary transportation and in manufacture of munitions of war, in shipbuilding, the raising of foodstuffs and other necessaries of life." It also favored elective conscription.

In another resolution Congress was asked for water-power legislation under substantially the following conditions:

"That permits granted by the departments involved should not be of a revocable nature, but should be for a definite period of time—not less than fifty years—and shall not be forfeited, except by appropriate proceedings in a court of competent jurisdiction whenever the permittee shall fail to comply with the provisions of any act of Congress in relation to the matter; and that if the government elect to take over the property, at the end of the term of years leased, it shall pay to the permittee a just compensation therefor; that the charges or rentals for all lands used shall be determined by the average horse-power sold or used by the permittee for any purpose other than the operation of the plant."



DELEGATES TO THE CONVENTION OF THE PACIFIC COAST SECTION, N. E. L. A.

RATE CASE DISCONTINUED BY NEW YORK COMMISSION

"In Times of Unsettled Conditions the Necessary Margin of Safety for Utilities Should Not Be Curtailed"

The New York Public Service Commission, First District, has adopted an order and has approved an opinion by Commissioner Travis H. Whitney discontinuing a proceeding against the Bronx Gas & Electric Company in reference to electric rates.

The company serves with gas and electricity that part of the borough of the Bronx lying east of the Bronx River formerly known as the town of West Chester except the portion included in the limits of the former village of Williamsbridge, in which the Westchester Lighting Company operates. The commission has also pending an investigation into the rates of the latter company, a decision in which, however, has not been made.

The Bronx Gas & Electric Company charges a maximum rate of 12 cents per kilowatt-hour. Commissioner Whitney in his opinion, in which the other commissioners concurred, held that it was inadvisable at this time to order a reduction in the rates. His opinion said in part:

"At the outset of the hearings the company submitted a statement of facts and reasons in support of a 'request that the proceeding be dismissed or withdrawn by the commission,' and other parties who appeared were also heard upon this request. In exercising its discretion, upon facts, the commission does not make a finding as to whether the rate in question has been shown to be unreasonable—the burden of such proof resting upon the proponents—but simply determines whether it should continue the proceeding upon its own motion.

"Upon this question the argument presented by consumers and property owners of the territory served by the company preponderated against any action involving a possible reduction in rates. They contended that the public interest would be better promoted by conserving the earnings of the company under existing rates, so as to enable it to provide for much needed extensions in facilities and service which will not for some time be self-sustaining, than by a reduction in rates which would diminish the company's earnings and its ability to secure additional capital required for the extensions.

"It appears that the company is not as a whole earning an excessive return. Organized in 1895, no dividends were paid by the Bronx Gas & Electric Company until 1901, when 15 per cent was paid, and thereafter these dividends were paid: In 1902, 16 per cent; 1903, 5 per cent; 1904, 9 per cent; 1906, 1907 and 1908, 5 per cent; 1905 and 1909, no dividend; 1910, 1911 and 1912, 5 per cent, and 1913, 1914 and 1915, 6 per cent.

"The investment and operations of the company in the electric service should be segregated from those in the gas service in order to determine the reasonableness of the rates and the return to be allowed for the separate and independent services. It is not, however, necessary to enter into the minutiæ of such a segregation. The records of the commission indicate that a reduction in the general electric rate is not now warranted.

"Nor will the normal increase of business combined with the increase of consumption which usually follows a reduction in rates justify a finding that the effective rates are excessive. The operating figures for 1915 do not take into account the increase in the cost of labor and materials which has taken place during 1916 and 1917, which may be augmented as a result of the national exigencies arising out of the war with Germany. While it would be unjust to permit a utility to exact demonstrably excessive rates from consumers in order to transfer to them the burden of the taxation which must be borne as the material sacrifice in support of the contest by arms, yet in times of unsettled conditions the margin of safety necessary for the stability of public utilities should not be curtailed.

"If the convenience of gas and electricity is not made fully available, the development of the territory will be thwarted. If the company is enterprising and responsive to public needs and would share in its commercial prosperity, it must prepare to extend and enlarge its facilities in order to supply new and additional buildings. The prospects justify the company in making provision to anticipate the community's requirements. The extensions of line and service will not themselves immediately provide a return upon their cost, yet the commission may order these extensions to be constructed. Obviously, if the rate be reduced and surplus be eliminated, the early losses on the investment in extensions will not be absorbed.

"The principle that should govern is that the commission will consider carefully the necessity for a proper credit on the part of a public service corporation in order that it may comply with its affirmative obligations to render adequate service for the franchise territory at reasonable rates, with proper and safe equipment, and that the commission, in assuring itself that a company has reasonable protection for its ability to secure additional capital, will expect and require full compliance with all such affirmative obligations including extensions."

INSTITUTE OF RADIO ENGINEERS TO AWARD MEDAL OF HONOR

Annual Presentation to Be Made to Persons Who Have Rendered Distinguished Service in Radio Telegraphy and Telephony

The board of direction of the Institute of Radio Engineers has decided to award annually a "medal of honor" to persons who have distinguished themselves by unusual advances in the fields of radio telegraphy and



telephony. It has been felt that some way should be found whereby valuable work in these fields might properly be recognized by an authoritative engineering society.

The front of the medal is a symbolic representation of electromagnetic waves, indicating the interlinking of the magnetic and electric forces in their rapid path through space. The sculptor is Edward Sanford, Jr., New York.

The award will be made yearly at the April meeting of the institute to the person who in the two preceding calendar years shall have made public the greatest advance in the art of radio communication. The advance may be a patented or unpatented invention, but it must be completely and adequately described in a scientific or engineering publication of recognized standing and must be in actual, though not necessarily commercial, operation. However, preference is to be given to widely used and widely useful inventions.

The advance may also consist in a scientific analysis or explanation of hitherto unexplained phenomena of distinct importance to the radio art, although the application may not be immediate. Preference will be given to analyses directly applicable in the art. In this case also publication must be full and in approved form.

The advance, furthermore, may consist of a new system of traffic regulation or control, a new system of administration of radio companies or the radio service of steamship, railroad or other companies, a legislative program beneficial to the radio art, or any portion of the operating or regulating features of wireless. It must be described publicly in clear and approved form and must, in general, be actually adopted in practice. In all cases marked preference is to be given to advances made in the preceding year.

At least thirty days before the April meeting the board of direction will call upon members and fellows whom it may choose to consult for suggested candidates. This provision will be waived wholly or in part for 1917 only.

At its April meeting the board, through those actually present or voting by mail, will nominate at least one and not more than three candidates, in order of preference, for the award. These names will be sent to each board member, who will return a vote for one candidate. Four weeks after the April meeting the ballot will b read, and the candidate receiving the most votes wi receive the award.

The official presentation to the successful candidat or his representative will occur at the May or Jun meeting.

ILLUMINATING ENGINEERING CAMPAIGN FOR NEW MEMBER

Society Membership Co-operating in Movement t Interest Men in Fields of Illuminating and Allied Arts and Industries

A statement in regard to the membership campaig of the Illuminating Engineering Society has been r ceived by the ELECTRICAL WORLD from C. D. Fawcet assistant secretary of the society. Mr. Fawcett says

"The professional man has an interest in the societ since it affords a direct approach to special knowledg on all lighting subjects. The architect, teacher, r search scientist, illuminating engineer and physici have an outlet for their opinions in the society's *Tran actions* and before the several sections of the societ which hold monthly meetings.

"The membership at large have been asked to c operate during the course of the campaign. Individu application to those men in the several fields of illum nating and the allied arts and industries is the metho emphasized. Many of these men are seeking inform tion on one or another subject of illumination of dire bearing on their daily work. The electrical contracto gas and electric fixture manufacturer, glassware manu facturer and salesman in these branches are continual confronted with new phases of illumination not prev ously available in any printed matter. The socie attempts to publish up-to-date papers on these subject The papers deal with the manufacturing, physica psychological, technical and fundamental aspects illuminating engineering.

"Thus far the campaign shows encouraging result It has been found that the average prospective memb has been seeking the benefits which the society offe but has not previously been brought in contact with th development in this specialized field."

General Electric Company Gardens

The General Electric Company has loaned unoccupi land to employees for garden purposes. There a about 60 acres of rich river-bottom land at Schenectad west and south of the company's plant.



Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public-utility companies.

Supreme Court May Affirm or Set Aside Orders of Commission, but May Not Revise or Modify Them.—Under an act concerning public utilities, the Supreme Court has jurisdiction to review the orders of the Board of Public Utility Commissioners and to set aside or affirm the orders in toto, but the Supreme Court has no power under said act either to revise or modify an order of said board, was the decision of the Court of Errors and Appeals of New Jersey (100 A-346).

Necessity of Bidding for Municipal Street-Lighting Contract.—A city charter requirement that contracts for "work," "including printing," should be let to the lowest bidder is inapplicable to a street-lighting contract, especially since the rate charged is constantly subject to the Railroad Commission's supervision under the public utilities law, according to the Supreme Court of Wisconsin in Oconto Electric Company versus People's Land & Manufacturing Company (161 N. W. 789). Where an electric lighting company's bid did not designate which schedule of service it would give but it later advised the Council that it would give either of two services the Council might elect, one of which the Council accepted, it was held that the contract was valid, and upon filing with the Railroad Commission the rate became enforceable and presumptively reasonable.

Indeterminate Permits.—Where a Wisconsin corporation was doing a commercial electric lighting business when the public utilities law became effective and continued to do so, it secured an indeterminate permit for such lighting, the Supreme Court of Wisconsin held in Oconto Electric Company versus People's Land & Manufacturing Company (161 N. W. 789). A franchise granted in 1904 for furnishing lighting to a city's inhabitants to a corporation doing a commercial lighting business until 1909, when it also did street lighting, became an indeterminate permit for street lighting under the law, transforming into such permit every license, etc., granted prior to July, 1907, although the 1904 franchise was ineffectual as a legal grant, because the company's articles of incorporation were not sufficiently comprehensive. Where a franchise for electric lighting granted by a city was assigned and later taken over by a company which gave the street lighting to another concern and later took an indeterminate permit under the public utilities law, it was held that its rights, although imperfect in inception, were exchangeable for a valid indeterminate permit for both street and commercial lighting The provision of the public utilities law that no public utility shall exercise a lighting privilege suspended for more than a year without obtaining a certificate of convenience and necessity is not retroactive. The provision that no public utility shall exercise lighting privileges where suspended for more than one year without obtaining a certificate of convenience and necessity refers to voluntary suspensions and is inapplicable to a suspension caused by a rival concern obtaining a franchise for a year's street lighting. An electric lighting company did not abandon its permit for street lighting by not submitting bids where it reasonably considered the Council's specifications designed to exclude it and upon a rival securing a contract for five years sold such rival the street-lighting equipment it could not use for commercial lighting.

Court Instructions Regarding Assumption of Risk and Due Care.—Instruction directing verdict for employee's death upon finding specified facts, regardless of employee's knowledge of danger in working near high-voltage electric wires, was erroneous either under common law or employers' liability act, since the doctrine announced was contrary to common-law rule and did not set forth facts to bring it under the statute which abrogates the doctrine of assumption of risk in certain cases, but, since the undisputed evidence showed that the employee was directed to do dangerous work, in which case the law eliminates assumption of risk, such instruction could not have harmed defendant, it was held by the Supreme Court of Indiana (115 N. E. 577). An act permitting employee's recovery for personal injuries in certain cases, although he knew or could have learned of the danger, modifies the common-law rule of assumption of risk. Instruction in action for employee's injury, charging that it was employer's duty to keep high-voltage wires "perfectly" insulated and use "utmost" care in maintaining them, was held erroneous as charging more than reasonable care required. Instruction authorizing recovery for employee's personal injury if high-voltage wires were "imperfectly insulated" was erroneous, since defendant was not liable unless defect was due to want of reasonable care or discoverable by exercising such care and was not an insurer of perfect insulation of its wires. The "duty to use due care" is absolute, certain and unchanging and a question of law, but acts, precautions and conduct necessary to constitute "due care" are relative and variable and questions of fact in the particular case. It is the employer's duty to use reasonable care for his employee's safety, whether the business is comparatively safe or extremely dangerous, but the acts of care necessary are to be determined from consideration of dangers incident to use of agency employed as well as to the circumstances and inherent conditions. The law fixes no different standard of care for those using high-voltage electricity from that for any other business, but the same duty exists to use reasonable care under the particular circumstances.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Municipal Service Extensions When Financial Condition Is Poor.—A decision of the Wisconsin Railroad Commission, affecting the city of Spooner, says: "A municipal water utility will not be required to make an extension where the net return therefrom will be less than interest on borrowed funds for the cost and the city is in poor financial condition and needs money for other public improvements."

Discontinuance of Service.—In a decision dismissing a complaint against the New York Edison Company the New York Public Service Commission, First District, holds: "An electric company may require a tenant in an apartment house to which service is furnished through a general riser owned and controlled by the landlord to agree to a duly filed and published provision in a standard contract that, if the company is obliged to discontinue service to the building for any cause, the tenant will not request service 'through a sub or series meter,' since the company cannot lawfully change the contract or accept an alteration without previously filing and publishing the same so that all consumers may have the benefit. A statement added by an applicant to his service contract that he signs under protest reserving the right to attack the legality of a provision is ineffective, since the contract is made in contemplation of the regulatory power of the commission."

Extra-Hazardous Business Recognized in Ohio.—In upholding an appeal of the Ashtabula Gas Company against a rate of 30 cents per 1000 cu. ft. for natural gas, fixed by city councils of three communities, the Ohio Public Utilities Commission declared that a corporation engaged in producing and distributing natural gas should have a return of not less than 10 per cent on the invested capital. The commission made a rate of 34 cents with a service charge of 20 cents a month per meter. The commission says: "The natural-gas business differs materially from that of any other which is classed as a public utility. Its production is in the nature of a mining venture. It can be produced only in limited areas and when once discovered it is only by continuous mining that the extent of the field can be ascertained and the supply maintained. Telephonic communication and railway transportation may be indefinitely carried on anywhere. But natural gas is limited to comparatively few localities and the life of the enterprise depends upon the uncertain supply of nature. Experience has taught that at the best a natural-gas field cannot last longer than two or three decades."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Launching of the New Mexico.—The superdreadnought New Mexico was launched at the Brooklyn Navy Yard on April 23. Directly afterward it was taken back to the yard and the work of preparation for active service was begun. It will be the first dreadnought to be electrically propelled.

Utilities Bureau Election.—At the annual meeting of the Utilities Bureau, Philadelphia, Charles R. Van Hise was elected president. Rudolph Blankenburg, former Mayor of Philadelphia, and F. H. Newell, professor of civil engineering of the University of Illinois, were made trustees to fill vacancies.

Powerful Radio Station for Philadelphia.—An official announcement says that preliminary construction of one of the most powerful wireless stations in the world has been begun at the Philadelphia navy yard. The station will have a sending radius of approximately three-fourths of the distance around the globe.

Incorporation in Venezuela. — The business of Angarita & Company, formerly proprietors of the Empresa de Alumbrado Electrico de San Cristobal, Venezuela, was incorporated recently as a joint stock company, Energia y Luz Electrica de San Cristobal, and the shareholder, J. Manuel Angarita, will be in charge of the affairs of the new company.

New Tax Laws in Kentucky.—By the provisions of laws enacted at a special session of the Legislature, Kentucky hereafter will classify property for taxation purposes, instead of making use of the old system of a general property tax. A commission is created with supervisory powers and it will assess public service corporation franchises and property for taxation.

State Control Upheld in Illinois Case.—A decision has been rendered by the Illinois Supreme Court holding that the State Public Utilities Commission has jurisdiction over utilities in Chicago. It follows an appeal from the decision of Judge Taylor of the Circuit Court, Chicago, denying the authority of the commission to issue orders affecting service and equipment of Chicago electric railways.

Large Utility Earnings.—Reports of 325 public utility corporations to the *Financial World* show for 1916 a total gross revenue of $1,223,006,181, an increase of $227,945,649, or 29.25 per cent over 1915. Net earnings were $550,920,933, a gain of $158,171,953, or 20.24 per cent over 1915. The companies have $2,864,325,700 outstanding bonds, $963,377,500 preferred stock and $2,506,637,835 common stock.

Platinum Refining in 1916.—Preliminary estimates based on practically complete returns made to the United States Geological Survey, Department of the Interior, by domestic refiners of platinum indicate that in 1916 approximately 488 ounces of domestic crude platinum (about 74 per cent metal) were refined, producing 172 ounces of platinum, 84 ounces of iridium, and 113 ounces of iridosmine, and that 10,118 ounces of South American crude platinum, about 88 per cent pure, were refined.

The Electric Vehicle as a Carrier of Explosives.—A. Jackson Marshall, secretary of the Electric Vehicle Section of the National Electric Light Association, calls attention to the value of the electric vehicle in the transportation of explosives. He says: "The electric vehicle is particularly adaptable because of its lack of fire danger and its fixed maximum speed and easy control, which lessen the chance of collision. These electric trucks are used in New York City by a large manufacturer of explosives, and are accepted by the bureau of combustibles of the New York Fire Department as the safest means of transporting explosives through the city streets."

Export Situation Discussed Before St. Louis Jovians.—At the luncheon of the St. Louis Jovian League on March 27, D. S. Kramer, head of the export department of the Century Electric Company, St. Louis, delivered an address on trade conditions in foreign countries. Mr. Kramer had just returned from an extended tour of the world. He stated that some of the British manufacturers, in their attempt to supply inexpensive electric motors like those furnished by the German manufacturers before the war, had designed motors along similar lines. He pointed out the fact that American manufacturers would do better to build a reputation for reliable apparatus at consistent prices than to compete with the low prices of inferior-quality motors. R. J. Russell, secretary of the Century Electric Company, presided as chairman of this meeting.

Increased Costs Overcome in Part by Larger Gross.—In the statement covering the period of twelve months ended March 31, 1917, the American Light & Traction Company, through Alanson P. Lathrop, the president, says: "This company, in common with others, is experiencing a period of high operating costs, due principally to unusual conditions prevailing in the labor and material markets, and to the increased taxes. Fortunately these abnormal operating costs are offset to some considerable extent by the very satisfactory increases in gross business, these increases in volume being, in nearly every instance, the largest the subsidiary companies have ever experienced. The increased gross for March is $179,939, or 14.5 per cent; for the three months ending March 31, $471,471, or 12.35 per cent, and for the twelve months ending March 31, $1,682,177, or 11.69 per cent. This expansion of business promises well for the future and for the time when operating conditions return to a more nearly normal basis."

Associations and Societies

The Directory of Electrical Associations, which is regularly printed in the first issue of each month, appears on page 879 of this number.

Lafayette College Branch of A. I. E. E.—The student branch of the American Institute of Electrical Engineers at Lafayette College held a meeting on April 19. The subjects of the papers presented were "Elementary Principles of Light and Lighting," by E. E. Tanzer, instructor in illumination, and "The History of the Manufacture of Incandescent Lamps," by Dr. J. T. Rood, head of the electrical department.

Missouri Association of Public Utilities.—The entertainment committee of the Missouri Association of Public Utilities has arranged to have its annual convention on board the steamer Quincy. The convention will be held May 17, 18 and 19. The boat will leave St. Louis on May 17 at 9.30 a. m., run to Cape Girardeau and return. The details of the program have not yet been fully arranged, but will be announced later in these columns.

Hudson County (N. J.) Electric Club Organized.—The electrical contractors of Hudson County (N. J.) met at Jersey City, N. J., on April 18, and organized the Hudson Electric Club. The following officers were elected: President, H. J. Reitze, Jersey City; first vice-president, A. L. Hildner, Weehawken; second vice-president, H. A. Schuller, Bayonne; third vice-president, Samuel Cross, Hoboken; secretary, William Doellner, Jersey City; treasurer, Frank B. DeWitt, Jersey City; sergeant-at-arms, B. Moser, Jersey City. The object of the club is to hold regular meetings at least once a month, when subjects of interest will be discussed and in most cases a speaker secured for the evening. Membership is open to any one connected with the electrical industry.

Recent Applications of Electricity in the Steel Industry.—The Philadelphia Section of the Association of Iron and Steel Electrical Engineers held its regular monthly meeting on May 5, at which meeting G. E. Stoltz of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., spoke on some recent applications of electricity in the steel industry. Mr. Stoltz briefly outlined the more recent developments in the application of electric motors in the steel mill, such as the use of the Illgner system to drive a 28-in. (70.7-cm.) three-high structural mill, in order to accomplish the rapid changes in speed found desirable. The recent tendency toward large turbine units in the steel plant was also brought out and a comparison was made of 25-cycle and 60-cycle generating economies. The broadening field of the central station in supplying power to steel mills was also discussed.



JOHN G. BARRY

Men of the Industry

Changes in Personnel and Position— Biographical Notes

John G. Barry of Schenectady has been appointed general sales manager of the General Electric Company. Mr. Barry has long been manager of the company's railway department, the duties of which he will continue to exercise. He began his business career as production clerk for the Thomson-Houston Company at Lynn, Mass., in 1890. Soon, however, he was transferred to the company's Boston office in the commercial department. In 1892 the Thomson-Houston Company and the Edison General Electric Company were united to form the General Electric Company, and two years later Mr. Barry was transferred to Schenectady, where, in the railway department, he soon became assistant manager and in 1907 manager.

Robert Lindsay, vice-president and general manager of the Cleveland Electric Illuminating Company, has been elected a director and member of the executive committee of the Republic Railway & Light Company.

William D. Ray, for the past two years vice-president and general manager of the Pennsylvania Utilities Company at Easton, Pa., was on April 17 tendered a banquet at the Pomfret Club, Easton, by a number of his friends among the leading business and professional men of the city, upon his retirement from active charge of the electric and gas properties at Easton. Following several complimentary speeches, Mr. Ray was presented with a gold watch as a token of the esteem of the community.

H. C. Morris, general manager of the Dallas (Tex.) Gas Company, was elected president of the Southwestern Electrical and Gas Association at its annual meeting in Dallas on April 26-28. He was born in Detroit in 1879 and entered the service of the Detroit City Gas Company in 1898. For two years following 1902 he was superintendent of the Saginaw (Mich.) City Gas Company, and thereafter until 1908 he acted as assistant general manager of the Bay City Gas Company and the Bay City Traction & Electric Company. He then went to Dallas as superintendent of the company he is now with and later was made general manager.

O. R. Sturzinger, superintendent of the Northwestern Ohio Railway & Power Company, Toledo, Ohio, has resigned, and the office has been abolished.

Ernest Vanarsdel has resigned from the Kentucky Utilities Company, where he was in charge of operation, to become connected with the operating department of the Interstate Public Service Company at Indianapolis.

E. E. Nelson, for the past eleven years electrical engineer for the Northern Texas Traction Company, Fort Worth, Tex., has resigned to become connected with the Adirondack Electric Power Corporation, Utica, N. Y.

J. E. Wilson of Boston has been appointed secretary of the Electrical Contractors' Association of Massachusetts to fill the vacancy caused by the death of Henry D. Templex. Mr. Wilson was formerly special representative of the association.

Walter Alexander has resigned as chairman of the Wisconsin Railroad Commission, effective May 1, to accept the position of superintendent of motive power of the Chicago, Milwaukee & St. Paul Railroad Company. Mr. Alexander was appointed a member of the Wisconsin Railroad Commission a little more than two years ago, to succeed David S. Harlowe. At that time he was master mechanic of the Chicago, Milwaukee & St. Paul Railroad Company. No successor to Mr. Alexander has as yet been named.

Joseph Pratt, for the last twelve years employed by the Woonsocket branch of the Blackstone Valley Gas & Electric Company, has resigned his position as superintendent of outside distribution and has accepted a position as salesman with the Boss Electric Supply Company of Providence. Mr. Pratt entered the employ of the lighting company as office boy and was later made assistant in the stock rooms, from where he was transferred to the inside-wiring department. When the concern ceased to contract for house wiring he was put in charge of the trouble and meter department, a position he held until last fall, when he was made superintendent of outside distribution.

H. F. Jackson, newly elected president of the Pacific Coast Section, N. E. L. A., was born in Kansas City, Mo., in 1871. At the age of twenty-one he was appointed to the United States Military Academy at West Point, from which he was graduated with the class of 1896. He was detailed with the regiment at Newport, R. I., until the fall of 1898, when he went to Cuba for service during the Spanish-American War. From 1898 to 1901 he served with



H. F. JACKSON

General Fitzhugh Lee and General Leonard Wood in various staff capacities and during this time gained a wide variety of experience. His responsibility at times extended over some 15,000 men. He became acting chief engineer of the Seventh Army Corps, captain and acting judge advocate, Department of Western Cuba, and served with General Gorgas in camp location and general sanitary work. G. F. Greenwood of the Havana Electric Railway induced Mr. Jackson to secure a leave of absence from the army in the latter part of 1900 to take charge of the railway system and in the capacity of assistant general manager. Mr. Jackson managed these properties for one year. In 1901 he was appointed a member of a board of three officers to plan and carry out army and navy maneuvers in connection with the defenses of Portland, Me. This work called for the co-ordination of various government departments involving pioneer work along this line, which culminated in the highly successful maneuvers carried out in 1903. Mr. Jackson then attended the government school of submarine defense, from which he was graduated in 1904, and was immediately detailed as the first army officer to take up instruction at the General Electric Works in Schenectady. In 1905 he became artillery engineer of defenses at Old Point Comfort, Va., whence he was transferred to Washington, D. C., as assistant to the chief of artillery. Mr. Jackson resigned from government service in 1906, with the idea of rounding out his training by experience in civil life. Since that time he has been identified with the construction and operation of the Stanislaus hydroelectric development, working up through the ranks to be general manager, and recently to the position of president of the Sierra & San Francisco Power Company and the Coast Valley Gas & Electric Company. During this time he has controlled the expenditure of about $11,000,000, at times directing the work of some 1500 employees. Captain Jackson reported to Washington by telegraph at the outbreak of the war to place at the government's disposal such service as it might be considered that his training qualifies him to render.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

FIRM UNDERTONE IN JOBBING CONDITIONS

Little Change During Past Month, Collections Somewhat Better, Prices on Iron Conduit Higher, Insulated Wire Lower

Jobbing conditions throughout the United States, according to the regular reports received by the ELECTRICAL WORLD, show little change from last month in spite of the existing state of war. With the exception of New England, the entrance of this country into the war has had little apparent effect on the electrical trade. New England jobbers are using telegraph and telephone facilities more than ever before in the effort to meet the increasing business due to the war. Preferential shipments based on bona fide war order or allied business are being handled with appreciation of their importance by the railroad interests. Some war order jobs are being taken by jobber contractors on a "cost-plus" basis.

Prominent jobbers feel that the entry of New England into active manufacturing of wooden munition and food carriers for overseas trade to offset the losses of vessels resulting from the submarine campaign will bring increased prosperity to the coastal sections and indirectly stimulate the demand for electric service. The need of closer cooperation between the government and manufacturing interests has been emphasized, notably along the line of permitting plants to continue their normal industrial output up to the latest possible moment before taking on preferential governmental contracts, some delays having occurred due to shutdowns ordered to take place before the plants were actually given the word to start production on military or quasi-military material. By subdividing government orders much work can be handled flexibly and rapidly with minimum interference with regular industrial needs.

LITTLE CHANGE IN PRICES

Prices are for the most part stationary. Iron conduit has advanced considerably, while insulated copper wire in large lots has softened somewhat. Iron conduit in two years has advanced over 100 per cent. In the past month it increased per hundred almost $1.

There has been little change in the condition of stocks during the past month. Generally they are large and ample. Stocks in which the price of copper wire is a dominant factor, according to an Eastern report, such as insulated wire, knife switches, etc., are rapidly diminishing and are relatively low as compared with a year ago. The most notable feature in stock movement on the Pacific Coast is that in practically all lines the number of turnovers has increased; that is, where the rate last year was three and a half turnovers it is now four and a half.

In the Middle West delayed deliveries are still forcing the jobbers to keep on hand wherever possible a stock larger than normal. Jobbers' customers in this section are carrying practically normal-size stocks, so that a large percentage of the business the jobber handles consists of material that is to be used immediately.

Volume of buying is still large, although there has been an appreciable slowing up in some directions. In some instances jobbers find it advisable to buy from hand to mouth, following the example of customers. There has been a marked falling off in many lines purchased for retail consumption. Decreased building has been responsible for this in many centers. For wholesale consumption, however, it is reported that business is still as brisk as ever.

An unusually heavy demand for electric motors, cable and flood-lighting equipment is a feature of the present situation in New England. Deliveries cannot be said to have improved much, and the pressure upon the manufacturers is now so great in industrial supply lines that it is practically hopeless to expect anything like early deliveries on non-standard equipment. Transportation difficulties continue to handicap the movement of goods, but perhaps to a less degree than a month ago. Jobbers allied with electrical contracting interests are doing all they can to adapt equipment for temporary industrial service, especially in the motor field, where approximate sizes, combinations of motor types, pulley adjustments and modifications, etc., must be made to provide the solution for many local power situations. A prominent central station man remarked last week that he could dispose of a thousand dollars' worth of motors every seven days if he could obtain them, and in some localities a rushing business is being done in the reconnecting of induction motors for higher or lower voltage service. Price is no object in many of these motor installations at present, speed of installation being the *sine qua non*.

APPLIANCE DEMAND OFF IN NEW ENGLAND

As for appliances, it is feared that the demand for these in New England may not attain the desired volume unless the tendency toward hysterical parsimony is counteracted by a more intelligent appreciation on the part of the public that so far as possible the tide of general business must flow full under war conditions no less than in peace. Some prospect exists that prices of appliances may go lower if overstocking becomes acute. A good start is being made on fan motor business.

The volume of buying during the next thirty to ninety days in the Middle West will, of course, depend on general business conditions. If prices remain firm, jobbers will expect no let-up in business. If prices weaken business will fall off, since the trade declines to buy on a falling market. There is a divergence of opinion as to the extent of business which may be expected from industrial plants. A few think industrial-plant expansion has reached its zenith; others believe that manufacturers will succeed in getting a part of the $7,000,000,000 the government will spend and that this must of necessity make for sound business conditions. A rumor is abroad in the trade that a Detroit company has already secured an order for 100 carloads of conduit and 250 100-kw. generators to be used in shipbuilding. The most noticeable demands are, of course, for the things which the jobber finds hardest to get. The lamp situation is still bad and the inability of the manufacturers to supply the jobbers is accredited to a combination of causes, including cessation of foreign shipments, extraordinary demand, and difficulty with the glass situation. Motors, transformers and conduit, which come from the East, are very much delayed by railroad embargoes. Telephones are almost impossible to get. Some jobbers find that magnet wire and stranded wire are hard to get and report that the mills are drawing only the larger sizes. The effect of the "wire-your-home-time" campaign has made itself felt to some degree, so that there has been a demand for wiring devices and some socket appliances. Jobbers who are carrying automobile specialties are, of course, experiencing a seasonable increase in this class of goods and look for a good year unless gasoline goes to more than 30 cents a gallon. At present it is the general feeling that the current year to date has produced a business above normal and that a continuation of good times may be expected.

Buying on the Pacific Coast will be, as heretofore, conservative and careful. However, the jobbers have found it advisable to order farther ahead than heretofore, charge to be made for goods at market price on date of delivery. This eliminates the gambling element in advance orders

and at the same time gives the manufacturer advance notice of requirements.

Plant and line equipment has been in demand in south Pacific Coast territory. Wire in system extensions and shipyard work has marked the Northwest trade. The most active demands are in the industrial and government fields. Contractors' business is about par.

During the last two weeks buying has been considerably heavier in the Northwest, on account particularly of steel advances. The orders being placed now call for early fall delivery. Many of the larger houses in that vicinity are trying to cover for months ahead, but are being held back by uncertain freight conditions which show no signs of improving. Demand continues about the same. The bulk of the business is being carried on with the shipbuilding concerns in the large cities of the Puget Sound country, which are rushed to capacity. An increase in demand from the shipbuilding firms, due to the wooden-ship-building program announced by the United States government, is anticipated. Supply dealers are making all preparations possible to care for the increase.

A heavy demand in wiring materials has been felt in the South, especially for textile industries.

Credits and collections have shown little change during the past month, what change there was being generally better. Less speculation has been noted and therefore a falling off somewhat in credits.

In the Southern districts that were visited by the boll weevil collections are not good. In certain counties whole communities are practically destitute; merchants in the towns dependent on these communities having sold a considerable volume of their stock are without means of replacing same, and in some instances small country stores may be found with shelves almost entirely empty. The condition in these sections is very serious and steps are being taken by public-spirited citizens to furnish these destitute farmers with sufficient seed to make their crops this year. In such communities, which are situated principally in what is known as the hill country of Mississippi, it is almost hopeless for jobbers to collect past-due accounts until better conditions are created.

In the Middle West credits and collections for a time slowed up with some jobbers, the slowing up being attributed to the difficulty jobbers' customers had for a short time in collecting from their customers. This period, however, seems to be passed so that credits and collections are now about normal.

The war has had little effect in the Far West in shortening terms or restricting credits to regular customers. The trade acceptance plan in the Northwest is working well, no defaults having yet been reported. There is plenty of money in evidence.

CANADIAN MARKET FOR FOREIGN ELECTRIC GOODS

Statistics for Year Ended March 31, 1916, Show a Marked Falling Off in Imports—All Countries Affected

Statistics have recently been issued showing the import trade of Canada for the year ended March 31, 1916, compared with that for the previous year. With the exception of carbons, all of the strictly electrical material listed showed a decreasing value of imports for the 1915-1916 period over the 1914-1915 period. Imports of copper wire dropped from $25,000 to $18,000; incandescent lamp bulbs from $70,000 to $63,000; insulators, batteries, telegraph and telephone instruments from $4,344,000 to $3,582,000; motors, generators and dynamos from $1,249,000 to $901,000. The increase in carbons was from $44,000 to $52,000.

While in the 1914-1915 period, which included the four months previous to the war, the imports were from almost all of the principal nations of Europe, since that time practically the entire electrical imports to Canada have been supplied by the United States and Great Britain. The British trade in purely electrical goods fell off from around $700,000 to a little more than $200,000. The imports of American electrical goods dropped from around $5,000,000 to a little more than $4,300,000.

THE DAY OF THE SMALL ELECTRICAL MANUFACTURER

He Is Receiving the Overflow Business from Larger Concerns and Thereby Laying Foundation for Larger Business in the Future

Without a doubt this is the day of the small electrical manufacturer. Orders are coming his way that ordinarily he would not even have an opportunity to bid on. Now, however, the large manufacturers are sold out and orders are taken only on the understanding that it will be a long time before the goods are delivered. The overflow trade, therefore, is going to the small manufacturer who is in a position to turn out a limited amount of goods in less time than it would take the larger manufacturer. It has been estimated that 50 per cent of the orders received by the smaller manufacturers are orders that the large manufacturers cannot handle.

Because of the smaller overhead and less complex organization and routine of the small manufacturers their profits have undoubtedly been larger proportionately than have those of the large concerns. It has been estimated that the routine cost per order for the large manufacturers is in the neighborhood of $25.

The smaller manufacturers, being as a rule specialists on some one class of goods, furnish a product that generally is excellent. In order to compete their article must be sold on a quality basis with emphasis on special features.

Consequently the small manufacturer of electrical equipment views the present with the utmost satisfaction for two reasons: First, his business is larger and more profitable than ever, and second, he has accumulated a large list of customers whom he probably never would have served except for such unusual conditions.

METALS MARKET IS FOR THE MOST PART QUIET

Lead and Iron Products Advance Under Large Demand—Little Buying in Other Metals—Copper Quotations Nominal

With the exception of iron and lead, the metals markets continue dull. There is no demand to speak of, and what buying there is is spot and in small quantities. Copper prices hardened somewhat at the beginning of the week on rumor of heavy foreign inquiries. At present the market seems stagnant. Nominal quotations on Tuesday for electrolytic were as follows: May, 31.25 cents; June, 30.25 cents; third quarter, 26.5 cents; fourth quarter, 25.5 cents.

The market for tin stays quiet. London prices are higher in expectation of American demand. Imports continue light.

Spelter market is quiet but firm. Demand is small.

Lead prices are advancing under a heavy demand.

Iron and steel continue to advance. Prices for iron pipe are expected to go six to eight points higher before the week is out.

NEW YORK METAL MARKET PRICES

	April 24 Selling Prices Bid	Asked	May 1 Selling Prices Bid	Asked
Copper:	£ s d		£ s d	
London, standard spot	130 0 0		130 0 0	
Prime Lake	30.50	to 31.00†	30.50	to 31.00†
Electrolytic	30.00	to 31.00†	31.00	to 31.50†
Casting	26.75	to 27.25†	27.50	to 28.50†
Copper wire base	37.50	to 38.00†	36.50	to 37.50†
Lead	9.00		9.00	
Nickel	50.00		50.00	
Sheet zinc, f.o.b. smelter	21.00		19.00	
Spelter, spot	8.92½	to 9.17½	9.55	to 9.67½
Tin, Straits	57.50†		58.50	
Aluminum, 98 to 99 per cent	56.00	to 58.00	56.00	to 58.00

OLD METALS

Heavy copper and wire	25.50	to 26.50	25.50 to 26.50
Brass, heavy	16.00	to 16.50	16.00 to 16.50
Brass, light	12.00	to 12.50	12.00 to 12.50
Lead, heavy	7.50	to 7.75	7.50 to 7.75
Zinc, scrap	6.25	to 6.50	6.50 to 7.00

†Nominal.

Current Prices of Electrical Supplies

The prices quoted are those prevailing in standard package or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists to contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East, its nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

RUBBER-COVERED WIRE N. C.

Solid-Conductor, Single-Braid

	Price per 1000 Ft. Net					
	Less than 500 Ft.		500 to 1000 Ft.		1000 to 5000 Ft.	
No.	Chicago	N. Y.	Chicago	N. Y.	Chicago	N. Y.
14	$18.00	$18.00	$16.00	$14.50	$14.00	$12.50
12	29.89	29.71	25.62	25.30	21.35	18.60
10	41.51	41.16	35.58	35.28	29.65	25.87
8	60.13	59.64	51.54	43.12	42.95	46.28
6	82.20	94.71	75.35	81.18	68.50	59.53

ANNUNCIATOR WIRE

Per Lb. Net	Chicago	N. Y.
No. 18, less than full spools	$0.65	$0.45¼
No. 18, full spools	0.56	0.44¼

WEATHERPROOF WIRE

Solid-Conductor, Triple-Braid, Sizes 4/0 to 8, Inc.

Per 100 Lb. Net	Chicago	N. Y.
Less than 25 lb	$45.00	$43.25
25 to 50 lb	44.00	42.25
50 to 100 lb	43.00	41.25

LAMP CORD

Cotton-Covered, Type C, No. 18

Per 1000 Ft. Net	Chicago	N. Y.
Less than coil (250 ft.)	$38.16	$35.77
Coil to 1000 ft.	28.62	27.18

PIPE FITTINGS

Conduits, V.V., Unilets and Similar

Discount	Chicago	N. Y.
Less than 1/5 std. pkg.	25%	25%
1/5 to std. pkg.	32%	32%
Std. pkg.	40%	40%

RIGID IRON CONDUIT, CARD NO. 37

Conduit, List, per Foot

Size, in.	Chicago	N. Y.
¼	$0.08½	$0.08½
⅜	.08½	.08½
½	.08½	.08½
¾	.11½	.11½
1	.17	.17
1¼	.23	.23
1½	.27½	.27½
2	.37	.37
2½	.58½	.58½
3	.76½	.76½

COUPLINGS AND ELBOWS, CARD NO. 37

	Couplings, List,		Elbows, List.	
	Each	Each	Each	Each
Size, in.	Chicago	N. Y.	Chicago	N. Y.
¼	$0.05	$0.05	$0.19	$0.19
⅜	.06	.06	.19	.19
½	.07	.07	.19	.19
¾	.10	.10	.25	.25
1	.13	.13	.37	.37
1¼	.17	.17	.45	.45
1½	.21	.21	.60	.60
2	.28	.28	1.10	1.10
2½	.40	.40	1.80	1.80
3	.60	.60	4.80	4.80

	Discount, ¼ In. to ½ In., Per Cent		Discount, ¾ In. to 3 In., Per Cent	
	Chicago	N. Y.	Chicago	N. Y.
Less than 2500 lb	13.8	20	15.8	22
2500 to 5000 lb	16.8	23	18.8	25

(For galvanized deduct six points from above discounts.)

NON-METALLIC FLEXIBLE CONDUIT

	List, per Foot.			List, per Foot.	
Size, in.	Chicago	N. Y.	Size, in.	Chicago	N. Y.
7/32	$0.05½	$0.05½	1	0.25	$.25
¼	.06	.06	1¼	.33	.33
⅜	.09	.09	1½	.40	40
½	.12	.12	1¾	.47	.47
⅝	.15	.15	2	.55	.55
¾	.18	.18	2¼	.65	.65

	7/32 In.		¼ In.	
Per 1000 Ft. Net	Chicago	N. Y.	Chicago	N. Y.
Less than $15.00 list	$36.67	$55.00	$40.00	$60.00
$15.00 to $60.00 list	27.50	24.50	30.00	27.00
$60.00 to $150.00 list	24.75	21.50	27.00	23.50

METALLIC FLEXIBLE CONDUIT

		List per 100 Ft.	
Size, In.	Feet per Coil	Chicago	New York
5/16	250	$5.00	$5.00
⅜	250	7.50	7.50
½	100	10.00	10.00
¾	50	13.00	13.00
1	50	21.00	21.00
1¼	50	26.00	26.00
1½	25-50	35.00	35.00
2	25-50	45.00	45.00
2½	25-50	52.00	52.00

	⅜" Single Strip		⅜" Double Strip	
	Chicago	N. Y.	Chicago	N. Y.
Less than coil per 1000 ft., net	$71.25	$75.00	$75.00	$106.00
Cost to 1000 ft. per 1000 ft. net	60.00	61.50	67.50	90.00

	½" Single Strip		½" Double Strip	
	Chicago	N. Y.	Chicago	N. Y.
Less than coil per 1000 ft., net	$95.00	$105.00	$100.00	.....
Cost to 1000 ft. per 1000 ft., net	80.00	82.00	90.00	.....

FLEXIBLE-STEEL ARMORED CONDUCTORS

Single Conductor

	List	
	Chicago	N. Y.
B. & S. Size	Per 1000 Ft.	Per 1000 Ft.
No. 14 solid	$61.00	$61.00
No. 12 solid	71.00	71.00
No. 10 solid	90.00	90.00
No. 8 solid	106.00	106.00
No. 6 solid	145.00	145.00

	List	
	Chicago	N. Y.
B. & S. Size	Per 1000 Ft.	Per 1000 Ft.
No. 10 stranded	$95.00	$95.00
No. 8 stranded	115.00	115.00
No. 6 stranded	160.00	160.00
No. 4 stranded	205.00	205.00
No. 2 stranded	266.00	266.00
No. 1 stranded	315.00	315.00

Twin Conductor

	List	
	Chicago	N. Y.
B. & S. Size	Per 1000 Ft.	Per 1000 Ft.
No. 14 solid	$104.00	$104.00
No. 12 solid	135.00	135.00
No. 10 solid	185.00	185.00

	List	
	Chicago	N. Y.
B. & S. Size	Per 1000 Ft.	Per 1000 Ft.
No. 8 stranded	$235.00	$235.00
No. 6 stranded	370.00	370.00
No. 4 stranded	575.00	575.00

DISCOUNT PER 1000 FT.

Single Conductor

	Chicago	N. Y.
No. 14 solid:		
Less than coil	+10%	Net
Coil to 1000 ft.	—10%	3%
No. 12 solid:		
Less than coil	+10%	Net
Coil to 1000 ft.	—10%	3%

Twin Conductor

No. 14 solid:		
Less than coil	+10%	Net
Coil to 1000 ft.	—10%	3%
No. 12 solid:		
Less than coil	+10%	Net
Coil to 1000 ft.	—10%	3%

KNIFE SWITCHES

250-Volt, Front Connections, No Fuse

	List	
	Chicago	N. Y.
Perkins or Trumbull Type A:		
30-amp. S. P. S. T.	$0.80	$0.80
60-amp. S. P. S. T.	1.20	1.20
100-amp. S. P. S. T.	2.25	2.25
200-amp. S. P. S. T.	3.48	3.48
300-amp. S. P. S. T.	5.34	5.34
30-amp. D. P. S. T.	1.20	1.20

KNIFE SWITCHES (Continued)

	List	
Perkins or Trumbull, Type A (Continued):	Chicago	N. Y.
60-amp. D. P. S. T.	$1.78	$1.78
100-amp. D. P. S. T.	3.38	3.38
200-amp. D. P. S. T.	5.20	5.20
300-amp. D. P. S. T.	8.00	8.00
30-amp. 3 P. S. T.	1.80	1.80
60-amp. 3 P. S. T.	2.68	2.68
100-amp. 3 P. S. T.	5.08	5.08
200-amp. 3 P. S. T.	7.80	7.80
300-amp. 3 P. S. T.	12.00	12.00
Perkins Type B or Trumbull Type C:		
30-amp. S. P. S. T.	0.42	0.42
60-amp. S. P. S. T.	0.74	0.74
100-amp. S. P. S. T.	1.50	1.50
200-amp. S. P. S. T.	2.70	2.70
30-amp. D. P. S. T.	0.68	0.68
60-amp. D. P. S. T.	1.22	1.22
100-amp. D. P. S. T.	2.50	2.50
200-amp. D. P. S. T.	4.50	4.50
30-amp. 3 P. S. T.	1.02	1.02
60-amp. 3 P. S. T.	1.84	1.84
100-amp. 3 P. S. T.	3.76	3.76
200-amp. 3 P. S. T.	6.76	6.76

DISCOUNT

Type A, Perkins or Trumbull:	Chicago	N. Y.
Less than $10 list	Net	Net
$10 to $25 list	15%	15%
$25 to $50 list	18%	18%
Type B, Perkins, or Type C, Trumbull:		
Less than $10 list	10%	10%
$10 to $25 list	20%	20%
$25 to $50 list	28%	28%

OUTLET BOXES

Union Cat. No.	Black List per 100 Chicago	Black List per 100 N. Y.
101	$30.00	$30.00
102	30.00	30.00
103	25.00	25.00
106	20.00	20.00

Union Cat. No.	Galv. List per 100 Chicago	Galv. List per 100 N. Y.
101	$30.00	$30.00
102	30.00	30.00
103	25.00	25.00
106	20.00	20.00

	Black		Galvanized	
Discount	Chicago	N. Y.	Chicago	N. Y.
Less than $10.00 list	40%	Net	35%	Net
$10.00 to $50.00 list	50%	25%	45%	20%

SECTIONAL CONDUIT SWITCH BOXES

C. F. Mfg. Co.	List, Each Chicago	List, Each N. Y.
No. 155	$0.34	$0.34
No. 160	0.60	0.60

	Black		Galvanized	
Discount	Chicago	N. Y.	Chicago	N. Y.
Less than $2.00 list	40%	40%	30%	30%
$2.00 to $10.00 list	50%	50%	40%	40%
$10.00 to $50.00 list	64%	60%	52%	52%

MAZDA LAMPS

105 to 125 Volts

	Std. Pkg.	List Chicago	List N. Y.
Regular, clear:			
10 to 40-watt—B	100	$0.27	$0.27
60-watt—B	100	.36	.36
100-watt—B	24	.65	.65
75-watt—C	50	.65	.65
100-watt—C	24	1.00	1.00
200-watt—C	24	2.00	2.00
300-watt—C	24	3.00	3.00
Round bulbs, 3½ in., frosted:			
15-watt—G 25	50	.50	.50
25-watt—G 25	50	.50	.50
40-watt—G 25	50	.50	.50
Round bulbs, 3¾ in., frosted:			
60-watt—G 30	24	.72	.72
Round bulbs, 4⅝ in., frosted:			
100-watt—G 35	24	1.05	1.05

	Discount	
	Chicago	N. Y.
Less than standard package	Net	Net
Standard package	10%	10%

PORCELAIN KNOBS

	5½ N.C.—Solid Std. Pkg. 3500		Nail-it—N.C. Std. Pkg. 4000	
Per 1000 Net	Chi.	N. Y.	Chi.	N. Y.
Less than 1/5 std. pkg.	$9.75	$11.25	$20.75	$18.00
1/5 to std. pkg.	9.00	9.00	16.30	15.00

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

	Per 1000 Net	
	Chicago	N. Y.
Less than 1/5 std. pkg.	$14.00	$15.00
1/5 to std. pkg.	13.00	12.00

Standard package, 2200. List per 1000, $20.

DRY BATTERIES

	No. 6 Regular,		No. 6 Ignitor,	
Each Net	Chicago	N. Y.	Chicago	N. Y.
Less than 12	$0.35	$0.35	$0.35	$0.35
12 to 50	.30	.30	.30	.30
50 to barrel	.26¼	.26	.27¼	.27
Barrel lots	.24¾	.24½	.25¾	.25½

ELECTRIC TOASTERS, UPRIGHT

	Chicago	N. Y.
List	$4.50	$5.50
Discount	25%	Net

ELECTRIC IRONS

	Chicago	N. Y.
List	$5.50	$5.50
Discount	30%	Net

WIRE LAMP GUARDS

Per 100 Net	Chicago	N. Y.
Less than 50, Matthews 16-cp	$20.00	$20.00
Less than 1/5 std. pkg. Hubbell	28.35	23.80
Less than 36, 60-watt Loxon	25.00	26.25

ATTACHMENT PLUGS

	Std. Pkg.	List Chicago	List N. Y.
Benjamin No. 903	100	$0.25	$0.25
Hubbell No. 5406	250	.30	.30
Bryant No. 706	100	.25	.25
G. E. 50996	250	.22	.22

Discount	Chicago	N. Y.
Less than 1/5 std. pkg.:		
Benjamin No. 903	12%	12%
Hubbell No. 5406	+10%	Net
Bryant No. 706	+20%	10%
G. E. 50996	+20%	20%
1/5 to std. pkg.:		
Benjamin No. 903	20%	20%
Hubbell No. 5406	10%	15%
Bryant No. 706	Net	20%
G. E. 50996	Net	44%
Std. pkg.:		
Benjamin No. 903	44%	52%
Hubbell No. 5406	34%	28%
Bryant No. 706	30%	34%
G. E. 50996	30%	52%

SNAP AND FLUSH SWITCHES

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List Chicago	List N. Y.
5-amp. single-pole	250	$0.28	$0.28
5-amp. single-pole, ind.	250	.32	.32
10-amp. single-pole	100	.48	.48
10-amp. single-pole, ind.	100	.54	.54
5-amp., three-point	100	.56	.56
10-amp., three-point	50	.76	.76
10-amp., 250-volt, D. P.	100	.66	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List Chicago	List N. Y.
10-amp. single-pole	100	$0.45	$0.45
10-amp. three-way	50	.70	.70
10-amp. double-pole	50	.70	.70

Discount	Chicago	N. Y.
Less than 1/5 standard package	Net	Net
1/5 to standard package	15%	15%
Standard package	20%	28%

INCLOSED FUSES

	Std. Pkg.	List Chicago	List N. Y.
250-Volt			
3-amp. to 30-amp.	100	$0.25	$0.25
35-amp. to 60-amp.	100	.35	.35
65-amp. to 100-amp.	50	.90	.90
110-amp. to 200-amp.	25	2.00	2.00
225-amp. to 400-amp.	25	3.60	3.60
450-amp. to 600-amp.	10	5.50	5.50
600-Volt			
3-amp. to 30-amp.	100	$0.40	$0.40
35-amp. to 60-amp.	100	.60	.60
65-amp. to 100-amp.	50	1.50	1.50
110-amp. to 200-amp.	25	2.50	2.50
225-amp. to 400-amp.	25	5.50	5.50
450-amp. to 600-amp.	10	8.00	8.00

Discount	Chicago	N. Y.
Less than ½ standard package	28%	28%
1/5 to standard package	38%	38%

FUSE PLUGS

3-Amp. to 30-Amp.

Per 100 Net	Chicago	N. Y.
Less than 1/5 standard package	$6.25	$5.00
1/5 to standard package	5.25	4.50

Standard package, 500. List, $0.07.

SOCKETS AND RECEPTACLES

	Std. Pkg.	List Chicago	List N. Y.
⅛-in. cap key socket	500	$0.33	$0.33
⅛-in. cap keyless socket	500	.30	.30
⅛-in. cap pull socket	250	.60	.60

Discount	Chicago	N. Y.
Less than 1/5 standard package	Net	Net
1/5 to standard package	15%	20%

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Lamp for Floodlighting

Standard lamps of any rating having a mogul base can be used in the projector shown herewith, manufactured by the X-Ray Reflector Company of Chicago and New York. This unit has



PROJECTOR THAT USES STANDARD MOGUL-BASE LAMPS

a range of 300 to 1500 watts. When mounted on its base this projector is easily adjusted for position in both the horizontal and vertical planes and securely clamped. Attention is called to the hinged top hood. When opened, the focusing mechanism is readily accessible, lamps may be replaced and the reflector and front glass easily cleaned. A reflector of special parabolic design is used. The device is made of heavy steel and castings, finished in black and is weatherproof, well ventilated and light in weight.

Entrance Fitting

Entrance fittings that are reversible and may be used either for vertical or horizontal installations have been de-



REVERSIBLE ENTRANCE FITTING

veloped by the E. H. Freeman Electric Company of Trenton, N. J. Removing the porcelain cap leaves a straight pull for the wires, which can be easily fed through the well-glazed outlet holes of the cap. These holes are provided with drip sheds for carrying off the moisture. The porcelain cap is fastened to the flange of the hub by two heavy brass screws, which are locked in the cap to prevent loss as well as to cut down the time of installing. These fittings are made in ½, ¾ and 1-in. (1.27, 1.9 and 2.54-cm.) sizes and can be furnished either in black enamel or galvanized finish.

Vibrating-Reed Slip Indicator

Vibrating-reed slip indicators that consist essentially of a gear box, a rotating slotted disk, an electromagnetic vibrator with a steel reed and a lamp for illumination purposes have been developed and are being used by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa. The gear box consists of three sets of



SLIP INDICATOR OF VIBRATING-REED TYPE

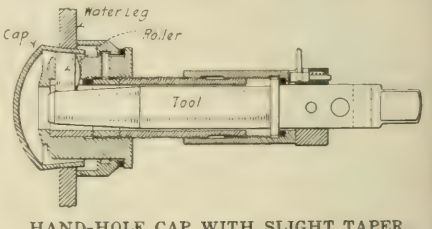
pinions by means of which the disk may be driven at various speeds with respect to the speed of the motor under test. So that the indicator may be attached to and detached from the driving shaft of the motor while running, a short flexible shaft and separable coupling with a sleeve is provided. Five disks are furnished with each indicator, each having a different number of slots. For a two-pole and four-pole machine a two-slot disk should be used, for six, twelve and eighteen-pole machines a six-slot disk and so on.

When the motor under test is operating on a 110-volt circuit the electromagnet of the vibrator is excited from the same circuit. When, however, the motor is operating on higher voltages the magnet is excited from the 100-volt secondary of a potential transformer whose primary leads are connected across one phase of the same circuit on which the motor under test is operating.

In operation the reed is observed through the slots in the rotating disk. If the motor is operating at a speed slightly different from synchronous, the reed will be seen in a different position at each revolution of the disk, apparently oscillating from side to side similarly to a pendulum. A complete oscillation corresponds to one alternations slip. When the disk is direct-connected to the motor the number of these apparent oscillations per minute divided by the frequency of the circuit is equal to the per cent slip. When the disk is driven through the gears the per cent slip is equal to the marking on the pinion (0, 4 or 8) to which the motor is connected, plus or minus the per cent slip as determined above. Whether the sign is plus or minus may be ascertained readily by noting the change in the rate of oscillations with change in load. The gear box is used since it is difficult to count oscillations occurring faster than 150 per minute.

Cap for Boilers

The Key Boiler Equipment Company, Pierce Building, St. Louis, Mo., has brought out a metal hand-hole cap which eliminates the necessity for gaskets in water-tube boilers and produces a metal-to-metal joint which, it is claimed, is more satisfactory than a joint made by the use of a gasket. In applying the caps all of the hand holes are converted to a standard size by revolving special rollers furnished with the caps. As the rollers revolve they remove any roughness from the interior diameter of the hole and impart to it a slight but effective taper. The hand-hole caps are also tapered slightly. After being coated with a graphite and linseed-oil paste they are driven by means of a lead mallet into the holes from inside the



HAND-HOLE CAP WITH SLIGHT TAPER

water leg. Then the rollers of the setting tool are revolved inside the open cup face of the cap, thereby pulling the cap tightly into the hole and

making a metal-to-metal contact which will stand more than 1500 lb. per square inch (105.5 kg. per sq. cm.) on hydrostatic tests. This tightening of the cap is not an expanding operation but is one of rounding out the cap to fit the tapered hole. Steam pressure on the cap in this position of course helps hold it like a check valve. When it is necessary to remove the caps they can be unseated by a hammer blow on the protruding edge. The same caps can be reused several times before they have finally to be discarded.

Electric Hair Curler

A small light-weight curling iron which is convenient to use has been brought out by the Russell Electric Company of Chicago. The device is made of steel and has a black walnut



LIGHT-WEIGHT CURLING IRON

handle. A 20-watt heating element is used. Instead of being mounted on a mica or lava core it is wound on an asbestos one. This construction makes a more durable heater, it is said, since the treatment which the curler receives will not be so likely to break the element as it would if the resistance wire were wound around on a rigid core.

Floodlighting Projectors

Incandescent floodlighting projectors mounted on cast-iron swivel bases which permit the projector to be turned in any direction are being made by the Crouse-Hinds Company of Syracuse, N. Y. They are equipped with a quadrant which provides means for elevating or depressing the beam. The casing of the projector, which is made of black-japanned, alloy-coated iron (rust-resisting), is thoroughly weatherproof and is ventilated to dissipate the

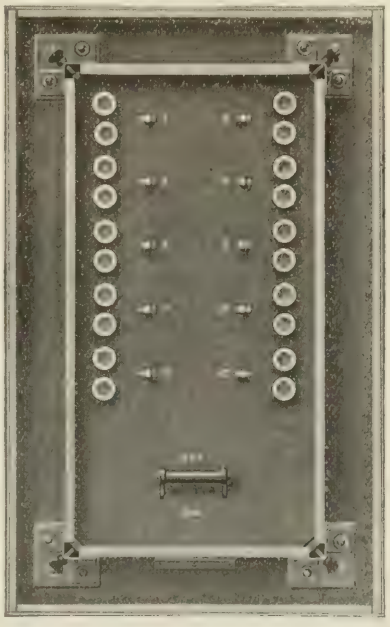


PROJECTOR MOUNTED ON SWIVEL BASE

heat given off by the lamp. The reflectors used in the projectors are true paraboloids, consisting of metal which has been spun over accurate steel forms. The glass reflectors are ground, buffed and polished on both surfaces. Focus-type lamps are mounted horizontally in the reflectors. On the back of each projector case is a knurled wheel, which furnishes means for moving the lamp forward or backward as desired. Because of the concentrated lamp filament used, a narrow beam of light having only about 10 deg. divergence can be obtained, it is claimed.

Safety Lighting Panels

Safety lighting panels furnished in steel cabinets have been placed on the market by the Sprague Electric Works of the General Electric Company, New York City. When the door is open the receptacles for the plug fuses and the operating handles of branch-circuit switches are exposed. The latter are of the 30-amp., 250-volt quick-make-and-break tumbler type. The "on" or "off"



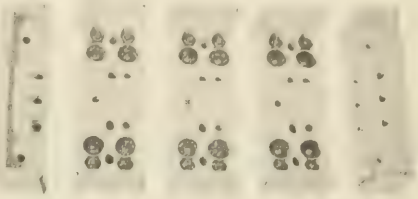
LIGHTING PANEL OF SAFETY TYPE EQUIPPED WITH MAIN SWITCH

positions of the switch are indicated by the position of the switch handle. Current-carrying parts are protected under a neatly finished cover, through which the switch handles and fuse receptacles protrude.

This type of panel is also furnished with a brush-contact, double-break, quick-break main switch when desired, the handle of which also protrudes through the cover. When in the open position this switch is entirely disconnected from live parts of the panel. The brushes are furnished with secondary contact tips to break the arc, thus reducing the possibility of burning the main brushes. The switch is held in the closed position by a toggle mechanism. All parts of the panelboard, including both branch-circuit and main switch, are removable from the front of the board. The construction employed permits the use of a minimum number of electrical joints. This panel can also be furnished with National Electrical Code inclosed fuses in the branches or with main fuses or sub-feeder switches with fuses.

Barrier Cut-Out

Cut-outs designed for cabinet work where a wiring gutter is desired have been developed by the C. & P. Electric Works of Springfield, Mass. They are made of white glazed porcelain with an upturned end which forms a barrier around the wiring gutter. Each cut-

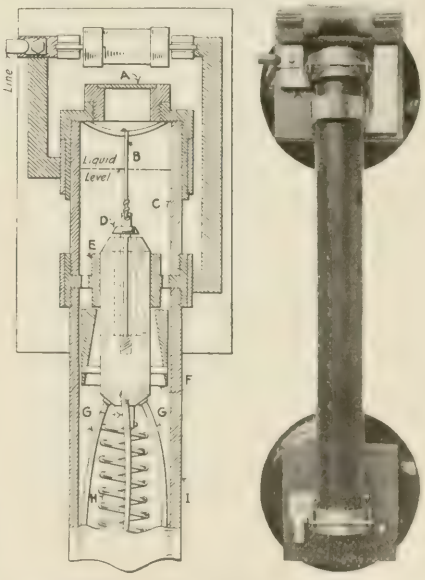


METHOD OF FITTING CUT-OUTS TOGETHER TO FORM PANEL

out is furnished with a busbar, which may be joined to the sections of the adjoining cut-outs. The end pieces are furnished in pairs with sectional busbar lug ends for one end. The cut-outs are made to fit into a box 3 in. (7.6 cm.) deep.

High-Tension Circuit-Breaking Device

An automatic high-potential circuit-breaking device that has been developed by Schweitzer & Conrad, Inc., of Chicago, is shown in the accompanying illustrations. According to the manufacturers it is particularly well adapted to service where automatic reclosing is not necessary and at substation feeder ends, in industrial stations, and where



FIGS. 1 AND 2—HIGH-VOLTAGE SWITCHING DEVICE AND CROSS-SECTION OF UPPER PART

A—vent. B—fusible retaining link. C—insulating tube. D—replaceable arcing tip. E—main circuit-breaking contact. F—liquid director. G—flexible cable. H—spring. I—insulating tube.

outdoor air-break switches are now being used. While the unit is limited in application by the fact that it must be reset by hand owing to the use of spring-opened contacts and a fuse normally holding the spring extended, the

device has numerous advantages. For example, it is relatively inexpensive, occupies very little space, presents practically no fire hazard (because the contacts are immersed in carbon tetrachloride), can be renewed at small expense, permits the line to be opened under load, can be used in conjunction with relays, and is said to rupture an arc inside one cycle.

In general, the device consists of cartridge-inclosed, carbon-tetrachloride-immersed, spring-opened contacts normally held closed by a fusible link. Shunted across the latter so that it will not heat perceptibly and thus deteriorate under normal conditions is an auxiliary fuse such as is used on low-voltage circuits. When the low-voltage fuse opens because of overload the fusible link is compelled to carry the entire current. Having low-current carrying capacity it is ruptured immediately, thereby releasing the spring, which in turn opens the circuit by immediately separating the contact. While the gap thus interposed is usually sufficient to extinguish the arc, a funnel-shaped liquid deflector is attached to the movable contact so that it will cause carbon tetrachloride to be projected against the arc.

The spring employed to separate the contacts is shunted by flexible conductors and therefore does not deteriorate from carrying current. The inclosing tube is made of non-fragile Bakelized material. The fusible link is non-corrosive and has high resistance and high tensile strength.

If desired, a low-voltage circuit breaker may be shunted across the fusible link instead of using a low-voltage fuse, thus making it possible to open the circuit by hand and eliminating the necessity of the auxiliary fuse. By connecting the line directly to the stationary contact instead of to the cap of the tube and using relays to close a battery circuit through the fusible link the device can be controlled from a distance and several circuit breakers of this type can be made to operate simultaneously.

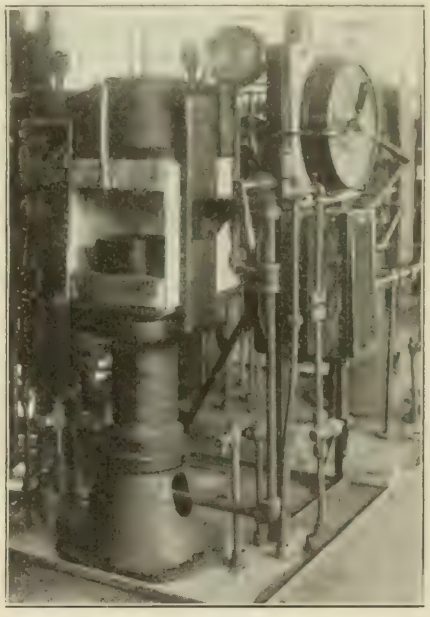
Three successive short-circuit tests were made recently on a 100,000-volt circuit breaker of this type in which a current of about 1500 amp. at 12,000 volts was ruptured each time without any damage to the device. Energy for the tests was furnished by two 3000-kw. transformers in series, the combined impedance of the circuit being approximately 10 per cent. A 110-amp. fuse was employed.

Electrically Heated Molding Presses

The Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., has adopted electric heating for twenty-three presses used in the manufacture of molded-composition material. These presses were formerly heated by steam, but a trial of an electrically heated press proved so satisfactory that the entire set of presses in the company's molded insulation department is now being modified for equipping with electric heaters.

The heat is furnished by means of two plates 1 ft. by 1 ft. by 3½ in. (0.3 m. by 0.3 m. by 8.9 cm.) thick, covered on their exposed surfaces with magnesia to reduce the radiation losses. The upper plate is stationary and is in contact with a thermometer. The lower plate is movable vertically. Each plate is made up of two halves, in each of which are two grooves holding the heating units. Thus there are four heating units to each plate, or eight per press. Each unit is 12 in. long by 2¼ in. wide by 3/16 in. thick (30.5 cm. by 5.75 cm. by 4.8 mm.) and is rated at 300 watts. The heating units are of the Westinghouse steel-clad bayonet type, consisting of a flat ribbon resistor assembled in a mica sheath and inclosed in a heavy steel casing. This construction reduces to a minimum the possibility of injury and also provides rapid transfer of heat from the resistance element, thus insuring long life under severe conditions of service.

The presses are arranged in sets of four. Current is supplied to each set through a multi-tap transformer and a dial face plate. The dial has fifteen contacts and furnishes fifteen voltages, varying from a maximum of 220 volts, the line voltage, to a minimum of 150 volts, with relative inputs for each set of heaters of from 2400 watts maximum to 1200 watts minimum. This arrangement provides for an input of high value for quick heating when the press is cold and it is desired to heat it rapidly; one of low value when the press is not to be used but it is desired to keep it hot for later use, and several intermediate inputs when it is desired to keep the press hot while in steady use on work having different heat requirements.



ELECTRICALLY HEATED PRESS AND CONTROL

A series of tests made on one of the presses show that from one to one and one-fourth hours are required to heat the plates, starting cold, and that 1800 watts is required to keep the press hot while in steady use for work requiring a temperature of 190 deg. C.

Improved Wall Bracket

Wall brackets which Spring & Buckley of New Britain, Conn., claim always remain firm are shown herewith. These brackets consist of two parts, an angle socket and a canopy with screw holes near the outer edge with a ⅜-in. (9.5 mm.) nipple soldered firmly in the end. These brackets are easily installed, No. 14 B. & S. gage wire being run direct to the binding screws in the socket. This construction avoids the use of fixture wire and splices, it is claimed. The Plume & Atwood Manufacturing Company of Waterbury, Conn., makes up the parts.



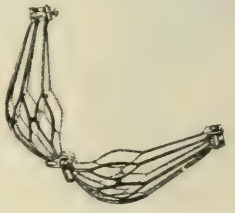
WALL BRACKET OF TWO PARTS

Garage-Door Opener

The Richards-Wilcox Manufacturing Company of Aurora, Ill., has developed a motor-driven door opening and closing apparatus. The equipment consists of a specially built motor mounted on a base with reduction gears, drums and a control relay, in addition to two limit switches, three sets of push-buttons and the necessary cable and chain. The apparatus can be adapted to practically any style of door and has been designed so that it cannot be harmed by the operation of switches in the wrong sequence.

Lamp Guards

The Flexible Steel Lacing Company of Chicago, Ill., is marketing guards for incandescent lamps. The guards are made from expanded flexible steel coated with tin, and are shaped so that they fit closely around the lamps they protect and cannot be taken off without a special key. The accompanying illustration shows the guard open for removing or inserting the lamp.



FLEXIBLE STEEL LAMP GUARD OPEN

Trade Notes

THE GROSSMAN ELECTRIC COMPANY has moved from Philadelphia to 142 South Seventh Street, Allentown, Pa.

THE McINTOSH & SEYMOUR CORPORATION has established its New York office in the Singer Building, 149 Broadway.

THE NATIONAL CONDUIT & CABLE COMPANY has changed the location of its Chicago office from 72 West Adams Street to the Rookery.

THE ROBBINS & MYERS COMPANY has changed the location of its Chicago office from 320 Monadnock Building to 1444-6-8 Conway Building.

THE JENT ELECTRIC COMPANY, manufacturer of tungsten lamps, has leased property at 369-371 Ogden Street, Newark, N. J., for a new manufacturing plant.

THE ATLANTIC INSULATED WIRE & CABLE COMPANY announces the removal of its general sales office from 120 Liberty Street to the Vanderbilt Concourse, 52 Vanderbilt Avenue, New York City.

THE ELECTRIC DYNAMIC COMPANY, Avenue A, Bayonne, N. J., manufacturer of dynamos and motors, has filed plans for the erection of an addition on North Street and Avenue A, to cost about $15,000.

THE SERVICE SUPPLY & EQUIPMENT COMPANY of Pittsburgh, Pa., will move its sales office about May 1 from the Fulton Building to the Bessemer Building, where it will have larger and better quarters.

VERNE W. SHEAR & COMPANY, Akron, Ohio, sales engineers, have established a branch office in the Illuminating Building, Cleveland, Ohio, in charge of Bon J. Ballard, formerly with the H. W. Johns-Manville Company.

CHARLES M. CROFOOT has been transferred from the post of district sales manager of the Cincinnati office to the New York City office of the Crouse-Hinds Company and not of the Federal Sign System (Electric) as stated in the ELECTRICAL WORLD for April 28.

H. B. KANTER announces that the copartnership existing between W. F. Austin and H. B. Kanter, under the style of Austin & Kanter, has been dissolved by mutual agreement. Mr. Kanter has formed the H. B. K. Electric Company, 92 Jackson Avenue, Long Island City, N. Y.

THE CUMBERLAND ELECTRIC MANUFACTURING COMPANY, manufacturer of low-voltage transformers and electrical specialties, has moved its office and factory to Memphis, Tenn., because of increased business and to have better shipping and working conditions. This company was formerly established at Clarksville, Tenn.

H. A. HOWARD, for many years connected with the C. & C. Electric Company, and until recently associated with the Diehl Manufacturing Company, has been appointed manager of the New England office of the C. & C. Electric & Manufacturing Company. Mr. Howard has had a wide experience in the electrical line, this experience extending over a quarter of a century.

THE AUGUST MIETZ CORPORATION announces that the business of August Mietz (Emma C. Rueff, proprietress) has been sold and transferred to the August Mietz Corporation. The officers of the new corporation are: Emma C. Rueff, president; Emil Rueff, vice-president and treasurer; Otto Von Schrenk, secretary, and Louis C. Eitzen, general manager. The business will be continued under the corporate form of organization, at the same address, and without any change in its policy, under the personal management of Louis C. Eitzen.

AUTOMOTIVE ELECTRIC ACCESSORIES MANUFACTURERS ORGANIZE.—An organization of manufacturers of automotive electric accessories was formed at Atlantic City, N. J., on April 16. This new organization will be known as the Automotive Electric Association. Among its members are the largest and best known manufacturers in this line. The purposes of the organization are to improve and develop this branch of automotive electric accessories business through standardization and by friendly interchange of experience with reference to design and manufacture. The following officers were elected at this meeting: President, G. Brewer Griffin, Pittsburgh, Pa.; vice-president, C. O. Mininger, Toledo, Ohio; secretary, G. S. Cole, Cleveland, Ohio; treasurer, C. L. Amos, Syracuse, N. Y. The next meeting of this association will be held at Hot Springs, Va., May 17, 18 and 19.

THE AMERICAN-RUSSIAN CHAMBER OF COMMERCE of New York announces that the 1918 edition of "Industrial America," a handbook of industrial, commercial and financial information, together with a classified trade directory of American firms for use in Russia, is now in course of preparation. American manufacturers who are interested in the Russian field are invited to forward to the American-Russian Chamber of Commerce information regarding their firms and their products for listing in the trade directory section of the handbook. There is no charge for such listing, the purpose of the directory being to place before Russian purchasers the most complete and comprehensive list possible of responsible American firms that can supply the wants of Russian consumers. Proper forms for supplying information for the trade directory may be had by applying to the American-Russian Chamber of Commerce, Woolworth Building New York.

New Incorporations

THE LIGHTING FIXTURE STUDIO of Chicago, Ill., has been incorporated by Daniel C. Jones, Frederick Arnd and M. E. Troyer. The company is capitalized at $25,000.

THE ELECTRIC REPAIR COMPANY of Chicago, Ill., has been incorporated with a capital stock of $2,500 by Edward Sherburne, John T. Hartley and H. P. Williams.

THE ELECTRIC SUPPLY COMPANY of Ogden, Utah, has been incorporated with a capital stock of $5,000, to deal in electrical supplies. The officers are: R. C. Carter, president; C. J. Elder, vice-president, and F. E. Young, secretary and treasurer.

THE FRANKLIN POWER COMPANY of Farmington, Me., has been incorporated with a capital stock of $300,000 to develop water powers and supply electricity in Farmington and surrounding towns. F. J. Savage of Fairfield, Me., is president of the company.

L. J. LEWERY & COMPANY of New York, N. Y., have been incorporated with a capital stock of $25,000 to do a general mechanical, electrical and industrial engineering business. The incorporators are: Leonard J. Lewery, Charles W. Sutton and Walter H. Carman.

THE ELECTRIC COAL MINING & MACHINERY COMPANY of Chicago, Ill., has been incorporated with a capital stock of $150,000 to manufacture coal-mining machinery. The incorporators are: Arthur A. Bettridge Ralph E. Battan and Seward N. Mighell of Chicago, Ill.

THE PLAYER SPECIALTIES COMPANY, 418 East Water Street, Milwaukee, Wis., has been organized to manufacture automatic playing devices for pianos and organs, to be operated by electricity. The incorporators are: James C. Arthur, John C. Stenger and Frank J. Clark.

THE LANTON ADAMS ELECTRIC COMPANY of New York, N. Y., has been chartered with a capital stock of $10,000 to manufacture and deal in electrical machinery. The incorporators are: E. Schuster, S. Hess and R. A. Lan, 315 West Ninety-fourth Street, New York, N. Y.

THE MORRIS PROCESS OF NEW JERSEY of Jersey City, N. J., has been incorporated by C. H. Jarvis, P. L. Neiser and J. L. Turner of Jersey City. The company is capitalized at $150,000 and proposes to manufacture and deal in engines, motors, compressors, power-distributing machinery, etc.

THE WELCH ARMATURE COMPANY of Welch, W. Va., has been incorporated by John M. Lewis, Joseph A. Lewis of Elkhorn, W. Va.; Carl H. Ehret, T. Miller Freeman and D. J. F. Strother of Welch, W. Va. The company is capitalized at $5,000 and proposes to deal in electrical supplies.

THE SIMS MAGNETO COMPANY of East Orange, N. J., has been incorporated by R. C. Anderson, E. O'Meara of New York, N. Y., and A. A. Fisher of East Orange, N. J. The company is capitalized at $1,250,000 and proposes to manufacture and deal in electrical and mechanical apparatus, boats and aircraft.

THE MANCHA STORAGE BATTERY LOCOMOTIVE COMPANY of Wilmington, Del., has been incorporated with a capital stock of $300,000 to manufacture, use, lease and install locomotive and electric devices of all kinds. The incorporators are: Herbert E. Latter, C. L. Rimlinger, Clement M. Egner of Wilmington, Del.

THE WATERLITE POWER & ENGINEERING COMPANY of New York, N. Y., has been chartered with a capital stock of $5,500 by A. W. Cubby, H. L. Shartle and G. R. Bennett, 183 Madison Street, Brooklyn, N. Y. The company proposes to manufacture and deal in compressors, water supplies, electric-lighting appliances, motors, pumps, etc.

THE GENERAL GAS-ELECTRIC COMPANY of Hanover, Pa., has been chartered with a capital stock of $104,000 to manufacture and deal in engines. The company manufactures the Genco light and power equipment for farms and rural dwellings. The incorporators are: V. K. Jordan, John J. Schmidt and W. F. Kintzing, all of Hanover.

THE ELECTROLYTIC ENGINEERING CORPORATION of New York, N. Y., has been incorporated by M. Kirschberg, P. R. Gordon and A. Heyert, 170 Broadway, New York, N. Y. The company is capitalized at $50,000 and proposes to deal in electrolytic processes, apparatus and machinery for distributing electricity for light, heat and power purposes.

THE NEW JERSEY PRODUCTS COMPANY of West Orange, N. J., has been incorporated with a capital stock of $500,000 by Thomas A. Edison, Charles Edison, R. H. Allen of West Orange, N. J.; Stephen B. Mambert of East Orange, and A. C. Emery of Montclair. The company proposes to manufacture chemicals, glues, veneers, stains and shellac, paper products, phonographs, sound records, storage batteries, etc.

Trade Publications

AMPLIFIER.—The Standard Radio Apparatus Company of Ocean Park, Cal., has prepared a leaflet descriptive of its amplifiers.

PAINT.—The National Lead Company of New York is distributing a booklet entitled "Red Lead and How to Use It," by Prof. A. H. Sabin.

IRONS.—The "American Beauty" electric iron is described and illustrated in a leaflet issued by the American Electric Heater Company of Detroit, Mich.

LAMPS.—Plumwood adjustable electric portable lamps are illustrated and described in a bulletin distributed by the Plume & Atwood Manufacturing Company, Waterbury, Conn.

SPEED INDICATORS.—The Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., has prepared leaflet 3977, descriptive of its electrical speed indicators for use in power stations, industrial plants and similar applications.

METERING EQUIPMENTS.—Outdoor metering equipments are illustrated and described in leaflet 3976, recently prepared by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa. These equipments are adapted for use on transmission lines where the expense of a substation is not warranted.

FAULT LOCALIZERS.—Leaflet 3890, descriptive of portable fault localizers, is being distributed by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa. This instrument is designed for locating grounds in feeder circuits, being an application of the Wheatstone bridge mounted in a portable case.

OVERHEAD RELAYS.—The Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., has prepared leaflet No. 3978, descriptive of its type HB overhead relays. These relays are designed for use on high-voltage circuits, and are for indoor use, offering ample protection and sufficiently accurate time element for ordinary service.

BATTERIES.—The Electric Storage Battery Company of Philadelphia has issued catalog KXS, describing its latest type of portable battery for railway signal service. This battery has been especially designed to give sixty-day service on one charge with very little increase in weight as compared with types heretofore used for thirty-day service. Particular attention has been given to details of design making for durability and long life. The plates, separators, jars, covers and carrying cases are of especially rugged construction. The E. S. B. double-flange cover and automatic filling and vent plug are important features, eliminating the escape of acid spray during charge and preventing slopping of acid over the tops of the cells while filling.

New England States

HIRAM, ME.—Plans are being prepared for the construction of two extra penstocks at the large dam of the Cumberland County Power & Light Company at the Great Falls of the Saco. The proposed improvement will enable the company to double the output of its plant.

PORTLAND, ME.—The Cumberland County Power & Light Company has applied to the Public Service Commission for permission to issue $340,000 in bonds, of which the proceeds of $261,177 are to be expended for improvements to its property during the period ending Dec 31, 1917, as follows: Hiram hydroelectric development and transmission lines, $14,000; extension of lines and services for the year ending Dec 31, 1917, $35,000; high-voltage tie line between Sewall Street station and Plum Street station, $35,000; extension of transmission lines from Cumberland to Yarmouth, $20,000; 16-way duct line between Sewall Street station and Deering Avenue, $32,396; grounding service to existing customers, $6,000, and additional voltage regulators to control two additional circuits, $7,000.

BRISTOL, VT.—The Hortonia Power Company of Rutland has acquired property in the town of Bristol, above its present dam, which provides for 250 hp. The company proposes to extend the penstock at the Bristol plant at the stream about 1000 ft., increasing the head from 115 to 250 ft. As soon as material can be secured it is planned to install a new waterwheel and generator in the present power house, increasing the output to 1000 hp. The company will also extend its electric transmission lines to Monkton, Monkton Ridge and Hinesburg, supplying electricity to farms between Brandon and Hinesburg in addition to the villages named. It is also proposed to connect the generating station by transmission line with the generating stations of the company located at Bethel, Gaysville, Hortonville, Salisbury, Danville, Barnet, Groton, Ryegate, Brandon and Port Benson and with the plant at Port Henry, N. Y.

NEWFANE, VT.—The Twin State Gas & Electric Company is planning to extend its electric transmission line from Newfane to Townshend, for which the company is now securing right of way.

RUTLAND, VT.—A new 1200-hp. turbine is being installed at the power plant of the East Pittsford Company in Chittenden. This additional energy will be transmitted over a new transmission line, to be erected from the power plant to the substation in Castleton, where it will be stepped down for distribution for commercial and domestic use.

GREENFIELD, MASS.—The Greenfield Electric Light & Power Company has been granted permission to extend its electric transmission line to Northfield Farms.

SPRINGFIELD, MASS.—The Turners Falls (Mass.) Power & Electric Company has purchased a site of forty acres at Chicopee Junction, on which it will erect a large relay steam generating plant, to cost approximately $1,500,000. The initial installation will have a generating capacity of 40,000 hp. The present plans provide for an ultimate output of 80,000 hp. Three buildings will be erected, the main one 370 ft. by 180 ft. F. L. Hunt is chief engineer. Robert W. Mitchell is local representative.

CLINTON, CONN.—A bill authorizing the Clinton Electric Light & Power Company to issue $100,000 in bonds and $70,000 in capital stock has been passed by the Senate. The proceeds will be used for extensions to the system and for refunding purposes.

DANBURY, CONN.—The Danbury & Bethel Gas & Electric Company has petitioned the State Legislature for permission to increase its capital stock to $1,000,000.

NAUGATUCK, CONN.—The United Electric Light & Water Company is erecting a second 13,200-volt circuit between Waterbury and Naugatuck to increase the capacity of the Waterbury, Naugatuck and Seymour transmission line. The company is also erecting a transmission line between Seymour and Derby. W. T. Pratt of Naugatuck is local superintendent.

Middle Atlantic States

BROOKLYN, N. Y.—Bids will be received by Robert Adamson, fire commissioner, Municipal Building, New York,, N. Y., until May 7 for furnishing and installing new electric-lighting systems at the quarters of engine companies Nos. 239 and 202, and for hook and ladder companies Nos. 101, 103, 104, 105 and 107, borough of Brooklyn. Bids will also be received at the same time and place for furnishing and installing new electric-lighting systems at the quarters of engine companies Nos. 221, 238, 255, and hook and ladder company No. 102, borough of Brooklyn. Blanks and further information may be obtained at the above office.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

NEWARK, N. Y.—Bids will be received by Albert W. Beaven, president of board of managers of Custodian Asylum for Feeble-Minded Women, until May 18 for two new boilers, stokers, auxiliary equipment, piping and heating work at the institution, at Newark, N. Y. Louis F. Pilcher, State Capitol, is state architect.

NEW YORK, N. Y.—Improvements are contemplated by the Interborough Rapid Transit Company to its substation station on Nineteenth Street, to cost about $15,000.

NEW YORK, N. Y.—The New York Telephone Company has purchased a site at Grand View Place and 167th Street, on which it proposes to erect a telephone exchange building at a cost of about $50,000.

PULASKI, N. Y.—The Public Service Commission has granted the Salmon River Power Company of Buffalo permission to purchase the property of the Pulaski Electric Light Company at $60,000, and to acquire the Box property from Fred D. Comy for $15,000; also the completion of distribution system for street and commercial lighting in the villages of Altmar, Lacona and Sandy Creek and the towns of Richland and Orwell, at a cost of about $30,000.

SYRACUSE, N. Y.—Plans are being considered by the New York Central Railroad Company, it is reported, to equip the Auburn division, from Syracuse to Geneva, for electrical operation.

BAYONNE, N. J.—The City Commission has refused the request of the Public Service Electric Company to eliminate improvement work in the city during the present year, in accordance with contract with the municipality, and has authorized the work to proceed, including the extension of street-lighting system on Broadway from Fifth Street to the Central Railroad of New Jersey bridge with underground conduits.

BRIDGETON, N. J.—The Electric Company of New Jersey, with main office in Bridgeton, has closed a contract with the Cumberland Glass Company to furnish energy (750 hp.) for lamps and motors. This includes not only the Cumberland plant proper, but the More-Jonas plant. A contract has also been closed with the Seabrook Farms Company for 200 hp., with I. P. Thomas, manufacturer of fertilizer, Paulsboro, for 1000 hp.; with the Glenshaw Glass Company at Swedesboro for 200 hp., and there will also be an installation at the Hurff canning factory at Swedesboro. These contracts will require the erection of many miles of high-tension transmission lines and substations. W. J. Kyle of Bridgeton is general manager.

ELIZABETH, N. J.—Plans are being considered by the City Council for preliminary surveys and estimates of cost for the proposed municipal electric-light plant.

JERSEY CITY, N. J.—The Board of Education has authorized bids advertised for the installation of electric-lighting systems in Public Schools Nos. 1, 9, 11 and 20. S. Fred Ege is secretary.

KEANSBURG, N. J.—Arrangements are being made by the New York Telephone Company for the installation of a new submarine cable from Annadale, Staten Island, to Keansburg, about 28,900 ft. in length. The new lines will be used for a direct trunk system from Red Bank, Asbury Park and vicinity to New York, allowing the elimination of existing aerial lines.

NETCONG, N. J.—Arrangements are being made by the Willsbrook Light & Power Company of Netcong to connect its lines with the transmission system of the New Jersey Light & Power Company, from which it will purchase energy. Right of way for the proposed transmission line has been secured by the Willsbrook company and preparations are being made for the erection of a substation. Energy will be secured from the Bowlbyville plant of the New Jersey company.

NEWARK, N. J.—Plans are being considered by the Board of Fire Commissioners for improvements to the fire-alarm system, to cost about $5,000. Adam Bosch is superintendent of Telegraph Department.

NEWARK, N. J.—The Board of Freeholders is considering plans for remodeling and extensions to the electric power plant at the County Penitentiary and improvements in the lighting, heating and power systems.

PENNSGROVE, N. J.—The Council is considering the installation of a municipal fire alarm system in Pennsgrove.

WEEHAWKEN, N. J.—The New York Telephone Company has applied to the township committee of North Bergen for permission to install overhead and underground lines in about twenty streets, including Main Street, Hackensack Turnpike and Bergenline Avenue.

WHARTON, N. J.—The Wharton Steel Company is planning to equip the Hibernia iron ore mines for electrical operation. Energy will be transmitted from Wharton to the mining properties in Hibernia.

ERIE, PA.—The City Council has granted the Erie County Electric Company and the Erie Light Company franchise rights for extensions to conduit systems in State Street.

FRANKLIN, PA.—The plant and holdings of the Franklin Electric Company have been purchased by the Citizens' Light & Power Company of Oil City.

GETTYSBURG, PA.—A franchise has been granted to the Washington, Westminster & Gettysburg Railway Company to construct an electric railway in Gettysburg.

KUTZTOWN, PA.—The Town Council is considering the installation of a municipal electric-light plant, to cost about $23,000.

PHILADELPHIA, PA.—Plans are being prepared for the erection of a new boiler house, 30 ft. by 50 ft., at Girard Point, to cost about $12,000, for the Pennsylvania Railroad Company.

PHILADELPHIA, PA.—The United Gas Improvement Company has announced that it will make improvements and extensions to its properties during the present year, at a cost of $1,262,500.

PHILADELPHIA, PA.—The Philadelphia Electric Company contemplates the installation of a new cable railway line and other improvements at its power plant on Christian Street, to cost about $45,000.

PHILADELPHIA, PA.—The Bureau of Health and Charities is asking for bids for the erection of a new power plant and other buildings at the Byberry Hospital. Philip H. Johnson, Land Title Building, Philadelphia, is architect.

PHILADELPHIA, PA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 15 for the installation complete of an electric mail elevator in the United States post office and court house at Philadelphia, Pa. For details see proposal columns.

READING, PA.—The Metropolitan Electric Company, it is reported, has placed orders for an additional turbo-generator, to cost about $500,000, which will increase the output of its plant from 30,000 hp. to 62,000 hp.

READING, PA.—The Reading Transit & Light Company and the Metropolitan Electric Company are planning to install underground wires in the existing conduit system in the business section of the city, including connections, etc., at a cost of approximately $1,000,000. The Reading Transit & Light Company has been granted permission by the Public Service Commission to acquire a number of small electric-lighting and railway properties in Berks and Lebanon Counties.

SOUTH BETHLEHEM, PA.—The Town Council of Northampton Heights is considering the installation of a new fire-alarm system.

BALTIMORE, MD.—Contract has been awarded by the United Railway & Electric Company for the erection of a new substation, 60 ft. by 90 ft., at Sollers Point, to the West Construction Company, of Baltimore, Md.

BLUEFIELD, W. VA.—The Appalachian Power Company is reported to be considering extending its railway system from Bluefield to neighboring sections, including about 40 towns, covering a distance of about 50 miles.

WASHINGTON, D. C.—The Chesapeake & Potomac Telephone Company is planning to remodel and enlarge its central exchange at 722 Twelfth Street N. W., at a cost of about $35,000.

WASHINGTON, D. C.—Plans are being considered by J. J. Moebs, Colorado Building, Washington, for the construction of an electric service station at 1829 L Street N. W., to cost about $15,000.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until May 7, for construction of nine one-story wood frame buildings, including heating and electric-lighting systems and plumbing. Three wards will be required at each of the naval hospital reservations at Newport, R. I., Portsmouth, N. H., and Great Lakes, North Chicago, Ill. Drawings and specifications (No. 2366) can be obtained on appli-

cation to the above bureau or to the commandant of the navy yard and naval stations named.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until May 14 for repairs and improvements to kitchen, conservatory, greenhouse and power house at the naval station, Washington, D. C. Drawings and specifications No. 2369 can be obtained on application to the above bureau.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval station the following supplies: Portsmouth, N. H., Schedule 1016—twenty-six air compressors complete f.o.b. works; Schedule 1025—four steam-driven torpedo air compressors. Philadelphia, Pa., Schedule 1023—one electric passenger elevator; Schedule 1040—one hydraulic frame bender machine, one 350-ton hydraulic press joggling machine. Norfolk, Va., Schedule 1026—three circulating and air pumps, miscellaneous main air pumps, 22 feed, fire and bilge pumps, etc., 12 lubricating oil pumps, etc. Brooklyn, N. Y., Schedule 1028—four combined aid and circulating pumps, two dynamo air condenser pumps, 18 dynamo-room, hot-well pumps, etc., 16 feed pumps, 15 oil-cooler pumps, etc. Brooklyn, N. Y., Norfolk, Va., Schedule 1027—thirty fuel-oil service pumps. Pensacola Fla., Schedule 1029—230 ft. double braided, rubber-insulated, single-conductor cable, 15,450 ft. lead-covered, paper insulated, single conductor cable, 15,450 ft. lead-covered, paper-insulated, single-conductor cable, 5005 ft. lead-covered, rubber-insulated, duplex cable, 10,400 ft. lead-covered, paper-insulated, duplex cable, 10,900 ft. lead-covered, paper-insulated, 3-conductor cable, 2850 ft. lead-covered, rubber-insulated, 3-conductor cable, 1500 ft. double-silk and single-cotton pothead wire. Brooklyn, N. Y., Mare Island, Cal., Schedule 1046—miscellaneous electrical supplies, distribution boxes, junction boxes, switches, receptacles, etc. Newport, R. I., Schedule 1030—900,000 unannealed brass tubes, 35,000 lb. medium hard-drawn brass tubing. Puget Sound, Wash., Schedule 1003 — miscellaneous seamless copper or bronzed pipe, black-welded steel pipe, seamless black steel pipe. Applications for proposal blanks should give the schedule desired by number.

North Central States

ALPENA, MICH.—Plans are being considered for improvements to the street-lighting system in the business district.

JACKSON, MICH.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 24, for the installation of a complete hoistway, hydraulic freight lift, etc., in the United States post office at Jackson, Mich. For details see proposal columns.

NEW BALTIMORE, MICH.—The Village Council is negotiating with the Eastern Michigan Edison Company of Detroit to furnish electrical service in New Baltimore. If satisfactory arrangements are made an election will be called to submit to the voters the proposal to sell the municipal electric plant. The village has operated a municipal plant for fourteen years.

CINCINNATI, OHIO.—Estimates have been presented to the City Council for the installation of an ornamental lighting system on McMillan Street, from May Street to Alms Place, and on Gilbert Avenue, from Court Street to Locust Street. The cost for McMillan Street is estimated at $14,300 per year, and on Gilbert Avenue at $5,850 per year.

CLEVELAND, OHIO.—Application has been made to the Public Utilities Commission by the Lake Shore Electric Railway Company for authority to issue $51,000 in bonds, the proceeds to be used for improvements, etc.

DAYTON, OHIO.—Bids will be received by A. Giesler, Riebold Building, Dayton, until May 16 for construction and equipment of the new District Tuberculosis Hospital to be located on the Covington Pike and to be erected for Montgomery and Dark counties. Bids are also asked on the erection of motor-driven pumping machinery and connecting same to a driven well, under a separate contract, and laying approximately 1780 ft. of 4-in. cast-iron pipe, for pump and transmission line, including pump house, and for two 80-hp. tubular boilers, sanitary sewer system, etc. Plans are on file at the office of A. H. Wetchampe, superintendent of construction, New Court House, Toledo.

SPRINGFIELD, OHIO.—Work has begun on extensive improvements to the plant of the Springfield Light, Heat & Power Company, which will involve an expenditure of $125,000, and will include the construction of a 5200-ton coal storage bin, a new boiler room, 60 ft. by 70 ft., to provide space for four new boilers; also new transformers, stations, purifiers, condensers, etc.

BRANDENBURG, KY. — The Kentucky Lithographic Stone Company of Louisville is contemplating changing its local quarry and manufacturing plant to electric drive. The company proposes to install an isolated electric generating plant and is considering using gas for fuel.

CAMPBELLSVILLE, KY.—The Campbellsville Electric Light & Power Company, recently organized with a capital stock of $40,000, proposes to build a plant here. Charles Walls, W. G. Hesser, C. L. Hesser and B. Walls are interested.

WINCHESTER, KY. — The Kentucky Court of Appeals has handed down a decision upholding the validity of the $180,000 bond issue voted by the city of Winchester for the establishment of a waterworks system. The construction of a hydroelectric power plant on the Kentucky River to supply power for pumping water for the city is included in the plans.

GARY, IND.—Authority has been granted to Charles B. Davidson, receiver of the Gary & Interurban Traction Company, to borrow $192,000 on receiver's certificates, the proceeds to be used for the purchase of new equipment and for improvements to system.

GARY, IND.—The Gary & Hobart Traction Company, recently incorporated, with a capital stock of $60,000, proposes to construct and operate an electric railway between Gary, East Gary, New Chicago and Hobart; also to furnish electricity for lamps, heaters and motors in these cities. William Earle, Ora L. Wildermuth, Grant Crumpacker and others are interested.

HAMMOND, IND.—A petition has been filed with the Public Service Commission by the Northern Indiana Gas & Electric Company for authority to issue and sell $609,000 in bonds and $93,000 in notes. The company also asks for permission to sell $151,000 in bonds of the Indiana Lighting Company, now held in the treasury of the former company. The proceeds to be used for refunding purposes and for improvements and extensions.

KOKOMO, IND.—Steps have been taken by the Indiana Railways & Light Company for the erection of a larger terminal in Kokomo, to cost about $150,000. New equipment for power plant, most of which has been purchased, extensions to the Kokomo street railway system and improvements to the electric-lighting system are included in the project.

DIXON, ILL.—Contracts have been awarded by the Illinois Northern Utilities Company for the erection of a new steam generating plant in Dixon as follows: For substructure and superstructure to the Adams Construction Company of Chicago, at $45,000, and for structural steel work to the Lakeside Bridge & Iron Company of Milwaukee, Wis., at $23,000.

DU QUOIN, ILL.—The Du Quoin, Christopher & Eastern Traction Company is considering the construction of an electric railway from Du Quoin easterly to West Frankfort and from Du Quoin to Carbondale.

HARVARD, ILL.—The Chicago, Harvard & Geneva Lake Railway Company has been granted a franchise by the City Council to construct an electric railway on West Front Street, between West Diggins Street and South Eastman Street.

LOCKPORT, ILL.—Bids will be received by the clerk of the Sanitary District of Chicago, 700-910 South Michigan Avenue, Chicago, until May 17, as follows: Division (A) for a vertical hydraulic turbine; (B) an alternating-current generator, to be installed in the power house in Lockport. Specifications and forms of proposal may be obtained from the clerk of the board or the electrical engineer. John McGillen is clerk of the board.

PRINCETON, ILL.—Local business men are advocating the installation of an ornamental lighting system in the business district. This, it is understood, would require the installation of an additional generating unit in the municipal electric-light plant, to cost about $18,000. A special election may possibly be called to vote on the proposal to provide funds for the proposed improvements.

SUMMIT, ILL.—Bonds to the amount of $6,000 have been voted for extensions to the street-lighting system.

EMBARRASS, WIS.—Plans are being considered for the construction of a hydroelectric power plant in Embarrass.

GLENWOOD, WIS. — The Glenwood-Downing Light & Power Company contemplates extending its electrical service to Boyerville.

MILWAUKEE, WIS.—The construction of a new power and boiler house, 50 ft. by 100 ft., with a 100-ft. stack, is contemplated for the Milwaukee Protestant Orphans Asylum, Prospect and East North Avenues, Milwaukee. Schuchardt & Judell have charge of the work.

WONEWOC, WIS.—Bids are being asked by the Power Engineering Company, 510 Corn Exchange, Minneapolis, Minn., for construction of power house, transmission equipment, etc., for a hydroelectric power plant at Wonewoc, also for auxiliary plant with internal combustion engine. A. B. Gale of Wonewoc is owner.

NEW VIENNA, IOWA.—The Eastern Iowa Electric Company of Dyersville will soon begin work on the erection of the overhead electric distributing system to supply electricity in New Vienna.

RED OAK, IOWA.—The date for receiving bids for wiring and furnishing fixtures for the court house at Red Oak, Iowa, has been changed from May 1 to May 7, 1917. C. D. Forsbeck is county engineer.

RUTHVEN, IOWA.—The Northern Gas & Power Company has applied for a franchise to supply electrical service in Ruthven.

SIOUX CITY, IOWA.—Work, it is reported, will soon begin on extensive improvements to the system of the Sioux City Gas & Electric Company, which will nearly double the output of the plant. The proposed improvements will cost about $250,000 and will include the installation of a 3000-kw. turbo-generator. An addition will be erected to the power station and part of the boiler room will be rebuilt.

BOONVILLE, MO.—Plans are being prepared for improvements to the power house at the Kemper Military School, including the installation of additional generators and boilers.

HARRISONVILLE, MO.—A special election will soon be called to submit to the voters the proposal to award a franchise to L. R. Green & Son of Pleasant Hill to supply electricity in Harrisonville.

MALTA BEND, MO.—The installation of an electric-lighting system in Malta Bend is under consideration.

MINE LAMOTTE, MO.—The Missouri Metals Corporation has awarded the contract for construction of power house, about 60 ft. by 150 ft., to the Unit Construction Company, Title Guaranty Building, St. Louis. Diesel engines, it is understood, will be installed.

PARNELL, MO.—The Maryville (Mo.) Electric Light & Power Company has been granted a franchise to supply electricity in Parnell for commercial purposes.

ST. LOUIS, MO.—A building permit has been granted to the Union Electric Light & Power Company for the construction of a three-story power house at 908 St. Charles Street, St. Louis, to cost about $75,000.

SMITHVILLE, MO.—The local electric-light plant, recently destroyed by fire, will be rebuilt. The cost of the equipment is estimated at about $7,500. C. Morton and H. Gordon are owners.

VALLEY PARK, MO.—Plans are being considered for the installation of an electric-lighting system in Valley Park.

JUD, N. D.—The installation of an electric-lighting plant in Jud is under consideration.

RYDER, N. D.—Plans are being considered by E. E. Freeden, owner of the local electric plant, for changing the system from direct to alternating current.

VOLIN, S. D.—The Citizens' Light & Power Company is reported to have decided to increase the output of its local plant.

ALBION, NEB.—The Albion Electric Light & Power Company is installing a new 35-in. type "K" Leffel waterwheel and a 125-kw. vertical generator, directly connected. The company has also awarded a contract for the construction of a new penstock to the Western Bridge & Construction Company of Omaha.

HARRISON, NEB.—Bids will be received by the city of Harrison until May 9 for the construction of a municipal electric-light plant, including construction of power house and a 10,000-gal. fuel-oil tank; one 35-hp., one 25-hp. and one 15-hp. oil engine, one 30-kw., one 25-kw. and one 15-kva., 60-cycle, 2200-volt generator, air compressor and water-cooling apparatus. E. F. Pontius is chairman. Royal D. Salisbury, 1455 Gaylord Street, Denver, Col., is engineer.

AGRA, KAN.—At an election held recently the proposal to issue $8,000 in bonds for the installation of a municipal electric-light plant was carried.

BALDWIN, KAN.—Bonds to the amount of $20,000 have been authorized for improvements to the municipal electric-light plant and water-works system.

KANSAS CITY, KAN.—The installation of an ornamental street-lighting system and other improvements, between First Street and the Fair Grounds, is under consideration.

TORONTO, KAN.—Bonds to the amount of $15,000 have been voted for the installation of an electric-lighting system in Toronto.

Southern States

ASHEVILLE, N. C.—Improvements are contemplated by the Asheville Telephone & Telegraph Company, which include replacing poles within the fire limits on Charlotte and Woodfin Streets, and in other districts with conduits. The cost is estimated at $70,000.

DURHAM, N. C.—The Durham Traction Company has placed orders for a new turbine, which will more than double the present output of its plant.

WILMINGTON, N. C.—The controlling interest of the Tidewater Power Company, which controls the electric and gas properties, street railways, interurban electric railway and 1,500 acres of suburban real estate in Wilmington, has been purchased by Brooks & Company of Scranton, Pa. L. H. Conklin of Scranton, Pa., general manager of the Brooks & Company properties, has taken charge of the Tidewater properties.

ATLANTA, GA.—The Georgia Railway & Power Company is erecting a new 110,000/38,000-volt substation at Norcross to feed the Stone Mountain line at 38,000 volts. This line, which has substations at Stone Mountain, Lithonia, Conyers, Covington, Social Circle and Monroe, was formerly operated from the Boulevard station, Atlanta. The line from Norcross to Stone Mountain will be 10 miles long (cutting out a total of high and low voltage lines of 25 miles). The station will be equipped with two banks of three 1000-kva. General Electric transformers, with one spare for each bank.

TAMPA, FLA.—Rights of way are being obtained by the West Coast Electric Railway Company for the construction of an electric railway from Tampa to Sarasota and Venice, a distance of about 65 miles. A. E. Townsend of Tampa is general manager and chief engineer.

DYERSBURG, TENN.—The Water and Light Department is considering asking for bids for motor-driven centrifugal pumps for a deep well. S. R. Blakeman is superintendent.

LAWRENCEBURG, TENN. — Preparations are being made for extensions to the ornamental lighting system.

OOLETEWAH, TENN.—Steps have been taken to organize a company under the name of the James County Power Company to supply electricity in Ooletewah and vicinity. The new company will secure energy from the Ocoee plant of the Tennessee Power Company, which will install a transformer station here.

PULASKI, TENN.—The Board of Mayor and Aldermen has voted to purchase an additional electric generating unit for the municipal electric-light plant. A day electrical service will soon be established.

FORT SMITH, ARK.—Surveys are being made by the Fort Smith Light & Traction Company for an extension of its street railway system to Jenny Lind and Greenwood.

HUNTINGTON, ARK.—The Fort Smith Light & Traction Company is contemplating erecting an electric transmission line from Fort Smith to Huntington, to furnish electrical service there.

JENNY LIND, ARK.—Surveys have been made by the Fort Smith (Ark.) Light & Traction Company for the erection of a high-tension transmission line to Jenny Lind and Greenwood.

ADA, OKLA.—The proposal to issue $60,000 in bonds for improvements to waterworks system will be submitted to the voters. The proposed work will include the construction of a new reinforced concrete flume for water power plant and a 500,000-gal. elevated tank. The Benham Engineering Company, Colcord Building, Oklahoma City, is consulting engineer.

ARDMORE, OKLA.—Plans are being prepared for the construction of a hydro-electric power plant on the Washita River, to develop 2500 hp. and to store water to irrigate 40,000 acres. J. A. Cosner and others are interested. J. W. Maxey of Houston, Tex., is engineer.

BUTLER, OKLA.—The installation of a municipal electric-light plant, to cost about $6,000, is under consideration.

CARMEN, OKLA.—Bonds to the amount of $25,000 have been voted for the construction of an electric-light plant in Carmen.

HASKELL, OKLA.—The Central Oklahoma Light & Power Company of Oklahoma City has been granted a franchise to supply electricity for lamps and motors in Haskell.

MANGUM, OKLA.—The City Council has engaged the Benham Engineering Company, Colcord Building, Oklahoma City, to appraise the local electric light plant, and make an estimate of cost of installing a new municipal electric plant.

MOUNDS, OKLA.—The Central Oklahoma Light & Power Company of Oklahoma City has applied for a franchise to supply electricity in Mounds.

TULSA, OKLA.—The George A. Fuller Construction Company, Dwight Building, Kansas City, Mo., has been awarded the contract for the construction of an office building at Fourth and Boston Streets, to cost about $750,000, for J. S. Cosden, Daniels Building. Contracts will be awarded later for electric wiring, electric passenger elevators, lighting fixtures, steam heating system, etc., by H. F. Holt, architect, 315 East Tenth Street, Kansas City, Mo.

VINITA, OKLA.—The Public Service Company of Oklahoma is installing a 100-kw., three-phase, 60-cycle, 2200-volt, Allis-Chalmers generator, driven by a 250-hp Buckeye gas engine and a 250-hp. Babcock & Wilcox boiler, in its local plant, and is also erecting a 6600-volt transmission line to the Sinclair refinery, 3 miles distant.

WAPANUCKA, OKLA.—The City Council is considering calling an election to submit to the voters the proposal to issue bonds for the installation of a municipal electric-light plant.

BALLINGER, TEX.—The capital stock of the Ballinger Light & Ice Company has been increased from $50,000 to $90,000.

BEAUMONT, TEX.—The Eastern Texas Electric Company has sold $600,000 in bonds, the proceeds of which will be used to take up the floating debt of $90,000; to install 5300-hp. additional generating equipment at the Port Arthur plant and for the erection of a 33,000-volt transmission line between Port Arthur and Beaumont.

COPPERAS COVE, TEX.—A franchise has been granted to C. W. Roberts to supply electricity in Copperas Cove.

DALLAS, TEX.—The Standard Utilities Construction Company, recently incorporated with a capital stock of $100,000, contemplates the construction of an interurban electric railway from Dallas to Slidell, a distance of 48 miles. The project includes the construction of a large electric power plant. M. W. Davenport of Denton, Tex.; Ira E. Cornelius of Muskogee, Okla., and C. F. Hopkins of Tulsa, Okla., are among the incorporators.

POLYTECHNIC, TEX.—Plans are being considered for improvements to the street-lighting system.

SAN ANGELO, TEX.—The Texas Electric Light & Power Company, recently incorporated with a capital stock of $200,000, will take over and operate the local electric-light and power plant and transmission system in this section. The power station will be enlarged and extensions made to the transmission lines. The company will also build and operate a street railway system in San Angelo and construct an interurban railway to Ballinger, a distance of about 30 miles. Charles W. Hobbs of San Angelo is president of the company.

SEMINOLE, TEX.—The installation of an electric-lighting system in Seminole is under consideration. W. M. Breckon is reported interested in the project.

WICHITA FALLS, TEX.—The Wichita Falls Electric Company is contemplating extending its electric transmission lines to supply electrical service in the towns of Bowie, Electra, Burkburnett, Henrietta and Iowa Park.

Pacific and Mountain States

CHESAW, WASH.—Plans are being considered for the installation of an electric-light and power plant in Chesaw to supply electricity for both street and commercial lighting. William Powell of Chesaw is interested in the project.

PORT ANGELES, WASH.—The City Council is considering calling an election to submit to the voters the proposal to issue $25,000 or $30,000 in bonds for extensions to the local electric-lighting system.

BEND, ORE.—The Bend Water, Light & Power Company will soon begin work on the erection of an addition to its power plant. The new equipment will include a new 600-kw. generator and a 600-hp. waterwheel. The cost of the work is estimated at $30,000.

GARIBALDI, ORE.—The Coast Power Company of Tillamook, which some time ago took over the holdings of the smaller electric companies in this section, is planning the installation of street-lighting systems in the Tillamook Beach resorts, including Garibaldi, Bar View, Rockaway, Saltair, Manhattan and other smaller places. C. J. Edwards will be in charge of the work.

SALEM, ORE.—Application has been filed in the office of the State Engineer by Scott Catterson for permission to appropriate 40 second-ft. of water from Donner and Blitzen River, in Harney County, for the development of 200 hp. The plans provide for the construction of a dam 60 ft. long and a canal and pipe line 9 miles in length.

BISHOP, CAL.—The Darwin Development Company is contemplating the construction of an electric railway along the south shore of Owens Lake to connect with the Southern Pacific Railroad tracks at Olancha, a distance of 23 miles.

CHINO, CAL.—The installation of an ornamental street-lighting system in Chino is under consideration.

FRESNO, CAL.—The San Joaquin Light & Power Company is erecting an electric transmission line, 5 miles long, to the Lost Hills Development Company's property in the Lost Hills field, which was recently taken over by the General Petroleum Company. Arrangements are being made for the wiring of the lease and the installation of a complete electrical equipment.

HOLTVILLE, CAL.—The State Railroad Commission has approved the contract of the Holton Power Company under which the company will erect a 55,000-volt electric transmission line to Yuma, a distance of 53 miles. The company will also erect telephone and telegraph lines across the sandhills to the Colorado River.

LOS ANGELES, CAL.—The City Council has approved the assessment district for the ornamental lighting system for Camino Palermo and has authorized the city attorney to prepare the necessary ordinance.

MANTON, CAL.—The local electric plant and water rights, owned by V. B. Taylor, has been purchased by the Northern California Power Company of San Francisco, at $5,000. Extensions and improvements will be made to the system.

BUTTE, MONT.—In compliance with governmental orders directing the dismantling of all privately operated wireless plants, the Montana Power Company has announced that it would at once cease the use of its wireless facilities between various substations. The company will resort to telephones which are already installed.

JUDITH GAP, MONT.—An electric-lighting system is being installed in Judith Gap by the Montana Power Company of Butte.

FORT MORGAN, COL.—Extensive improvements have been completed at the municipal electric-light plant, including the construction of a new boiler house, erection of smokestack and installation of a new 253-hp. boiler. Estimates are now being received for the installation of a new 500-kw. generating unit to be connected either to a reciprocating engine or a steam turbine; also on a deep well, 180 ft. deep, with a vertical centrifugal pump, directly connected to a 50-hp. motor. George C. Cox is superintendent.

YUMA, COL.—New equipment, including a 100-hp. Fairbanks-Morse engine and a 67½-kw., three-phase, 60-cycle, 2200-volt Westinghouse generator, is being installed in the municipal electric light plant. An addition is also being erected to the power station to provide space for the new unit.

Canada

EDMONTON, ALTA.—J. H. Moir, traffic manager of the Edmonton (municipal) Radial Railway System, has recommended the installation of a motor-generator set.

MONCTON, N. B.—The Moncton Tramways, Electric & Gas Company is considering extensions to its tramway system.

GALT, ONT.—The Galt Hydro-Electric Commission expects to erect a new substation, 46 ft. by 107 ft., three stories and basement, to be equipped with switching apparatus, three additional transformers, 750-kva., three-phase. A. B. Scott is secretary.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until May 19 for furnishing track bolts, rivets, sheet copper, sheet brass, grommets, electric cable, magnet wire, resistance testing set, spark plugs, storage batteries, dry cells, motor-driven planer, drill press, etc. Blanks and general information relating to this circular (No. 1141) may be obtained from the above office or the offices of the assistant purchasing agents, 224 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, Arthur Kneisel, 29 South LaSalle St., Chicago, Ill.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 8 West 40th St., New York.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, INC., Secretary, F. A. Molitor, 35 Nassau St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country. Annual convention, Hot Springs, Va., June 26-29.

AMERICAN PHYSICAL SOCIETY. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio.

AMERICAN SOCIETY OF TESTING MATERIALS. Secretary-treasurer, Edgar Marburg, University of Pennsylvania, Philadelphia.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary-treasurer, Roy B. Fowles, Pine Bluff, Ark. Annual convention Pine Bluff, May 16-18.

ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. General secretary, C. E. Dustin, 30 East 42d St., New York.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, George C. Holberton, San Francisco, Cal.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, John F. Kelly, McKeesport, Pa.

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COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, T. F. Kennedy, 900 15th St., Denver, Col.

COMMERCIAL SECTION, N. E. L. A. Secretary, F. D. Beardslee, Union Electric Light & Power Company, St. Louis, Mo.

EASTERN NEW YORK SECTION, N. E. L. A. Asst. secretary, J. L. Hemphill, General Electric Company, Schenectady, N. Y.

ELECTRICAL CONTRACTORS' ASSOCIATION OF CONNECTICUT. Secretary, George M. Chapman, Waterbury, Conn.

ELECTRICAL CONTRACTORS' ASSOCIATION OF MASSACHUSETTS. Secretary, H. D. Temple, 30 Foster St., Worcester, Mass.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, A. J. Burns, 318 West Tenth St., Kansas City, Mo.

ELECTRICAL CONTRACTORS' ASSOCIATION OF THE STATE OF PENNSYLVANIA. Secretary, M. G. Sellers, 1518 Sansom St., Philadelphia.

ELECTRICAL CONTRACTORS' ASSOCIATION OF WISCONSIN. Secretary, J. C. Staff, 578 Jackson St., Milwaukee, Wis.

ELECTRICAL DEALERS AND CONTRACTORS' ASSOCIATION OF ONTARIO. Secretary, E. A. Drury, 45 Murray St., Toronto, Can.

ELECTRICAL MANUFACTURERS' CLUB. Secretary, H. B. Crouse, Crouse-Hinds Co., Syracuse, N. Y.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill. Semi-annual meeting, Hot Springs, Va., May 22-24.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, 34 Ellis St., San Francisco, Cal.

ELECTRIC POWER CLUB. Secretary, C. H. Roth, 1410 West Adams St., Chicago. Meeting, Hot Springs, Va., June 11 and 12.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Affiliated with the N. E. L. A. Secretary, A. Jackson Marshall, 29 West 39th St., New York.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 29 West 39th St., New York.

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Printed in the First Issue of Each Month

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GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA. Secretary-treasurer, L. W. Marrow, Norman, Okla.

GEORGIA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, Gadsden Russell, Atlanta, Ga.

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ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary, R. H. Abbott, Petersburg, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, G. H. Stickney, Fourth and Sussex Sts., Harrison, N. J. Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston. Annual convention, Newark, N. J., September.

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INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

IOWA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, M. T. Humphrey, Waterloo, Iowa.

IOWA SECTION, N. E. L. A. Secretary-treasurer, L. E. Caldwell, Iowa City, Iowa. Annual meeting, Des Moines, May 24 and 25.

JOVIAN ORDER. Jupiter (president), Henry L. Doherty, New York City; Mercury (secretary), E. C. Bennett, Syndicate Trust Building, St. Louis, Mo.

KANSAS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. A. Mercer, 108 West Eighth Ave., Topeka, Kan.

KANSAS PUBLIC SERVICE ASSOCIATION. Secretary, E. A. Wright, Manhattan, Kan.

KENTUCKY ASSOCIATION OF ELECTRICAL CONTRACTORS. Secretary, Herbert E. Ottenheimer, Louisville, Ky.

LOUISIANA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. J. Zeigler, 227 Bourbon St., New Orleans.

MAINE ELECTRIC ASSOCIATION. Secretary-treasurer, Walter S. Wyman, Augusta, Me.

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MINNESOTA ELECTRICAL ASSOCIATION. Secretary, Fred A. Otto, Albert Lea, Minn.

MINNESOTA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, G. M. Jones, 14 Seventh St., N. Minneapolis, Minn.

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NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, H. C. Brown, 41 Martin Building, Utica, N. Y. Next meeting, New Orleans, October, 1917.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1343 Marquette Bldg., Chicago, Ill.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, B. E. Egan, Room 201, Union Pacific Building, Omaha, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 15 State St., Boston, Mass.

NEW ENGLAND SECTION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass. Annual convention, New London, Conn., Sept. 11-14.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, E. A. Thiele, Roswell, N. M.

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OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO SOCIETY OF MECHANICAL ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus.

OREGON ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary-treasurer, J. W. Oberender, 502 Dekum Building, Portland, Ore.

PACIFIC COAST SECTION, N. E. L. A. Secretary, A. H. Halloran, Crossley Bldg., San Francisco, Cal.

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PUBLIC SERVICE ASSOCIATION OF VIRGINIA. Secretary, W. J. Kehl, Virginia Railway & Power Co., Richmond, Va.

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VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, C. H. West, Rutland, Vt.

VIRGINIA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, E. M. Andrews, Richmond.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 Jackson Bldg., Chicago, Ill.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, E. N. Layfield, 1735 Monadnock Block, Chicago.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, 1410 First National Bank Building, Milwaukee, Wis.

1,223,[illegible]. Composite Titanic-Oxide Pig-ment and Method for Producing the Same; Louis F. Barton, Niagara Falls, N. Y. App. filed Aug. 29, 1916. Im-provement.

1,223,475. Electrical Toy; Gale E. Elliott, Needles, Cal. App. filed Dec. 14, 1915. Toy motor.

1,223,487. Socket; Herman G. Papa, New York, N. Y. App. filed June 23, 1916. Bracket having open slots to guide the slots and to permit ease of assembling and disassembling.

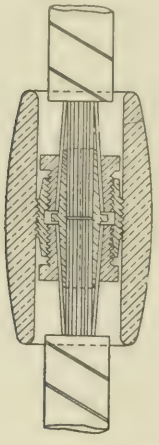
1,223,134. Manufacture of Electric Cables; William F. Smith, Brooklyn, N. Y. App. filed May 23, 1914. Pairs of insulated conductors for use in elec-tric cables.

1,223,137. Protective System; James B. Speed, West New Brighton, N. Y. App. filed Sept. 3, 1915. Relates to the oper-ation of protective reactances designed to protect the apparatus included in high power transmission circuits.

1,223,144. Joint for Electric Cables; Albert E. Tanner, Stretford and Ernest Alexander Claremont, High Leigh, Eng-land. App. filed July 22, 1916. Improve-ments.

1,223,449. Dynamo-Electric Machine; William A. Turbayne, Niagara Falls, N. Y. App. filed Sept. 16, 1916. Im-proved.

1,223,467. Means for Attaching Elec-trical Appliances to Conduit Outlet Boxes; Carl H. Bissell, Syracuse, N. Y. App. filed June 19, 1911. Comprises a body for engaging one face of the margin of the wall around the opening.



1,223,444.—Joint for Electric Cables

1,223,471. Apparatus for Charging Stor-age Batteries; Arthur R. Bullock, Cleveland, Ohio. App. filed Sept. 20, 1916. Produces a pulsating direct current.

1,223,472. Method of Running a Syn-chronous Motor; Arthur R. Bullock, Cleveland, Ohio. App. filed Sept. 20, 1916. Improved.

1,223,473. Current-Converting Device; Arthur R. Bullock, Cleveland, Ohio. App. filed Sept. 20, 1916. Equalizes the flow of current from a plurality of terminals of a circuit in which a pulsating current is flowing.

1,223,475. Calcining Furnace; William R. Clymer, Lakewood, Ohio. App. filed Oct. 16, 1915. Continuously and uni-formly heating the materials to a high temperature.

1,223,481. Factory Fire-Drill System; David G. Dee, Chicago, Ill. App. filed June 7, 1915. Improvements.

1,223,527. Signal Device for Elevator Systems; Charles D. Seeberger, New York, N. Y. App. filed March 13, 1914. Adjacent cars are independently actuated and controlled both up and down in the same shaft.

1,223,530. Automatic Electric Control-ler; Burton W. Sweet, Cleveland, Ohio. App. filed April 21, 1913. Adapted to cut automatically into a translating cir-cuit a resistance upon a sudden increase in the current which is flowing through the circuit.

Record of Electrical Patents

Notes on United States Patents issued on April 24, 1917

1,223,532. Lamp Hanger; Allison J. Thomp-son, Cleveland, Ohio. App. filed Jan. 3, 1916. Hanger member is properly cen-tered and placed with respect to the main hanger member.

1,223,549. Circuit-Protecting Apparatus; James G. Zimmerman, Milwaukee, Wis. App. filed May 17, 1912. A fluid current-conducting body which is responsive in a manner to current passing therethrough to cause operation of circuit breaker upon the occurrence of abnormal circuit conditions.

1,223,620. Stopping Mechanism for Wind-ing Machines; Claes Ryden, Cranston, R. I. App. filed Nov. 19, 1914. Auto-matically arrests the winding operation at the completion of each layer of wire so that certain steps in the process of building up the coil can be performed manually.

1,223,623. Fuse Device; Edmund O. Schweitzer and Nicholas J. Conrad, Chi-cago, Ill. App. filed Dec. 20, 1913. For taking care of extra high potentials.

1,223,669. Electrical Heating Attach-ment for Soldering Irons; John G. Clemens, Buffalo, N. Y. App. filed Feb. 27, 1917. Includes two carbons with which are electrically connected the con-ductor wires leading from the source of electrical supply and these carbons are so supported that they will be held with their points in contact with the head of the soldering iron as they are consumed.

1,223,674. Water Heater and Steam Boiler; Major E. Dearing, Salt Lake City, Utah. App. filed Oct. 11, 1916. Heating devices are self-contained with a hollow removable section co-operatively related to the heating cells or chambers in a novel manner.

1,223,699. Conduit Threader; Stephen Kamowski, Nanticoke, Pa. App. filed May 6, 1915. Provides a means for drawing wires, cables or analogous con-nections through a conduit tube or similar duct.

1,223,704. Electric Generator; Leon J. Le Pontois, Cleveland, Ohio. App. filed May 18, 1911. For use in connection with internal-combustion engines.

1,223,729. Electric Water Heater; Frank C. Perkins, Buffalo, N. Y. App. filed Dec. 1, 1916. Improvements.

1,223,750. Cable Box; Albert A. Wake-field, Chicago, Ill. App. filed May 14, 1910. For use in high-potential systems.

1,223,789. Burglar-Alarm System; Simon B. Hess, New York, N. Y. App. filed May 17, 1915. Person using the alarm system may select and use any means of exit as the last exit.

1,223,791. Lineman's Device; Van Buren Jackson, Pedro Miguel, Canal Zone. App. filed April 24, 1916. For making a con-nection or tap from a high line wire while the current is flowing through it.

1,223,865. Electric-Conduit Fitting; Daniel C. Gidley, Winthrop, Mass. App. filed April 10, 1916. Electrical appliance supported thereby can be adjusted axially and easily adapted to different conditions.

1,223,869. Hand Lamp; Carl Hambuechen, Belleville, Ill. App. filed Sept. 30, 1916. Improved means for making and break-ing the electrical connection.

1,223,881. Electrical Insulation; Willis A. Ishler, Pittsfield, Mass. App. filed Sept. 11, 1916. Insulating barriers or pads such as are used for insulating electrical windings.

1,223,885. Portable Electric Lamp; Law-rence F. James and Richard F. James, New York, N. Y. App. filed Nov. 2, 1916. Hand or self-contained type.

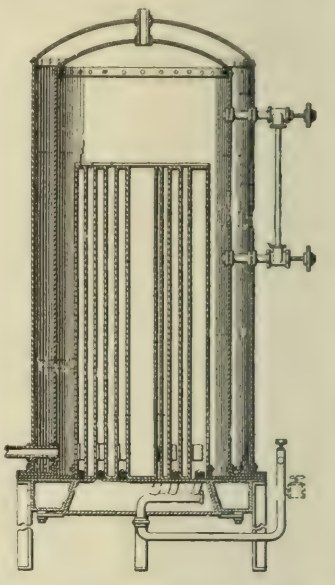
1,223,909. Line Strain Insulator; Louis Steinberger, Brooklyn, N. Y. App. filed Jan. 3, 1913. Structure which comprises ridges formed on the surface of the disk radiating from the body, the ridges, after leaving the body, being so shaped or curved as to dispose a plurality of dis-tinct ridges in the path of any current tending to creep radially across the sur-face of the disk.

1,223,916. Lightning Arrester; Frederick B. Wiegan, Cleveland, Ohio. App. filed April 29, 1915. Will ground the high-potential pulsating destructive electric current produced in lightning discharges.

1,223,958. Metallic-Filament Incander-cent Electric Lamp; Emil G. Barnes, London, England. App. filed Oct. 3, 1912. Improvements.

1,223,986. Electrode and Coating There-for; Jesse C. King, Montreal, Quebec, Canada. App. filed July 31, 1916. For use in electric furnaces.

1,223,987. Cut-Out Switch for Series Loops; William A. Kirkland, Cedar Falls, Iowa. App. filed Feb. 14, 1916. Make-and-break device in a series circuit of loops capable of use in switching off a loop from the circuit while leaving the remainder of the circuit closed.



1,223,674.—Water Heater and Steam Boiler

1,224,030. Water-Tight Lamp Socket; Stanley B. Smith, St. John, N. B., Canada. App. filed April 23, 1915. Resilient water-tight sleeve attached to and forming a part of the socket.

1,224,057. Method of Recovering Zinc and Iron from Solutions Thereof; Charles E. Baker, Chicago, Ill. App. filed Jan. 26, 1917. Simultaneously deposits the metals and then effects a separation thereof by vaporizing and recovering the zinc.

1,224,116. Electric Switch; Ragnar O. W. Lundin, New Britain, Conn. App. filed Dec. 16, 1915. Flush type.

1,224,117. Electric Water Heater; Samuel D. Nesmith, La Jolla, Cal. App. filed Nov. 8, 1916. Suitable insulating mate-rial through which a series of narrow flat channels extend and within which insulating material multiple-connected conductors are embedded.

1,234,118. Fuse Box; Roscoe Ratcliffe, New Britain, Conn. App. filed Aug. 14, 1916. Protects the interior of the box when the fuses are not in place.

1,224,119. Safety Switch; Alexander K. Sutherland, New Britain, Conn. App. filed May 4, 1916. Inclosed-type switch.

1,224,122. Storage-Battery Locomotive; Raymond Mancha, St. Louis, Mo. App. filed Feb. 5, 1917. Improvement.

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Opportunities for Service Developed by the War

CONFRONTED by the stern realities of war and the imperative need of meeting the problems arising therefrom intelligently, the electric light and power companies of the country have reason to give earnest attention to the new questions demanding solution. While there is every reason why hysteria and alarm should be avoided and every indication that there will be abundant business not only during the war but for a term of years thereafter, the present is nevertheless not the time for over-easy optimism and neglect of great responsibilities. Happily the National Electric Light Association senses the situation and is proceeding to place its house in good order. It is a courageous grasp of problems which the industry needs, and that we believe is assured by the effective measures now sanctioned. The special meeting of the association supplanting the usual type of convention was dignified, sagacious and rational and revealed far-sighted plans for active co-operation with the government. The selection of John W. Lieb of New York as a war president was as commendable as he is deserving, and the entire proceedings showed a sincere and ardent desire for an intelligent adaptation of private policies to the public needs.

How great the disturbance of the electrical industry in this country will be it were vain to guess. Certainly we realize that this war overshadows all human affairs, and while it lasts it is to be the principal business of the country. All else must be subordinated to it. The government rightfully has the first call upon all resources, both human and material, and is now organizing its quota of men, equipment, supplies and credit. Every man who is eligible under the selective draft system adopted will be subject to call regardless of wealth, position or personal inclination, and the strength of the government will be measured by the degree to which the people concentrate their efforts to this purpose. Labor is limited and fully employed. If 2,000,000 men are to go to the front, and four times that many are needed at home to keep them supplied with food and munitions, it is patent that all industries having no military value must be prepared for readjustment. The central stations of the country will adapt themselves quickly to changed conditions. Greater efficiency will be developed, women will be substituted for men in many departments and labor-saving schemes widely adopted. By this means the companies will place themselves on a war basis and release for military needs all men not absolutely essential to the operation of the system.

IN THE case of fuel and other supplies there will naturally have to be a considerable shift. Husbanding of coal will be imperative owing to the lack of labor in the mines and the insufficiency of transportation. The electric utility companies will as a result interconnect their systems as a matter of economy and as a matter of public policy. Coal will not only be hard to get but will be very high in price, and all this in face of the fact that the systems will be more heavily loaded. Efficiency of production will mean what it never meant before, and co-operation between public utilities will reach a maximum. The railroads of the country have already pooled their equipment and physical resources and are being operated as one system. Co-ordination which will result in very material savings of fuel, equipment and men and mean more effective service the central stations of the country will do their utmost to carry out.

The war involves the country in great expenditures. Every one recognizes that taxation must be heavy and that huge loans must be floated. There should not be any hoarding on that account because that would bring about cessation of industry which would be a worse calamity than the war itself. It is well to bear in mind that there is not going to be less work to be done; there is more work than ever in sight. There is no reason to anticipate any conditions under which credit will be difficult to obtain for the regular business operations of the country. Right now public utilities may have to wait until the government has secured sufficient funds for its purposes, and their business and profits may be subjected to heavy taxation in addition; but such burdens will fall on all industry, and what with wants kept down to a minimum and economies effected some of the increases will be passed on to the consumer. Fortunately for the industry, the affairs of the N. E. L. A. are in the hands of men so experienced and capable that the uncertainties of the moment will give way before clear and constructive policies. The problems will be solved, questions will be answered and the central station will be enabled to keep its proud position as a utility of indispensable value to the nation. The signs for a very profitable future are propitious.

Lighting Outdoor Substations

A BRIEF description in this issue of the floodlighting of outdoor substations will give some very useful hints to those who have to deal with this somewhat troublesome problem, and incidentally it offers suggestions on the protection of such parts of transmission systems from malicious attack. The requirement of a large amount of space is one of the few drawbacks of the outdoor substation, and this is really not a serious matter under ordinary conditions, although it complicates the situation with respect to seeing what one is about if repairs or changes have to be executed. It is to relieve this difficulty that the floodlighting scheme described by M. M. Samuels is worked out. It is really rudimentally simple, consisting merely of turning upon the outdoors apparatus the light from four projectors, each carrying a 500-watt lamp. The point most worthy of note in this application is the use of two distinct types of lighting units, one giving a somewhat concentrated beam for lighting the high-tension apparatus, the other giving a much wider beam and covering the somewhat extensive low-tension equipment. A less shrewd judgment in making this installation would have sacrificed something to the fetish of uniformity, and thereby would have lessened the efficiency and general usefulness of the installation. The floodlight is coming to be a rather important item in central station affairs, and we have seen no better example of its usefulness than this direct application to the lighting of the vital parts of the high-tension plant.

Underground Construction

THE recent rise in the price of copper, or, to be more specific, the recent fall in the purchasing power of money, owing mainly to conditions brought about by the world war, has checked the ordinary growth of electric cable conductors and has compelled the existing cable systems of our large cities to be loaded more nearly up to the full economic limits than heretofore. This means that more attention is being devoted to determining the temperature elevation of cables in service than in the past, and that the margin of safe carrying capacity in cables tends to acquire increased importance. The report of the N. E. L. A. committee on underground construction and electrolysis contains useful information on this subject.

Reference is made to the advantages claimed for three-core cables, consisting of three separate metallicly covered cables in an external cylindrical sheath, over three-cored cables having individual as well as joint insulation. The advantage is attributed to the equalization of tangential electric stresses. Such triple separate metallicly covered cables have, indeed, been known for many years, and the electric stresses in them are all radial; but their advantages in this respect have only received recent recognition, with increasing transmission voltages and dielectric stresses. The report contains some interesting information concerning the uses and connections of split-conductor cables, which lend themselves particularly to automatic disconnection in case a sudden fault should develop in them. A number of special cable devices and tools for underground construction are also described in detail.

Standardization of Meters

THE meter committee of the N. E. L. A. has made an interesting report. Watt-hour recording meters have become so thoroughly standardized that but little change has been made recently in well-established types. Demand meters, however, have come into extensive use of late years, and the report deals with them at considerable length.

There is perhaps no type of electric apparatus which calls for more standardization and testing than meters. The aggregate amount of capital involved in the recording meters of the United States is enormous, as is evident from the fact that the great majority of all the watt-hours consumed in the United States are recorded on watt-hour-meter dials. In fact, some enthusiastic meter men take the position that the object of all the power plants in the country is to work the dial mechanisms in their meters. In a certain sense this cannot be denied, but the perspective betrayed in the assertion seems distorted.

In the care and maintenance of customers' meters the practice of oiling the jewels is recommended in the report, and it is indicated that the practice of keeping oil in the jewels is common among the operating companies. It would be interesting to know why oil increases the working lifetime of a jewel. It seems likely that the benefit is not so much in diminishing the rubbing as it is in levigating dust particles, so that dust may be kept out of the reach of the rubbing surfaces.

Inductive Interferences

IN THE earliest days of electric communication the telegraph lines were the only ones seen on the highways. These ground-return telegraph lines had the entire field to themselves, and inductive disturbance, except to a small extent, between neighboring telegraph circuits was undreamed of. During the last thirty years, however, electric light lines, telephone lines, railroad lines and power-transmission lines have been jostling each other along the highways. The city streets became such tangled meshes that the wires had to be placed underground. The expense was great, but it had to be supported in congested city thoroughfares. Out in the country the cost of placing the wires in underground conduits would be prohibitive in most cases.

The inductive interference between neighboring lines on the same highways rapidly became obtrusive. The telephone lines were the principal sufferers, and next the telegraph lines. These communicating systems with their feeble currents and relatively sensitive instruments, were no match for the light and power circuits with their strong currents, and the mutual interference between the latter systems has been negligible.

As the country develops its population and resources, the tendency to inductive interference steadily increases. More power circuits spring up. Existing power circuits ramify. Every little town and village needs its electric light and railroad lines. The telephone and telegraph lines extend and multiply. Meanwhile the number of highways along which all these lines are carried remains almost stationary, while private rights-of-way for new lines are luxuries that can be afforded only in special cases. Consequently all the highways become congested, and the various types of line are driven into closer proximity. Under these conditions it is no wonder that inductive disturbances thrive and multiply.

The report of the committee on overhead lines and inductive interference to the National Electric Light Association convention draws attention to the necessity for co-operation between the engineers of the power systems and those of the telephone systems for their mutual benefit. The principal rules for minimizing interference are to avoid depending on ground-return circuits and to transpose the conductors systematically. However, unless the engineers on both sides co-operate to the end that the differences between telephone and electric power transmission companies be speedily adjusted the constituted authorities will stipulate what shall and what shall not be done.

Keeping an Eye to Windward

THE enormous increase in the price of steam coal is a sufficient cause of worry in many a central station. Large plants handling their own mines or having long-term contracts can look forward to going through the probable period of the war with some equanimity. Smaller establishments cannot, for the price of coal has shot up out of all comparison with the scarcity that confronts us because of the difficulties of transportation. Possibly the government may succeed in effecting some measure of relief, but at present small stations undefended by contracts must be prepared to pay any price for coal which the coal pool shall name, unless the government, as it may, steps in and lays an iron hand on the situation.

Facing such conditions, the need of remedial measures is obvious, and one of them which can be applied to many a small station is described in this issue in L. D. Shank's brief account of how one should beat the game by installing an oil engine. The plant he describes is typical of many an installation of moderate importance. It had a good steam plant, but, realizing that the rising price of fuel was becoming a very serious matter, the management deliberately changed over to oil-engine drive. The particular case is interesting in that it discloses some of the differences which depend merely upon size in picking out a suitable power plant. On general principles a four-stroke-cycle engine would have been chosen for the sake of economy, as Mr. Shank points out. It is held, and in general very correctly, that the two-stroke-cycle engine is not so efficient, particularly on varying loads, as the four-stroke-cycle type. It is, however, simpler, and in a size as small as 125-kva. simplicity, low first cost and low repairs count more heavily than does a moderate difference in oil consumption. The experience in this particular case seems to have borne out the wisdom of the choice.

At the present time one of the steam-driven sets is kept ready for operation, but the bulk of the work falls to the oil-engine set. An ingenious modification to improve the efficiency of the combined system is the water jacketing of the exhaust pipes from the oil engine to provide circulating water in the spare boiler. In this way the waste heat of the oil engine is utilized to keep the water in the steam boiler at a temperature which enables steam to be made quickly and which cuts out the usual expenditure of fuel for banked fires.

The net result of the scheme here worked out is from the commercial standpoint highly satisfactory. The actual saving, as reckoned on five months' operation, has amounted to about $32 a day, which is a very practical answer to all the theoretical objections which might be raised against the change. In point of fact, ordinary steam plants of so small output as are here required are not very efficient and can often be beaten out by oil engines with the greatest readiness. The chief practical question as it appears to central station men is at what approximate output the costs by steam engine and oil engine become equal. This is a question which can be answered only by a careful investigation of detail in each particular instance, for one cannot in these times generalize on either the cost of coal or the cost of oil. Appearances all indicate, however, that the coal costs are likely to run up very seriously, so that it would not be surprising to see many a small plant follow the precedent here laid down.

The Coming Issues

OWING to the variety of conditions under which underground cables may be installed and operated, it is sometimes difficult to foretell what performance can be expected from them. The rating of a cable may be affected by any number of causes. All possibilities have to be considered if reliability of service is to be assured. Some of the principal causes of cable failure experienced by one large operating company will be outlined in the next issue, dated May 19. Remedies will also be suggested for most of the troubles. In the same number will be an article which points out the practical value of measuring reflection factor in connection with illumination calculations and which explains how the difficulties usually encountered in such measurements can be minimized. The second section of Walter Arthur's article on the characteristics of standard inclosed fuses, which was started in the March 10 number, will also appear in the next issue. The number following, dated May 26, will contain, besides the regular departments and technical and operating material, feature articles treating of various phases of central station, commercial and managerial work. One article will present the practices of the industry in dealing with the customers who use energy without paying for it.

N. E. L. A. in Historic War Convention

Patriotic Outbursts Mark the Proceedings of the Special Meeting to Consider How the Industry Can Best Serve the Nation—John W. Lieb the New President

IT WAS essentially a war convention that the National Electric Light Association held in New York on Wednesday and Thursday of the present week. Stripped of all things but war problems and necessary formal steps to continue the power of the organization, the fortieth annual convention passed into history in strict conformity with the rigid requirements of the times. From the opening words of President Herbert A. Wagner to the final adjournment half a day earlier than anticipated the serious responsibilities resting upon the industry to make the best use of its facilities for the country were the dominant note of all business transacted. Co-operation among members, co-operation with gas or other utilities, most of all co-operation with the government, were pledged by every act and word. And as a token of the attitude of this great organization there were the bright display of the colors of three allies and the military salute and patriotic demonstration which came with the raising of the "Star-Spangled Banner."

"As this is primarily a business meeting," said President Wagner in calling the members to order at 10.30 a. m. on May 9, "we will proceed at once with our program without formality."

W. F. Wells, Edison Electric Illuminating Company of Brooklyn, then took the chair while Mr. Wagner read the annual address of the president. An abstract of this address is published on pages 891 and 892. In accordance with the usual practice, Mr. Wells appointed as a special committee to report on the address Joseph B. McCall, E. W. Lloyd and Holten H. Scott.

Patriotic Demonstration

Following the appointment of the committee on the president's address a bugle was sounded, a squad of khaki-clad men marched in and the flag was raised, while the convention joined in the patriotic strains of "America."

President Wagner then resumed the chair and called upon Secretary T. C. Martin for his annual report.

Public Policy Committee Report

W. W. Freeman, Union Gas & Electric Company, Cincinnati, presented the report of the public policy committee, of which he is chairman, saying:

"Your public policy committee has devoted considerable time and thought during the year to the proposed plan of enlarged activities as discussed and authorized at the last convention, subject to the necessary and financial support being forthcoming from the member companies.

"A definite call for subscriptions was issued by the committee in a letter to the member companies dated Feb. 14, 1917; the responses to this letter were distinctly encouraging and indicated a willingness on the part of the companies to support the plan to an extent adequate to meet all anticipated requirements.

"A meeting of your committee was called to formulate plans for the inauguration of the work, but in the interim before the date of the meeting war was declared against Germany, and when the committee met it was the unanimous opinion that all such plans should give way to the more immediate and imperative problems growing out of the war situation.

"The committee desires to thank sincerely the member companies for the support and confidence which were so promptly and heartily proffered in this matter.

"It is hoped that events may render it practicable and advisable to renew favorable action upon the plan at a date not far distant.

How Can We Best Serve?

"The thought now uppermost in the minds of the committee is how we as companies and an industry can most effectively serve the nation and protect our properties in the emergency and the peril with which we are confronted.

"It is realized that the continued maintenance of reliable service on the part of the public service companies is as necessary a factor in supporting our sinews of war as is the raising of the army.

"We have in our charge, to a considerable degree, the health and safety of the public, and must conserve them as a public duty, not less than from financial considerations.

"On the other hand, we can furnish through our organizations, especially with our technically trained men, much valuable information and assistance to the government.

"Realizing the importance of these considerations, your committee a month ago appointed a sub-committee on war conditions, consisting of Messrs. Lieb, Edgar, McCall, Insull and Wagner. This committee has conferred at length and consulted freely with the National Defense Council, with federal and local

FULL AUTHORITY GIVEN TO CO-OPERATE WITH THE GOVERNMENT

Resolved, That the sub-committee appointed by the public policy committee—namely, Messrs. Lieb, Edgar, Insull, McCall and Wagner—be continued as a committee of the association, with full authority to take such action in behalf of the association as they may deem advisable to establish full co-operation between the United States government and the electric light and power industry of the country, to the end that the best industrial results may be obtained in connection with the prosecution of the existing war. The committee is authorized to establish or join in establishing and maintaining an office in the city of Washington if deemed advisable and to incur such expenses in the performance of its duties as it may find necessary.

officials and others qualified to furnish information and advice.

"The public policy committee respectfully recommends that its committee on war conditions be continued as a committee of the association with direct authority to represent the N. E. L. A. in the securing of information and the formulation of such plans of action as may seem necessary or desirable."

Mr. Freeman added that he would be glad to submit, after the discussion, a resolution which, if adopted, would carry out the thought of the committee.

[Later in the proceedings such a resolution was passed; it is published on the opposite page.—EDS.]

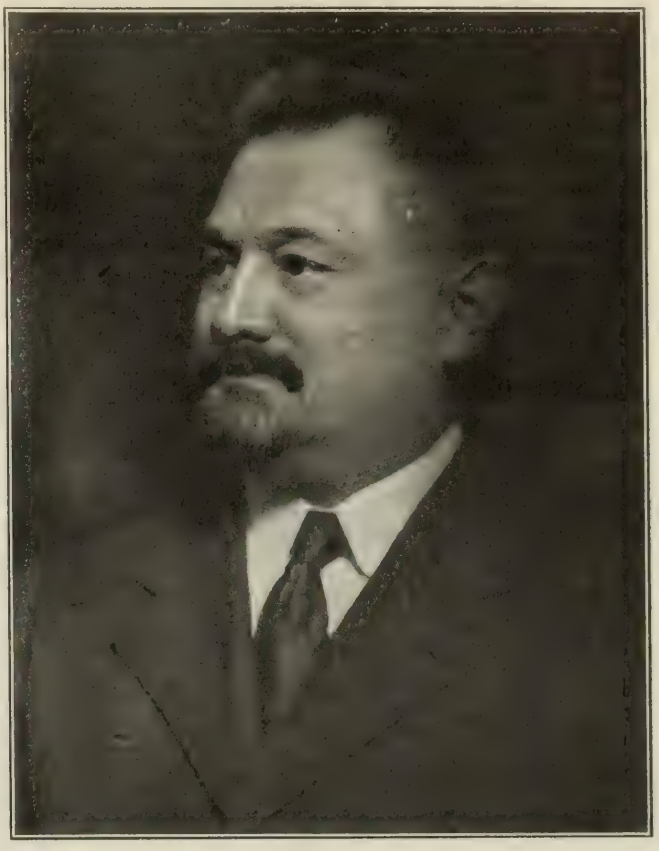
President Wagner asked J. W. Lieb, New York Edison Company, chairman of the sub-committee of the public policy committee which Mr. Freeman referred to as the committee on war conditions, to report on the progress that that committee had made, and also in regard to the conditions confronting the industry.

REMARKS OF MR. LIEB

Mr. Lieb, speaking informally, said in part:

"Your committee has given the matter of the relations of this industry and its allied interests the most careful consideration. As a result, it was felt early in our conference that it would be wise to ally ourselves with the sister industry, the gas industry, with which we have many problems in common."

Mr. Lieb then presented detailed information bearing on various problems created by the war, showing how the unemployment which existed in the British Isles at the commencement of the war was not comparable with the present scarcity of labor here. He paid a glowing tribute to the great body of young men in the electrical industry who would be ready to respond to the call of the nation, but said that another vital question, that of continuing utility service, was concerned.



JOHN W. LIEB

Who Will Join the Responsibilities of War President of the N. E. L. A. with His Work as Chairman of the Special Committee on War Conditions of the Public Policy Committee

EXPERIENCES IN ENGLAND

Quoting from the London *Electrical Review* of April 20, 1917, Mr. Lieb reported that a commission representing the electricity supply undertakings in Great Britain had taken up with the government authorities the question of the continual drains.

The British committee presented to the authorities the great importance of electricity supply from both the public utility and munitions standpoint, the very large number of employees affected and the amount of machinery dependent upon it, the danger of too severe cutting down of the staff and employees in electricity works, the necessity of considering employees in electricity departments from the standpoint of technical capability, experience and physical fitness, the difficulties, dangers and limitations of substitution, the employment of disabled soldiers and sailors and women and girl labor, the shortage of labor in the neighborhood of some of the large undertakings, the difficulty, and in some cases the impossibility, of making even the slightest reductions in the staffs of small undertakings, the necessity for each case to be considered on its merits by expert advisers; that women labor is employed in some instances to the extent of 25 per cent or more, but that the extent necessarily depends upon the local conditions that may prevail.

The result was that the most important men of the undertakings subject to call to the colors received temporary exemptions of a month or two months at a time.

CARE OF DEPENDENTS

On this subject Mr. Lieb said in part:

"Our industry has ever been a leader in providing for the welfare of our workers. Our workers are very dear to us all and have a first call, second only to that imperative call of the nation, upon our consideration and care, but it is very necessary that we shall not plunge into this matter of deciding what it is desirable or best to do hurriedly, but give it careful and thoughtful consideration.

"Our allies in Great Britain went into the matter with enthusiasm in the hope to go the limit in taking care of their men, as was done in the case of Canada, but they soon found out that to carry out the original expectations would lead the companies into bankruptcy. Therefore, this question of adjustments for employees who go to the front is one requiring the greatest care and will no doubt form an important consideration for your committee in consultation also with other similar committees, so that our industry may align itself with what is or may be the best policy to pursue, a policy which will commend itself to the public and which may be practicable in view of the condition in which our financiers may find themselves."

Continuing his presentation of data in the hands of the committee, Mr. Lieb read a letter received by Secretary Martin from P. H. Gadsden, Charleston, (S. C.) Consolidated Railway & Light Company, who spoke of

the opinion of a special committee on war payrolls of the United States Chamber of Commerce. This committee held that employers should not assume any responsibility for wages of employees enlisting in the army or navy, on the ground that this burden should primarily be borne by the government, and that, in case government provision was inadequate, it should be provided for by public subscription as in Canada and England. Upon analysis of the conscription bill now in the Senate, the committee felt that under such an act the problem would be reduced to a minimum, as it specifically eliminates men with dependent families.

"This simply means," Mr. Lieb added, "that we are still not in a position to take a definite stand as to what may be the best policy to be pursued, and your committee will consider it one of its duties to follow this up, with a view of making a report at the proper time, and an interim report if it becomes necessary, through the public policy committee."

The possibility of substitution of women for men called to the colors was discussed briefly by Mr. Lieb in the light of foreign experiences. Women are taking the places of three-fourths of the electric railway motormen in Germany. Women are now switchboard attendants, meter readers, etc., in Great Britain.

Mr. Lieb also mentioned the scarcity of metals and substitution practiced in Germany and the possible revolutionary permanent effect.

Mr. Lieb added that one of the problems here will be the great readjustments that may become necessary in company construction due to the impossibility of getting apparatus. It may also be necessary to transfer apparatus destined for one company to another whose demand has grown imperative, owing to necessities of local munitions or some urgent supply-manufacturing industry. It is believed that the committee may be called upon to represent the industry in such readjustments.

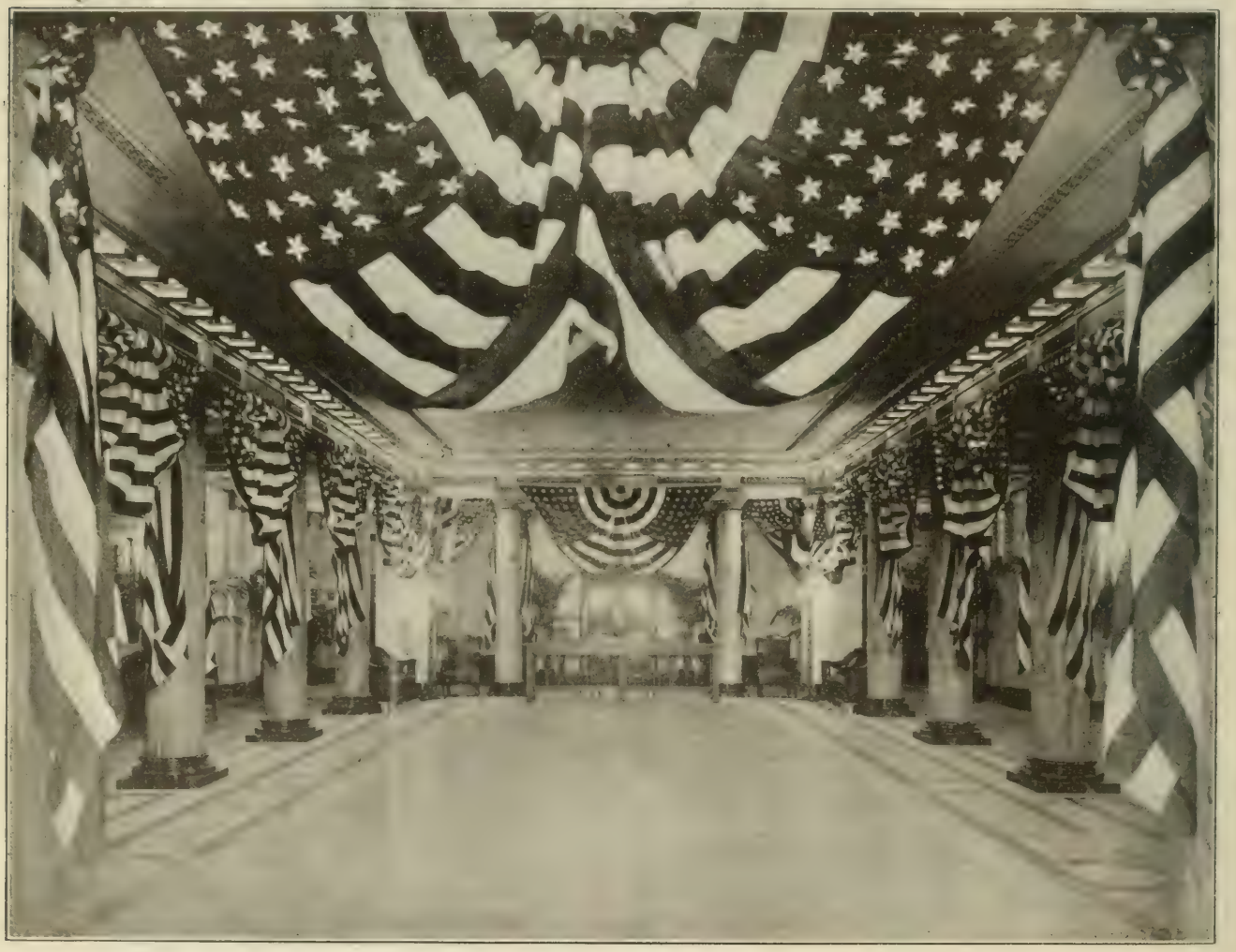
Coal and Fuel

"We have already had an experience," said Mr. Lieb, "which it is unpleasant to recall—indeed, it is not a matter of recall, we are right in it now, and the end is not yet—and it is felt that there again such a committee as has been indicated will be of value in being the channel of contact with the United States government, under one of its committees, to see that coal is delivered regularly and in quantities that may be necessary. It is quite possible that the stress may become so great that it will be necessary to classify our business, to curtail the less urgent business and curtail our coal requirements."

Protection of Property

Mr. Lieb drew attention to the importance of protecting property and the responsibility of the companies in that respect as well as in rendering service.

An outline of the advantages and logical reasons



ENTRANCE HALL AND REGISTRATION DESK IN ENGINEERING SOCIETIES BUILDING, WHERE N. E. L. A. WAR CONVENTION WAS HELD

for close association with the gas industry was given by Mr. Lieb, to the end that the most effective co-ordination for government service may be assured. He mentioned the counsel and advice received from Alex Dow of Detroit and Prof. D. C. Jackson of Boston.

Major J. H. Finney

Howard E. Coffin of the Advisory Council for National Defense was prevented by conditions in Washington from addressing the convention. In his absence Major J. H. Finney spoke of the organization in which Mr. Coffin ably fills so large a place. Major Finney said:

"Your first problem is to get and keep your house in order so that you shall not only meet present demands but shall take care of an almost overwhelming additional demand that will be expected of you in this emergency. How this is to be done is not my province to say, and I shall leave it in the most capable hands of my friend Lieb to discuss. But that it will be done and well done I am sure.

"But that is not enough to do, nor all that you can and must do, for it is up to this great organization as technical men and as employers of technical and skilled men to keep supplied the many thousands of skilled and trained men required by the army and navy—and to do this promptly and effectively at a time when you feel that your own organization must be kept intact."

Patriotism Aroused by Mr. Aldred

In introducing J. E. Aldred, New York, chairman of the board of directors of the Consolidated Gas, Electric Light & Power Company of Baltimore, who has also large interests in Montreal and other places, President Wagner said that Mr. Aldred has the administration and control of 500,000 hp. Mr. Aldred created great enthusiasm by recounting the part of the Montreal company in caring for men who are at the front and giving his personal view that such men should feel that they and their dependents are provided for. Mr. Aldred spoke in part as follows:

"It is quite true at the outset of the war that practically every corporation in Canada came out with the proposition of paying the men who went to the front the difference between their present wage and what the government gave them in service, and it is also quite true that afterward that scheme was abandoned to some extent and its place was taken by what is known as the patriotic fund; but I may say from my personal experience and knowledge that it was not because the companies feared bankruptcy on account of the application of the first proposition. In fact, so far as the companies that I have anything to do with are concerned that cut absolutely no figure and would have been an impossibility.

Montreal Company Experience

"The Montreal Light, Heat & Power Company, with an average number of 1375 employees during the last three years, had an average enlistment of 10 per cent. At $1,000 a year each, or even $1,500 a year, that would amount to less than $200,000, and anybody who knows anything about the conditions of the so-called Civic Investment Company and the Montreal Light, Heat & Power Company will not for a minute think that we would have 'gone broke' on $200,000 a year, and that same thing applies to every other company that I have knowledge of in Canada.

"As a matter of fact, that was not the reason for the change at all. The change came about because while the corporations were still quite willing to carry out this proposition of paying their men their full wage minus what the government paid, the patriotic fund resulted from pressure from the agricultural sections.

"As a result of putting into effect this proposition of agreeing to pay our men, we not only stimulated enlistment, but we stimulated the efficiency of the force that was left at home, and we have not suffered by reason of losing as much as 10 per cent of the men. In fact, the efficiency has been maintained, and we have done 30 per cent more business than we ever did in any one year's history of the company.

"Now, it has been said in regard to this matter that the burden would be excessive on companies, and we are talking about companies in the United States. We have not found the burden excessive in Canada, and we furnished probably six men to every single man that will go to the front from the United States.

"That plan is still in effect, and it will stay in effect as long as the war continues.

Sacrifice for the Corporation

"I hope that there is an element of sacrifice to be met on the part of public service corporations. There certainly is going to be an element of sacrifice on the part of the mother that sends her son, and the wife that sends her husband, and I would feel ashamed to stand here now, speaking not as one only interested in the management of these corporations, but as one who happens to be in each case largely representative of the stockholders—I should feel ashamed if I felt for a moment that any consideration of that side of the question had anything whatever to do with my action in the premises. (Applause.)

"What we are trying to do at this time is to get men to the front, and we are not worrying about the men that stay at home."

A great outburst of applause followed Mr. Aldred's remarks, and Major Finney proposed three cheers for him, which were given heartily. The morning session was then adjouned.

WEDNESDAY AFTERNOON SESSION

At the afternoon session President Wagner referred to the plan for an evening meeting, which it had been hoped would be addressed by Herbert C. Hoover. Mr. Hoover was not able to leave Washington. Oscar T. Crosby, Assistant Secretary of the Treasury, was also unable to leave Washington. The result was the abandonment of the proposed evening meeting.

President Wagner spoke of the wide influence of the association.

"Before proceeding with the meeting this afternoon," Mr. Wagner said, "I think it fitting to emphasize the fact that this association has a wider influence and a closer touch with every city, town and hamlet in this country than any other association in existence.

"We will put patriotism before and above our more selfish interests in maintaining our profits, the question of providing for the dependents upon the men who are in our organizations and who enlist and go to the front. We will take as good care of the men that go to

the front as we do those employees who remain home, and that is a question we must consider carefully and thoroughly and in an unselfish and patriotic mood.

"In my position I hesitate to express any strong opinion on this subject myself, but we have had speakers this morning and we will have this afternoon who presented and will present both sides of the question, and I feel like saying to you that with all these different opinions we must hold patriotism and our duty to the country above everything else." (Applause.)

Chamber of Commerce Representative

Allen Walker, personal representative of the president of the United States Chamber of Commerce, spoke at length on the questions involved.

"Whether it be in regard to war taxation or in regard to this particular question of industrial payrolls during war time," he said toward the close of his remarks, "we have found throughout the country a determination on the part of business, not only to do its share and more than its share, but a voluntary offer to do its share regardless of personal results but with only one warning finger that is necessary to be uplifted, and that is 'Take care that you do not kill the goose that lays the golden egg,' because there never was a time in the history of this country when it was necessary for men to pay more attention to their business than right now, because if the business of the country slacks everything else in the country slacks in proportion and everything else suffers and the wheels stop, and unless you keep the wheels of the machinery of business going the whole problem of production is affected and your man at the front counts for a very negligible factor."



W. F. WELLS
Elected First Vice-President for the New Year



R. H. BALLARD
Elected Second Vice-President for the New Year

J. B. McCall

J. B. McCall, president Philadelphia Electric Company, said that he was in hearty sympathy of course with any project which this association or business men generally may adopt for the care of dependents of enlisted men. He added:

"I feel, however, that we ought to move carefully and practically; that the important thing is to so organize our own industry, in co-operation with others, that the wheels of business may continue.

"In our case we are practically the most vital industry in any community, and we ought to do our utmost. In connection with the sub-committee, I made the original proposition that if it was possible to impress upon the Council for Defense the formation of an industrial reserve that would in the beginning and as a foundation align our men in the interest of the government and of the nation, first, for whatever the nation might need, and, second, as a part of that need to continue the detail operations, conserving power and light in our communities, and as a step from that foundation for the man in charge of these various companies to make an inventory of the men, and to set aside first those men who are absolutely imperative under war conditions, which are likely to continue for two or three years, to the performance of service in a community, to keep a force that will enable us to supply all the power necessary in the manufacture of munitions and various other materials that are needed at the front.

"If we have the experience that they have had abroad as I understand it, it would be practically impossible for us to get the means, either by issuing securities or otherwise, to make very large extensions. It is important that we make an inventory of our requirements in that direction and get right down to a war basis and apply that same method to everything that we have in connection with business."

L. A. Ferguson

L. A. Ferguson, Commonwealth Edison Company, Chicago, described a plan adopted by that company which is tentative to the extent that it is definite only until Aug. 1. This is based on the theory that the company shall not pay anything to the man himself who goes to the front, but that it shall provide for the dependents that he leaves at home.

H. I. Harriman, New England Power Company, said that that company is having an investigation made to see what it costs the various employees to live in New England, and based upon the results a list of payments to the wife and the children at home will be made up.

Experience in Toronto

D. H. McDougall, Toronto Power Company, said:

"In Canada the power supply companies have been taxed to their utmost to supply the demands for energy for their customers, many of whom are manufacturing munitions of war.

"Every kilowatt of energy is put to work and many overloads have been carried that were previously thought to be hazardous.

"The company I represent has increased its load since before the war by over 505 per cent and now delivers energy to munition plants of various kinds totaling over 60,000 hp.

"This munition business is an important factor in the country's contribution to the cause of justice in Europe. Men are needed for the manufacture of munitions in all its branches and none are so necessary as the central station men who operate and manage the power supply plants.

"In regard to the wage question, the Toronto company had a great deal of the same kind of discussion you are having, only we think a much more serious problem than you have to face under the selective recruiting system. We decided that it would be unfair and improper to do anything for our men except contribute to the organized patriotic fund. All our contribution goes to the patriotic fund administered by the government or local commissions."

Mr. Freeman presented a resolution expressing the sentiment voiced by the public policy committee report

SECTION CHAIRMEN WHO ARE CONTINUED IN OFFICE FOR ANOTHER YEAR



J. L. BAILEY



E. S. MANSFIELD



R. J. M'CLELLAND



E. A. EDKINS

in regard to the special committee on war conditions. After discussion the resolution, which is published on page 884, was adopted unanimously.

Speaking further on the subjects under discussion, Mr. Freeman added:

"I am inclined to think that we can in each case make it easy for men to go to the front, for the right men to go, for the men who can be spared, as is the case with all of us, and I feel so far as the organization for which I am responsible is concerned that I would rather err on the side referred to by Mr. Aldred this morning than on the other side. (Applause).

"I think these plans that have been suggested, the Chicago plan, the Philadelphia plan, should be amplified for our benefit by the committee as doubtless they will be, and I am sure that the sense of this meeting is that we shall not leave things in the air, that we shall not take the risk of being misunderstood in our motives by placing an undue amount of emphasis on the holding of the men that we must hold as against the proper amount of encouragement to the men whom we do not need to perform the work which the nation needs of them, and needs primarily at this time.

"I am sure that the committee will have that thought in mind as much as the other thought, and so far as my own organization is concerned, I want it to feel that we have the interests of the nation first at stake, and that when we are asking men to remain at their work it is not selfishness, but that it is patriotism, and that that patriotism must be divided properly as between holding sufficient men to man the organization, and releasing the men whose duty it is to go to the seat of war." (Applause.)

C. M. Cohn of Baltimore, W. B. Tuttle of San Antonio and Samuel Scovil of Cleveland also discussed the position of those who go to the front.

Encourage the Man, Says Mr. Scovil

Mr. Scovil said: "The man who makes up his mind to lay down his life for his country wants all the encouragement to go to war that he can get. He goes because he considers it a duty to go, and I consider that every man who is allowed to stay at home should be thankful if he is in any way able to do anything, and he should consider it a great privilege that he is allowed to stay at home. Every man that is selected wants all the encouragement and enthusiasm put behind him that is possible, no matter how he is selected." (Applause.)

Helping Food Production

J. T. Hutchings, Rochester Railway & Light Company, said that Rochester manufacturers are not hiring men who have had farm experience and hope in that way to promote food production.

H. H. Ganser also spoke of the importance of aiding food production.

FINAL SESSION

President Wagner called the last session to order at 10.10 a. m. on Thursday.

Mr. Wagner read a telegram from Howard E. Coffin expressing deep regret that Washington business made his presence at the meeting impossible, and referring to the important and essential character of the service rendered by the companies.

Sound Financial Condition

Mr. McCall, as chairman of the finance committee, read the report of the treasurer, W. H. Atkins, Boston, who was unable to be present. It showed that the association is in better financial condition than ever before, having increased its investment funds and having available the amount necessary for expenses during the rest of this year with a balance besides.

Nominating Committee and Other Business

The nominating committee to name officers for the ensuing year was then appointed, as follows: Charles L. Edgar of Boston, chairman; Henry L. Doherty of New York, W. H. Johnson of Philadelphia, Douglass Burnett of Baltimore, and J. B. Miller of Los Angeles.

Walter Neumuller, New York chairman membership committee, said that the keynote of the report of that committee was that the 15,000 mark in membership had been passed.

President Wagner introduced the subject of the sections. W. H. Johnson offered the following resolution, which was passed:

"Be it resolved that no election be held at this meeting, and be it further resolved that the officers and committees of the four national special sections—to wit, the Technical and Hydroelectric, the Accounting, the Commercial and the Electric Vehicle Sections—be requested to continue in office until such time as their successors are elected."

It was decided that the papers and reports should be admitted to the *Proceedings* after submission to a

special committee composed of Secretary Martin and the chairmen of the various sections. The actual *Proceedings* of the special convention will be sent to Class A members at as early a date as possible.

Mr. Martin presented the report of the committee on memorials.

Frank W. Frueauff, in reading the report of the committee on constitution and by-laws, said that the work had been started and done largely by R. S. Orr of Pittsburgh, who died during the year.

President Wagner spoke briefly of the work of the safety committee.

Following this he gave an outline of the affairs of the exhibition committee.

Coal Situation

Mr. Wagner asked about the appointment of a committee in Washington on coal conditions.

Mr. McCall spoke of the appointment of the committee, of which F. S. Peabody of Chicago is chairman. He said that the situation was most serious. He suggested that the companies should inform themselves as to their needs so that if they are asked for definite information they will be ready. Mr. McCall also spoke of the necessity of financing capital requirements.

Financing Requirements

W. F. Wells, Edison Electric Illuminating Company, Brooklyn, recalled the Association Island address of Frank A. Vanderlip, and compared the enormous requirements of the government through the "liberty loan" with the normal demands of the great public utility industries. He counseled conservatism in expenditures which may be omitted.

Van Dusen Rickert, Pottsville, Pa., followed Mr. Wells.

John H. Roemer, former chairman, Wisconsin Railroad Commission, said that he thought the question of capital was serious. The industry cannot stand still. If it only keeps up with the normal increase in business without making extensions it will require a great deal of new capital. It behooves every company to provide for its capital requirements while it can do so.

Henry L. Doherty, Cities Service Company, said that the most serious question was that of getting capital for extensions. Mr. Doherty suggests that the government issue scrip as well as bonds to represent the new large obligation. This would help to develop a new class of investors among those who had not bought securities heretofore.

The Situation in New England

H. I. Harriman, New England Power Company, said that the coal situation was the most serious one which faced the companies in New England. The increase in cost at the mine and the difficulties of land and water transportation to New England coast points made the consideration of this question a vital necessity. If attention is not given to it soon and it is allowed to drift until cold weather there will be a grave crisis, at least in New England .

E. A. Barrows, Providence, R. I., and Mr. Edgar spoke of the coal situation.

Mr. McCall presented the report of the committee on the annual address of the president. One point in this report follows:

"The increasing cost of material, fuel and labor is a question that has been brought home to all our members and they should very carefully consider the effect of these changes of their rate schedules, recognizing the importance of maintaining their present rates for the smaller user, and in cases where it is evident that a raise in rates is necessary, the burden of this change should be made to fall on the power user who most frequently enjoys the benefit from lower rates."

Report of Nominating Committee

Mr. Edgar presented the report of the nominating committee, as follows:

President, J. W. Lieb, New York Edison Company; first vice-president, W. F. Wells, Edison Electric Illuminating Company of Brooklyn; second vice-president, R. H. Ballard, Southern California Edison Company; third vice-president, Samuel Scovil, Cleveland Electric Illuminating Company; fourth vice-president, D. H. McDougall, Toronto Power Company; treasurer, W. H. Atkins, Edison Electric Illuminating Company of Boston; executive committee, Paul Spencer, United Gas Improvement Company; Walter Neumuller, New York Edison Company, and E. W. Lloyd, Commonwealth Edison Company of Chicago.

The secretary was instructed to cast a ballot for the nominees.

Mr. Lieb, in expressing a sense of the obligation which he assumed in accepting the office, particularly at this trying moment, said that he would invite and urge the co-operation of the smaller companies in the work of the organization.

The convention then adjourned.

Appropriateness of Mr. Lieb's Election

Mr. Lieb is particularly well fitted to serve as a war president of the N. E. L. A. He has thrown himself with his customary vigor and earnestness into the work of preparedness. In addition to the chairmanship of the special N. E. L. A. committee he is a member of the Mayor's committee on national defense of New York City, a member of the executive committee of the military engineering committee of New York, a member of the committee on national defense of the American Institute of Electrical Engineers and vice-chairman of the citizens' protective committee of New Rochelle, N. Y., where his home is located.

Born in Newark, N. J., on Feb. 12, 1860, Mr. Lieb was graduated from Stevens Institute of Technology in 1880. His early work in this country, subsequently in Italy and then in New York City, is well known. Vice-president of the New York Edison Company, he is also president of the Electrical Testing Laboratories and is connected with other companies.

Mr. Lieb has always been an active supporter of the progress of the societies in the industry. He is a past-president of the American Institute of Electrical Engineers, the Association of Edison Illuminating Companies and the New York Electrical Society. For his achievements in Italy he was decorated by the King of Italy with the order of Knight Commander of the Order of the Crown of Italy. His many activities, intense as they have been, have been confined largely within the one industry to which he has devoted his life.

War Convention Address of President Wagner

Central Station Companies Face Problems of Man Supply and Fuel Supply and Great Demand for Power from Munitions Industries

PRESIDENT WAGNER'S address to the convention dealt partly with general association affairs, but mainly with the questions arising from the war. His address in part follows:

REGULATION AND PROFIT

"We have welcomed and encouraged regulation by public service commission as the best means of assuring the fair consideration of rights involved and supplanting the wasteful and inefficient regulation by competition, involving, as it did, the duplication of capital and effort and the subdivision of sources of supply. Experience has proved what theory had always maintained, that concentration of capital, effort and production is the only means of realizing the lowest costs and, with proper regulation, the lowest selling prices.

"The public has been slow to appreciate the full significance of this economic truth, but as those engaged in the public service have learned to realize more fully their duties to the public, the people have also begun to understand to some extent their dependence upon and duties to the public utilities. In bringing about this better understanding the N. E. L. A., through its co-operative and educational methods, has played an important part.

"Under wise public service commission regulation ample profit must result in constantly improved and extended service and lower rates. In any business lower prices for the product can be brought about only by better methods of production and management and by increased volume of production and sales.



RETIRING PRESIDENT H. A. WAGNER

"Some incentive is required, however, to make such improvement appear desirable to the management and owners. This incentive is usually found in the hope of greater profit. The public service business needs this same incentive for improvements and expansion which will make lower prices for service possible. If rates are continually being lowered, with no increase in profits, all incentive to adopt methods to lower operating expenses will naturally cease.

"Some fair division of excess profits between the consumers and the companies is therefore essential to assure the best results for the consumers. Reductions in rates, without the attendant possibility of increased dividends, are not only unfair but prejudicial to the best interests of the public. The consumers are dependent upon the public service company, and the company is dependent upon the consumers. The relation of the two should really resemble a partnership for mutual benefit. Their interests are not opposed, but actually interdependent. Neither should seek to reach for all the benefits, for they would be of short duration.

"With the view of making this mutualization of interest more effective on a profit-sharing basis, a number of our larger public service companies today are encouraging their consumers and employees to invest in the company's securities, and these efforts are meeting with very satisfactory results.

GEOGRAPHIC SECTIONS

"The latest development in geographic section organization is the proposal to admit as geographic sections those existing state and other associations having both electric company and gas company members, in which the electric companies that are members of the N. E. L. A. are in the majority.

NATIONAL CONVENTIONS

"For some years there has been a growing feeling among many of our members that the national conventions are becoming too large and unwieldy and an increasing burden upon member companies for loss of time and increased expense in attendance of so many of their busy men. The greatly curtailed and limited annual meeting which has been called this year to take the place of the usual form of annual convention may serve as an object lesson to illustrate practically both the advantages and disadvantages of a limitation of attendance at annual conventions. The growth of the geographic section idea and the multiplication of the conventions held by these sections must further modify the consideration of the possible future and character of national annual conventions.

OPPORTUNITIES OF THE CENTRAL STATION

"The dependence of the public upon the service of electric central station companies has been demonstrated

more clearly than ever before, and the growth of the demand for central station power, on the one hand, and the decadence of the isolated plant, on the other, have been unprecedented. There are before us to-day greater opportunities for the extension of our power service and for the practical elimination, through obsolescence and inadequacy, of all other sources of power for the country's industries, great and small, than the greatest optimist could have dreamed of a few years ago. In grasping these opportunities we are only limited by our ability to finance our unprecedented requirements, by the increasing difficulty of obtaining deliveries of apparatus and supplies, and by the greatly increased cost for all equipment, which may become well-nigh prohibitive without an increase in rates for service.

Preparedness for War

"Some fear has been expressed in this country that a general impulse for economy might suddenly contract the volume of business to such an extent as to disorganize industry, throw wage-earners into idleness and create a general state of alarm and confusion which would seriously impair the ability of the country to deal with the great emergency which confronts it. Many are urging that it is better for each person to go ahead in his accustomed way and with his usual expenditures than to run the risk of disturbing the orderly movement of trade by encouraging a general change of pace. It seems to be generally agreed, however, that there will have to be material changes in our industrial methods and a reduction of expenditure.

"But these changes should come about gradually and automatically, as government orders are given preference over private orders, by the effect of high prices, by the influence of taxation and by the patriotic desire to participate in the war loans. It is imperative that in all these readjustments we avoid hysteria and impulse.

Industry Dependent Upon Central Stations

"It is safe to say that there is to-day no class of industry, no kind of manufacturing enterprise, which is not dependent upon electric central stations for power or light, or both. Within the last two years the expansion of factories and mills engaged in the production of munitions for war and the various materials used for their manufacture has resulted in greatly increased use of central station electric power.

"Light for our streets and homes provides the most effective protection and security against all forms of disorder and crime which the unsettled conditions may encourage.

"In order to maintain our service with undiminished effectiveness it is, of course, necessary that the public utilities should retain at least the greater part of their forces of skilled men, and prompt measures must be taken to offset the effect of enlistment and the application of the selective draft in decimating our organizations. We must find ways and means of holding the bulk of our men in their present jobs without discouraging enlistment or in any way embarrassing the government in raising the required military forces.

"It is most desirable for us also to consider what position we are to take in contributing toward the support of those dependent upon our employees who enlist or who are drafted. Undoubtedly, our inclination is to be liberal in our contributions, but, on the other hand, the limitations of our financial resources, particularly in view of the great increase in the cost of fuel and supplies and the possibility of curtailed earnings, must warn us to pause before taking precipitate action which we may afterward be forced to modify.

"One of the most serious problems which confront us is the scarcity of fuel, or the means to assure its delivery in such regular quantities as our requirements demand. Some prompt and well-organized action must be taken to bring before the proper government authorities the extreme urgency of the adoption of measures to put public utilities in a preferred class for fuel supply.

"Without doubt our central station companies will be called upon for increased service for many industrial purposes in connection with government contracts for munitions and supplies, and this possibly without a proportionately diminished demand for the usual commercial and domestic service. With the slow deliveries of equipment and apparatus for extensions, and the possibility that available supplies may be commandeered by the government, we are faced with the possibility of increased demand upon our output beyond our capacities to supply.

"In such a contingency we will undoubtedly be forced to give preference to government requirements, and this may bring before us questions of discrimination which will present difficult problems in themselves and will, no doubt, call for relief through federal enactment.

"Another urgent question confronting us is the necessity and obligation of protecting our properties against interference, damage or destruction by the hands of fanatics, enemy agents and mobs. The extent to which such protection is desirable or feasible and the best means of securing it, considering both the urgency and expense, are matters upon which there are widely diverging opinions and counsel."

PRESIDENT WAGNER REVIEWS THE YEAR AND WAR PROBLEMS

By the campaign of the active membership committee the total enrollment has passed 15,000 for the first time, standing at 15,057, divided between 1134 Class A members, 12,715 of Class B, 95 of Class C, 245 of Class D, 831 of Class E and 37 foreign.

Particular attention was called to the great value of educational work for employees of member companies.

Mr. Wagner impressed upon his hearers these important points:

"Some fair division of excess profits between consumers and companies is essential to assure the best results for the consumers."

"The dependence of the public upon the service of electric central station companies has been demonstrated more clearly than ever before."

"There is more work in sight than ever before, and expenditures will not be lessened but will merely be shifted to new channels."

"Public utilities are standing behind the supply of the various sinews of war, and it is of paramount importance that service should be continued with undiminished efficiency and reliability and even extended where necessary."

Business of Country Must Go On

Society for Electrical Development, at Annual Meeting, Pledges Support to Movement Which Will Prepare Electrical Systems for Added Demands Brought by War—Organization of the Industry

ACTIVE support of the nation in the preparation of all electrical systems for the added demands brought by the war was pledged by the Society for Electrical Development at its annual meeting in New York, May 8, by the following resolution:

> Whereas the President in a proclamation to the people of the United States has urged the conservation of all resources and the devotion of all energies to the sole purpose of bringing victory to the arms of the nation in the war upon which it has so justly entered;
>
> Resolved that this society, at its annual meeting, pledges to the President its patriotic support of all measures which he may take in upholding the dignity and honor of our country and the rights, property and persons of its citizens on land and sea;
>
> Resolved that America's success in helping to win this war depends not alone on its ships or its food supply, but first of all upon our ability to keep the wheels of mercantile business going.
>
> Resolved that the business of this country must go on, and we pledge our active support to the movement by which every business man in this country agrees to hold up his link in the chain of mercantile enterprise, including the preparation of all electrical systems for the added demands, both military and industrial, which may be made upon them.

In line with its resolution the society is mailing a poster to its members which bears the following:

BUSINESS *MUST* GO ON

America's success in helping to win this war depends not alone on its military forces, or its ships, or its food supply. It depends, first of all, on our ability to keep the wheels of mercantile business going. In the months to come will be heard all about us the grumble of the pessimist. It will be said that trade is slackening, that there are food famines, coal famines, freight congestion, labor shortage, business stagnation. Those will be the days for the electrical industry to stand together as one man, and boost for prosperity.

We must be up and doing! We must co-ordinate and concentrate to push business. We believe that business must go on. We believe there are strong, optimistic men enough in the business fabric of this nation to keep it going! This republic has been built up through faith in itself.

This is not our first crisis. In other years men have fought side by side to save many a situation in business and in war, because they believed in each other. Confidence in ourselves, plus "Yankee ingenuity," have given to this nation an ability possessed by no other on the face of the globe—the ability to land squarely on our feet in any upheaval.

We of the electrical industry look to these days as our supreme opportunity to make good business better. We believe that as never before people are coming to recognize electric service, appliances, motors as economic necessities of home, workshop, store, office and farm. We pledge our active support to the movement by which every business man in this country agrees to hold up his link in the chain of mercantile enterprise. The business of this country must go on. Will you help?

To aid in organizing the industry a committee was appointed composed of A. K. Baylor and W. A. Layman, representing manufacturers; J. R. Strong and Ernest McCleary, representing contractors; W. H. Johnson and J. E. Montague, representing central stations; W. E. Robertson and Fred Bissell, representing jobbers, and James H. McGraw, chairman.

The committee is thus composed of two representatives of each interest in the electrical industry. These two men constitute a sub-committee, the duty of which is to ascertain what their particular branch of the industry wishes the Society for Electrical Development to do for them. Having ascertained this, a meeting of the committee on organization of the industry will be held at the offices of the society on May 29. This committee will then discuss the various suggestions and formulate plans to be submitted at a meeting of the board of directors of the society which will be held shortly after that date for the purpose of receiving, considering and acting upon the suggestions made by this committee.

Other Business Taken Up

Among other things taken up at the meeting was the annual report of J. M. Wakeman, general manager of the society, who reviewed the work of the year and set forth the plans for the coming year, including the publication of a number of new booklets for the use of salesmen, business managers and others in the industry.

The report was received with considerable enthusiasm and was commented upon most favorably by all present. Particular reference was made to the good work done in securing the publication of articles in the popular magazines bearing upon the uses of electricity. James H. McGraw, who presided as chairman at the request of President H. L. Doherty, said if the Society for Electrical Development did nothing else for a year but continue its good and unique work in educating the public through the magazines, daily papers and trade press it would justify the expenditure of all the money it collects. He added: "The society is the only organization in the electrical industry in a position to do this valuable and very necessary work."

The treasurer's report showed very satisfactory collections of subscriptions. Only 4 per cent of the subscriptions due up to March 31, 1917, have not yet been collected. The general manager's and treasurer's report will be printed and distributed to the industry later by the society.

The following directors were elected for the ensuing four years: Henry L. Doherty, A. W. Burchard, W. E. Robertson and Ernest Freeman. The board of directors held a meeting in the afternoon at which the following officers were elected for the ensuing year; President, Henry L. Doherty, and vice-presidents, W. H. Johnson, A. W. Burchard, W. E. Robertson, J. Robert Crouse and Ernest Freeman.

The members of the executive committee were appointed as follows: Chairman, W. H. Johnson; Henry L. Doherty, Ernest Freeman, A. W. Burchard, J. Robert Crouse, W. E. Robertson, L. A. Osborne, Gerard Swope and J. R. Strong.

The general manager and the secretary-treasurer were reappointed for another year.

N. E. L. A. Convention Papers and Reports

Abstracts of Principal Technical, Commercial, Vehicle and Accounting Section Committee Reports Prepared for the Annual Convention but Presented Only by Title at Special Meeting in New York

THE annual convention of the National Electric Light Association, scheduled to be held at Atlantic City the last week of this month, would, so far as could be gaged by preparations made for it, have eclipsed every other convention of the association. Unfortunately, because of the problems arising from the war, it had to be abandoned, and to comply with the constitution a special meeting was held in New York City on Wednesday and Thursday of this week.

Reports of all committees have been prepared, and abstracts of as many of them as were available for publication on going to press are presented in the following pages.

TECHNICAL AND HYDROELECTRIC SESSIONS

MOST prominent among the technical reports for amount and character of information presented is the report of the committee on prime movers. Among the principal subjects discussed were the tendencies in development and problems involved, feasibility of higher steam pressures, superheats and velocities, and solution of hydroelectric-plant ice problems. Four other reports and two papers were presented on electrical apparatus, underground construction, inductive interference, meters, the metric system, and working on high-voltage lines. Up to the time the convention was held no other reports or papers had been submitted. The electrical apparatus committee's work was principally the revision and extension of transformer standards and the further introduction of the uniform service rules for motors. A treatise on the handling and care of transformer and switch oil represented a valuable part of the report. Cable specifications and a method of making split-conductor joints constituted an important part of the report on underground construction. The chief subject discussed by the committee on overhead lines was the problem involved in mitigating interference with ground-return telephone lines. Acceptability tests and methods of maintaining meter accuracy formed the principal part of the meter report.

POWER PLANT EQUIPMENT AND PRACTICE

Prime Movers

For wealth of material and thoroughness with which each subject was covered, the report of the prime mover committee, of which J. M. Graves is chairman, is especially important. Reports from manufacturers on tendencies in development, problems involved in design, relative volume of business, etc., make up the greater part of the report. Experiences of operating companies in various lines are also included. Among the subjects taken up are turbines, condensers, station auxiliaries, stokers, refractory materials, coal handling and storage, weathering and spontaneous combustion of coal. Feasibility and practicability of higher steam pressures, condenser cleaning, economical steam velocities and pressure drops, station instruments, analysis of power requirements of station auxiliaries and treatment of boiler-feed water are also discussed and comments made regarding Diesel engines, progress in water-power development, operation and maintenance of hydroelectric stations, ice-handling methods and waterwheel testing.

Practically all manufacturers report a phenomenal increase in volume of business compared with previous years. There has been a great increase in the number of orders for large prime movers, the development of large

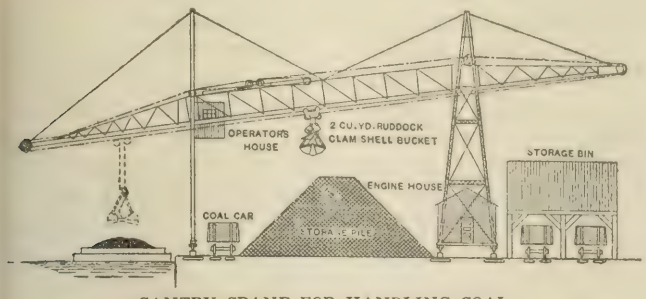


LOCOMOTIVE CRANE USED BY INDIANAPOLIS COMPANY

condensers, boilers, stokers and auxiliaries keeping pace with the development of the turbine. At the same time there has been an enormous demand for units of moderate size. The largest turbine so far developed is rated at 70,000 kw. and the largest condenser on order has 100,000 sq. ft. (30,480 sq. m.) of surface. Many industrial plants are now installing units rated at 10,000

kw. and 15,000 kw., whereas 2000 kw. or 3000 kw. was considered large before. Some of the most recent tendencies are toward the use of higher steam pressures and superheats, several plants now under construction having been designed for 300-lb. (21.1-kg.) pressure and superheat of 200 to 250 deg.

Turbines, Condensers and Auxiliaries.—When it is



GANTRY CRANE FOR HANDLING COAL

considered that about 76 per cent of the energy theoretically obtainable from steam expansion may now be realized at the switchboard, not much greater gain in power-house economies is to be obtained through further development of the turbine and its generator, according to the Westinghouse Electric & Manufacturing Company. Progress is to be looked for in other channels, higher pressures being one method.

The tendency in regard to circulating pumps is no doubt in the direction of more water per pound of steam. With steam-turbine drive, the general trend is toward higher turbine speeds. Development work during the past year has been along the lines of adapting the underfeed stoker to high-ash Middle Western coal and to lignite, both of which are now being handled with entire satisfaction. Particular attention has been given to dumping, the double dump gate being used satisfactorily with each fuel. In large plants the tendency is toward the use of higher rated boilers, 1000 hp. becoming standard equipment in the larger plants.

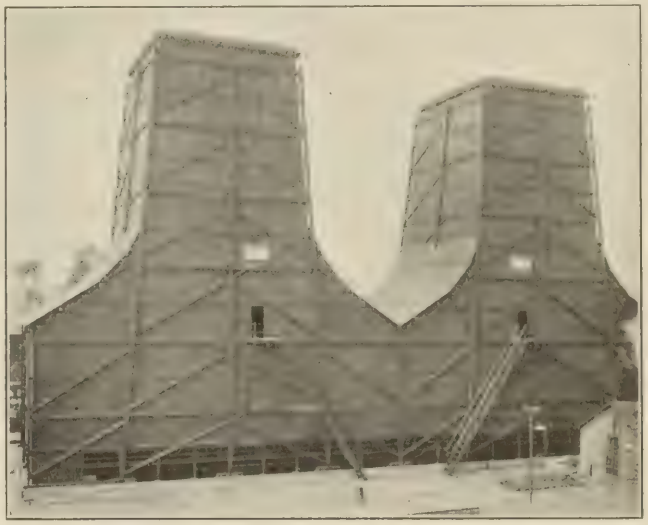
The Sanford Riley company repeats its prediction of 1916 that further developments in combustion efficiency will be obtained by feeding fuel slowly through the retorts and by providing for large volumes of coal in the furnace. These conditions may be obtained either by installing stokers back to back or by making the retorts extra large.

Firebrick Problems.—Owing to the increased rating of boilers, the firebrick surfaces have been proportionately increased, and the higher temperatures have produced greater expansion and contraction in them, so there are more frequent failures in both arch and side walls. Various methods have been tried to strengthen the flat walls, but with little success. Buttresses built inside of the combustion chamber were burned off in a very short time. Sheet-iron linings were also tried, but were melted down as soon as the firebrick inside had been burned away or partly destroyed by slag.

Developments in the standardization of methods of testing clay brick have been made during the past year. Modifications of tests recommended by C. E. Nesbitt and M. L. Bell in a paper before the American Society for Testing Materials have been included by the prime-mover committee in this year's report. Some of the subjects taken up are abrasion, slagging and softening tests, expansion and contraction, wall construction, heat insulation and airproof coatings.

Coal-Handling Methods.—Since the early fall of 1916 the delivery of coal has greatly hampered the operation of public utilities, so means have had to be provided for adequate storage to meet such contingencies. For this reason the prime-mover committee has outlined a number of methods of storing and handling coal. The ordinary mast and gaff arrangement is inexpensive and efficient when rapidity of handling and maximum storage are necessary. The traveling cableway is more efficient so far as utilization of ground area is concerned, but is slow in stocking and reclaiming where long travel is necessary. Many types of gantry cranes are employed, the choice usually being determined by the space available and the desired method of power operation. Locomotive cranes are extensively and efficiently used for rehandling, stocking and reclaiming, either by direct delivery or by means of belts or cable-car hauls. Combinations of the unloading tower and traveling bridge, fed either by electrically operated towers or by cable cars, utilize to the largest extent the ground area available, give maximum storage, and usually permit maximum speed with minimum labor for both stocking and reclaiming. For small installations an electrically operated bucket carrying its own motor is practicable.

Considerable data on the storage, weathering and spontaneous combustion of coal have been collected by the committee. The results show, in the case of the New River coal, a loss of less than 1 per cent in calorific value in a year by weathering in the open. The greatest loss was 1.85 per cent in two years. Practically no loss was observed in samples submerged for one year in fresh or salt water. There was almost no slacking of lumps in the run-of-mine samples. In all tests the crushed coal deteriorated more rapidly than the run-of-mine. Pocahontas run-of-mine coal in a 120-ton (108.8-metric ton) pile lost less than 0.4 per cent of its heating value during a year outdoors and showed little slacking of lumps. Gas coal suffered practically no loss of calorific

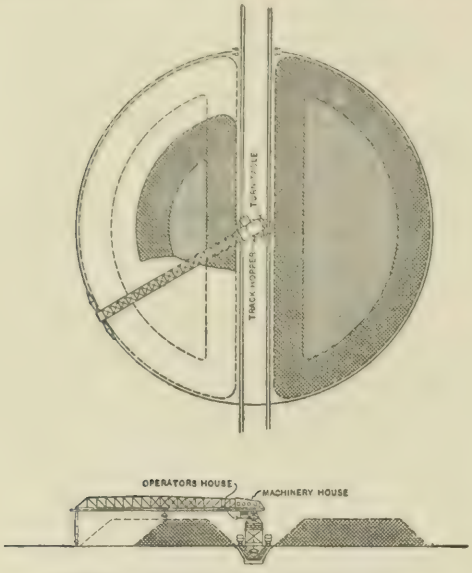


MAMMOTH COOLING TOWER (7500 GAL. PER MINUTE)

value in one year's exposure. Wyoming coal deteriorated 5.3 per cent during storage for two and three-quarter years and more than 2.5 per cent in the first three months. The committee points out that bulletins issued by the University of Illinois Engineering Experiment Station and the U. S. Bureau of Mines are well worthy of study in connection with this subject.

Higher Steam Pressures and Superheats.—Considerable of the prime mover committee report was devoted to a discussion of the feasibility and practicability of using higher steam pressures and superheats. While many manufacturers admit that it is entirely feasible to design a commercial boiler for 500-lb. or 600-lb. (35 kg. to 42 kg. per sq. cm.) pressure, many manufacturers and engineers contend that the economy in water rate brought about by using higher pressures will be offset by the higher cost of apparatus and by operating difficulties. On the other hand, a representative of one manufacturer says that the theoretical gain of about 13 per cent of the present fuel consumption, which corresponds to an increase in steam pressure of 200 lb. to 600 lb. (14.6 kg. to 42 kg. per sq. cm.) without increasing the temperature of the steam, would, even if only partially realized in practice, fully justify the considerable extra investment in high-pressure apparatus.

Looking at the use of higher steam pressures from an insurance viewpoint, S. F. Jeter, chief engineer of



PIVOTED BRIDGE FOR STORING COAL

the Hartford Steam Boiler Inspection & Insurance Company, says: "Mere increase in pressure would not in itself be a great menace to safety, because it is a simple matter to build boilers of any required strength. However, there is no doubt that the strains produced by expansion and contraction will be greatly increased by the use of higher pressures and superheats. Another factor to be considered is the increase in stored energy. A cubic foot of water at 100-lb. (7 kg. per sq. cm.) pressure contains 812,000 ft.-lb. (110,500 m.-kg.) of energy available for the destruction of surrounding property when an explosion occurs. At 500-lb. (35 kg. per sq. cm.) pressure the same amount of water would contain 2,344,340 ft.-lb. (321,000 m.-kg.) of energy."

The Edge Moor Iron Company points out that the life of high-pressure equipment and its maintenance must be considered. With smaller drums and smaller tubes the water content per unit of output will be increased, therefore the fluctuations of pressure will increase, according to the Badenhausen Company. In addition, there will be an increased expense for purifying boiler-feed water. Expansion troubles both in the boiler and piping will be greatly increased, and there will be more difficulty in keeping the setting tight. Owing to the higher temperature of ebullition the stack gases will have a higher temperature, consequently economizers will be necessary.

At exceedingly high pressure, say 600 lb., with comparatively low superheat of 100 deg., serious windage and friction loss will occur in the high-pressure stages of the turbine, according to R. J. S. Pigott. Reducing the superheat will advance the dew point well into the high-pressure stages, resulting in losses with which every one is familiar. With the increased density produced by high pressures the eddy losses are bound to be greater than at lower pressures. New designs of expansion joints seem essential. Frederick Sargent of Sargent & Lundy, who has great confidence in the economy that will eventually result from the high initial working temperatures, says that the high initial temperature is not the only line of advance. Raising the average temperature is equally beneficial. This can be done by superheating the exhaust from the high-pressure end of the turbine before it enters the low-pressure end. Samuel Insull says: "It is not at all beyond the range of possibility that eventually, and indeed in our own day, we shall be operating steam turbines with the aid of boilers carrying as high as 1000 lb. (70 kg.) pressure."

W. D. Ennis points out that thermodynamic considerations favor high initial pressure rather than high superheat. However, high superheats are necessary with high pressures in that the frictional losses in the turbine are proportional to the density of the steam. Again, with fixed exhaust pressure, the expansion of dry steam leads to greater liquefaction, as the initial pressure is greater. Moisture will cause friction and wear may be the source of danger. The Babcock & Wilcox Company is conducting a series of experiments to determine the practicability of constructing boilers designed for 500 lb. to 600 lb. (35 kg. to 42 kg. per sq. cm.) pressure.

In the opinion of the prime-mover committee 300 lb. (21 kg. per sq. cm.) pressure and 200 deg. Fahr. (93 deg. C.) superheat, or an equivalent total temperature, is about the practical limit until further developments have been made and higher-pressure boilers have been successfully tried out.

Cleaning Condensers.—Several methods of cleaning condensers were outlined in the report. Arrangements can be made so that the circulating water may be reversed in direction through the tubes and any deposits tending to block the tubes thus removed. Some companies have allowed ground cinder and flue dust to go through the condenser tubes with the circulating water to remove deposits. The most common method of removing accumulations of mud and slime consists in washing out each tube with a stream of water under high pressure. Another method, which is more effective but which requires considerable time, consists of shooting leather disks through the tubes with compressed air. Bristle, wire and fiber brushes as well as steel plugs surrounded by helical steel springs are also employed. Baking the conductor tubes with steam is effective, but care must be taken not to dry out the tube packing. With this method the accumulation on the inside of the tubes is dried so that it peels off and can be washed out with the circulating water. Sand blast may also be used, but erosion must be guarded against.

Steam Velocities.—The advisability of increasing steam velocities in pipings and fittings and the conse-

quent increased pressure drops were discussed at length. Velocities as high as 7500 ft. (2286 m.) per min. are being allowed and authorities are advocating those in excess of 10,000 ft. (3048 m.) per min. The higher steam velocities permit the use of smaller steam pipes, which means greater flexibility and decreased maintenance expense. The fact should not be overlooked, however, that with a fixed pressure at the prime mover the excessive pressure drop in the fittings and piping may result in such high pressure at the boiler that the cost at this point may be materially increased. The greater the loss in pressure between the boiler drum and the steam header, the greater the difficulty in regulating the supply of feed water, since when the maximum quantity of feed water is required a minimum pressure difference exists, and vice versa.

Instruments.—Comments were made on the suitability of various boiler-room and engine-room instruments. Flue-gas thermometers and pyrometers comprise one class of temperature-measuring instruments which does not seem altogether satisfactory. Regarding steam-flow meters it was pointed out that the absolute accuracy of these instruments, although desirable, is not necessary, a relative indication being sufficient to warrant their installation. The most popular feed and condensate water meters seem to be V-notch type. CO_2 recorders have the objection that they are too delicate and require too much attention. The fixed relation between vapor pressures and temperatures regardless of atmospheric changes gives the thermometer the preference as an indicator of steam pressure or vacuum, as it is not affected by such changes.

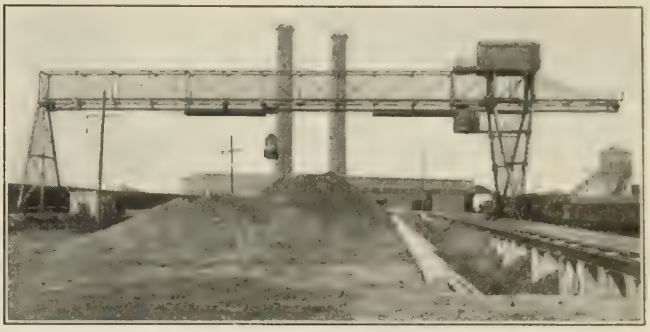
Methods of analyzing the power requirements of station auxiliaries using either steam drive or motor drive were outlined, a very interesting and valuable graphical method being presented. From the scheme outlined it is possible to select the auxiliary drives so that the heat balance will be maintained at all loads.

Some general remarks were made regarding the treatment of boiler-feed water, and information was presented on the methods of treatment used by different operating companies. With some feed waters, particularly in plants equipped with surface condensers, the most economical method of treatment is to feed the required reacting agent directly into the heater or feed line. Some of the new large central stations which use surface condensers are being equipped with evaporator systems. It is advisable in the case of any plant which does not employ a chemist to send samples of its boiler-feed water to boiler insurance companies or the State college for analysis and recommendations for treatment. A number of companies use the continuous soda-ash treatment, others filter the water through sand, and still others use lime, barium hydrate and iron sulphate, barium hydrate with soda ash, trisodium phosphate, soda ash and caustic soda, or the intermittent lime and soda-ash process. The cost varies from 3 cents per 1000 gal. to 10 cents (0.79 cent per 1000 l. to 2.64 cents).

The installation of large Diesel engines has increased remarkably during the past year, owing to the general rise in the cost of all fuels and the need of more motive power in the expansion of industries. The committee includes a résumé of the fuel-oil situation, pointing out the oil production of each oil-producing state for 1915 to 1916.

Water Power.—Owing to the rapid and general increase in power demands on central station systems and the increased cost and scarcity of fuel, there has been a resumption of activity during the past year in the construction of new hydroelectric plants and the extension of many existing systems. While most of these installations are of moderate capacity and medium heads, there have been a number of units installed of remarkable size. The single-runner scroll-case vertical-shaft turbine, using Francis-type runners and Kingsbury thrust bearings, has been generally adopted for new work. For heads of 80 ft. (26.7 m.) or more there is a tendency to use steel-plate or cast-iron casings owing to the difficulty of securing adequate reinforcement where scroll cases are very large. Efficiencies in the neighborhood of 93 per cent are being obtained. More care is being given to the design of intake and penstocks and to decreasing the losses in the draft tube and tailrace. Corrosion of waterwheel parts is most effectively prevented by removing the gate-rigging mechanism and moving parts to the outside of the turbine case. Erosion may be reduced considerably by eliminating eddies and cross currents.

Ice Problems.—Over nine pages of the prime-mover report were devoted to an extensive discussion by J. A.



COAL-HANDLING CRANE AT CLEVELAND PLANT

Walls on how to protect against different forms of ice, including frazil and anchor ice. It was pointed out that if the first formation of frazil ice is not quickly observed, the ice will accumulate so fast that shutdown cannot be avoided. The formation of frazil ice should be looked for during cold weather and high winds when there is no protective ice coating over the lake. Anchor ice is formed on cold nights when there is no ice covering on the pond or only a thin sheet of clear ice. One means of detecting the onset of frazil or ground ice is to immerse a chain in the flowing water of the forebay and examine it every half hour or oftener. Frazil or anchor ice cannot form until the temperature of the water drops to freezing, so a graphic thermometer will in many cases serve as a warning against any danger that may threaten from this cause.

Some of the protective features to be considered in guarding against ice are as follows: Inclose the gate-house and provide for heating it; warm the exposed metal parts of the screen; watch the guide vanes and runners of the small waterwheels as they collect ice before the larger ones; warm the metal parts of the waterwheels and generators by blowing warm air against them or otherwise; arrange for injecting steam into the turbine wheel-pit in case ice adheres; keep reserve units heated up with steam, and avoid allowing cold air to enter the wheel pits before water is admitted to them.

DEVELOPMENTS IN ELECTRICAL APPARATUS

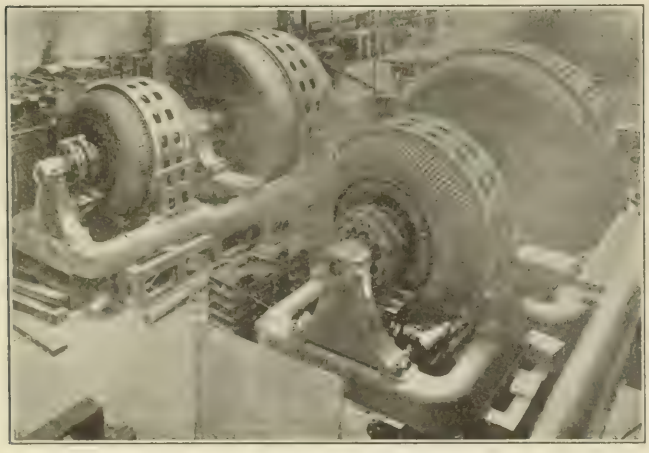
Electrical Apparatus

Again the committee on electrical apparatus, of which G. L. Knight is chairman, emphasizes its belief in the importance and value of standardization with respect to electrical apparatus used on central station systems. The most important work done along these lines this year has been the revision and extension of the transformer standards presented to the association last year. The standards are representative of the needs of the whole country and should be of real service to the industry, the committee reports.

The question of standardizing the impedance of distribution transformers was discussed at length during the year, and as far as the electrical apparatus committee is concerned was settled for the present by the decision that it is undesirable to hamper the satisfactory development of the art by standardization of this characteristic. However, it is recommended that manufacturers indicate the impedance on the name-plates of the transformers to permit proper selection of units for multiple operation.

One feature of the report is the presentation of a treatise on the handling and care of oil used in transformers and switches, with necessary information to keep it in first-class operating condition.

During the past year the committee has been engaged in a campaign to increase the use of uniform service rules for motors presented to the association in 1915. It was pointed out that these rules will not produce the maximum benefits until a large majority of companies have adopted the rules. Believing that failure to adopt the rules has been due to a lack of information about them and to misunderstandings in some cases, the campaign has been carried on with a view to clearing up

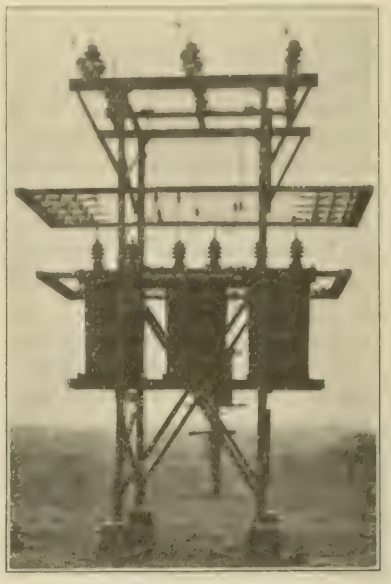


5000-KW. PHASE CONVERTER

all doubt regarding the intent of the benefit to be derived from the use of the rules. Reports from companies which have adopted the rules are uniformly satisfactory. One company in the East reports that:

"The adoption of the motor rules by this company has resulted in an entire elimination of complaints from manufacturers, dealers and customers with respect to the types of motor which are permitted to be used on the company's line. We are so well pleased with the outcome of the adoption of these rules that under no circumstances would we consider going back to the conditions which prevailed before the adoption."

Following the practice of previous years the committee has recorded the progress and development in the



STANDARD OUTDOOR STATION ON ATLANTA (GA.) COMPANY'S LINES

manufacturing and application of electrical apparatus, reviewing the increased capacity of generating and converting equipment. Particular attention is called to the unusually large production of turbo-generators rated at 20,000 kva. and over, a record which perhaps in normal times would not have been reached for several years.

A scheme for guarding against grounds or short circuits in large alternating-current generators was suggested, consisting of the use of balanced current transformers in all six legs of the windings. Frequency changers are increasing in size according to system requirements and speeds have also increased, as has been the case with other apparatus in both alternating-current and direct-current fields. A lubricating system for the bearings of hydroelectric generators is described wherein the entire apparatus is self-contained, the process continuous, the amount of storage relatively small and the system very much simplified. The only progress reported on synchronous motors is the trend toward larger sizes and somewhat higher speed. A comprehensive article has been included on the effect of different types of field construction on commutation and operation of direct-current motors, generators, etc.

According to reports received from several manufacturers, the induction-type regulators can now be built for any rating, voltage or current for which it is practicable to build generators. The replacement of steam engines in high-lift hoisting apparatus has been made possible by the development of an electric motor with light flywheel effect in its armature, thus securing the desired rapidity of starting, stopping and reversing. Attention is called to the fact that one operating company has standardized its outdoor stations with a view to minimizing the expense of construction and maintenance as well as promoting the speed of installation. This company keeps in stock all the material for the

complete erection of the standard size of outdoor transformer substations, and can erect the entire equipment in less than three days. The customer is required to provide the space and concrete foundation for the substation structure. The need of placing safety devices on revolving machinery before it leaves the manufacturer was also pointed out. While static condensers for correcting power factors are not yet ready for general commercial use, it is probable that they will be on a manufacturing basis within the next year. In selecting switches and circuit breakers of all kinds the committee recommends specifying larger ampere-carrying capacities than are actually required, as this class of apparatus is inherently incapable of maintaining its ratings throughout its life without very careful maintenance and frequent adjustment—usually difficult and impossible. Among other apparatus described is a device for controlling welding machines to prevent several machines taking current at the same moment, and an outfit including a kenotron for making high-potential tests on cable systems with high-voltage direct current.

TRANSMISSION AND DISTRIBUTION

Overhead Lines and Inductive Interference

The report of the committee on overhead lines and inductive interference, of which H. B. Gear is chairman, outlines the status of inductive interference as regards ground-return rural telephone lines, metallic circuits and series lighting circuits. It emphasizes the importance of power-company engineers co-operating with telephone engineers in the solution of these problems and informing themselves as to the principles on which means for mitigation of induction are based, so that they may be thoroughly familiar with the conditions which are likely to lead to inductive troubles. The report also outlines the progress made in various states during the year on rules affecting overhead-line construction and indicates their relation to the National Safety Code. The report also embodies an appendix, written by J. B. Taylor, outlining some of the fundamental principles of inductive interference.

The attention of this committee has been given to three principal classes of subjects during the year, namely, inductive interference of power lines with communication circuits, codes of rules affecting overhead construction under consideration or adopted by various states and federal authorities, and matters affecting construction of overhead lines.

The trouble arising from interference with ground-return rural lines is most acute in the states immediately west of the Mississippi River, where independent telephone companies have developed the rural farm line to such a point that it is practically impossible to construct transmission lines from town to town without paralleling such grounded lines for a considerable portion of the distance. Such interference can be avoided only by use of private rights-of-way or by arrangement with railroads for the use of their rights-of-way. Many of these transmission lines are being built to reach districts which are being newly developed, and the use of a private right-of-way is entirely impracticable. Thus the use of highways is usually necessary, and interference cases are the result.

The usual means of mitigating interference not being applicable where grounded-return telephone lines are used and the type of construction employed in connection with many of these telephone lines being of a low grade, but one course remains open for the treatment of the telephone line, namely, to make it metallic. The practice of jumping from one side of the highway to the other in building telephone lines also necessitates relocating considerable parts of such lines in many cases.

While no uniform solution has been found for these problems, power companies have, in general, taken the position that grounded telephone circuits are not a standard or approved method of construction, and that the telephone company could not insist upon any changes by the power company until it had put its own lines in standard condition. However, power companies have in some cases where lines are owned by farmers borne a portion of the expense of making the circuit metallic, as a matter of public policy.

If grounded telephone lines are on poles of uniform height and uniform separation from the power line, transpositions in the latter would be more effective than when the telephone line is of variable height and a variable distance from the power wires. Frequently grounded lines will work better, in spite of the humming produced by the power line, if broken insulators are replaced, high-resistance joints eliminated, tree grounds, etc., removed, grounds at telephone stations improved, and batteries and instruments overhauled.

Telephone engineers in some states have been making maps of all the transmission lines to which their toll circuits are exposed and have asked power companies to provide them with diagrams of generator and transformer connections used in the supply of these lines. It has been explained that this information is needed for the proper working out of transposition schemes for the mitigation of interference and for the guidance of the telephone company in planning new lines.

The problems arising from series lighting circuits are usually due to the use of open loops and are solved by bringing the two sides of the circuit together and by distributing the lamps on both sides of the loop as evenly as possible.

The committee is endeavoring to establish connection with a representative in each state in order to be kept fully informed of progress in matters relating to overhead lines and inductive interference. It is encouraging all member companies to co-operate in the gathering of data relative to the effect of the application of the lines section of the Code to actual construction, so that when occasion arises suitable revisions may be suggested.

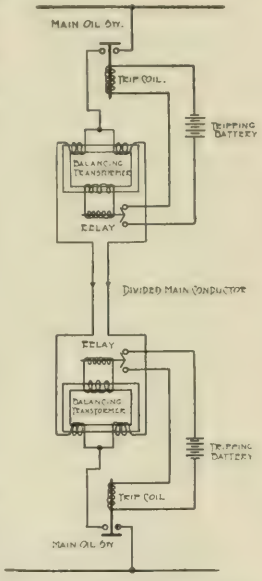
The committee has not undertaken to give attention to the details of overhead-line construction to any considerable extent. The committee has through one of its members kept in touch with the investigations conducted in California with regard to the aging of porcelain insulators. This work, which has a very important bearing on the service rendered by transmission lines, has made progress, but a solution of the difficulty has thus far not been found.

Certain test data on the strength of standard 1½-in. (3.8-cm.) locust pins have been accumulated, and the committee is keeping in touch with the experience of the companies which are using hard-drawn wire.

More attention is now being given to the wave shapes on circuits where there are telephone exposures, because irregular wave shapes may set up high harmonics. Telephones are many times more sensitive to frequencies in the neighborhood of 800 to 1000 cycles than to any of the commercial frequencies. On account of trouble experienced with some combinations of transformer and generator connections with grounded neutral which permit currents of harmonic frequencies to circulate through the earth return, some telephone companies have objected to grounded neutrals in general. Effort should be made to avoid and eliminate such connections at more than one point on a system, but it does not yet appear that there is any adequate ground for sweeping objections to all forms of grounded-neutral connections.

Underground Construction and Electrolysis

Current-carrying capacity of cables, cable specifications for various classes of service and use of split-conductor cable were the leading subjects presented in the report of the committee on underground construction and electrolysis, of which E. B. Meyer was chairman. Attention was also called to the features of a new design of three-conductor cable in which the belt insulation has been eliminated, the conductor insulation increased, and each insulated conductor enveloped by a metallic covering. Special devices and methods adopted by companies in the solution of operating problems were also included.



SPLIT-CONDUCTOR METHOD OF PROTECTION

In discussing the rating of cables special stress was laid on the relation of load factor to temperature, experience having shown that approximately 40,000 kw. per day is the maximum energy which can be safely transmitted over a No. 4/0 three-conductor 13,200-volt cable. This figure corresponds to a load factor of 73 per cent with a maximum current of 100 amp. and 37 per cent for a current of 200 amp. A number of companies experienced trouble during the summer of 1916 which was probably due to dielectric losses occasioned by the high temperature. The trouble appears to have been confined to sections of duct lines where local conditions impeded the dissipation of heat and to cables operating at pressures about 10,000 volts. It was pointed out that overheating of duct lines may be remedied by allowing water to percolate through the earth around the duct structure.

From tests made recently by the Consolidated Gas, Electric Light & Power Company of Baltimore the following observations have been made: (1) At low temperatures the type of insulating compounds has practically no effect on the dielectric losses. (2) At high temperatures the type of compounds has a very marked effect on the losses caused by variation of temperature in voltage. (3) The ideal impregnating compound should have a practically constant dielectric strength up to the maximum temperature at which the cable operates. (4) The magnitude of the loss may be decreased by changing the distribution of insulation around the conductors.

Various extracts were included from a paper presented by R. C. Powell before the American Institute of Electrical Engineers on the rating of insulated cable.

By revising a compilation of cable specifications prepared by various technical societies and adding new material collected from other sources, the committee has prepared a set of general specifications which should be applicable to all types of wires and cables. The specifications include properties of copper wire, stranding, tinning, and specifications for different types of insulation in common use, including weatherproof braids, high-voltage rubber compounds, low-voltage rubber compounds, varnished-cloth insulation, oil-impregnated paper insulation and national Code compounds.

The increasing importance of maintaining uninterrupted service has required the adoption of the ring or network system, and it has therefore been found necessary to perfect, for operation on a network, a relay system which will automatically disconnect the faulty feeder in a minimum amount of time without disturbing or tripping any other feeders in the network. While the pilot-wire system was satisfactory in theory, under actual operating conditions its disadvantages were serious enough to result in its abandonment in favor of the split-conductor system, one method being shown in the accompanying illustration.

The split-conductor method of protection appears to give practically perfect selective action, and in spite of the slightly higher cost of cable and cable joints it has been adopted by a number of central station companies in the United States. The cost of the cable required is 10 to 15 per cent higher than the cost of ordinary cable, and the cost of jointing is about 25 per cent higher, but additional expense appears warranted because of the better selective action obtained. To correct for any inequalities which may exist in the conductivity of the split conductors, it is usual to transpose the inner and outer conductors at intervals throughout the length of the line.

Joining Three (Split) Conductor 13,200-Volt Cables.—The following method is employed by the Public Service Electric Company of New Jersey for making joints in three (split) conductor cables: Before any work whatever is done on the joint the cables are trained so that they will occupy as closely as possible their permanent positions in the manholes. During installation and after the work has been completed no bends having a radius greater than 20 in. (50.8 cm.) are allowed to exist in the cable. After the cables have been trained to the proper positions, they are sawed off so that the ends to be joined will overlap 2 in. (5.1 cm.). The lead sheath is then removed 11 in. (27.9 cm.) from the end of each cable, the outer paper insulation stripped off to within 0.5-in. (1.3 cm.) of the lead, and 4½ in. (11.3 cm.) of the paper around each outer conductor removed. The outer conductors are then bent back out of the way and 1 in. (2.54 cm.) cut off the end of each inner conductor so they will butt squarely. One and three-eighths inches (3.5 cm.) of paper insulation is then cut off each inner conductor. Before proceeding farther the lead sleeve covering the cable joint is slipped over one end of the cable and the ends of the cable sheath slightly belled so there will be no acute edges that will augment

static discharges from the conductors. To aid in properly centering the sleeve before soldering, the lead sheaths are marked 9 in. (22.9 cm.) from each cable end. After the conductors have been cleaned with gasoline, thoroughly tinned and all burrs removed with a file, copper sleeves are slipped over the ends of the copper conductors and soldered thereto by pouring on melted solder. Split-copper sleeves 2¾ in. long and tapered to thin edges at each end are used for joining the conductors. The sleeve and copper conductors are wiped off while the solder is still hot to remove any drops or projections. To remove any insulation which may have been injured in soldering the paper insulation on each conductor is cut ⅜ in. (9.5 mm.) from the ends of the copper sleeve and that remaining is tapered 1 in. (2.54 cm.) further back. After this has been done the tapered ends are dried out by pouring over them melted paraffin heated to a temperature 125 deg. C. In the space which exists between the end of the paper insulation and copper sleeve is wrapped cotton tape to bring the diameter up to that of the sleeve. Tape is then wrapped back and forth between the two ends of the original paper insulation, first applying two layers of cotton tape, then six layers of 1-in. (2.54-cm.) black cambric laid with one-half lap. Upon each layer of varnished tape is applied a covering of petrolatum. Over these coverings of tape are placed two layers of asbestos tape which has been boiled in paraffin.

Over each inner conductor, now insulated, is wrapped a sheet of 3-in. by 4-in. (5.1-cm. by 10.2-cm.) No. 20 B. & S. gage copper which has previously been tinned. After the copper sheets have been soldered on their lapping edges the outer conductors are bent so they will lie flat on the copper sheet, where they are bound in place by No. 18 B. & S. gage copper wire. The copper-wire wrapping is sweated together, special care being taken to remove excess solder and projections. Two layers of cotton tape are wrapped over each outer conductor, overlapping these, turned slightly, and then covered with seventeen 5-ft. (1.5-m.) rolls of black cambric insulating tape.

In applying the tape each turn should be drawn tightly to exclude air and should overlap the preceding turn by two-thirds of its width. After all three conductors are joined and insulated as described, a roll of tape 0.5 in. (1.27 cm.) in diameter should be inserted between them at the center of the joint to serve as a spreader. A band of tape is then wrapped around all three conductors using one and one-third full-size rolls of 1-in. (2.54-cm.) cambric tape, bringing the diameter to such a size that the lead sleeve can be easily slipped over the joint.

After the lead sleeve has been centered, it is attached to the cable sheaths and filled with compound in much the same manner as is usually employed in making joints. The compound is poured at a temperature of 150 deg. C. After allowing it to cool for one hour or one hour and a half, depending on atmospheric temperature, hot compound is again poured into the sleeve to fill any cavities which may have formed during the interval allowed for cooling.

The material needed in making one joint consists of the following: Three copper connectors, three 3-in. by 4-in. (7.62-cm. by 10.2-cm.) No. 20 B. & S. gage copper, 15 ft. (4.6 m.) of No. B. & S. gage copper sheet, 5 yd. (4.6 m.) of cotton tape (one and one-half rolls), two and one-half rolls of varnished-cambric tape, 24 in. (61 cm.) of 5-in. (12.7-cm.) lead sleeving, 1 1/3 gal. (4.91 l.) of compound, 2 in. by 18 in. (5.1 cm. by 0.5 m.) paper pasters, and 3 ft. (0.9 m.) of asbestos tape.

METERS AND MISCELLANEOUS

Meters and Measurements

Standardization of design and methods of maintaining the accuracy of instrument transformers, watt-hour meters and demand meters were the chief subjects discussed in the report of the committee on meters, of which C. H. Ingalls is chairman. The greater part of the report was devoted to additions to the code for electricity meters, methods followed by operating companies in caring for watt-hour-meter bearings and the summary of recent developments in such instruments as watt-hour meters, demand meters, ampere-hour meters, portable instruments and portable test meters. The addition to the code for electricity meters refers to demand meters, the first three parts, devoted to definitions, classifications of meters and specifications for acceptance, being included in this report. Attention was also called to the addition of 160 pages of data to the "Electrical Meterman's Handbook." Among other subjects taken up were instrument-transformer cable terminals, methods of installing instrument transformers, methods of applying corrections to instruments used in connection with instrument transformers, metering house loads, and accuracy of meters on arc furnace loads.

According to letters from eighteen companies, representative of those having the best meter practice in this country, the following conclusions were drawn:

Inspection of Jewels and Pivots.—Practically all companies inspect the jewels at the time of use, but this plan is unsatisfactory because the bill has usually been paid by that time and the company is in a weak position to open a complaint. The needle and visual inspection methods are quick and effective for sapphires. About 33 per cent of the companies use the needle on sapphires and about 25 per cent use the microscope for diamond jewels. The microscope is slow to use, and rather trying on the eyes, but some experts insist that when inspecting diamonds it is necessary and a saving of time in the end. Most of the companies do not inspect new pivots.

The type of meter, its rating and the revenue derived therefrom are the determining considerations in selecting test intervals. Jewel wear alone does not determine the performance of a meter because there are so many other factors. The majority of the companies do not replace sapphire jewels on periodic tests and return the old ones to the laboratory, probably because it is felt that too much useless work is done for the slight benefit gained. Ball-bearing meter jewels are seldom found defective. It seems bad practice to replace a pivot only when the jewel is defective because, even with a smooth jewel, pivots frequently wear blunt and short when running on diamond jewels. The majority of companies inspect registers having jewel bearings at each test.

Care and Maintenance.—Talcum powder is seldom used to carry pivots in because it spills and is mussy.

The meter code recommendations seem weak in this respect, the committee points out, because pivots are always received from the manufacturer with a film of oil on them and they are covered with oil while in the meter. All companies oil the jewels, but some use a film only. It cannot be assumed that oil will remain in the jewel cup until it evaporates, therefore it would seem advisable to place as much oil as possible in the cup. The practice of repolishing sapphire jewels is spreading, but some trouble may be experienced therefrom with shallow jewels, since they are likely to crack. Experience with diamond jewels indicates that it is usually unnecessary to repolish them. The practice of repolishing pivots is coming into favor, but there is a strong difference of opinion manifested in regard to it. More data regarding this practice should be secured, because companies are apparently acting on opinion and hearsay rather than on the economy thereof. Balls are not repolished.

SPECIFICATION FOR ACCEPTABILITY OF DEMAND METERS

CURVE DRAWING DEMAND METERS

Test	*Test Condition*	*Permissible Error*
Registration	Normal voltage 25% rated current for 1 hour	2% on 25, 50 and 100% of full-scale reading
Equality of elements, two-wire and polyphase	Half full-scale indication	2% difference in current
Variation of voltage.	±10% rated voltage	1½% of full-scale indication
Variation of power factor, single-phase and polyphase meters		2% full-scale deflection
Variation in frequency, single-phase and polyphase meters	±5% rated frequency	1½% full-scale indication
Variation in temperature		Not to exceed 0.25% per deg. C.
Damping		3% in 15 seconds
Sensitivity		Respond to 2% of current of full-scale deflection
Timing	Two 24-hour runs	±0.25% of 24 hours
Legibility of record,	Scale over 2½ in. wide	1% of full-scale indication

INTEGRATED DEMAND METERS

Steps per demand interval		2%
Legibility of record, indicating and graphic recording.	Quarter and full scale	1% full-scale value
Equality of energy intervals	100% rated capacity for five revolutions	1% of time of one revolution
Demand intervals..	Three entire cycles	36 seconds
Contact mechanism.	Full load for 500 impulses	No failures should occur
Registering or recording mechanism	Full load for 500 impulses	No failures should occur
Clock	Two 24-hour runs	Two minutes in 24 hours
Timing motors	Cal. voltage and rated freq.	2% gain or loss
	±5% rated voltage	1% of speed
	±3% rated frequency	6% of speed
	10-deg. rise temp.	2% of speed

TIME-LAGGED DEMAND METERS

Indication.		
Speed of indicator proportional to the load	25, 50 and 100% of full-scale indication, normal ratings	3% full-scale indication
Speed of indicator decreases with deflection	60 and 100% of full-scale indication, normal ratings	5% full-scale indication
Equality of elements, three-wire and polyphase meters.	Same as on curve-drawing demand meters	
Variation in voltage.	Same as on curve-drawing demand meters	
Power factor — single-phase and polyphase meters.	Same as on curve-drawing demand meters	
Frequency, single-phase and polyphase meters	Same as on curve-drawing demand meters	
Variation in temperature	Same as on curve-drawing demand meters	

Use of Diamond Jewels.—Several companies feel that the sapphire gives such good service in small-capacity type C meters that diamond jewels are unnecessary. It is practically standard practice to use diamond jewels in all T. R. W. meters and in large-capacity type C meters. There is a marked tendency to use diamond jewels in alternating-current meters when the revenue is large and the moving part comparatively heavy.

Records.—Many companies have kept records in the past on meter bearings, but practically all have concluded that the expense of keeping them is not justified. When data on certain points are desired, it is best to select a limited number of jewels and keep special records of them rather than to establish a general system applying to all meters in use.

The following recommendations have been offered by the committee, to apply when installing instrument transformers. When a watt-hour meter is used with a current transformer the secondary load on the current transformer should be kept as small as possible, connecting in circuit only the watt-hour meter, the maximum-demand instrument or other necessary apparatus used for billing purposes, and the required leads. If it is found necessary to supply other apparatus from the same current transformers, the effect of this additional load should be determined by tests or from transformer curves. Special precaution should be taken when relays or trip coils are used. The resistance of secondary leads should be kept within 0.15 ohm per 25 volt-ampere capacity of the current transformer. It is recommended that similar precaution be taken in loading potential transformers. Wiring between instrument transformers and meters should be installed in such a manner that the external magnetic effect is reduced to a minimum. It is also recommended that an approved suitable arrangement be installed in the secondary leads to the watt-hour meter for the purpose of readily short-circuiting the current transformer, thus facilitating testing or changing the watt-hour meter. Every lead running between instrument transformers and meters should be identified throughout its entire length, by a color scheme or otherwise.

International Metric System

Supplementing English or American measures in the publications of the National Electric Light Association by metric equivalents is urged in a paper by A. E. Kennelly, partly on the ground of international courtesy, so as to open the meaning of the transactions to electric workers in other than English-speaking countries, and partly on the ground of conforming to similar usage in this country. Already the ELECTRICAL WORLD and several American engineering societies are expressing units of measure in the metric system, Dr. Kennelly points out.

Working on High-Voltage Lines

In a paper entitled "Methods for Working on High-Voltage Lines," by J. O. Hardin, the author takes up special arrangements and apparatus used by the Georgia Railway & Power Company when changing insulators or remodeling and rebuilding overhead circuits on lines operated at pressures up to 110,000 volts without interrupting service. Detailed information on this subject was presented by Mr. Hardin in the June 10, 1916, issue of the ELECTRICAL WORLD.

COMMERCIAL SESSIONS

MORE than ever before do the reports and papers of the Commercial Section emphasize the applications of electricity rather than the merchandising of energy and appliances. The reports of various committees on lighting show much care in compilation. As a catalog (1) of successful installations with the necessary illumination information and (2) of lighting equipment, the reports will undoubtedly form a very valuable part of every central station commercial library. In presenting the electric range situation from the standpoint of the central station and of the manufacturer a real advance was made. Each side freely and fully discusses the faults of the other in promoting electric cooking, and such frank discussion should be of material benefit to both sides in addition to proving of inestimable value to the future of cooking by electricity. The report of the committee on commercial service and relations with customers will be of tangible value to many central stations. There are given in great detail the results of a questionnaire regarding applications, credits, meter reading, collections and complaint. The committee has carefully weighed all of the returns, and where in its judgment the consensus of opinion in the answers did not agree with good practice it made recommendations to the contrary.

LAMPS AND LIGHTING

Commercial Aspects of Lamp Equipment

A very complete and comprehensive report on lamp equipment and merchandising is that of the sub-committee of the lighting sales bureau on commercial aspects of lamp equipment (O. R. Hogue, chairman). Suggestions are made for the proper equipment for direct, semi-direct and indirect lighting, and the report may be considered as a composite catalog, showing equipment for all purposes together with the special features of each. It is the first time that a report of this character has been presented.

The report, under the heading "General Discussion," points out the necessity of choosing proper equipment, giving reasons why equipment for use in one case would not necessarily fit all cases. This section is preliminary to the most important part of the paper, namely, the section on lamp equipment, in which the various types of equipment which have developed within the last few years are described together with the application and sales points of each. This section is profusely illustrated. The subject is taken up from the standpoint of both indoor service and outdoor illumination.

In summing up the commercial aspect of street-lighting equipment the committee pointed out that too great stress could not be laid on the importance from the central station standpoint of the appearance of lighting units for all classes of street lighting.

The selling methods are described under the separate heads "Advertising Salesmen," "Illuminating Engineering Service," "Rental," "Equipment" and "Deferred Payments."

Outdoor Lighting

The committee on outdoor lighting (Clarence L. Law, chairman) presents a report which incorporates a collection of material, including photographs, diagrams, equipment data and a discussion of what outdoor lighting comprises. The collection of photographs is a representative one, giving an illustration of each class of lighting and a diagram where available. Mention is made of the equipment. Part II is a presentation of all available equipment to date with illustrations of lighting units, photometric curves and other data which can be utilized in the designing and construction of a system of outdoor lighting of any description. The committee emphasizes floodlighting, which represents the greater portion of outdoor lighting exclusive of street and sign lighting. An effort was made by the committee to ascertain what methods have been employed by the central stations to take on floodlighting business and what campaigns have been started in this direction. It was found that practically nothing has been done to indicate that the subject has ever been very seriously considered as a method of increasing the lighting load. Floodlighting of vertical surfaces and horizontal surfaces is considered.



NIGHT VIEW OF DRILL FIELD FLOODLIGHTED

As a new field for the promotion of the lighting industry outdoor lighting promises to be a channel leading to greater volume and increased load. By the intelligent application of the available material this new field should be a stimulant to both lighting salesmen and prospective customers.

Industrial Lighting

The committee on industrial lighting of last year in its report outlined the field that was open for industrial lighting and its needs. It is the desire of this year's committee (J. J. Kirk, chairman) to emphasize the means of getting this business and to give such data and information as will be valuable in so doing.

Under the heading "New Ideas" is described in detail new apparatus for industrial lighting.

In last year's report a table will be found giving recommended intensities of illumination for different

classes of industrial plants. The committee calls attention to the present trend toward higher intensities and suggests that in most cases the maximum intensity, as recommended in the table, be used as the minimum value, and that the new higher intensities be increased in the same relative proportion.

Some of the methods used in selling industrial illumination are fully described.

In purchasing reflectors for any installation great care must be taken to select the fixture which is designed for the size of lamp desired. The committee feels that this is of prime importance. The style of reflector is largely determined by the spread of light required, the hanging height and the kind of work. The kind of factory must also be carefully considered.

As shown by the various photographs in the report, the common practice now is the use of general lighting. With a few exceptions, the illumination of nearly all factories can be taken care of by this method. To obtain good results from this method, however, it is necessary to use the larger lamps equipped with proper reflectors. Although each factory has its own requirements and no fixed rule can be followed in designing illumination, the average condition is taken care of by direct lighting with 200-watt gas-filled lamps spaced 15 ft. (4.5 m.) apart and having a hanging height of 9 ft. (2.7 m.). These photographs are accompanied in each case with full details of lamp spacing and requirements.

In conclusion the committee urges those connected with industrial lighting to keep on file for constant reference the data and general information on this subject which are being published by the technical press, the electrical societies and, more especially, by the Illuminating Engineering Society.

Commercial Aspects of Street and Highway Lighting

The purpose of the report of the sub-committee of the lighting sales bureau on commercial aspects of street and highway lighting (Alvah W. Young, chairman) was to present some facts and figures as well as opinions, indicating that the method of handling the street-lighting situation should be changed. The committee found that the increase in revenue in street lighting is not always kept up by the increases in other classes of business. During a period in which the population of a city has doubled its assets property valuations may have increased more than ten times and yet the expenses for street lighting have increased but a few per cent. The attention which small central stations have given to street-lighting business, the committee states, is decidedly not in proportion to the importance of this line of activities.

The favorable publicity which may be obtained from careful attention to this field is well worth the consideration of every central station, and it is recommended that central stations exhibit all types of lamp and standards which they are permitted to install and issue a booklet explaining the purpose of these different types of illumination in terms that the layman can understand.

In order to overcome the tendency to install units in haphazard fashion regardless of spacing and equal distribution of light, the entire street-lighting situation of a town, the committee feels, should be carefully analyzed and a perfect installation mapped out covering spacing and height and size of lamps; this plan, once adopted, should be strictly adhered to, even though growth will be gradual and the complete installation will not be secured for some time.

The committee urges that a lay-out of each lighting district be made and placed in view in a number of prominent places in business and residence sections, with a note of explanation as to what it is and why it was made. In many cities which are inadequately lighted it may be difficult to obtain authorization for a change without demonstrating in some way what a revision of the system will bring about, although a change may require but a moderate increase in cost. It is believed that in such cases it will no doubt be to the interest of the central station to install and maintain a thoroughly modern lighting system for perhaps one mile on a given street.

In order to supplement the larger lamps used at street intersections so as to provide illumination in the middle of long blocks or in outlying territories small incandescent lamps have frequently been recommended. Such installations, it is pointed out, represent a relatively high investment per candle-power, and it is usually found that the rate for a 32-cp. lamp should be but little less than that for a lamp three times as large. The committee therefore recommends that the 100-cp. size be considered the minimum for use in street-lighting installations.

The system of education which is recommended, it is felt, should be used not only for governing bodies of towns but also for the general public so that they may know what they are getting and what constitutes good lighting. Recommendations are made that the central station companies make an effort to co-operate to a greater extent with consulting engineers.

It has been a difficult problem to secure the proper illumination of interurban, county, state and national highways, and the committee recommends that this problem be taken up in the manner suggested for other street lighting. The public should be educated along this line and suggestive and carefully prepared advertising matter be sent to the various road associations, township bodies, county governing bodies and the state government, to bring to their attention the possibility of increasing the state revenue by encouraging interurban traffic and thereby raising land values.

The cost and selling rate of street lighting, it is felt, should receive more attention, and as a step toward standardization of costs by central stations the committee requests that consideration be given to the points enumerated in an endeavor to make the rates for street lighting uniform throughout the country.

The committee therefore recommends consideration of the following items of investment expenses, which should be used in formulating a street-lighting rate:

Consumption per lamp in watts; watts per lamp at station; consumption per lamp per annum; station output per lamp per annum.

Investment.—Real estate, including real estate for generating and substations, storeroom buildings, stables and offices; buildings and foundations, including generating and substation equipment; boilers, condensers, piping, etc.; engines and generators; switchboard, wiring, transformers, including substations; miscellaneous pumps, heaters, etc.; distribution and transmission lines; lamp and tub transformers; miscellaneous equip-

ment, horses, wagons, automobiles, tools, etc.; working capital and supplies.

Operating Expenses and Taxes.—Production and transmission; maintenance of lamps; line maintenance; general expense and taxes; franchise tax; lamp replacements; reserve for replacements other than lamps; return on investment. The total would equal the rate per lamp per annum.

ELECTRICAL ADVERTISING

In presenting this report on electrical advertising, the committee, of which C. S. Buller is chairman, decided to approach this subject from an angle somewhat unusual. Previous reports on electrical advertising read before the association dealt with the subject after the medium had been sold, neglecting the difficulties which are encountered both by the central station and the sign manufacturer. This committee, therefore, treats the subject from the standpoint of the central station and electric sign manufacturer, before the sale takes place.

The committee recommends that the term "electric sign" be stricken from the vocabulary of the central station and the words "electrical advertising" be substituted therefor.

From information secured by the committee it would seem that the field of electrical advertising has not been so energetically exploited by the central station as have other classes of business. The reasons given by the committee are, first, the apathetic attitude of central stations toward this subject, due to the fact that they have not sold themselves the idea of the electric sign or illuminated billboard as a means of electrical advertising.

In discussing the commercial advantages of electrical advertising, the committee points out that the load is practically over and above expenses. The service and meter are already in place and rarely have to be changed. No extra bookkeeping is required. The average use of the appliance load, so eagerly sought, is estimated at only 7 per cent of the sign hours.

The principal argument used against the usual electrical advertising campaign is that it is only a spurt and is generally followed by a period of inaction. Granting the truth of this, the committee states that for a moment it is possible to overcome any such tendency by consistent and steady plugging. It is most probable that herein lies the cardinal fault with electrical advertising, that although the electric sign campaign in itself may be successful the business as a whole may prove a failure because there was no intelligent follow-up system.

What has also been mentioned as a drawback to the sale of electrical advertising is restrictive or unreasonable sign ordinances. As an aid to those who have encountered this difficulty a model sign ordinance is appended to the report which embodies the best features of the ordinances of a number of cities. The committee recommends, however, that in the promulgation of new ordinances the work be done under the auspices of the local merchants' association or some similar organization.

Another practice that has hindered the successful sale of electrical advertising, and more than anything else has brought about the passage of restrictive ordinances, is that of putting up electric signs which, in point of design, are monstrosities. The fault, the committee states, lies entirely with the sign manufacturers and the central station, and it feels that the central station should in all cases act as the censor of every form of electrical advertising.

Regarding the advantages of a sign campaign, the committee states that the business is secured at a minimum cost per dollar of income. Successful requisites of a successful campaign were discussed. In the opinion of the committee, the representative of the central station engaged in selling signs should be a specialist in the sale of advertising. The committee recommends that central stations maintain a patrol system as the best means of keeping signs in service after erection.

The committee not only recommends but makes a plea for the establishment of a flat rate for electrical advertising. In all classes of advertising other than electrical a flat rate is charged.

The committee recommends that where signs are hung on side walls or against buildings the flashing effect be used on borders only, while the main portion of the sign remains fixed. It is recommended further that wherever possible every sign, no matter how small, have something in motion, as there is nothing else that will so quickly attract the eye.

The report concludes with a detailed discussion of some factors influencing sign design and illumination of billboards, such as spacing of letters, spacing of lamps, finish, color and candle-power of lamps.

ELECTRIC RANGE

ELECTRIC RANGE STANDARDIZATION

The report of the sub-committee on electric range standardization (C. E. Greenwood, chairman) shows evidence of a real desire to accomplish some tangible results, the most evident being that of urging economy in manufacture. This committee has studied its subject with two objects—standardization of the general features and standardization of the independent features of electric ranges.

The cost of range manufacture has increased to such a degree that this feature, it is pointed out, is one of the greatest impediments to the introduction of electrical equipment. Everything that can be done by the manufacturer to reduce this production cost will be beneficial.

The public need, it is felt, can be met with fewer models, and the committee therefore recommends that until such a time as the range field has reached greater development manufacturers sacrifice the commercial feature of individuality in numerous designs and decoration for the important features of better workmanship and lower production cost. Fundamental types would be (1) the so-called cabinet range with canopy, a minimum of three surface burners, side oven, right or left, and a warming closet, and (2) the flat-top range having a minimum of two burners and with oven below the cooking surface.

The committee believes that compactness in the range is a desirable feature and recommends that the manufacturers standardize on over-all dimensions for the fundamental types. A standard height of 33 in.

for cooking surfaces is suggested. The committee feels that further progress could be made if the manufacturers would get together on minimum standards in quality, in thickness of insulation and in gages and kinds of sheet steel. With full appreciation of the efficiency problem in heating, that only essential space be used for the performance of everyday cooking, the committee recommends ovens in three sizes, the smallest to be 18 by 12 by 12 in. (45.72 by 30.48 by 30.48 cm.), which is the standard used for small gas ranges, and the largest 18 by 18 by 14 in. (45.72 by 45.72 by 40.54 cm.). For broiler burners approximate dimensions 12 in. by 12 in. (30.48 cm. by 30.48 cm.) are desirable, with an approximate wattage of 1800. The size, wattage renewal, cost and maintenance are the vital features of surface burners in the development of the range business and are discussed to some extent by the committee in its report.

The committee is of the opinion that the built-in terminal box adds materially to the cost of the range and is not essential. The simpler method of merely three wires from the range to which the wireman can connect, and standardization on the point from which these wires lead from the range, is suggested. It is the consensus of opinion that separate fusing of burners is desirable, and the committee recommends strongly the placing of the fuse block in an accessible location. Pilot lights are another accessory that it is generally conceded should be omitted in the interest of the production cost of the range. The committee hopes to see every manufacturer adopt a range receptacle for small devices such as coffee percolators and toasters, which are practical accessories and in some instances more efficient for the purpose than surface burners would be.

The committee recommends that range switch design and operation be standardized. Standard labels on switch signals, it is recommended, should be "high," "medium," "low," "off," instead of "1," "2," "3," "off." The "off" position is an important point, and this signal should be distinctly different from the others.

Installing a low-wattage burner in the warming closet has been under consideration, but the committee doubts the wisdom of this additional expense, recommending that the warming closet always be placed next to the oven. Manufacturers are urged to adopt standard crates for ranges of various types, to have crates interchangeable if possible, and to exercise every possible care at the factory to insure safe delivery of their products at the point designated.

Appreciating the value of standardizing the names of range parts, the committee presents suggestions to this end in an appended list to its report, entitled "Electric Range Nomenclature."

Co-operation Between Manufacturers and Central Stations

The sub-committee of the electric range committee on co-operation between manufacturers and central stations, under the chairmanship of H. E. Young, points out that some national and local range advertising has been conducted which has in no small way contributed to the rapid introduction of the "cook-by-electricity" idea. The committee is of the opinion that this idea could be quickly, economically and convincingly conveyed to the public by national co-operative advertising conducted by the manufacturers of the ranges. While some publicity articles on the subject of cooking by electricity have appeared in the national and local publications, the committee feels that full advantage has not been taken of all the opportunities available, and that it could arrange for the preparation of educational articles which through the Commercial Section could probably be released to a large number of magazines and newspapers. Motion pictures and lectures are suggested, as are also demonstrations. The committee recommends that all manufacturers compare and send out with every range a booklet giving instructions as to the use of the particular range.

The committee feels that in view of the excellent organization effected through the electric range committee, the Commercial Section and the N. E. L. A. a separate society of electric range manufacturers should be unnecessary, and it recommends that the advantages of association membership be brought to the attention of any range manufacturer not at present a member. The report concludes with a general discussion on prices and merchandising.

Electric Range Manufacturers' Viewpoint

The work of the sub-committee on the electric range situation from the viewpoint of the manufacturer (J. Paul Clayton, chairman) was commenced by the chairman of the general committee, who sent to each member a letter in which was very clearly explained the necessity of the manufacturers pointing out frankly those conditions which in their experience are impediments to the more general introduction of the electric range. From replies received this report has been compiled.

No. 1. *General Education.*—A woeful lack of knowledge prevails in a great many places in regard to electric cooking and electric ranges.

No. 2. *Prices.*—There is some opposition, generally speaking, on the part of central stations to the slight preferential in discounts offered to jobbers under the Hoskins patent license, and it is suggested that until the time (probably one year) is ripe to secure modifications central stations forget if possible their objection to the schedule.

No. 3. *Quality of Ranges.*—One of the troubles with some central station men is that they oftentimes take a narrow view of a manufacturer's product and purchase entirely on low price rather than price and quality combined.

No. 4. *Sales Service.*—There is probably no one thing which has caused more annoyance to manufacturers during the past year than unreasonable demands for sales service on the part of central stations. It is not suggested that manufacturers ought not to do something in a broad way to help the sales locally, but that the manufacturers' representative should teach the local company's salesmen how to sell ranges.

No. 5. *Sales Methods.*—Size, arrangement of organization and difference in point of view vary the difficulties encountered in working with central station customers. For clearness in presenting this subject it is divided into five parts, covering successive steps in a range sale:

(a) Finding and Handling the "Prospect."—The central station by analyzing its lighting company customers and segregating the live range prospects can cut selling expense by confining range advertising to the real prospects.

(b) Selling the Idea of Electric Cooking.—A demonstration of the range to the prospect is necessary before a sale can be made.

(c) Selling the Range.—Range prices and wiring costs should be given to prospects as one quotation.

(d) Follow-Up Work.—Every purchaser of a range must be taught to operate efficiently.

(e) General.—The range problem should be considered from the consumer's point of view and not the engineer's.

Combined with these facts there are entirely too many models of ranges.

No. 7. Renewals and Repairs.—Another item which pertains entirely to the dealer or central station is that where a manufacturer has to absorb generally the expense of returned used material, this expense must be covered in the retail or trade prices of his product.

No. 8. Central Station Policies.—There is a lack of broad policy in central stations, of enlightened self-interest in assuming their proper share of the burden with the manufacturer.

No. 6. Operating Conditions.—A great portion of the trouble in the last two years has been, not with the attitude of the central station men themselves, but with the conditions which prevail in their territories. This especially applies to the variation and non-standardization of voltage.

Central Station Viewpoint

After very careful consideration it was decided that in the opinion of the sub-committee on central station viewpoint (R. B. Snyder, chairman) the most important impediments to the range business are included under the following general subjects: The absence of specific information as to the practicability of the electric range, and inactivity on the part of manufacturers and central stations in promoting range business among employees.

When effecting electric range sales it is found that the first cost is an item which is generally foremost in the minds of prospective customers, and heretofore at least this cost has been a marked obstacle to their more general introduction. This obstacle can be overcome in the majority of cases, where the customer can afford the price, either through adequate sales argument or by giving time-payment terms.

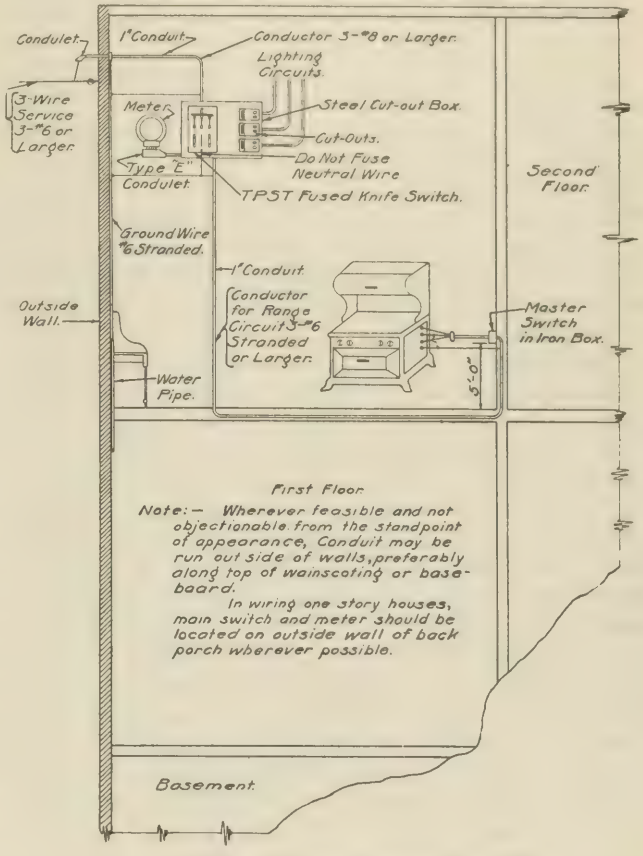
Many of the troubles of the electric range in service arise through the inefficiency and lack of preparedness of the central station companies, due in a great measure to the lack of foresight on the part of the sales department when planning the campaign that placed this electric range in service. Another impediment in the way of popularizing the electric range is lack of enthusiasm and faith on the part of the salesmen. Still another thing that stands in the way of developing a public opinion in favor of the electric range that will result in a demand for it, and for the service it means to central stations, is the lack of what is called the "humanizing" of it.

Technical Information and Data

The sub-committee on technical information and data (Hartwell Jalonick, chairman) had hoped to incorporate in its report curves and the data on the various makes of ranges, but found such a compilation practically valueless. Considerable technical information, however, is contained in data secured through the courtesy of A. Stockstrom, an electrical engineer.

From the results of certain tests made by Theodore Dwight of the Society for Electrical Development, the committee feels that it cannot too strongly urge that great care be exercised by range salesmen in their endeavor to have the customer use proper utensils if the most satisfactory results with electric cooking are to be secured.

Wiring.—Some of the features which contribute most to the possible success of the electric range when installed are (1) the matter of providing proper installation on the customer's premises, (2) proper service leads from the secondary lines to the customer's meter loop,



WIRING FOR RANGE INSTALLATION

and (3) the proper installation of secondaries, transformers and primaries on the company's distribution system.

A set of specifications for wiring of electric cooking and heating devices is included.

Information regarding expense incident to serving an electric range installation shows a total of $75.02, apportioned as follows: Pole line, $37.52; transformer, $16.50; service, $12.50; meter, $8.50.

The committee is prepared to suggest that when the manufacturer is in a position to supply speed in top-burner operation, without abnormally increasing the demand or account of the apparent present-day decrease in inherent efficiency, then it will recommend the installation of at least one fast burner element in each range. It is recommended that the central station go slow on the idea of endeavoring to secure for electric element speed the equal operation of the other fuels. For a similar reason the committee is of the opinion that boiler element wattage should be deferred. It is felt that by preheating the oven will give better and faster results.

INDUSTRIAL HEATING

Industrial Electric Heating Bureau

Numerous inquiries for information and figures on various applications of industrial heating have come to the members of the committee on industrial electric heating bureau (H. O. Lobell, chairman) from manufacturers in a great many lines.

It is most desirable in figuring on the application of electric heating to a process to make the operation automatic in so far as possible.

The application of continuous operation in the form of belt, chain or other means is not confined to low-temperature operations, but can be and is used in high-temperature work as well.

In designing apparatus of this type it is necessary to consider the entire operation as a unit so that each part of the apparatus and each step in the process as well as the heat application all work together in the proper cycle and sequence and each part does its work most economically.

The committee wishes to lay great stress on the importance of correct ventilation, which does not mean large piping with heat loss, but correct design.

In space heating there are several considerations to be borne in mind when the application is being laid out. The units must be placed so that there will be an even distribution of heat. There may be a flow of some liquid which would drop on the heaters if they were placed on the floor or beneath the work. This might damage the heater and also create a dangerous condition. Heating units must also be so placed that local heating or heating in a particular section is not excessive, for it is evident that if this condition is permitted it might damage not only the apparatus, but the material being heated and the heating unit as well.

The report gives a very brief outline of new developments in electric heating apparatus.

The committee in considering the advisability of publishing general or specific data resolved that in view of its variety a central point for the filing of this material should be established, thus making it available to all members for reference.

WIRING

The report of the committee on wiring, of which R. S. Hale is chairman, concerns itself largely with standardization and concentric wiring. Up to the present year the committee has considered actively standardization of the attachment plug only at the socket end of the portable cord, and, of course, the corresponding wall receptacle. When the problem was first assigned to the committee the number of non-interchangeable designs was very great. Because of patent difficulties and trade disputes the adoption of a single design of uniform arrangement so that all plugs shall be interchangeable has not been reached. The end is, however, not far off, and the committee hopes before many years to be able to report approximately complete success. The second part of the plug problem is that on the appliance end of the portable cord. Discussion has arisen as to whether round, square or flat prongs shall be used on the appliances, and if flat prongs are used, whether they shall be placed parallel or tandem. A conference of manufacturers indicated a cordial desire to co-operate and resulted in the appointment of two committees, reports from which, however, will not be available until next fall.

The question of polarity of plugs and receptacles is not very pressing, while almost no wiring installations are polarized, but this may become important, the committee feels, at almost any time. The committee believes that all the receptacles should now be designed for polarization as this involves no extra expense and no trouble in using, but that it is not worth while to make the plugs polarized until the need therefor shall arise. The consensus of opinion is that any standardization of the cord, as distinct from the plugs, would be undesirable.

Regarding the standardization of range connections, the committee has come to the conclusion that so long as a real demand exists for either type of construction—built-in-terminal box containing the switch, fuse and possibly a pilot light, or with three wires only—the manufacturer should be allowed and encouraged to supply that demand.

In connection with pilot lights the committee states that it is true that a pilot light on such installation may be very desirable to prevent energy being consumed unintentionally, thus obviating waste of electricity and deterioration of the heating elements from over-use, but this is purely an economic question. While the use of pilot lights might be encouraged for these purposes, it certainly should not be required for safety.

In connection with concentric wire the committee points out that a number of installations have been made in different cities and further reports have been received from abroad. In no case, it is stated, has any fire or accident or trouble of any sort due to the method of wiring been reported. Although now forbidden by the United States National Electrical Code, the use of concentric wire is permitted by the codes in nearly every other country in the world. It is true, of course, that many of these codes impose certain limitations on its use, but this is equally true of every form of wiring or conduit. Reports on the use of concentric wiring by various companies in this country are included. After presenting these reports the committee states: "All the evidence based on all the installations thus far made is to the effect that the method will be safe. There is absolutely no evidence that the method will give trouble, provided that the same precautions are taken for new installations that have been taken for those already installed all over the world, including of course those in the United States. We therefore ask: (1) That concentric wiring be allowed in America subject to the conditions under which it is freely and safely used elsewhere; (2) that further experimental installations be permitted with the object of ascertaining where it can be used to the best advantage and to a still greater extent."

At the request of the National Association of Building Managers, the committee has considered the use of the lead-covered twin wire recommended by it and used

in many of its buildings. An attempt has been made to secure other evidence, but a considerable prejudice has been found. This prejudice, however, seemed not very different from the general prejudice against anything that differs from present methods, and the committee therefore voted that, on the evidence presented, it was in favor of the wire.

The committee continues its recommendation for a solid neutral from the generator (or transformer) to the lamp in all grounded systems, this including the grounded side of two-wire branches from three-wire systems. In order to take advantage of the grounding of the neutral wire and also of the solid neutral, it is desirable, the committee states, that it should be of a color distinct from the outer or potential wire, and the committee last year took a position in favor of a standard color. After discussion with the manufacturers, the latter recommended the use of unbleached cotton with paraffine filler, which would be whitish, but not so white as to give trouble from getting dirty. The Underwriters, the committee believes, are also in favor of this but have apparently not yet felt the time ripe.

The committee has recommended a change in the Code to allow the use of cheaper insulation, for example, weatherproof instead of rubber for the neutral wire when it is of a distinct color. The committee considered the question of the use of the sizes of wire different from those permitted by the Code and voted that the use of No. 16 or larger sizes should be encouraged for fixtures or portables or for any location where devices larger than the ordinary lamp would be used. At the request of the insurance expert the committee has considered the question of whether devices for fusing solidly recently placed on the market would not be dangerous in the hands of customers. On investigation it was found that many manufacturers are selling similar devices and member companies use them or something similar freely. Standard rules regarding connection beween inside wiring and outside lines have been begun.

COMPENSATION AND EDUCATION

Compensation of Salesmen

Investigation of the methods in use by member companies with reference to the compensation of their sales forces, it is pointed out by the committee on compensation of salesmen (C. J. Russell, chairman), shows that the same diversity exists both in practice and opinion as is found in other organizations.

Fundamentally there are but two methods of compensation—the basis of the oldest and most popular method being a salary, and that of the modern and scientific method being a commission. As might be anticipated from the growth or rather the nature of the growth of the electric light business and of its commercial department, the straight salary method is in use to a greater extent than any other plan. Many of the most progressive and aggressive commercial managers believe it to be the best and many have returned to this basis after experimenting with other systems based on actual sales results. The essence of the opinions expressed by those writing in favor of the salary method of compensation is primarily that many elements outside of the question of daily sales enter into the work of the salesman, the value of which cannot be measured in dollars and cents. Some estimate the proportion of time given to actual sales as 40 to 50 per cent, the rest being devoted to holding business, commercial service and advisory work. It is also quite generally felt that a salary method of compensation appeals to the higher grade of salesman as being more dignified and a more permanent arrangement.

Very few companies are operating on a straight commission basis for other than appliance sales. The feeling is quite general that if a commission plan can be established on a proper basis such a method of compensation would be the best for the salesman as well as the company employing him. Modifications of a straight commission basis have been applied by a number of companies, and these are principally along the line of a small salary plus a liberal commission or a liberal salary plus a small commission. In some cases the salary is considered a compensation for that portion of time which is devoted to other work than that of securing new business, and commissions are allowed on all business connected up. In other cases the plan adopted represents a straight commission with a drawing account which must be offset by a given number of sales before commission allowances are added to the salary. The second plan of a liberal salary with a small commission on completed sales is equivalent to a straight salary method of compensation with an incentive to the salesman to increase his earnings to the utmost. A modified system of commission or allowances is found in the various methods of bonus payments.

In connection with power salesmen and specialists the committee reports that in most cases these members of the sales force are paid on a straight salary basis for obvious reasons. In general they handle only the larger or more important propositions, the average salesman being required to inform himself sufficiently to handle small and ordinary lighting and power cases. Certain companies have extended their commission schedules, however, to include such specialists as are actually engaged in sales work.

Education

The committee on education (Fred R. Jenkins, chairman) for this year has continued along the lines outlined in its report of last year. It is now conducting two courses by correspondence, the commercial engineering course and a course in practical electricity.

The commercial engineering course, while particularly adapted for the use of men employed in the commercial departments of the companies, is at the same time quite broad in its scope, and it has been found that a large number of subscriptions are from men employed in other than commercial departments. The course in practical electricity is a fundamental course for employees not having an electrical education and is an elementary course very broad in its scope. It is intended for employees of all departments who desire a foundation from which to specialize in any branch of the business. The former has proved successful, and while the latter was only recently started, from present indications it should prove equally popular with the first course, if not more so.

It is found that where some executive of a member

company takes a personal interest in acquainting the employees with these courses no difficulty is experienced in organizing a class, and that the employees look to the company for indorsement and assistance in educational work, which is mutually beneficial.

The first edition of the commercial engineering course has been practically disposed of, and the committee has considered the publication of a second edition and makes such recommendations in this report. The total subscriptions to March 1 amount to 1358, of which 20 per cent have received the last lesson. Of this number 25 per cent have qualified and received certificates.

There follows in the report a short description of each lesson with the table of contents. These lessons can be sent monthly or semi-monthly as desired. Sufficient stationery is sent to the subscriber for use in answering the tests, which consist of practical problems prepared from actual experience.

The course in practical electricity as recommended in the committee's report of last year has been inaugurated, the first lesson having been sent out on Jan. 1.

Owing to the necessary time required to organize the committee for this purpose, the course was not thoroughly advertised, but notwithstanding the late start and insufficient advertising there was a total enrollment to March 1 of 466 subscribers.

The committee recommends (1) a course in electrical appliances for the use of seminaries and colleges having courses in domestic science; (2) a second edition of the commercial engineering course to be printed and sold, and that the price be advanced from $12 to $15 for a complete course of seventeen lessons; (3) that the price of $12 for the course in practical electricity be continued to all subscribers during the coming year, and (4) that an active campaign for subscribers be started in the member companies as early as August.

MERCHANDISING AND COMMERCIAL SERVICE

Special Service and Relations with Customers

One of the reports that stand out is that of the committee on commercial service and relations with customers (R. F. Bonsall, chairman). The report gives the result of a questionnaire sent out to some seventy-five companies in various sections of the United States, replies being received from thirty-eight, showing present practice affecting applications, credit, meter reading, collections and complaints. All of the questions contained in the questionnaire are given, with the full results of answers, and where suggestions were received these are incorporated in the report.

Salesman's Handbook

The report of the committee on the "Electrical Salesman's Handbook" (R. H. Tillman, chairman) says that inasmuch as last year's committee completely revised the handbook, reindexing and publishing it in admirable form, the present committee has endeavored only to improve and add to the various sections.

As one member rarely uses more than one section, the committee makes the following recommendations: (1) That each member be furnished with a binder and only that section in which he is interested; (2) that for the present the sections be divided into three parts, lighting section, power section and electric vehicle section; (3) that a power salesman be furnished with the section on electric power, including industrial heating, and a lighting salesman be furnished with the section on lighting, including domestic heating; (4) that where a member desires a section in addition to the one furnished him he shall be charged for it; (5) that each member company shall be furnished with one or more complete volumes of the handbook to be placed on file for reference use.

Other suggestions and recommendations are made regarding the formation and work of the handbook committee.

Merchandising Committee

The merchandising committee for 1917 (J. V. Guilfoyle, chairman), having held six meetings and accumulated through correspondence and personal touch considerable information on the subject of the merchandising of electrical appliances in central stations, does not believe that progress in the merchandising of electrical appliances in the last year or two necessitates a revision of the policy or principles set forth in previous reports.

Clocks in the Field of Electric Light Appliances

A means of controlling frequency is described in a paper by Henry E. Warren entitled "Clocks in the Field of Electric Light Appliances," whereby, it is claimed by the author, it is easy to reduce the error in the average value of frequency to less than one-thousandth of 1 per cent as measured day by day.

Profitable Appliance Business

The committee on profitable appliance business (C. E. Greenwood, chairman) has studied its subject from three viewpoints of what constitutes a profitable appliance business, and has classified appliances according to their "profit" to the central station.

Appended to the report is a compilation of suggestions under the captions "Do" and "Don't."

Appliance Sales in Cities Under 30,000

The report of the sub-committee on possible appliance sales for central stations in cities of 30,000 or less (E. R. Davenport, chairman) states that there are a surprising number of small central stations which do not sell electrical appliances.

Business done with vacuum cleaners, washing machines, sewing-machine motors, electric fans, etc., was treated as a separate subject. This type of business has not been developed, and after investigation it was found that a figure equal to 50 per cent of the total appliance business must be added to include this apparatus.

The estimate of total electrical merchandising business per residential connection, for average cities of 30,000 or less, arranged geographically, is as follows: Northern Atlantic States, $0.506; Southern States, 0.675 cent; Middle Western States, $0.900; Southwestern States, $0.484; Pacific and Rocky Mountain States, $1.744. The figures given do not cover portable lamps. This business has not yet been developed with the small central station. The committee recommends that small companies take up the sale of portable lamps.

ELECTRIC VEHICLE SESSIONS

THERE is unusual evidence this year in the reports and papers presented before the Electric Vehicle Section of a desire on the part of those promoting this branch of the industry to get down to fundamentals and frankly and sincerely to look the underlying problems in the eye. Co-operation by all interested is the keynote of the contributions, and in view of the past history of electric transportation development is significant. Should the manufacturing interests and the central stations adopt and carry out the suggestions and recommendations made in these papers and reports, there is no doubt that a step will be taken in the right direction and should do much to put electric transportation of the future on a better footing.

SALES PROMOTION AND CO-OPERATION

Manufacturers and Central Station Co-operation

Appreciating the fact that little is to be accomplished by making a fresh start each year, the committee on co-operation between manufacturers and central stations (George B. Foster, chairman) determined to augment the work of previous committees so that results might be cumulative. The committee received from a member vehicle manufacturer a proposal to offer a maximum discount on its product to Class A members through this committee, and it was accepted on condition that all of the manufacturers should have the same opportunity. Considering the plan in its entirety, it was worth the effort and expense, but the results were disappointing as compared with expectations.

At a meeting of vehicle, battery and accessory manufacturers it was proposed that this committee should procure the services of a representative with all the qualifications to present the many advantages of electric transportation in a most convincing manner to the officials of the larger central stations that are not showing any marked interest in this field. The plan was approved on condition that the necessary funds could be secured for a trial of one year, the cost of which was estimated at $15,000.

This proposition met with the unqualified approval of the chairman of the publicity and advertising committee, and assurances of financial support were received. The sub-committee called upon the majority of the larger manufacturers and laid the plans before them with the request for financial assistance and co-operation. A very small minority of the manufacturers took a definite stand against the proposition. The majority were favorable to the plan but differed materially as to the basis upon which assessments should be made for the balance of the funds.

Correspondence has been had with manufacturers relative to establishing a uniform guarantee for electric vehicles exclusive of batteries and accessories. Most manufacturers are willing to co-operate in the matter. The standard of the National Automobile Association of Commerce has been recommended.

Motion-Picture Films

During the last year the committee on motion-picture films (Carl H. Reed, chairman) has endeavored not only to increase the number of films showing the electric, commercial and pleasure vehicle in action, but to enlarge the scope of its activity by securing motion pictures of electric industrial trucks. Co-operation of manufacturers was requested but the results were unsatisfactory.

Customer's Viewpoint on Electric Vehicle

"I want to say first," says F. M. Feiker in his paper, "The Customer's Viewpoint on the Electric Vehicle," "that, now I have found out all I needed to know, now that I have asked and persisted in questions, I am satisfied with the service my car is giving me."

He found it too hard to buy an electric car. As central-station men, as manufacturers of cars and batteries and equipment, the industry is talking too much about itself and too little for the customers.

Questions the Pleasure Car Buyer Wants Answered

(A summary of actual questions obtained by correspondence and from personal investigation.)

1. Is the "electric" a utility car? Is it cool in summer? What are the experiences of other users in my locality? Is the electric a "bad-weather" car?
2. What special advantages has the electric for me—as a suburbanite with children to take to school, station trips, theater, etc.; as a business man about town; as a professional man, doctor, lawyer, teacher, clergyman?
3. How far can I go? Can I use the car every day? How long does it take to charge it?
4. How much does it cost to operate in my locality?
5. Have you a booklet in which these questions are answered?
6. Is there any one in town of whom I can ask questions?
7. What do I have to watch about the car? Are there special points I ought to know about?
8. How do I know when the batteries are "full"? How do I know when they are empty?
9. Can I buy charging equipment on time as one does an electric washing machine?
10. Can I get the car charged anywhere in town? How much does it cost?
11. How can I charge it at home? Where can I get the equipment? What does it cost? Can I operate it myself?
12. Do I have to have a garage in any way special? Do I have to heat the garage in winter? Is there any difference in insurance rates between electric and gas cars? Can I leave the car standing in winter without danger of its freezing?

His second problem proved to be how to get the car charged, which is, first, one of cost; second, one of methods. His third hurdle was how he could charge his car. Not only must the customer buy the car but a charging outfit.

The owner of an electric truck is in much the same relation to his vehicle as the owner of the pleasure car, the paper continues. The group of questions asked, which were gathered together from several sources, is curiously like the questions the pleasure-car man asks.

There is no more important factor in the successful use of "electrics" than the relation of driver and garage man to costs. If the last penny is squeezed out of drivers' salaries, the trucks will be abused. If costs for garaging are placed so low that there is nothing in it for the garage man, the truck will soon fall to pieces.

Questions the Commercial Car Buyer Wants Answered

1. Are electric trucks used in any business like mine?
   Who are some users that have proved the electric truck's value to themselves?
2. What sizes of electric trucks are made? How much can they carry?
   What size of truck do I need in my business?
   What are inside dimensions of the body?
3. Can I buy the chassis separate?
   Can I use my present delivery bodies?
   Do you (the truck manufacturers) make special bodies?
4. Who guarantees the operation of the batteries—the battery maker or the car maker?
5. What does the truck cost? Are car and batteries sold separately?
   Can I buy an electric truck on time?
6. What is the average mileage of a car under fairly good conditions?
   How much charge does a truck hold?
   Will the truck operate in snow?
7. What are upkeep costs compared with gas-car costs?
   What are operating costs compared with horse-drawn wagons?
   Would it be possible to use two electrics instead of three horse-drawn wagons, each wagon serving about thirty customers and covering a distance of two or three miles? What number of stops can be covered?
8. How shall I get car charged?
   What is the cost of a charging outfit?
   Who will sell me a charging outfit?

APPLICATIONS

Central Station Use of Electric Vehicles

The companies situated in the big cities of the United States have one after another adopted the electric vehicle for nearly all the branches of their work, Arthur Williams points out in his paper, entitled "How and Where Central Stations Can Use Electric Vehicles." The first few cars purchased with the idea of making such an experiment proved so successful that large orders followed, and in many cases all other types of vehicles were displaced. Ten of the companies alone use 650 cars, representing the largest central stations.

But this gratifying appreciation of "electrics" is largely confined to the central stations in the large cities. While instances may be mentioned where they are used in the small towns, these are distinctly exceptions rather than the rule. A large proportion of the smaller central stations and some pretty large ones lack a proper realization of how "electrics" can be applied to their transportation work. The author presents in great detail the practice of the larger central stations, considering the branches of work which are being handled successfully by the electric vehicle.

Applications of Industrial Truck

In a paper entitled "The Modern Applications of the Electric Industrial Truck and Its Earning Power for the Central Station," J. Crawford Bartlett explains the electric tractor idea for industrial applications with a number of trailers and explains how it is to the advantage of central stations to obtain this class of business.

LEGISLATION, STANDARDIZATION, GARAGING AND ACCOUNTS

Standardization

The work of the committee on standardization (E. R. Whitney, chairman) at the present time is largely of an advisory or consulting nature, for the reason that, in accordance with arrangements made a year or two ago, all matters of standardization are being handled by the Society for Automobile Engineers, it having created for this purpose a special division of its standards committee known as the electric vehicle division.

The committee's report consists largely of a review of the work that has been done by this division.

Legislation

It has been the aim of the committee on legislation (P. D. Wagoner, chairman) to combat energetically all unreasonable and unnecessary bills which have come to its attention and to lend support wherever possible to such measures as might be of benefit to the industry. The committee presents in its report a résumé of the more important changes which have been made or proposed in the automobile laws of the various states since the last annual convention of the association.

Operating Records

"Cost Accounting for the Transportation Phase of the Central Station Industry" was the subject discussed by the operating records committee, of which P. E. Whiting is chairman. An outline was presented making possible classification of the cost of operating any type of vehicle in various classes of service for the purposes of comparison. Committee work for the future was also outlined, some of the subjects treated being as follows: Standard classification of accounts, standard classification of statistics for comparison of performance data, form of comparative reports for in-

terchange of information, application of system to typical installation, standard departmental operating methods, and standard system of cost accounts.

The expenses have been subdivided to conform with the broad classification of accounts presented heretofore, the subdivision being broad enough for larger companies and still not burdensome to small companies. To facilitate the interchange of reports the big companies have announced that they will be represented by the following men: New York Edison Company, P. C. Savage; Edison Electric Illuminating Company of Boston, C. H. Hodkinson; Philadelphia Electric Company, G. B. Landwehr; United Electric Light & Power Company of New York City, R. B. Grove; Cleveland Electric Illuminating Company, J. A. Scovell; Consolidated Gas, Electric Light & Power Company of Baltimore, H. B. Lohmeyer; Commonwealth Edison Company of Chicago, E. J. Fowler.

Garage and Rates

The garage and rates committee (C. H. Miles, chairman) believes that the most important requirement for the growth of the electric vehicle industry is the establishment of additional high-grade garage facilities and to that end urgently requests every member company to arrange at least one charging station in the territory served by its line. This charging equipment should preferably be placed in a public garage which gives twenty-four-hour service. It should be in charge of some one thoroughly competent to care for and maintain the batteries and vehicles in proper working condition.

The committee feels that the results obtained in larger centers can be duplicated in smaller communities if the local central station will get behind the movement and provide the necessary facilities.

Reduction in price and lessening in weight of passenger cars has helped their distribution and sale, and satisfaction is now being obtained on a single battery charge. There appears to be little difficulty in selling passenger vehicles in centers where suitable garaging facilities are provided.

As a means of securing larger distribution of charging apparatus, it is suggested that a policy of selling apparatus of this nature to garage owners on a deferred-payment plan be adopted by the member companies. It is thought by the committee that apparatus manufacturers should co-operate by making a concession in price to central stations to cover the cost of selling and handling this business.

At the present time there is a great variety of charging apparatus on the market, and synchronous converters of various sizes which give good efficiency and are reasonable in price are at hand. It is the opinion of the committee that this form of apparatus has advantages which commend its use for general garage service.

The committee has given some thought to the standardization of garage rates, but feels that this is largely a matter for local consideration. There are two methods in force for charging the customer for the care of his car—the first a flat monthly rate covering all expense of garaging including energy, the second a certain fixed sum for the care of the car and an additional sum for the energy used on a meter basis. Both systems seem to have worked satisfactorily in certain sections, and the committee feels that although the second method is the fairer and more equitable, each garage should be left to adopt whichever seems to give satisfaction.

There has been a tendency in certain localities to offer garage service to car users at a price which leads to practically no profit to the garage owner. The result of this means poor service and general dissatisfaction with the electric vehicle.

It is felt that the rates given by member companies for this class of service throughout the country are as a whole satisfactory. A high rate per kilowatt-hour for this purpose tends to hinder the development of the business, and the committee recommends that member companies not now having a preferential rate give consideration to the off-peak character and relatively high kilowatt-hour consumption per unit of this class of business.

The committee has considered the matter of the official sign of the association but has taken no action upon it. It feels, however, that some form of sign should be continued for electric garages and recommends that such a sign be furnished by member companies to garages in their territory conditional upon their service measuring up to a certain fixed standard. This sign should remain the property of the member company and be removed from the garage in the event of unsatisfactory service.

Insurance

During the past year the committee on insurance (Day Baker, chairman) has found it impracticable to attempt the securing of a decrease in rates on any of the forms of electric vehicle insurance. Most of the larger users feel that the present rates, which in many cases give the electric vehicle a fair preferential, are reasonably satisfactory and that under existing circumstances these should not be disturbed.

The committee is endeavoring to obtain some reliable data from the police departments of the large cities on the proportion of street accidents due to electric vehicles. Owing to the fact that New York City is the only place where details of this character have been collected for more than a few months, no reliable figures have thus far been obtainable. It is believed that next year's committee will be able to collect and present some interesting figures and facts.

CIVIC USES

Federal and Municipal Transportation

From every standpoint of economy, reliability and efficiency the electric truck is the logical vehicle for government and municipal transportation service, the committee on federal and municipal transportation (James H. McGraw, chairman) points out. Its dependability under all conditions, its speed, its hill-climbing power, its simplicity of drive and its cleanliness all make it the ideal form of truck for fire department, police patrol and hospital ambulance purposes. For street cleaning, sprinkling, garbage and ash haulage, the electric vehicle's flexibility of operation, economy at low speeds and ability to handle heavy loads give it unique advan-

tages with which no other form of motive power can compete. In government mail and parcel post service, too, electric delivery cars have well demonstrated their economy under every kind of service and weather conditions—in long-haul runs as well as on local delivery routes with numerous stops, both in winter and in summer.

Preceding reports of this committee have described at length the manifold advantages of the electric truck in all these forms of government service, and for detailed data concerning such municipal and federal uses of electric vehicles reference is made to earlier publications of this committee.

With the present trend toward the rapid motorization of all forms of municipal equipment as a matter of local civic pride and progressiveness, and with the makers of gasoline trucks straining every effort to secure this profitable business for their less appropriate products, it is believed that no time must be lost if the electric vehicle manufacturer and central station are to secure a fair share for the electric truck with all its many points of superiority over the gasoline car. The committee urges that immediate steps be taken to go after this valuable municipal business which stands waiting, ready to be diverted to the electrical industry instead of the gasoline interests, if an effort is made to secure it. The central station must be brought perhaps to realize more fully the value of the electric truck business as an off-peak load, and to appreciate that the municipal truck business offers a unique opportunity to drive in an entering wedge for commercial haulage business.

The central station man, it is pointed out, is the logical booster for the electric vehicle locally, and it is the central station man's interest and help that must first be gained if electric trucks are to be put into municipal and post office service in his town. First of all, then, the central station man must be won over to becoming an advocate of the electric vehicle through every channel by which his interest can be elicited.

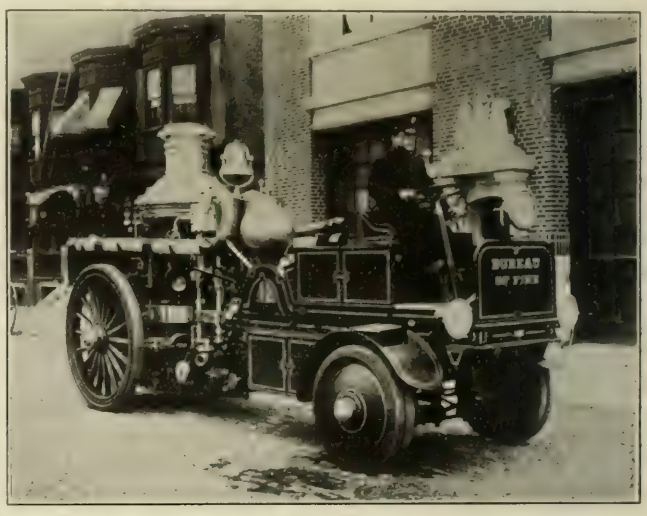
Besides urging upon the electrical industry this warning concerning the municipal truck opportunity that is slipping through its fingers into the grasp of gasoline competitors, the committee has undertaken the preparation of a booklet designed to inform, in a rather popular way, municipal officers and officials concerning the practical advantages of electric trucks. The text and illustrations for this booklet are submitted in an appendix to the report, and it is recommended that this booklet be issued for the use of central stations which desire to distribute literature concerning the electric car among local city officials, councilmen, politicians and citizens at large.

Under the political system prevailing in most American communities to-day the sale of any commodity to the municipality is fraught with its own peculiar difficulties. But the politician in every case is responsive to his own master, the voting public. It is urged, therefore, that the line of attack for the electric vehicle man who wishes to get, say, the local fire department to install electric truck equipment is through the town's leaders and shapers of public opinion as well as through officialdom itself.

The central station man will, for example, do well to get into touch with the newspaper men. Because of the news value of the idea, they will be glad, the committee believes, to run articles on electric vehicles in city use in nearby towns, and should therefore be encouraged to boost the idea editorially and to secure interviews expressing the opinion of representative townspeople.

Meanwhile plans for electric truck apparatus, the committee suggests, should be discussed with the leading citizens—bankers, lawyers and merchants—and their interest secured in the plan to electrify the fire department. If there is a civic improvement association in the town, its help should be enlisted to make a cleaner, better city through the use of electric equipment. While the public is being told about electric trucks, the electric advocate must keep sustained the interest of the heads of the city departments. The fire chief may be shown pictures of what other fire departments are doing with electric equipment and how it is superior to all other forms of motive power, and the chief of police may learn about the advantages to be derived from an electric patrol wagon.

The effort must be kept up, it is felt, in a sustained campaign, since while a single blast may make little or



ONE OF THE MANY MUNICIPAL USES TO WHICH ELECTRIC TRUCKS CAN BE PUT

no impression on the Council or the city buying power, a week's continuous musket fire of opinions expressed by newspapers and representative citizens will attract the attention of these same politicians, and such a campaign continued a few weeks longer will have the political elements on the run, looking for advice from any quarter concerning the use and purchase of electric truck equipment.

If the electrical industry is to have the share of the municipal truck business to which the superior advantages of the battery-propelled vehicle entitle it, and if the central station is to grasp the opening offered by the municipal field as an entering wedge for the development of a local commercial-car business, the committee feels that quick work will have to be done before this municipal business goes over to the electric truck's competitors. Unless the central station acts at once a great opportunity for present and future business will have passed forever. It is urged therefore that central stations lose no time in starting local campaigns for electric municipal equipment and that manufacturers and central stations afford each other every possible cooperation to facilitate the capture of this important municipal business that rightfully belongs to the electric truck.

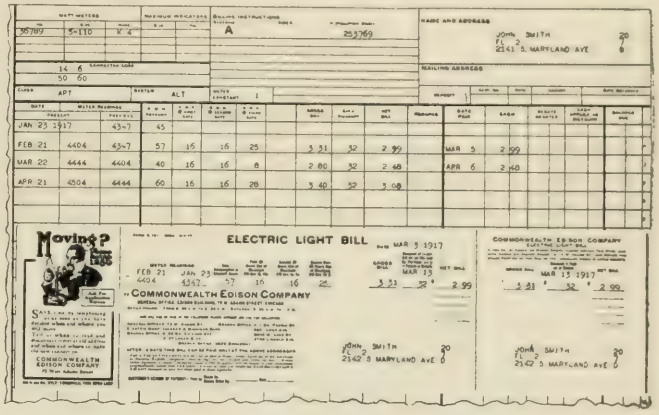
FOURTEEN accounting committee reports were scheduled for the convention, but only seven were submitted by the committees up to the time when the conference was held in New York City. Of these reports two were especially interesting for the amount of information presented—the report for the committee on purchasing and storeroom accounting and the report of the committee on customers' records. The first included information on methods of accounting for tools and methods of following up purchase orders. Inventory of stores was a related report. The report on customers' records traced accounts receivable from the time payments are received to the final balancing of the customers' ledger. Details of a method used by the Consolidated Gas, Electric Light & Power Company for balancing cash receipts daily were included. The uniform classification of accounts and methods of carrying merchandising accounts should be interesting to small and large companies alike, as the requirements of both have been taken into consideration in these reports. Arrangements have been made by one of the accounting committees to assist small companies in their accounting matters. The report of the committee on accounting efficiency is valuable in that it points out how a department covering this subject can eliminate duplication of effort in a company.

ACCOUNTING FOR PAYMENTS RECEIVED

Customers' Records

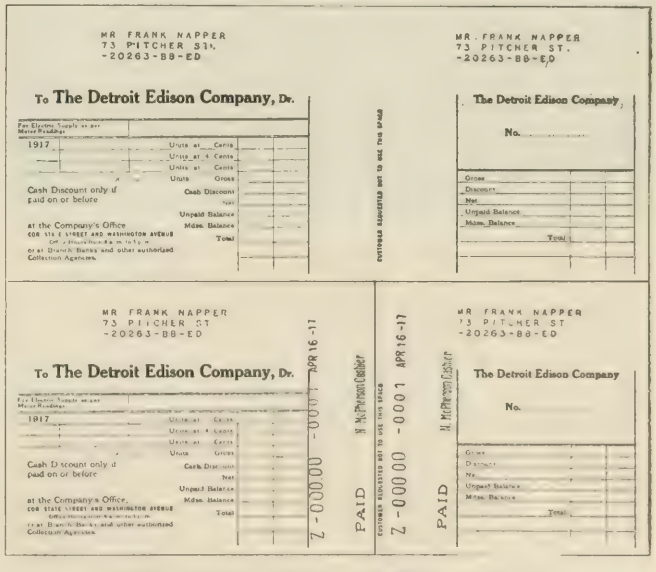
Tracing accounts receivable from the time of receipt of payment to the final balancing of the customers' ledger constituted the principal work of the committee on customers' records, of which E. J. Fowler is chairman. This subject was taken up under the following heads: (1) Compiling aggregate amount of customers' bills rendered and energy sold; (2) proving that all energy sold has been properly charged and billed; (3) handling all cash received in cashier's department and reporting the same to bookkeeper, also whether amount paid is stamped on coupon and automatically accumulated; (4) posting cash to customers' account by bookkeeper; (5) reporting delinquent accounts and drawing of balances; (6) balancing customers' ledger against general control account.

From one hundred satisfactory replies to letters asking questions on the above subjects the following conclusions were made: Regarding subject (1) 12 per cent of the companies replying employed punched cards, 41 per cent used column-listing machines, and another 41 per cent recapitulated the kilowatt-hours sold and net bills, while still others used adding typewriters. Recapitulation was used for other purposes. Bearing on subject (2) most of the companies compared the number of meters with the number of bills, keeping track of removals and installations. Others compared the total kilowatt-hours indicated by the meter reading sheets with the total on the Hollerith cards. The committee recommended checking the record of meters with the meter reading sheet by comparing kilowatt-hours and meter readings as reported on the bills or ledger with the recapitulation of the kilowatt-hours sold.



LEDGER SHEET AND ELECTRIC-SERVICE BILL USED BY CHICAGO CENTRAL STATION COMPANY

About as many companies post cash from the bill stubs as from the recapitulation sheet. It was pointed out by the committee that the latter method is simpler in that large sheets are easier to handle than small stubs. One company is using a machine which cuts the bill stub, receipts the bill, prints the amount paid on both stub and bill and records the total. Various methods were used in reporting delinquent accounts and drawing off balances. Most of them involved the recapitulation of delinquent accounts or of all accounts in the ledger. A method was described whereby billing, ledger posting and recapitulation can be carried on in one operation. Other methods of taking care of delinquent accounts involved the use of collection coupons



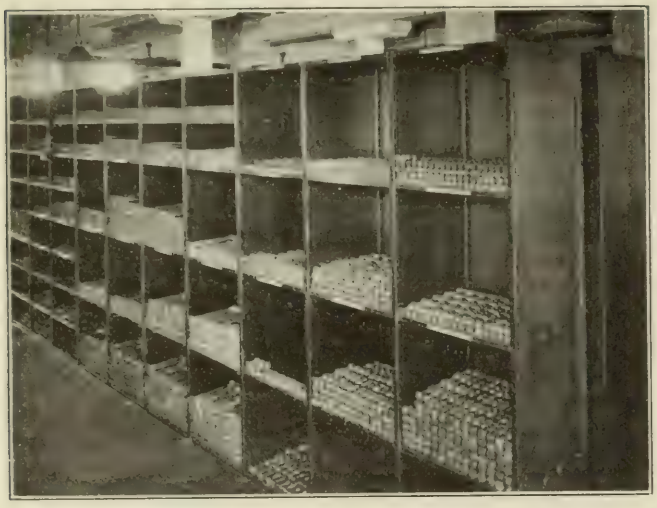
FORM OF BILL USED BY DETROIT COMPANY

on bills and the issuing of collection notices. In connection with this subject the committee recommends the careful study of the advantages of some form of recapitulation supplementary to the customers' ledger. In an appendix to the report was an outline of the method used by the Consolidated Gas, Electric Light & Power Company of Baltimore for balancing daily cash receipts.

STOREROOM ACCOUNTING AND INVENTORY METHODS

Purchasing and Storeroom Accounting

Eight subjects are treated in the report of the committee on purchasing and storeroom accounting, of which K. C. Campbell is chairman. Handling and accounting for tools are discussed, and methods of accounting for wagon stock are taken up. The importance of the handling, reclaiming and disposing of scrap is brought out, and details are given of the principal methods employed in handling scrap cable and wire. The report calls attention to some of the common errors in following up purchase orders and tracing shipments of material and shows how this problem is successfully



STEEL COMPARTMENTS FOR STORING SUPPLIES

handled. Some items of storeroom equipment are explained. The need of short cuts in cases of petty cash and emergency expenditures is pointed out, a system now in use being explained in detail. Three classifications of materials and supplies now followed by some of the large companies are also given. A list of items which should enter into the storeroom expense is given. Of three methods described for distributing these items over various accounts the following is recommended by the committee: Analyze the actual expenses over a given period and determine the percentages chargeable to each department, or class of work, on the basis of services rendered, and dispose of estimated future expenses by allocating to each department served a corresponding uniform monthly charge, which may remain unchanged for as many months as is consistent with the services rendered. The committee reports that considerable time was spent on the subject of the "handling of invoices," but in view of the lack of time to collect data on the variety of methods now in use it was decided to leave this matter for the succeeding committee.

The investment in tools used by public utility corporations is considerable and should have thorough supervision. A system of handling and accounting for tools should be used which will prevent overstocking, insure proper distribution, prevent an unnecessary accumulation of tools in the possession of workmen, and permit the exchange of tools of the same size and character between workmen and the tool room without the formality of any papers whatever. Furthermore, all tools of every description, except shop equipment and tools employed only for plant operation, should be charged to a separate material and supplies account. Expenses connected with the operation of the system, such as repairs, replacement, etc., should be charged to a tool expense account, which should be kept separate from storeroom expense, cleared monthly and prorated over all departments benefiting by such service.

In order to carry out this purpose it is recommended that a card record should be kept of all tools. To avoid an excessive number of cards average prices should be obtained by combining the various purchases with amounts on hand. The other portion of the record should consist of a specially ruled loose-leaf record sheet with a number of lines, on which to record the movement of tools to and from the tool room. To avoid opening accounts for all employees using tools this record is limited to foremen, who are held responsible for the care and prompt return of all tools used by their men.

Inventory Methods

New and improved methods of organizing and operating a stores inventory department are prescribed in the report of the committee on inventory methods, of which W. E. Long is chairman. It takes up the functions of such a department, including the relationship of the department to the auditor, purchasing agent and storekeeper. The procedure recommended by the committee represents an advance or improvement over the methods adopted in many storerooms and is developed on a simple basis, calling for trained representatives to work in conjunction with representatives of the storeroom.

The proposed method requires only two forms. The inventory is ordinarily made at least once a year at such times as will cause the least inconvenience to the storeroom force; that is, at a time when supplies are moving slowly. An experienced stores man works with each inventory man, each pair taking charge of a separate section or aisle of the storeroom. The inventory clerk is furnished with a quantity of bin tags numbered consecutively in duplicate, the original being carbonized on the back. The stores man calls the name of the article to be counted, giving such information as will tie it with the description on the stock records. This name is transcribed to the bin tag by the inventory clerk, who repeats it to the stores man. The stores man in turn counts the number of articles in the bin and the inventory clerk records this quantity on the bin tag. The original tag is then placed in the bin and the duplicate is retained by the inventory clerk as a check on the return of the original. All subsequent issues from or

additions to the material in the bin are noted on the original bin ticket by the regular employees of the storeroom.

At the close of business each day the original bin tags are collected and put in numerical order to ascertain that none are missing. The following morning as soon as the previous day's receipts and issues are posted to the stock records and the balance brought down the total quantity shown on the bin tag is compared with the stock-record balances. Any differences are immediately reported to the storekeeper and any adjustments are made on the stock record, his approval appearing on the bin tags showing the differences. These corrections on the stock records are made by the inventory clerk.

CLASSIFICATION OF ACCOUNTS AND EFFICIENCY

Accounting Efficiency

The object of an accounting efficiency department, organization thereof, scope of work and method of procedure, and examples of improved efficiency and economy, were subjects taken up in the report of the accounting efficiency committee, of which H. B. Lohmeyer is the chairman. According to letters received from different companies, about fifty different mechanical devices are used for accounting purposes, the uses of which indicate considerable flexibility in the application of the devices. For this reason it was suggested that the next committee list all the accounting machines and indicate the different methods of applying them. It was pointed out that the object of an accounting efficiency department should be to develop better and more economical methods of conducting business, to co-ordinate activities of various departments with a view toward eliminating duplication in work, and to assist associated departments in analytical and constructive duties when daily routine prevents other departments of the organization performing them themselves.

The department should be organized from the company's forces, should have at its head a man with general knowledge and experience in the various ramifications of the company's activities, and should include men with accounting knowledge backed by common sense, breadth of vision and tact. At least one man in the department should have engineering knowledge and appreciate the operating men's viewpoint.

Standing in the capacity of counsel, the accounting efficiency department should limit its work to recommending changes in practice. In considering any changes the following subjects should be taken into account: (1) Utility of operation performed, service rendered and the reason for existence; (2) effects of discontinuance; (3) if disastrous, consider the best alignment; (4) cost of performing service or obtaining data in relation to utility thereof; (5) possibility of duplication of work and, if so, efficacy and cost of different methods, in order to know which to dispense with. Copies of the department's reports should be sent to the heads of all departments and the chief executive, by whom it should be analyzed.

Uniform Classification of Accounts

The committee on uniform classification of accounts, of which William Schmidt, Jr., is chairman, reports that its efforts have been directed toward the adoption by all public service commissions of a natural uniform standard classification of accounts.

The recommendations of this committee are as follows: That a committee continue the work of this committee, in order that the comparison of the entire classification may be completed at the earliest possible moment; that the association permit this committee to confer with similar committees of other associations whenever in its own judgment it is found desirable to do so (the present arrangement is that the committee on uniform classification of accounts, which is practically a sub-committee of the committee on accounting relations with other associations, must submit its requests to the latter body, which in turn takes them up with other associations, and in this way much time and effort is lost); that a letter be prepared and published showing in detail in what way the smaller companies can make use of the associations' standard classification of accounts. The classification is particularly well adapted to use by small companies, and the methods of use have been pointed out on a number of occasions. The committee mentions that the smaller companies complain that the classification entails too much bookkeeping and is entirely too elaborate. The committee feels that the present classification, with only a few changes, could be adapted so as to fit the requirements of every member company.

Merchandising Accounting

A classification covering the accounting requirements of a central-station merchandising department is proposed by the committee on merchandising accounts, of which L. A. Coleman is chairman. The classification covers the needs of large as well as small companies. The index included in the report will enable the members to select enough of the classification to suit their requirements. The main division consists of the following accounts for the use of the smaller companies: Revenue from merchandise sales, cost of goods sold, cost of installation, selling expenses, general expenses, fixed charges and interest on working capital. Companies desiring more than the six main accounts mentioned may use the first twenty subdivisions thereof, while larger companies may avail themselves of all thirty-nine accounts listed. In this report is also included a suggested form of income and expense statement.

Accounting Service for Small Companies

The committee, of which Frederick Schmitt is the chairman, reports that it has instituted a campaign to develop the committee subdivisions so that through state representation the smaller companies located therein could benefit from the work of the committee in the speediest and most effective manner possible. The committee now has active representation in forty-three states containing 718 central stations operating in cities having a population of less than 25,000. It was recommended that a high-grade man well versed in central station accounting be employed, whose duties would be to visit, upon request, small central stations and, in co-operation with their accounting department, assist in installing standardized systems suitable to their requirements.



Floodlighting Outdoor Substations

How the Difficulties That Were Formerly Experienced in Illuminating High-Tension Apparatus and Wiring Have Been Attacked and Overcome in a Massachusetts Outdoor Station

BY M. M. SAMUELS

EVER since the beginning of high-voltage construction the problem of properly illuminating apparatus and wiring in high-tension rooms has been a puzzle to every engineer who has tried to solve it. Disconnecting switches, buses, fuses and other apparatus mounted overhead must be properly illuminated; otherwise the plant cannot be operated and inspected efficiently or safely. The chief objection against locating lighting fixtures among high-tension apparatus is that the lamps would be inaccessible for replacement or maintenance. Installing reflectors with the reflecting surface facing upward is equally impracticable, since the reflectors would collect dust and dirt rapidly and thus lose their efficiency. The method usually employed to illuminate open-work high-tension apparatus has been to install lamps without shades on walls or columns and depend on the upward radiation of light for illuminating overhead apparatus. Aside from the inefficiency of this method, the glare of the unprotected lamps has always been a just cause for complaint from operators, even when frosted bulbs were used.

With the advance of outdoor construction within the last three or four years, the problem of illuminating high-tension equipment has become more difficult, since poles in outdoor stations are usually far apart. Fixtures cannot be installed anywhere, and walls are not available at all. Air-break switches and lightning-arrester gaps are always placed at a great height, and their illumination is of far greater importance than the illumination of indoor apparatus.

Equipment Illuminated

On page 995 of the Nov. 18, 1916, issue of the Electrical World the writer first suggested that floodlighting be tried out for outdoor stations. Since then an opportunity was afforded for applying this idea, and it may be of interest to engineers to hear that the installation has proved very satisfactory. The station which was illuminated belongs to the Leominster Electric Light & Power Company, Leominster, Mass. Several day-time and night-time views of the station are shown herewith to indicate the position of the lighting units and the satisfactory results obtained with artificial illumination. The station proper occupies a ground space measuring approximately 170 ft. by 70 ft. At present the installation consists of two 66,000-volt incoming lines with corresponding oil switches and disconnecting switches and electrolytic lightning arresters, two sets of pole top air-break switches with their mechanisms, one bank of three 1000-kva., 66,000/13,200/2300-volt single-phase, self-cooled transformers, one set each of 13,200-volt and 2300-volt oil switches and metering equipment and one 2300-volt outgoing feeder. Provision was made for another bank of transformers and 13,200-volt electrolytic lightning arresters, four 13,200-volt feeders with their air-break switches and three additional 2300-volt disconnecting switches. As shown by the illustrations, all of the overhead equipment is supported by

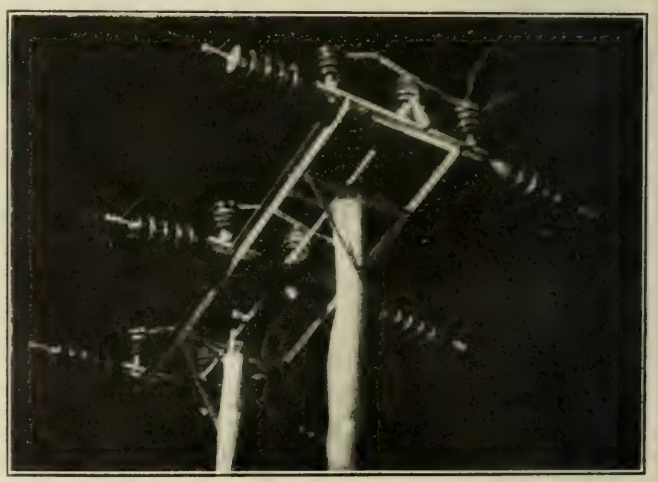


FIG. 1—POLE-TOP EQUIPMENT ILLUMINATED BY FLOODLIGHT AT LEOMINSTER, MASS.

wooden poles with angle-iron cross-arms. The 66,000-volt wiring is supported by strain-type insulators, while the 13,200-volt and the 2300-volt circuits are supported on pin-type insulators. Solid, not stranded, wire is em-

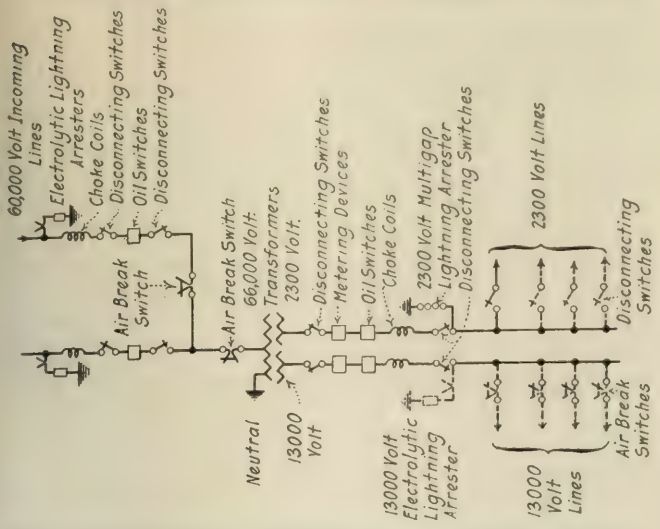


FIG. 2—CONNECTIONS OF ELECTRICAL APPARATUS EMPLOYED IN OUTDOOR SUBSTATION

ployed for the 13,200-volt buses and copper pipe for the 2300-volt buses. The high-tension airbreak switches are approximately 35 ft. above the ground.

Near the low-tension end of the station and adjoining the operator's house is a transformer repair tower which affords a very convenient place for mounting the floodlight projectors. Directed toward the 66,000-volt end of the station, which is furthest from the transformer repair house, are two General Electric type L-1 projectors having a beam angle of 16 deg. These units are mounted on the corners of the transformer repair tower as shown in the accompanying illustration and adjacent to the transformer territory, two General Electric type L-3 projectors are mounted on the corners of the transformer tower nearest the equipment to be illuminated. These units have a beam angle of 50 deg.

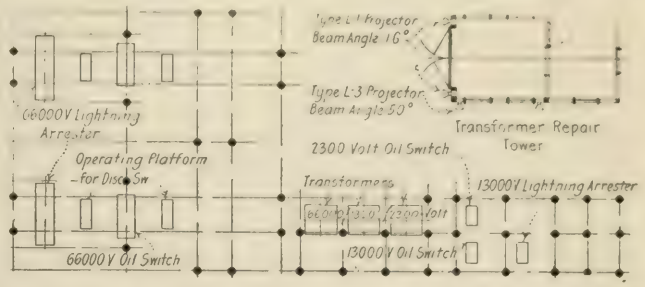
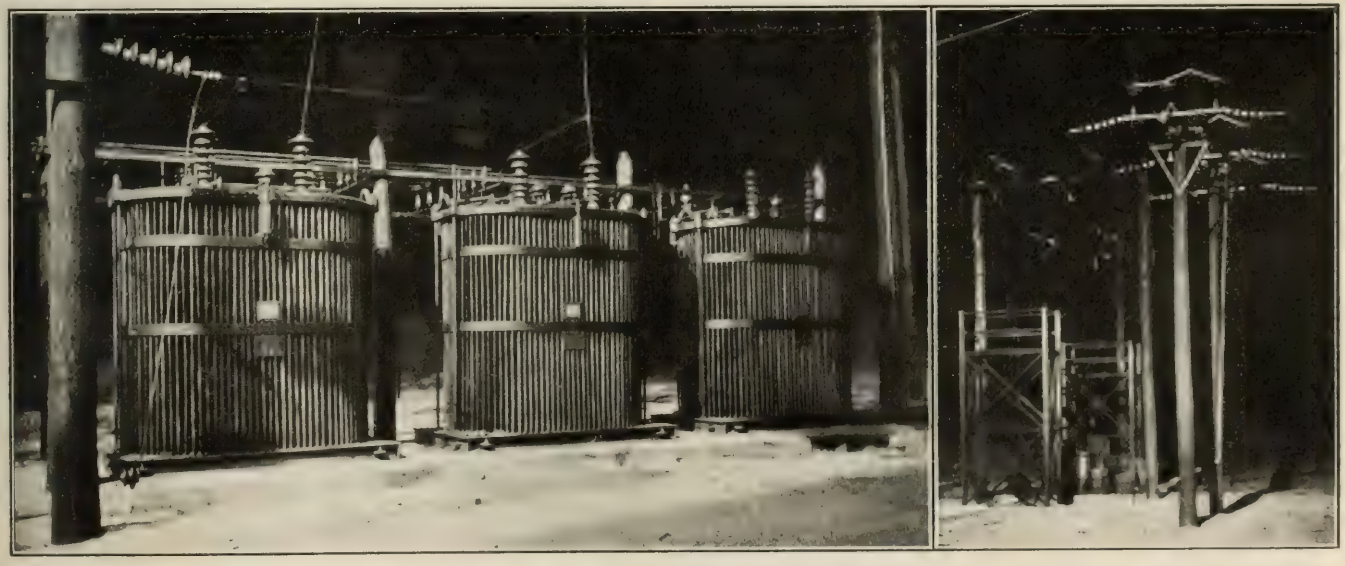


FIG. 5—POSITION OF FLOOD-LAMPS WITH RESPECT TO STATION EQUIPMENT ILLUMINATED

Projector lamps rated at 500 watts are used in both types of projectors.

RESULTS OBTAINED

The entire station is excellently illuminated, the light distribution being about as uniform as it could be made with direct or indirect lighting. Although the contrast desired to make small objects readily discernible has been obtained, no deep shadow concealing important equipment has been produced. At a distance of 150 ft. from the projectors the smallest type can be distinctly read and the stamped lettering on the apparatus name plates stands out very clearly. The details of the pole-top apparatus can be discerned more clearly with artificial light than in daylight, as shown by the illustration, because the objects observed are brighter than the broad expanse of sky back of them. No glare, which would be a hindrance to efficient station operation, is experienced anywhere in the plant due to the floodlight illumination. It may be added that the cost of installing



FIGS. 3 AND 4—EFFECTIVENESS OF FLOODLIGHTING SHOWN BY DISTINCTNESS OF DETAILS IN TRANSFORMER INSTALLATION AND POLE-TOP EQUIPMENT

illuminate an area approximately 50 ft. wide and 175 ft. from the projector, the average intensity being about 3 ft. candles. From this performance it is evident that this type of projector is particularly adapted to illuminating long, narrow stretches of high-tension apparatus each side of the station center line. To illuminate the low-tension equipment, which, as mentioned before, is floodlighting equipment for outdoor stations is a great deal less than that of any other form of illumination.

Considering the conditions mentioned and the results obtained, floodlighting may be recommended as the only practical and efficient method of illuminating outdoor stations. The installation described was made by the J. G. White Engineering Corporation.

Testing of Linemen's Rubber Gloves

Arrangements Provided by Pittsburgh Operating Company for Testing Gloves Bi-monthly in Central Laboratory—Method Employed and Data Secured

BY C. W. WARD

THE widespread "safety-first" movement has led the Duquesne Light Company of Pittsburgh, Pa., to adopt among other things a rubber glove that affords maximum protection and maximum usability. This glove is made of pure rubber varying in thickness

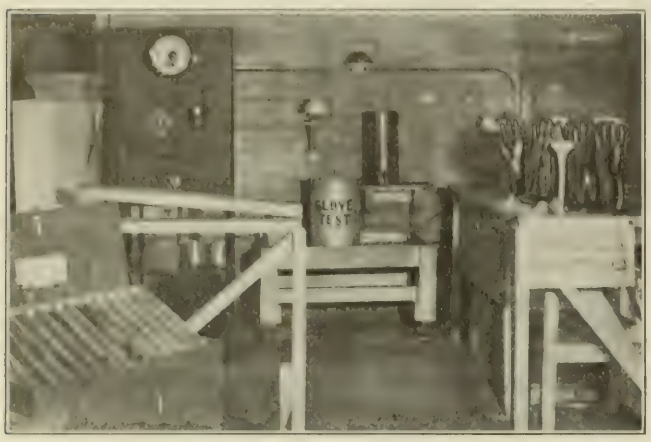


FIG. 1—OUTFIT USED IN TESTING RUBBER GLOVES

from 0.038 in. to 0.040 in. (0.97 mm. to 1.02 mm.), having a guaranteed dielectric strength of 10,000 volts and actually withstanding 18,000 volts. Over the glove is worn a horsehide glove, which protects the rubber one from mechanical abrasion.

So that the interests of the users of these gloves can be thoroughly safeguarded, the Duquesne Light Company has installed in its laboratory the necessary equipment to give all gloves an acceptance test upon their receipt from the manufacturer and to give periodic tests to the gloves after being issued for service. All used gloves are tested bi-monthly and must withstand the same test as when new. The linemen, operators and other glove users are compelled to exchange the pair they have in their possession for a new or tested pair on each semi-monthly pay day before their pay vouchers are given them. The gloves to be tested are transported from the various districts to the laboratory by the general storeroom truck on its regular delivery days. For this purpose each district has a rugged box in which are two or more trays, one above the other, each divided into a dozen spaces 15 in. long by 2 in. wide and 5 in. deep (38.1 cm. by 5.1 cm. by 12.7 cm.). A pair of rubber gloves fits snugly on edge in each space. The hinged cover is provided with a hasp and padlock, while inside on the cover are two spring clips under which the tester at the laboratory slips his report of the test on the particular quantity of gloves for the information of the district superintendent. A box with its top tray tilted is shown in front of the railing in Fig. 1. Each used pair of gloves successfully passing the test imposed is placed in a specially made envelope 14½ in. long by 4 in. wide (36.8 cm. by 10.2 cm.), with the gummed fly on the end. Thus inclosed they are placed on edge in the trays, one in a space. The lineman or operator receiving a pair of gloves in a sealed envelope knows at once that they have been properly tested.

The apparatus for making the necessary tests is simple, but complete. One pair of gloves is tested at a time, being slipped into a specially constructed holder made of copper, shown in Fig. 2. This permits the glove to stand with the wrist or gauntlet end open, so that it can be readily filled with water to within 1 in. (2.54 cm.) of the top. For convenience in filling, a spigot is used on the tank shown against the wall in Fig. 1.

The glove holder is immersed to within an inch of its top in an iron bucket of water. Ten thousand volts is applied between the water inside the gloves and that on the outside. The transformer is located on the floor behind the switchboard, its high-tension insulators being visible in Fig. 1. The voltmeter shown on the switchboard is connected to the 110-volt or low-tension side of the transformer, but its scale is calibrated to give the corresponding high-tension voltage. A rheostat is connected directly across the 110-volt line and arranged to give an unbroken range of voltages from zero to full rated potential of the primary winding.

When the testing of rubber gloves was first started on a large scale investigations were conducted to determine both the charging and the leakage currents of the gloves under test. It was recognized that the water inside the glove separated from that outside the glove by a rubber wall constituted a condenser, and that the charging current together with the leakage current could be indicated on a milliammeter in the high-tension circuit. The instruments used for these tests included a very delicate pivot-type indicating milliammeter and wattmeter. The wattmeter does not indicate the charging component of current, for the reason that this component is in quadrature with the voltage.

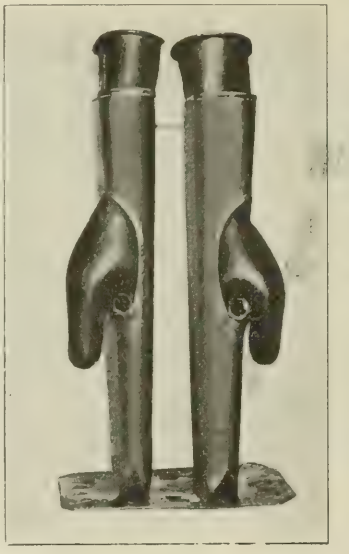


FIG. 2—SPECIALLY CONSTRUCTED COPPER HOLDERS FOR TESTING GLOVES

From tests made on a dozen pairs of gloves the average total milliamperes per pair was found to be 17.13 and the average total leakage per pair only 0.25 milliampere. The average energy leakage of a pair was 2.51 watts. These tests were made at 11,000 volts and with a frequency of 60 cycles. At 25 cycles the total current per glove, including charging and leakage, would be 7.14 milliamperes, and at 133 cycles it would be 37.01

milliamperes. The leakage current would be the same proportion of the total current as with the 60-cycle tests. The leakage currents have been found so negligible that it was decided that any glove which would stand the 10,000-volt test for one minute is a safe one to use. When a glove breaks down under this test a quick-acting circuit breaker in the low-tension circuit of the transformer gives the necessary protection to the equipment.

After a test the water in the gloves is poured back into the open tank. The gloves withstanding the test are placed on the wooden stands shown and allowed to drip, the fan being run to assist the drying. After being thoroughly dried both inside and outside with dry towels and with powdered soapstone shaken in them the gloves are ready for the envelopes, the box and for service. While the periodic tests do not eliminate all defective gloves in service, they do reduce the number to a minimum. The cost per pair per test is about 3 cents and is an expenditure fully warranted.

Meeting the High Price of Coal

How the Electric Service Company at Centerville, Md., Supplemented Its Steam Plant Equipment with a Crude-Oil Engine to Anticipate the Increasing Cost of Coal

BY L. D. SHANK

Manager Centerville (Md.) Electric Light Plant

ABOUT a year ago the writer saw the handwriting on the wall, that is, the increasing cost of coal and the possibility of its going much higher. With this in mind, the situation was studied and various motive powers were considered to take the place of the steam apparatus used. The power plant served both an electric and water system, furnishing electricity for lighting and pumping the water for fire protection. The pumping is done principally with electrically driven pumps, although one large steam pump is used. Being much more economical than the steam pump, the motor-driven pump is employed to do practically all of the pumping, even though the plant is steam-operated.

In the study which was made it became obvious that the only practical way out of the situation would be to use oil instead of coal. However, the price of oil delivered precluded the use of oil burners under the boilers. Therefore it was decided to purchase an oil engine, a 125-kva. direct-connected generator with belt-connected exciter being selected. While arguments have been advanced that four-stroke-cycle engines are more economical in fuel and lubricating oil on light loads, the two-stroke-cycle type was chosen, as it was considered best for small installations and had the additional advantage that it could be started quickly and would emit very little smoke from its exhaust. Among other reasons for selecting the two-stroke-cycle engine are the following: Reliability, fewer parts to get out of order and repair, relatively small attention required, ability to run for a long period without stopping (which does not seem to be possible with the high-compression type), and possibility of employing inexpensive labor without sacrificing economy of operation.

The engine selected is a three-cylinder, vertical, two-stroke-cycle, hot-ball, ignition-type Mietz engine. The cooling water is evaporated into steam in passing through the engine jacket and is allowed to enter the cylinder with the explosive mixture and pass out with the exhaust gases. This process helps to keep the cylinder walls and piston well lubricated, eliminates the necessity of using a large amount of cooling water, prevents reduction in efficiency due to using excess cooling water, and makes tanks and a complex circulating water system unnecessary. Moreover, the cylinder temperature is maintained constant under all load conditions so that the engine can operate at its highest efficiency.

The fuel oil is injected into the cylinders by an injection pump through a simple distributor. The governor acts directly on the injection pump regulating the speed by altering the amount of fuel used. Regulation as good as is usually secured with the best steam engine is being obtained. Unlike the steam-engine-driven generator which the oil-engine set replaces, the latter can be paralleled with the other steam equipment readily, and operated in multiple indefinitely. By retaining one complete steam set it is now possible to operate with either steam or oil and give twenty-four hours' service.

In supplementing the steam equipment with oil-engine apparatus several problems arose. Probably the most important one was how to maintain continuous service should the engine stop suddenly, it not being desirable to bank fires under the boilers. This difficulty was overcome by water-jacketing the exhaust pipes from the oil engine and circulating the water through one of the 125-hp. boilers. In order to do this the exhaust pipe from each cylinder was extended 8 ft. (2.4 m.) and a larger-sized pipe slipped over it and secured concentrically therewith by packing glands at each end. The arrangement employed is shown in an accompanying illustration.

With this provision it is possible to maintain the water in the boiler at or near the boiling point, so that with the firebox filled with wood and oily waste steam can be raised in thirty to forty minutes. This arrangement also eliminates the expenditure ordinarily involved when fuel must be used for banking fires, and the heat ordinarily lost through the engine exhaust is utilized. Furthermore, the water surrounding the exhaust pipe tends to cool and contract the hot gases, thereby reducing the back pressure considerably.

Eliminating smoke and noise from the exhaust was another problem of considerable importance. While a large cast-iron muffler was furnished with the engine and eliminated most of the noise on light load, it became very noticeable on quiet nights when the engine was operated at full load. In order to avoid this difficulty, the engine exhaust was connected with an old brick stack which formerly served two small boilers (one of which

has been taken out), thus requiring the exhaust gases to pass up the stack before expanding completely, and also deadening the noise almost entirely. So that this arrangement would not increase the back pressure an injector was constructed between the muffler and the pipe leading to the stack. This arrangement produced very satisfactory results. Occasionally the soot is al-

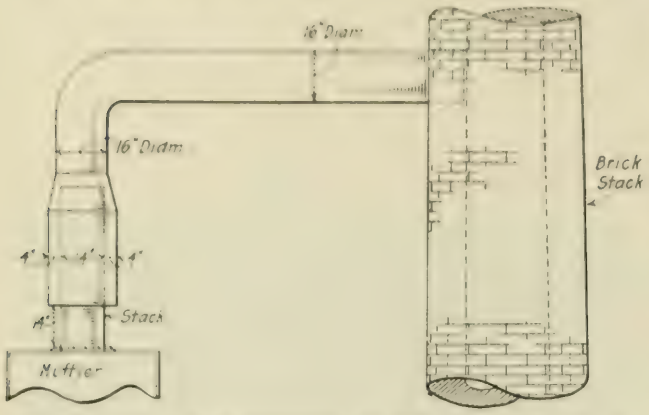


FIG. 1—METHOD OF CONNECTING ENGINE EXHAUST WITH OLD BRICK STACK TO REDUCE NOISE

lowed to burn out even up to the brick stack, a continuous occurrence of this kind being prevented normally by admitting water to the cast-iron muffler.

The oil used in this plant is received by gravity from tank cars through a 2300-ft. (701-m.) pipe. With average temperatures (temperature affecting the viscosity of oil) a car can be unloaded in five hours, the elevation of the railroad above the tanks being 50 ft. (15.2 m.).

The installation has proved entirely satisfactory from every angle. As far as economy is concerned, the saving over steam operation—that is, the saving in coal—is quite an inducement to use the oil engines even when coal is at normal prices. When abnormal prevail, as in the last few months, the saving is enormous. Even if the price demanded for coal could be paid, it would have often been difficult to get a sufficient supply of fuel.

With coal at the average price of $4 a ton, the steam plant burns $20 worth of fuel in twenty-four hours. Added to this expense is the labor cost of employing one fireman at $2 a day. The general upkeep expense is estimated at $200 per year, not including natural wear and depreciation of the plant as a whole. Included in this expense are such items as firebrick, labor, packing, gaskets and various small items.

With the oil-engine set the average upkeep expense is $100 per year. In fact, this is liberal, for it is difficult to foresee where $25 can be spent on upkeep, since no packing is required except for the gaskets, cylinder heads and plates, about the only replacements necessary being for small items such as broken pipe connections or petcocks. The average fuel consumption of the oil engine is 140 gal. (529.9 l.) per day. Thus with oil at 6 cents per gallon delivered, the fuel cost is $8.40 per day, in contrast with $20 per day for coal. Operating with twelve-hour shifts, two men are required in the plant. The long hours may appear to be a hardship on the men, but wakefulness is the main requirement.

The oil engine installed costs more than a corresponding steam engine and generator and about the same as a four-stroke-cycle engine of the high-compression type. The low upkeep expense and the reliability of the engine more than offsets the extra fuel consumed, a two-stroke-cycle engine being somewhat less efficient than a four-stroke-cycle engine.

Extraordinary conditions in the coal market have made this installation a most profitable venture. Instead of saving $14 per day as would have been the case under normal conditions, about $32 per day is saved, this amount being based on figures for five months.

The adoption of oil-engine drive was not prompted alone by the unusual condition in the coal market. By watching conditions and estimating the probable duration of the war it was figured that the railroads would be deluged with work, causing labor to be high and scarce at the mines, and that for several years at least it would be difficult to fill coal bins at any price.

While the installation of this plant has been regarded as radical and reckless by some engineers, and the plant has been watched day and night for the slightest failure that might indicate the fulfillment of prophecies, there has not been a single shutdown. It has been possible to maintain continuous service while other power-plant operators have suffered interruption to operations or are borrowing money to buy coal.

Although the results obtained lead the writer to believe that the Mietz engine direct-connected to a Westinghouse generator is the most reliable set for small stations, it is probable that some other type of prime mover might prove better, because of the fuel saving permitted, if a unit as large as 800 hp. or 1000 hp. had to be installed. The success obtained with this installation indicates that more small plants, either municipal or privately owned, would do well to consider using oil engines for their central stations, even where they do not require them as auxiliaries to large powers. This is particularly true in small plants, which do not have the trained forces of larger ones for studying operating problems. This article was prepared in the hope that

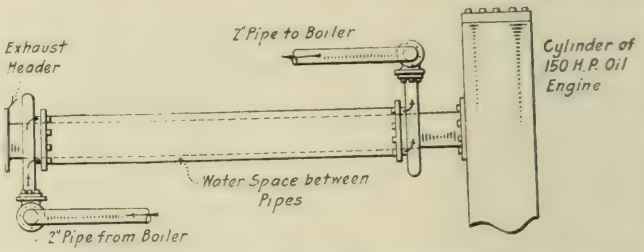


FIG. 2—WATER CIRCULATED AROUND EXHAUST PIPE TO REDUCE BACK PRESSURE AND AVOID NEED TO BANK FURNACES

other operators in small central stations will come forward with their experiences and that a discussion will arise regarding operating problems relating to plants ranging from 100 kw. to 500 kw.

Oil-Immersed Key for Wireless Transmission

Where the primary current for wireless telegraphy is large, difficulty is experienced in operating the transmitter key at high and even at low speed. Frederick G. Creed of Croydon, England, in patent No. 1,218,062, suggests the use of oil-immersed contacts. To this end two mercury cups are provided in the oil chamber for leading in the current. The current is broken by a lever one end of which is immersed in one of the mercury cups while the other makes contact with a rotating disk having an annular boss immersed in the second mercury cup. Thus quenching of the arc is most effectively attained.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

JOINT CONSTRUCTION OF LINE

Transmission Line Built by Arrangement Between Central Station and Hydroelectric Company

The Fitchburg (Mass.) Gas & Electric Light Company and the Connecticut River Transmission Company recently constructed a transmission line under a joint arrangement, each company furnishing its own power to its own customers. The agreement provided that the Fitchburg company should pay all the costs of constructing a 33,000-volt line from Fitchburg to Townsend (except the cost of copper, which the transmission company would supply). On half the cost (including that of right-of-way) the transmission company is to pay the Fitchburg company 15 per cent per year. To avoid the necessity of duplicate investment in copper for the line, it was agreed between the two companies that the transmission company would supply all the power required by the other company for its own customers in Townsend. The Fitchburg company is to return from time to time an equivalent number of kilowatt-hours at the Fitchburg substation of the transmission company plus sufficient kilowatt-hours to compensate for line and transformer losses. The line mentioned is about 8 miles (12.8 km.) long.

ADJUSTING COMPOUNDING

How Shifting the Brushes May Suffice if the Generators Are Not Operated in Parallel

BY E. C. PARHAM

Sometimes where one tap of a series field shunt "compounds" too much and the next tap too little the exact voltage desired under the given load conditions may be obtained by shifting the brushes. If a generator is to be operated alone there is no objection to this method of changing the voltage characteristics, but if the machine is to be operated in parallel with another generator it is better to adjust the compounding by means of the shunt with all brushes on neutral. This is true since if two machines are compounded under different brush positions and shunt conditions the machines will fail to divide the load proportionately when operated in parallel. Under no condition should the brushes be shifted enough to cause serious sparking under either load extreme.

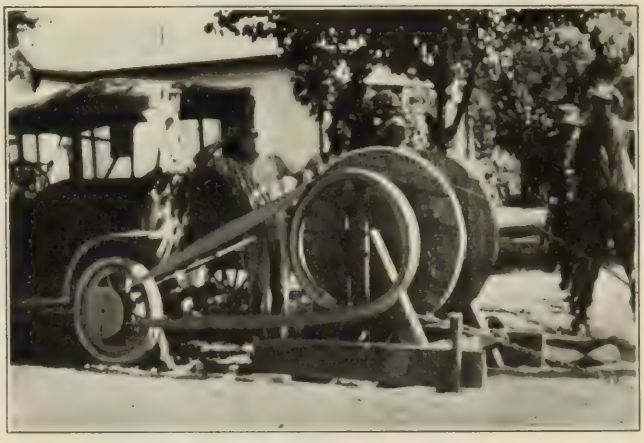
Considerable trouble had been experienced with the commutation of a large multipolar generator that was operated in parallel with a more modern machine. The machines divided the total fairly well, but the brushes of the older machine sparked just enough to prevent the commutator from developing a polish. As the brush holders were old and worn, it was decided to install a more recent type. After applying the new holders the commutation was somewhat improved, but it was noticed that the machines did not divide the load in the same ratio as they had done before the change was made. The situation was not serious, because the total capacity was much greater than the demand at that time. As it was purposed to increase the load later, however, the matter was investigated.

The trouble was found to be due to a difference between the overhang of the new and that of the old holders, the new ones being shorter and thereby shifting the brushes off neutral. On shifting the holders about one and one-half bars forward in the direction of rotation not only was commutation perfected but satisfactory load division was restored.

FORD CAR USED TO REEL WIRE

Rear Wheel of Car Belted to Cable Drum and Arrangements for Removing Coils from Reel

Eight blocks of No. 4/0 copper wire were taken down and reeled with the use of a Ford car by H. W. Cox at McCook, Neb. The arrangement employed is shown herewith. One rear wheel of the automobile was jacked up and supported so the car could not move but so that the elevated wheel would turn. A drum, wide enough to accommodate the belt used, was then attached to the spokes of the wheel and provided on the outer side with a disk to prevent the belt slipping off. To obtain the torque required, a large pulley was fastened on the end of the shaft carrying the cable reel. The axle was supported on A-frames attached to a common base that could be easily transported. This was held in line by stakes driven into the road. Adequate belt tension was secured by driving iron pins into the ground several feet from the cable-reel base and connecting them therewith by chains and turnbuckles. To permit removing the wire after it had been coiled the cable reel was modified as follows: One end was separated from the drum and a loose sleeve fitted over the drum. Thus after the wire is coiled the sleeve can be slid off, the wire easily removed and the reel put in service again.



WIRE REEL DRIVEN FROM AUTOMOBILE WHEEL

DRYING GENERATORS

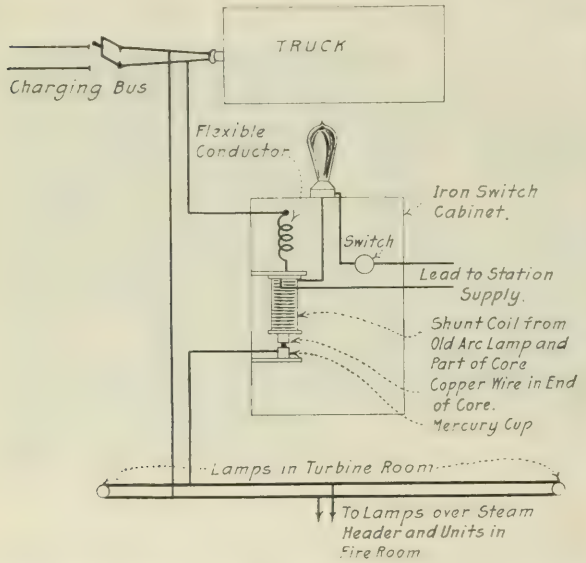
Method of Applying Low Voltage to High-Voltage Windings to Drive Out Moisture in Insulation

Owing to the atmospheric conditions close to the ocean, the generators at the Redondo plant of the Pacific Light & Power Corporation have to be dried out periodically. Since the armature windings are connected in "star" with the neutral grounded the drying-out operation may be performed by connecting two terminals of each generator to one side of a 440-volt circuit and one terminal to the other side. While this arrangement does not give an equal amount of current in each phase winding, it was found to be suitable for the voltage available and provides sufficient heat to keep the windings dry without an excess of current in any one winding. Disconnecting switches are arranged so that it is impossible to connect the generators to the high-tension buses until the dry-out connection is open. The temperature of the windings varies according to atmospheric conditions and ranges between 35 deg. and 46 deg. C. About 500-kw.-hr. per day per generator is required for this purpose. As three 18,000-volt generators are dried out together, the load on each phase of the station auxiliary transformers may be fairly well balanced. This scheme was brought out by Don D. Morgan of the Pacific Light & Power Corporation in a paper recently presented before the Pacific Coast Section of the N. E. L. A.

EMERGENCY STATION LIGHTING

Truck Battery Used as Reserve Energy Source at Night When Vehicle Is Not in Service

The Citizens' Light & Power Company of Adrian, Mich., is using one of its electric trucks as an emergency source of energy for station lighting. The truck,



CIRCUIT ARRANGEMENTS FOR USING ELECTRIC TRUCK TO SUPPLY EMERGENCY LIGHTING

which is of the light delivery type operating on a potential of about 100 volts, is connected to the emergency lighting circuit of the power house each night and disconnected each morning. Otherwise the operation of the emergency system is automatic.

As shown in the accompanying sketch, a pair of leads is tapped into the circuit between the charging-bus switch and the truck plug. One of the conductors extends directly to one side of the station-lighting circuit. The other is passed through a home-made contactor. This latter consists of an old arc-lamp shunt coil which is connected so that it is energized as long as the regular station-lighting supply line is energized. Should service on this circuit be interrupted the coil will be de-energized and its core will drop so that the emergency circuit is closed through a flexible conductor, a copper wire running through the core and a mercury cup beneath. The establishment of this emergency circuit lights two lamps in the turbine room, one lamp over the steam header and one in the fire room.

In commenting on this use of an electric truck H. A. Fee, president of the Adrian company, said: "While we have had no use for emergency lighting during the last two years, it is a great comfort to know that if the supply fails the operators will not have to stumble about in the dark hunting for lanterns."

BALANCED DRAFT FOR EMERGENCY NEEDS

How a Fully Loaded Power Plant Was Enabled to Carry 200 Per Cent Load Without Increasing Its Boiler or Stoker Equipment

BY ALBERT MARTINEAU

The unprecedented demand for certain products which has resulted from the European situation and the accompanying profits have caused the establishment of numerous manufacturing plants in various parts of this country. Some of these have "sprung up over night," so to speak, to be used only under present conditions.

Increase in power-generating facilities was needed recently in a steel plant, and needed quickly. The load was such that an increase in boiler capacity of 25 per cent had to be obtained continuously and 100 per cent occasionally. The plant consisted of six 250-hp. Stirling boilers equipped with chain-grate stokers firing Illinois screenings and washed slack—a bituminous coal high in volatile matter, ash and moisture. Natural draft was used. It was out of the question to await the installation of additional boilers and stokers owing to the delay incident to installing them, and to the inability to obtain immediate delivery. Moreover, this method of obtaining the increased capacity was undesirable since the cost of doing so would be high with the prevailing prices of steel and apparatus.

As a result, the problem was attacked with a view to obtaining the desired increase in capacity with the use of existing apparatus and by improving operating conditions. Since the limitations in output were partly due to scant chimney capacity the first thing to do was to extend this, not by increasing its height or volumetric capacity (operating conditions and the foundation would not permit this), but by reducing the volume of gases it was called upon to handle. With this in view two Orsat testing sets were installed on one of the boilers, one for the gases at the top of the first pass and the other just ahead of the back damper at the top of the last pass. These meters showed that not only was the chimney being greatly overtaxed by excess air due to infiltration from a boiler setting, but also from careless

firing. The test also indicated that, based upon the analysis of the coal combustion, efficiencies were far from what might reasonably be expected—a particularly undesirable condition where increased capacities were desired, apart from the loss resulting from such an uneconomical manner of operating.

As a result of the investigation the settings were repaired, the heating surfaces were cleaned, and a test run was made with the boiler and furnace in charge of the boiler-room force. While the efficiency improved the limitations imposed by the stack still prevented attaining the capacity desired. This had been expected, however, so while one boiler was shut down for overhauling an automatically controlled motor-driven blower was installed, the blower being controlled by a gas-pressure damper regulator which in turn was controlled by pressure of the gases in the furnace. The equipment was like that described in the Sept. 20 and Oct. 19 issues.

Tests were then made with balanced draft, using the same coal as used previously; also with a better grade of coal, it being thought that it might be advisable to use a more expensive coal to obtain the occasionally high rating, namely, 200 per cent. It was found that owing to the absence of air infiltration the CO_2 increased from 6.9 per cent to 11.9 in one case, and to 12.4 in the other. This change, together with the accurate control of the air supply according to the requirements of the fire, reduced the gases handled by the chimney to such an extent that it was found feasible to operate this boiler at 200 per cent of rating with comparative ease, notwithstanding the fact that some of the other boilers were using the chimney, too, with their large quantity of excess air.

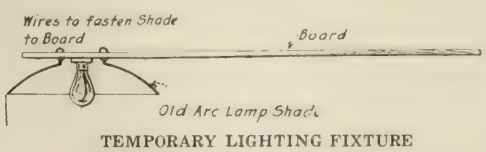
In the present instance, the adoption of balanced draft was so successful in increasing the combustion efficiency, the capacity of the boiler and the capacity of the stack that a similar change is being undertaken under the remaining boilers. This will considerably increase the capacity of the plant, continuously, as well as for carrying peak demands, and will also increase the water evaporation per pound of coal. Installation of economizers is now under consideration, since they will still further increase the over-all efficiency of the plant.

USING OLD ARC-LAMP SHADES

Reflector and Incandescent-Lamp Receptacle Fastened to Board for Temporary Illumination

BY C. B. DEAN

In the accompanying illustration is shown a method of utilizing old arc-lamp shades for temporary flood-lighting. The reflectors were taken from arc lamps



TEMPORARY LIGHTING FIXTURE

that had been discarded, each shade being fastened to a board which was not as wide as the diameter of the reflector. A gas-filled lamp receptacle was also fastened to each board and the leads were left long enough so that they could be tapped on a circuit within reasonable distance. The outfit was fastened to a tree or post. A narrow board was used to permit good ventilation.

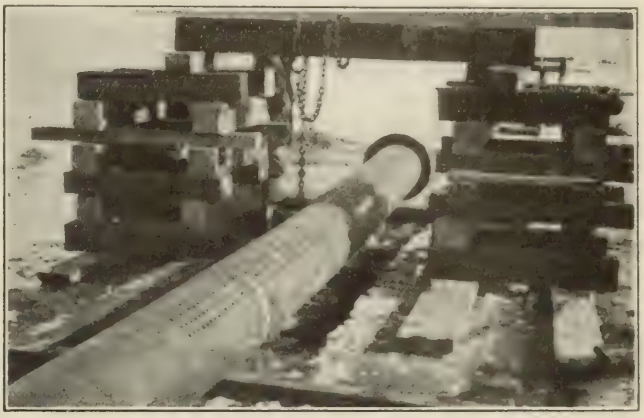
INSTALLING SUCTION LINE

How a Circulating-Water Line Was Constructed and Lowered into a River, with Data on Cost Thereof

BY G. T. SHOEMAKER

United Light & Railways Company, Davenport, Iowa

Delayed delivery of material saved the Muscatine Lighting Company, Muscatine, Iowa, a considerable amount of money in installing an 18-in. (45.7-cm.) circulating-water suction line, which extends 200 ft. (60.9 m.) from the power house to the Mississippi River, and an additional 200 ft. (60.9 m.) out into the river. It was originally intended to have a contractor install the entire pipe line, at a cost of $4,000, the plan being to lower the pipe into the river with the help of boats.



SUCTION PIPE READY TO SUBMERGE

When the material arrived, however, there was 22 in. (55 cm.) of ice on the river, so the operating company decided to do the work itself. Accordingly the pipe was dragged to the desired location and welded together. In order to conform with the government's requirements, it was necessary to place the line several feet below the river bottom. Since there was only 5 ft. to 6 ft. (about 2 m.) of water in the section of the river where the pipe had to be buried, a strip of ice was cut out and the mud bottom scraped with special tools made for the purpose. After the trench was ready the line was moved to a position directly over the trench and supported every 50 ft. (15.2 m.) by bents. To form a sort of strainer at the outer end of the pipe 1600 holes were cut in the upper half of the pipe with a cutting torch. The end of the pipe on shore was then sealed, and by submerging the strainer end it was possible to let the pipe down gradually into the river trench by regulating the flow of air from the upper end of the pipe.

Using men employed by the company, the actual material and labor cost to complete the work, exclusive of pipe cost, was $1,515, a saving of $2,485. This figure includes tunneling under two railroad tracks. Care was taken to obtain accurate expenses, the chief unit costs being $1.05 per cu. yd. ($1.38 per cu. m.) of main ditch excavation, $2.60 per cu. yd. ($3.42 per cu. m.) for tunnel excavation, $2.65 per foot ($8.83 per m.) for timbering in tunnel (47 ft. (14.3 m.) total), and $4.11 per joint for making 18-in. (45.7-cm.) pipe welds. The tunnel was 2 ft. 6 in. (76.2 cm.) deep and 5 ft. (1.5 m.) wide. The pipe was black steel, 5/16 in. (7.9 mm.) thick, and the ends had 22-deg. levels to facilitate welding.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

NECESSITY FOR MATERIALLY INCREASING OFF-PEAK LOAD

Operating Ratio Is Growing, Compelling Central Station Managers to Seek Some Means of Reducing Unit Cost of Production

Cost of rendering service is daily becoming greater and greater, and executives are now faced with what is probably the greatest customer-relation problem ever presented. Certain it is that under the present rates with a load of the present character and with the costs for maintenance, operation and overhead advancing as rapidly as they now are central stations will not be able to lay aside the amounts for various reserves demanded by the state utility commissions and at the same time earn an adequate return on the investment.

A table is here shown giving for 1915 and 1916 the gross operating revenues, operating expenses and operating ratios (ratio of operating expense to operating revenue) for fourteen electric utilities ranging from very large down to medium-sized companies. These are not picked companies but were taken at random and well indicate general conditions.

An analysis of these figures shows that every company received a greater income from operation in 1916 than in 1915, the average for the fourteen being 11.4 per cent. At the same time, owing to the greatly increased price of fuel and to the high cost of labor, the operating expenses of all but the smallest increased in spite of better economies of operation in other directions, the average being 13.3 per cent. True, the net revenue from operation was greater in 1916 than in 1915, but the fact still remains that the relation of the net to the gross operating revenue was less in 1916 than in 1915, in other words that the operating ratio had increased as is shown in the table from an average of 52.2 per cent in 1915 to 53.3 per cent in 1916.

Offhand it would seem that apparently these figures offer no cause for apprehension on the part of utility operators. The net operating revenue is growing, and is that not sufficient? On the bare face of these figures it would of course seem to be so, but behind the scenes, so to speak, there is the matter of investment, depreciation and reserves for contingencies.

Central station investment increased to a considerable extent in 1916—the new load demanded increased generating facilities. This investment, owing to higher prices of materials, was much greater than it would have been in normal times for the same quality and quantity of equipment. To produce the same rate of return on this investment in normal times a much greater net revenue from operation is therefore necessary.

Besides, there must be on this added investment, between now and the time prices come down to the normal basis, a depreciation reserve sufficient to wipe out this loss in value—which is bound to happen—in order to keep the investment always down to the rate-making value of cost to reproduce less natural depreciation. Inasmuch as equipment costs have advanced from 50 to 100 per cent, this additional amount to be deducted from net operating revenue is not insignificant.

A third element is involved, and now that the United States is at war assumes greater proportions, namely, reserves for contingencies. Canadian companies have found these to be very large. Such reserves act, of course, to reduce the amount of net earnings available for dividends.

Nor must it be lost sight of that conditions were much worse during the latter part of 1916 than in the first part. Materials, wages and fuel were considerably higher at the end of the year. In other words, the evil is not abating but is greater than ever before. Had the conditions throughout 1916 been the same as at the end of the year it is extremely doubtful if the net earnings from operation for 1916 would have exceeded those for 1915.

It becomes evident, therefore, that some effort must be made, and that at once, to increase the operating revenue of electric light and power utilities without increasing expenses unduly and without increasing investment charges.

OPERATING RESULTS OF FOURTEEN COMPANIES

	Gross Operating Revenue		Operating Expenses		Operating Ratio, per Cent	
	1916	1915	1916	1915	1916	1915
A	$22,863,000	$20,882,000	$11,908,000	$10,457,000	52.0	50.1
B	16,963,000	14,590,000	8,375,000	6,965,000	49.4	47.8
C	15,160,000	13,472,000	7,731,000	6,798,000	51.0	50.5
D	8,130,000	6,928,000	5,014,000	4,570,000	61.8	66.0
E	8,091,000	7,635,000	5,013,000	4,877,000	62.0	63.9
F	7,201,000	6,952,000	3,604,000	3,411,000	50.1	49.1
G	6,863,000	6,244,000	3,741,000	3,201,000	54.5	51.3
H	4,492,000	3,980,000	2,569,000	2,024,000	57.3	50.9
I	1,810,000	1,770,000	737,000	687,000	40.8	38.9
J	787,000	701,000	507,000	440,000	64.5	62.8
K	714,000	567,000	474,000	362,000	66.5	63.8
L	570,000	499,000	326,000	273,000	57.2	54.8
M	457,000	440,000	270,000	244,000	59.0	56.5
N	425,000	350,000	113,000	117,000	26.6	32.4
Total	$94,526,000	$85,010,000	$50,382,000	$44,426,000	53.3	52.2

Two ways are open—(1) increase rates or (2) make strenuous efforts to increase off-peak load.

To do the first might involve criticism and certainly would mean a commission investigation in those states having commissions with regulatory powers on rates if domestic rates were involved. In the end this might prove very costly in legal fees and in engineering investigation fees. Power rates, on the other hand, are so low that it would probably not be difficult to increase them to keep step with the increasing cost of fuel and labor. In fact, some companies are now making power contracts with provisions that rates shall bear a direct relation to the cost of fuel.

The second method, on the other hand, arouses no animosity, keeps employees hired, and builds up a better and more stable business not only for the present but for the future, first, by increasing the diversity factor and,

second, by leveling out the load curve and thereby cutting down the overhead cost per kilowatt-hour generated.

To let go or cut down a productive sales staff at a time when it can be most useful in building for all time, besides strengthening the resources of the present, is, of course, a dubious policy and hardly in harmony with the great economic principle that business must go on.

The one question, therefore, that remains is, can the central station sales department develop an off-peak load to keep down the cost of energy? This, of course, must be answered by each company individually. There still remains the thought, however, that no city has reached its saturation point for electrical installations. Domestic consumption along the lines of appliances will probably be the most effective method to pursue. This for the reason that the consumption is large and the energy rate high. Next in line are the store appliances involving the use of fractional horsepower motors, and next are probably the small industrial heating appliances for the mechanic. There are many other varied opportunities, but it all simmers down to the one thing—a drive to increase the appliance load.

This is almost entirely an off-peak load, and the only added operating expense that would amount to much would be fuel. The sales expense in a well-directed utility would come out of the profits on appliances.

As a result there would be, (1) increased earnings from appliance profits, (2) increased earnings from operation, (3) a better load curve that would be of value in the future as well as the present, and (4) a reduced cost per kilowatt-hour generated.

POLICY OF LARGE-SCALE APPLIANCE PURCHASING

Successful Experience of One Central Station That Is Buying at Wholesale for Resale at List

In view of the greatly enhanced prices of to-day, central station managers, it is known, are hesitating to lay in large stocks of appliances. Two of the reasons most frequently advanced are that prices may decline, resulting in a loss, and that customers will not pay the price.

Under the present conditions of material shortage, factory congestion and labor shortage it is extremely doubtful if any recession in prices will occur for a long time. As regards the customers' willingness to pay the price the doubt is largely the child of the central station managers' fancy.

Of course the central station manager knows to what extent appliances have advanced—practically doubled in price in many cases—but there is absolutely no good reason for believing that customers realize this. In fact, it is much more reasonable to believe that customers know almost nothing about what electric appliances should cost. To refrain at the present time, when the off-peak load is of greater economic value than ever before, from pushing appliances, on the assumption that customers feel that prices are too high, is, to say the least, a highly inexpedient policy to pursue.

The experience of a central station in what is probably the most conservative section of the United States in buying on a large scale for resale purposes is extremely interesting and should prove of value to central station managers who are undecided on this matter.

The sales manager of this company took a flyer in electric lighting fixtures a few months ago, while on a visit to New York, to the extent of some $10,000, and without asking for an "O. K." from home. When the bills began to appear on the chief executive's desk some question arose as to the wisdom of the purchase, but the sales manager secured a "stay" of sentence. Within six months all the fixtures were sold and the consumers were "hollering for more" in the face of a two-dollar advance for the fixtures at the factory on supplementary orders. The sales manager's judgment was vindicated, and he followed up his advantage by buying 1000 vacuum cleaners and a carload of electric signs, all of which will go to the consumer at list price. Large-scale buying is the business policy of this company when price and market conditions can be correctly "sensed."

SERVICE TO "LESS-THAN-MINIMUM" CONSUMER

Southern California Company Makes Improvement on Former Method for Bringing Monthly Consumption Up to Par

An improvement to the method of calling a customer's attention to the fact that he is using less energy than the minimum bill allows, described on page 516 of the ELECTRICAL WORLD for March 17 last, has been made by the Southern Sierras Power Company. It is a simple sticker in red ink, a reproduction of which is shown herewith.

Additional Service Without Expense

You might have used more energy for the same expense. If interested let our Local Superintendent show you how to secure the best results from our service.

STICKER NOTIFYING CUSTOMER THAT LESS ENERGY THAN IS ALLOWED UNDER MINIMUM BILL WAS USED

INTENSIVE SOLICITATION OF HOUSE-WIRING CONTRACTS

Tendency Noticed to Spend More Time in Signing Up Customers in Effort to Secure Orders for More Outlets

For some years central station business has been developed extensively, the principal idea being to install service. Of late, it has been noticed, there has been accumulating gradually a well-defined feeling that more pains should be taken with individual installations, that campaigning should be more intensive.

It is not enough that a customer have the regulation outlets. Efforts are now being made by many progressive central stations to induce the house owner to have additional outlets for dining-room appliance service, for floor lamps, for vacuum cleaners, washing machines and other appliances. Even though the customer has no appliances and even though he has no im-

mediate desire to purchase any, the fact that the outlets are there will simplify the purchase of these appliances once they are desired.

Among those central stations that are leaning toward this idea of more intensive work in contracting for house wiring is the Public Service Company of Northern Illinois. Speaking before the commercial men of the Illinois State Electric Association, Fred H. Scheel of Joliet said: "I think that two or three years from now a campaign for added outlets will be just as popular as a campaign for old-residence wiring is at the present time. In analyzing ways and means of promoting this work we find that the field naturally divides itself into three distinct units:

"First, the proposed house or the new house under process of construction; second, the house already wired but not provided with appliance outlets; third, the house not yet wired.

"Our method of getting business from the first of these fields is through an educational campaign. In the second field we solicit additional outlets on the same basis on which we now solicit old-house-wiring business. For getting business in the third field a plan has been adopted for making appliance outlets an important part of every job taken either by us or by the contractor. Our slogan throughout the campaign is 'More sockets for more service!'

"In the house not yet wired commissions are paid as follows: The salesman receives a commission on any contract for wiring completed residences or flat buildings which are signed by him. Commission will not be paid on a re-wiring job. The salesman is paid a commission on each contract secured for wiring a completed or flat building, provided the residence or flat building requires only a secondary service wire drop to connect it to the company's lines. These commissions are paid in accordance with the following schedule:

"A. A commission of 50 cents where the contract for wiring only, exclusive of fixtures, is $15 or less than $20.

"B. A commission of 75 cents where the contract for wiring only, exclusive of fixtures, is $20 or less than $30.

"C. A commission of $1.25 where the contract price for the wiring only, exclusive of fixtures, is $30 or less than $60.

"D. A commission of $1.50 where the contract price for wiring only, exclusive of fixtures, is $60 or more.

"Additional commissions are paid as follows:

"A. A commission of 40 cents for the installation of wiring from the floor underneath the dining-room table to a point under the leaves of the table, at which point there shall be installed a receptacle for attaching electrical appliances.

"B. A commission of 20 cents for each baseboard or floor receptacle installed and wired for in dining room, kitchen or basement where usual outlets for lighting are also installed.

"C. A commission of 10 cents for each baseboard or floor receptacle installed at any other location in the house where usual outlets for lighting are also installed."

Contracts are not taken on the company's twenty-four-payment plan where the contract price including wire and fixtures amounts to less than $24. The salesman, in addition to receiving his commissions on contracts signed by himself, receives, at the discretion of the general superintendent, one-half of the commissions on contracts signed by the contractor. It is thought that this plan of paying commissions greatly accelerates the sale of extra outlets.

OPERATING EXPENSES OF ELECTRIC DELIVERY TRUCK

Daily Cost for 2-Ton Truck, $6.92; for 3½-Ton Truck, $7.92, and for 5-Ton Truck, $8.87, in Ice-Cream Delivery Service

At a recent convention of the National Association of Ice Cream Manufacturers, A. L. Parkhurst gave some figures showing what it costs to use electric trucks for ice-cream delivery. The figures shown herewith are for 2-ton, 3½-ton and 5-ton trucks:

	2-Ton Truck	3½-Ton Truck	5-Ton Truck
Repairs and painting	$140.00	$165.00	$180.00
Battery repair and renewal	312.75	347.00	428.88
Tire repair and renewal	212.90	344.61	439.80
Miscellaneous, grease, water, etc.	40.00	50.00	50.00
Garage, at $15 per month	180.00	180.00	180.00
Driver, at $15 per week	780.00	780.00	780.00
Electric energy, at 4 cents per kw.-hr.	316.00	362.00	446.00
Depreciation of chassis, at 10 per cent	185.30	225.00	253.72
Depreciation of body, at 20 per cent	60.00	95.00	100.00
Interest, at 3 per cent	99.00	123.75	143.25
Liability insurance	100.00	100.00	100.00
Fire insurance, at 1 per cent	33.00	41.25	47.75
Total cost, per year	$2,458.95	$2,813.61	$3,149.40
Total cost, per day	$6.92	$7.92	$8.87

FLOODLIGHTING AN ART MUSEUM WINDOW

Five-Hundred Watt Unit Used to Bring Out Full Beauty of Costly Window at Worcester, Mass. Designed by Lafarge

An unusual application of floodlighting was recently made at the Worcester (Mass.) Art Museum by the Worcester Electric Light Company. At the rear of the building is a stained-glass window, 20 in. by 40 in. (50.8 cm. by 101.6 cm.) in dimensions, designed by John Lafarge of New York. The figure is that of a peacock in full high colors, the deepest and darkest of colors being on the neck and head. The window is composed of three layers of heavy glass. The first layer consists of eight pieces leaded together, the second layer is composed of a larger number of pieces fused together, and the third layer consists of a very heavy piece of ground glass binding the three layers together.

To see the window in its full beauty it was necessary to have a bright, sunny day; on dark days and at night it was obscure. To overcome this difficulty, a 500-watt gas-filled lamp with a floodlight projector was mounted on the outside of the building about 15 ft. (4.6 m.) from the wall and placed in such a way as to throw the direct rays on the window. The lamp was supplied by a circuit of No. 14 wire run from a panelboard in the basement. The cost of the installation was about $100. The problem of properly lighting this window had been several times considered by electrical interests in Worcester, but until the application of floodlighting was made it had not been solved. The window is said to be the most expensive one for its size in the United States, having cost about $7,000.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

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SWITCHBOARD MEANT FOR ELECTRIC-FURNACE WORK

A Description of an Inexpensive Switchboard Giving Great Flexibility in the Operation of Small Electric Furnaces

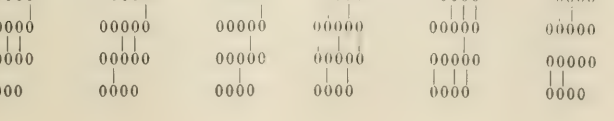
AT THE meeting of the American Electrochemical Society held in Detroit from May 2 to 5 a paper was presented describing a rather simple switchboard for experimental electric-furnace work, the author being W. L. Badger of the University of Michigan.

The transformer is rated at 10 kva. and is built for 230 volts on the high-tension side. The high-tension winding has five taps, so that low-tension voltages of 10 per cent above nominal, 5 per cent above nominal, 5 per cent below and 10 per cent below may be obtained. On the low-tension side are two 10-volt coils and two 20-volt coils.

A diagrammatic sketch of the wiring is shown in Fig. 1. The supply line is connected to a double-pole circuit-breaker at the top of the board. This is provided with both overload and shunt-release coils. From the breaker the current passes to the double-pole double-throw switch *I*, which connects the 220 volts either to the busbars direct or to the high-tension side of the transformer through the three single-pole, double-throw switches *E*, *F*, and *G*. The five taps of the high-tension winding are connected to these as shown by the numerals. The connections are as follows:

Switches			Voltages Generated in Low-Tension Coils
E	F	G	
Down	Down	Down	10 per cent above nominal
Down	Up	Down	5 per cent above nominal
Up	....	Down	Nominal
Down	Up	Up	5 per cent below nominal
Up	....	Up	10 per cent below nominal

The connections of the low-tension coils are made by means of the four rows of knife-blade fuse clips shown at the right side of the board. The four upper clips are connected by a busbar, as are also the four lower ones. The low-tension coils are connected diagonally across the two middle rows as indicated. The extreme left clip of the second row and the extreme right clip of the third row are to form a bridge in making the 30-volt connection. Connections are made by short copper bars with suitable handles, which can be plugged into any pair of clips in a vertical line. By this means any combination of series, parallel or series-parallel connections can be made, giving low-tension voltages of 60, 50, 40, 30, 20 or 10 volts at ratings of 100, 83, 67, 100, 100 and 33 per cent respectively. The connections are shown below:



With any one of these arrangements the voltage may be varied through five smaller steps by means of the switches *E*, *F* and *G*, as shown above. The result is a very flexible arrangement, particularly suitable for granular carbon resistance furnaces where there is a wide range of resistance as temperature changes. The

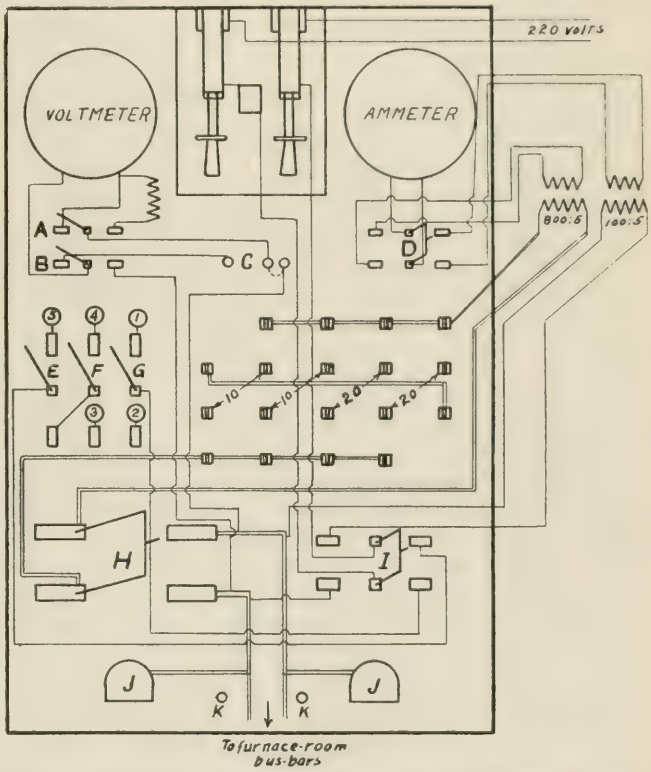


FIG. 1—WIRING OF SIMPLE SWITCHBOARD FOR EXPERIMENTAL ELECTRIC-FURNACE WORK

actual voltages delivered when no current is being used are as follows:

64.5	53.5	43.0	32.5	21.5	12.0
61.5	51.0	41.0	31.0	20.5	11.5
59.0	49.0	39.0	30.0	20.0	11.0
56.0	46.5	37.0	28.5	19.0	10.5
53.5	44.5	35.5	27.5	18.0	10.0

From the low-tension connections the current passes through the ammeter transformer and then to the furnace-room busbars. A pair of terminals *J* is added so that current may be taken directly from the board. The voltmeter is so connected that it can be used to read the voltage on the busbars or the voltage across the binding posts *C*. By this latter arrangement it is possible to take the voltage drop across any part of the furnace. At the bottom of the board is a pair of binding posts *K* to which the shunt coil of the circuit breaker is attached. By means of a 220-volt push button the breakers may thus be tripped by the person working at the furnace.

Since the busbars may carry both 220 volts and the low-voltage current, both ammeter and voltmeter have

double scales. The voltmeter reads 0 to 75 or 0 to 350 volts, the change being made by the switch A. The low-tension circuit includes an 800 to 5 transformer, and the high-tension circuit a 100 to 5 transformer. Some suggestions of possible improvements are added.

Generators, Motors and Transformers

Torque and Slip of the Induction Motor.—M. Kloss.—Neglecting in Fig. 2 the stator resistance, it is shown that $M/M_m = 2S(S_m + S_m S)$, where M = torque at

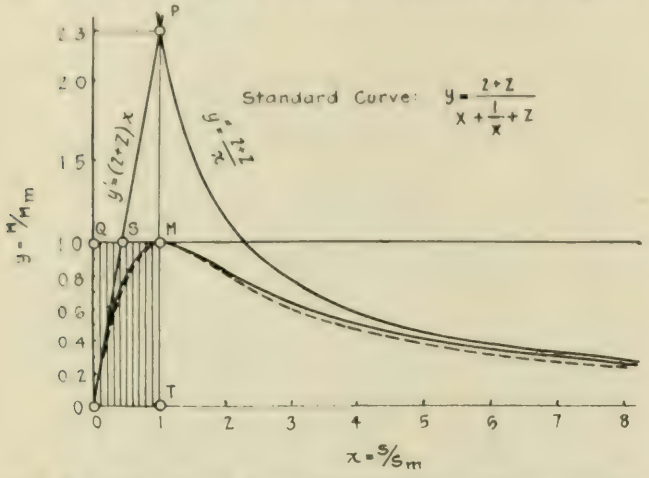


FIG. 2—CURVE GIVING RELATION BETWEEN TORQUE AND SLIP

slip S, and M_m and S_m are the torque and slip when the torque is a maximum. This equation is of the form $y = 2/(x + 1/x)$, and is the same for all motors; the curve can be drawn once for all. If the starting moment be M_1, then $M_1/M_m = 2/(S_m + 1/S_m)$, and this equation can be represented by the same curve if the abscissæ are taken to represent $1/S_m$ and the ordinates M_1/M_m. With the aid of this curve the relations between torque and slip can be immediately determined for any motor for which M_m and S_m are known. The geometrical properties of the curve are very fully discussed. The value of S_m is shown to be $R_2 I_{2d}/E_{2\cdot0}$, where $E_{2\cdot0}$ = rotor emf. per phase with circuits open and machine stationary, R_2 = resistance per phase of rotor winding, I_{2d} = ideal short-circuit current in rotor winding (corresponding to the diameter of the current circle). In order to obtain the maximum torque at starting, $S_m = 1$, and $R_2 = E_{2\cdot0}/I_{2d}$. The relation between normal full-load torque M_n and the maximum torque is determined from the point of view of overload capacity; suppose the required overload capacity be p, and that an allowance of 15 per cent be made for safety, $M_n = 0.85M_m/p$, and it follows that $M_1/M_m = 2.35p/(S_m + 1/S_m)$. The ratio between the starting torque and full-load torque can thus be found from the value of S_m for any given value of the overload capacity p. A series of curves connecting these quantities is given in the original. The influence of the resistance of the stator windings is next considered; it is shown that the formula $S_m = R_2 I_{2d}/E_{2\cdot0}$ is applicable to this case as well as to the previous one, and that $M/M_m = (2 + z)/(S/S_m + S_m/S + z)$, where $z = 2I_{1d}r_1/E_1$, I_{1d} being the diameter of the current circle measured to the scale of the primary current, r_1 the resistance of the stator winding per phase, and E_1 the applied emf. per phase. For motors with a pole pitch of about 10 cm. or 15 cm. the value of z is about 0.30; for those with a pole pitch of 20 cm., $z = 0.15$. For smaller values of z the curve connecting M M_m with S/S_m is indistinguishable from that obtained by neglecting the stator resistance, and when the latter is employed in determining the starting torque the error is on the side of safety. In the illustration the full-line curve passing through M is drawn for $z = 0.30$, while the dotted curve applies for $z = 0$; *i.e.*, for no stator resistance. The maximum torque is given by $M_m = 0.973P_m/n$ in kg. m., where n_1 = synchronous speed of motor in r.p.m. and $P_m = 3E_1 I_{1d}(2 + z)$.—From *Archiv. f. Elektrot.*, Vol. V, page 59, 1916, abstracted in *Science Abstracts*, Section B, Feb. 26, 1917.

Lamps and Lighting

Arcs Under Pressure.—W. Mathiesen.—Investigations carried out by O. Lummer on the melting of carbon and the production of the temperature of the sun showed that the brilliance of the positive crater of an arc increases with the pressure of the surrounding air. This has led to the expectation that arc lamps might be improved by the use of compressed air. The present tests were made in the laboratories of Körting and Mathiesen with the object of developing an improved commercial lamp, with the result that the conclusion has been drawn that the use of compressed air shows no promise of being usefully applicable to arc lamps in the present state of technical knowledge. The tests were made at a constant current of 10 amp. with various types of carbons of diameter 10 mm. for the positive and 9 mm. for the negative. In one series of experiments the arc had inclined carbons, with the positive horizontal, that could be viewed from two different directions through openings in the containing vessel. These openings were used for photometric measurements and also to project images of the arc on a screen, so as to study the length and form of the arc and the shape of the carbon tips. A large number of pictures of the arc under varying conditions are reproduced in the article. The air pressure was varied from 3.4 atmospheres vacuum to 5 atmospheres compression. It was found that the arc becomes unstable and shrinks in dimensions at the higher air pressures and that its length is shortened at constant voltage. If the arc is

AIR-PRESSURE TESTS WITH VARIOUS TYPES OF CARBON

	Atmospheres		Cp. at 45 Deg. to Axis of Positive Carbon					
			0	1	2	3	4	5
Noris cored (pos.)	Inclined	Volts	68–70	68–70	73	72–75	75	75–80
Noris solid (neg.)	carbons	Cp.	2170	2600	2930	3200	3100	2820
10 mm. and 9 mm.	10 amp.	Watts/Cp.	0.318	0.265	0.250	0.230	0.242	0.274
Excello 104 (pos.)	Inclined	Volts	35	40	45	50	55	60
Noris solid (neg.)	carbons	Cp.	1400	2100	2720	3420	4300	4600
10 mm. and 9 mm.	10 amp.	Watts/Cp.	0.26	0.19	0.166	0.146	0.128	0.130
			Mean Hemispherical Cp.					
Noris solid (pos.)	Vertical	Watt	698	692	692	710	710	720
Solid with graphite (neg.)	carbons	Cp.	960	1000	1000	1040	975	760
12 mm. and 10 mm.	11 amp. 65 volts	Watts/Cp.	0.725	0.692	0.692	0.680	0.728	0.945

to be maintained of approximately constant length, increased voltage has to be applied with increased air pressure. When Excello cored carbons (fluoride of calcium) were used as positives it was found that with inclined carbons and increased air pressure the positive carbon tended to form a wedge-shaped projection over the negative carbon so as to cut off the light given out

by the crater. This could be removed by increasing the arc voltage. On one series given the voltage was increased from 30 volts at 0 atmosphere to 60 volts at 5 atmospheres with the arc length approximately constant. Regarding the instability of the arc it appears that while it is possible to work up to 5 atmospheres with vertical carbons, the arc becomes too erratic for useful purposes at 1 atmosphere when the carbons are inclined. The consumption of carbon increases with the air pressure, being nearly doubled when the pressure is raised from 0 atmosphere to 5 atmospheres. Photometric tests are given for many series of tests with various types of carbons. Those shown in the table are typical.—*Elek. Zeit.*, Oct. 12 and 19, 1916; abstracted in *Science Abstracts*, Section B, Feb. 26, 1917.

Traction

Inductive Field Shunts for Railway Motors.—L. ADLER.—In the early days of electric traction the weakening of the field of motors was recognized as a method of reducing the current consumption and heating of the motors. The use of this principle was abandoned owing to the fact that flashing-over resulted. Its adoption was again tried with the advent of motors with commutating poles, but although the motors were well able to carry the full steady load, flashing-over and severe sparking at the brushes occurred if the armature current was momentarily interrupted, as is common when the current is taken through a sliding contact. This was due to the fact that the series fields of the motors were shunted by non-inductive resistances, which caused abnormal current rushes to occur on account of the magnetic inertia of the polar windings. Improvement was effected by strengthening the springs of the sliding contacts and increasing the number of contacts. It was found that the trouble was marked if the time of interruption of the current exceeded one-third second and that flashing over took place with 50 per cent weakening of the field if the interruption was of the order of one to one and one-half seconds. If the field of the motors was reduced by shunting to 85 to 90 per cent of its full value, no trouble was experienced at the brushes due to the shunting. One method of preventing the above ill effects is to install relays that cut off the shunts when the armature current is broken, so that when the circuit is re-established the motors have their full fields. This method is efficient on current interruption, but does not give the required result when short circuits occur in the network. It involves the use of somewhat delicate apparatus on the vehicle. A second method that is applicable is to weaken the fields of the motors by subdividing their field windings and bringing out tappings. The method that is now advocated is the provision of inductive shunts instead of non-inductive shunts. The self-induction of the shunts should be somewhat greater than that of the field coils to which they are connected in parallel. If the field current is to be reduced to less than 60 per cent of its full value, the shunting should be effected in two steps to avoid serious rushes of current in the armature. In this case the first step, which is not used for steady running, connects across the field a shunt containing a non-inductive resistance in series with an inductive resistance, and the second step is obtained from the first by short-circuiting the non-inductive resistance. Illustrations are given of shunts of this type built by a German company and used with success on a large number of railways.—From *Elek. Zeit.*, Nov. 30, 1916; abstracted in *Science Abstracts*, Section B, March 31, 1917.

Installations, Systems and Appliances

Heating of Plant and Transmission Lines by Short Circuits.—L. BINDER.—In large generating stations and distributing networks it is customary to adjust the circuit breakers so that on a short circuit the current is not interrupted until after one to ten seconds. On this account the fear has been expressed that the plant and line may be exposed to excessive heating or mechanical strains. As oscillograms have shown that the maximum forces come into play with extreme suddenness, it is not possible to protect the apparatus by circuit breakers against strains arising from this cause. In the present article the heating effects are calculated, and it is shown that in general no overheating of the generators, transformers and line will take place even in the extreme case of the circuit being interrupted after as long as ten seconds. The coils of current transformers and circuit breakers are endangered most, and it is recommended that for these parts the ratio of the greatest possible effective short-circuit current to the rated current should be not greater than $65/\sqrt{t}$ for these parts, which t seconds is the duration of the short circuit. The ratio of the effective short-circuit current to the permanent value of the short-circuit current may be taken as averaging 1.3 for short circuits of ten seconds' duration, and this would give a value $50/\sqrt{t}$ for the above ratio in terms of the permanent short-circuit current. The calculations are extended to the case of electrical apparatus and lines made of "substitute" metals such as aluminum, zinc and iron, and it is found that notwithstanding the higher resistivity of these metals compared to that of copper, the heating effects are generally smaller.—From *Elek. Zeit.*, Nov. 2 and 9, 1916; abstracted in *Science Abstracts*, Section B, Feb. 26, 1917.

Wires, Wiring and Conduits

Insulating Material.—A note on a German-made insulating material, called "galalith," which resembles horn and celluloid and consists essentially of casein and formaldehyde. Galalith is prepared by heating skimmed milk with caustic alkali; from the clarified solution the casein is precipitated by means of acid and filtered. The water is removed by compression and by drying; the latter process has to be very slow and takes several weeks. The resulting dry casein plates are saturated with formaldehyde and dried again. The final product is of a yellow-white color and translucent and makes an excellent insulator, which may be shaped cold after having been softened by the aid of hot water. It has no odor and is less inflammable than celluloid, but it is not quite transparent and cannot be prepared in the thin films in which celluloid is utilized. The specific gravity is about 1.32, and the hardness 2.5 on the Mohr scale. —London *Electrician*, April 6, 1917.

Miscellaneous

Depreciation of Plant.—F. GILL and W. W. COOK.—Their full paper read before the (British) Institution of Electrical Engineers on principles involved in computing the depreciation of plant. A full account is also given of the discussion which followed the presentation of the paper in London as well as in other local sections.—*Journal Inst. of Elec. Engineers*, February, 1917.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

CONTROL OF OMAHA COMPANY PASSES TO NEW INTERESTS

American Power & Light Company and Local Omaha Capitalists Acquire All of the Outstanding Common Stock

The American Power & Light Company and local interests at Omaha, Neb., have acquired all of the common stock of the Omaha Electric Light & Power Company.

Combined gross earnings of the Omaha Electric Light & Power Company and its subsidiary for the twelve months ended March 31, 1917, were $1,851,161. Operating expenses were $1,100,245, and net earnings $750,916.

PROGRESS ON LOS ANGELES AQUEDUCT POWER SYSTEM

Total of 37,500 Hp. Available for City Distribution, Contracts Being Signed for New Business, and Substations Under Way

Pending final completion of the plan for purchasing distributing systems of the Southern California Edison Company and the Pacific Light & Power Corporation, as outlined in the ELECTRICAL WORLD of April 28, the city of Los Angeles is finishing the construction of its system for generating and distributing energy.

On April 10 current was delivered at the central substation at Holly and St. John Streets, Los Angeles, over the 100,000-volt line from the generating plant in San Francisquito Canyon. This plant, which is connected with the city by 44 miles of transmission line, is now fully equipped and able to deliver the full rating of 37,500 hp. as soon as there is demand for this quantity. Final work on the transmission line has been rushed during the last few months, a great portion of it having been done between Jan. 15 and March 15.

In addition to the central receiving substation, three distributing substations within the city limits are under way or contemplated. The Garvanza substation, in the northern part of the city, is now operating, being fed by two duplicate 33,000-volt lines from the central receiving substation. The total transformer capacity at this plant is 1800 kw., the secondary system fed from this point being 2200 volts, three-phase, three-wire.

A substation at Slauson Avenue and Figueroa Street, to have an ultimate capacity of 3600 kw., stepping down from 33,000 volts to 2200 volts, is under construction. This is expected to be ready about July 1, to supply the 12,000 consumers in the district, one-half of whom have signed up for municipal service. This district is now served exclusively by the Los Angeles Gas & Electric Corporation, which is not considering the transfer of its rights to the city. The city is therefore planning to parallel the distribution system of that company in this district. The 900 street lights that would logically be served from a station at this point are being supplied by the Los Angeles Gas & Electric Corporation on a contract which can be terminated on thirty days' notice, and this business will of course be assumed by the city as soon as the substation is ready for service. About 700 new lights will then be installed.

The distributing lines of the municipal system have been laid out with the idea of placing other substations in the San Pedro and Wilmington district and in Hollywood, these points being centers of consumption within the city limits. The lines have been built to these two points, but construction on the substations is not yet under way.

As the ELECTRICAL WORLD goes to press the city and representatives of the power companies have agreed on terms of a contract for purchase of the two distribution systems and have executed a working agreement which provides for distribution of the city's power over the companies' lines for two months or pending the results of a bond election to be held on June 5, when the people will be asked to authorize $12,000,000 bonds for consummating the purchase plans and for further power development.

This working agreement became effective May 1. The city, however, will continue to maintain its own forces to manage the business, which will be increased materially by entry of the Los Angeles Gas & Electric Corporation. Under the two contracts the lines of the two companies which it is proposed to purchase are not to be paralleled.

LOS ANGELES MUNICIPAL SYSTEM APPLICATION FILED WITH COMMISSION

The city of Los Angeles, the Southern California Edison Company and the Pacific Light & Power Corporation have filed with the California Railroad Commission a joint application for determination by the commission of its jurisdiction over an agreement for the sale of electrical energy by the city to these companies, an approval of this agreement if the commission holds that it has such jurisdiction, and pending this determination an order by the commission authorizing the petitioners to carry out the contract made by the three parties.

The agreement that the city and electric companies want approved is the result of long negotiations for the purchase of distribution systems in Los Angeles of the two companies by the city and for a temporary operating agreement. The temporary contract will permit the issue and sale of the city's electric energy until after the election of June 5, when, if the systems are bought, the city will distribute its own electricity. The details of the temporary agreement were announced in the ELECTRICAL WORLD for April 28, page 816.

If the twelve-million-dollar power-bond issue is not carried the city may extend the contract beyond July 1 upon ten days' notice to the companies, and will have the right to cancel the extension of the contract, which calls for two years' operation, upon three months' notice. The right to cancel the contract is available to the city

upon the initiative or by two-thirds vote of the City Council of Los Angeles, after the Public Service Commission of Los Angeles has voted to do so. The fact is that the companies have already connected their distributing systems with the Los Angeles power lines in anticipation of approval by the Railroad Commission following the signing of the contract by the companies and the city.

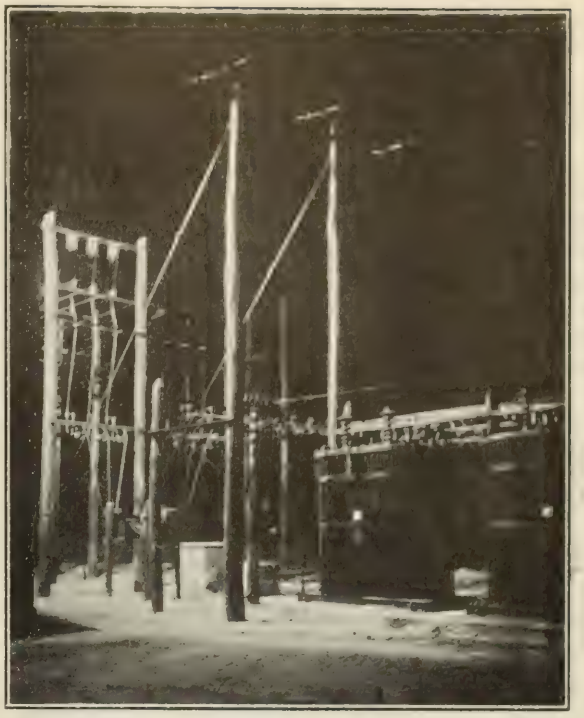
STRONG POLICE POWER OF FLOODLIGHTING

Value of Electric Illumination as Protection for Coal Piles and Other Property of Central Station Companies

In the comparatively short space of time since war was declared against the German government much has been done in all parts of the country to protect plants by the use of floodlighting at night. Fortunately the commercial progress and technical development of floodlighting enabled its instant utilization in this necessary safeguard.

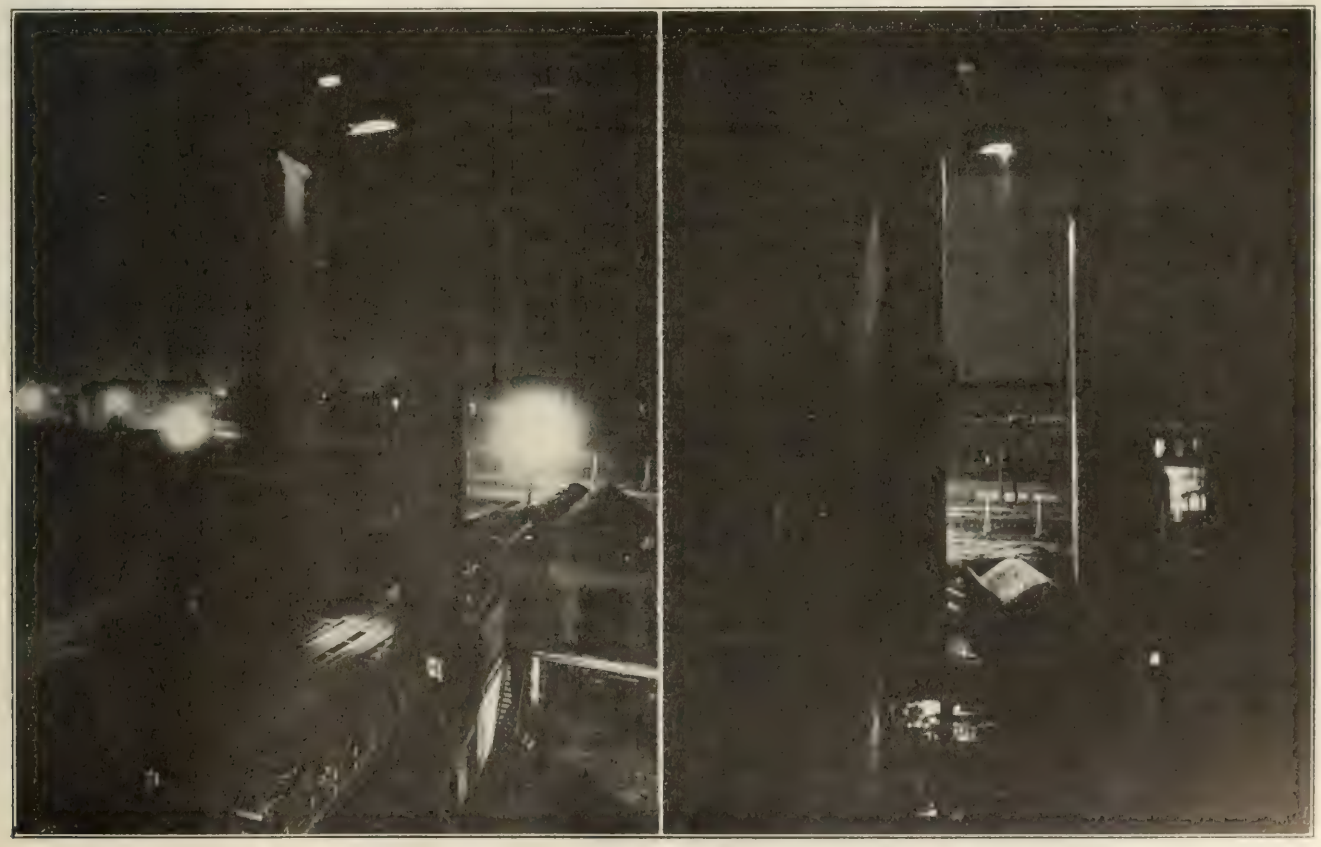
Central station companies operating by steam power and hydroelectric properties turned promptly to flood lamps as providing a valuable supplement to their policing plans. Industrial establishments of every character are installing flood lamps in large quantities. Whether they employ large or small forces of employees, manufacturing companies have learned that such illumination is a powerful moral deterrent against possible disorder or sabotage.

Thus the old lesson of "the police power of light" is being put to new use to guard plants. It does not require much argument to convince the owner of a factory that, aside from the moral suasion wielded by strong light, there is economy in the use of a medium which reduces the number of men for guarding a plant after dark and at the same time makes their work more thorough and the results surer.



OUTDOOR SUBSTATION FLOODLIGHTED

One of the greatest advantages of floodlight can be obtained by its use on the coal piles of a central station company. Depleted though such piles have been by the abnormal coal situation, they represent greater value per ton, as coal remains high and the companies are making every effort to build up adequate reserves.



PROTECTING COAL-CONVEYING SYSTEM AND STORAGE YARDS OF CENTRAL STATION BY LIGHTING AT NIGHT

FLOODLIGHTING PROTECTS A PLANT ON RIVER FRONT

"Somewhere in New England" Flood Lamps Are Used to Light the Entire River Wall and the Adjacent Waters

An important steam-turbine plant supplying a large number of power and lighting customers and also an electric railway "somewhere in New England" is protected at various points by well-placed flood lamps. Several are mounted on brackets on the side of the station building bordering a river navigable to small craft. The management decided to take no chances on the approach of hostile parties by water, and the lamps flood the entire river wall of the station and the adjacent waters most satisfactorily. A 500-watt unit is employed in the case illustrated. It throws a spreading sheaf of light rays along the wall in the form of a luminous curtain parallel with the brickwork.



METHOD OF FLOODLIGHTING A NEW ENGLAND RIVER-BANK PLANT

BUSINESS OF UNITED GAS IMPROVEMENT COMPANY

More Electrical Properties Acquired—Electrical Energy Sales Gain 20.61 Per Cent—Analysis of Assets and Liabilities

Samuel T. Bodine, president United Gas Improvement Company, says in the annual report to shareholders for 1916 that the company has arranged recently to purchase certain electric power properties in order to increase its business.

In the properties outside of Philadelphia in which the company is interested sales of manufactured gas increased, in comparison with 1915, 5.83 per cent, of electrical energy 20.61 per cent, and of natural gas 13.83 per cent. Net profits were $7,269,331, or 13.1 per cent on the stock or 8 per cent upon "the capital actually employed and invested in the business, which includes the undivided profits."

The directors are of the opinion that the company is now established on such a firm foundation that, when annual earnings and general business conditions permit, it is safe to adopt the policy of distributing in extra dividends a larger proportion of the earnings than heretofore.

As the company books and reports state assets at cost price, frequent inquiries are made as to whether this represents actual value. Therefore an analysis of assets and liabilities, as a going concern as of Dec. 31, 1916, has been made by officers of the company. The president and directors feel that a fair liquidating value of the stock should be not less than $100 per share.

CLEVELAND COMPANY RAISES POWER RATES 20 PER CENT

Result of Increased Cost of Coal and Other Materials —Earnings of Holding Company Show the Reasons Clearly

Beginning May 1, the Cleveland Electric Illuminating Company made an increase of 20 per cent in its schedule for large consumers who have very low rates. The necessity for this lies in the increased cost of coal and other materials. The new rates have been approved by the Ohio Public Utilities Commission. Light rates remain unchanged.

The reason for this action is apparent in the following statement of the Central States Electric Corporation, which controls the Cleveland Electric Illuminating Company:

EARNINGS AND EXPENSES OF HOLDING COMPANY

	1917	1916	Increase
For month of March:			
Gross earnings	*$548,145	*$442,108	$106,037
Expenses and taxes	†443,951	233,042	210,909
Net income	$104,193	$209,066	‡$104,873
Interest charges, etc.	49,216	36,634	12,582
	$54,977	$172,431	‡$117,454
Depreciation	54,815	44,211	10,604
Applicable to common dividends	$162	$128,220	‡$128,058
Three months ended March 31:			
Gross earnings	*$1,715,801	*$1,348,017	$367,783
Expenses and taxes	1,322,433	669,807	652,626
Net income	$393,367	$678,209	‡$284,842
Interest charges, etc.	141,114	109,604	31,510
	$252,252	$568,605	‡$316,352
Depreciation	171,624	134,802	36,821
Applicable to common dividends	$80,628	$433,802	‡$353,174
Twelve months ended March 31:			
Gross earnings	$5,477,521	$4,535,591	$941,029
Expenses and taxes	3,635,679	2,418,419	1,217,259
Net income	$1,841,841	$2,117,171	‡$275,329
Interest charges, etc.	495,612	428,510	67,102
	$1,346,229	$1,638,661	‡$342,431
Depreciation	547,795	553,559	‡5,754
Applicable to common dividends	$798,434	$1,135,102	‡$336,857

*Earnings subsequent to April 25, 1914, are subject to adjustment after decision in pending rate proceeding.
†The extra cost of coal in March due to higher prices per ton is included, and amounts to $168,000.
‡Decrease.

The Cleveland Illuminating Company has so far oversold its plant capacity that all new-business endeavor has been abandoned, thirty-two men on the commercial force having been discharged. Those desiring service are compelled to apply to the company's office in person, and where the service requires an extension it is granted only upon the payment by the customer of all costs. Power contracts of 400, 1000 and 3000 kw. have been summarily rejected or indefinitely postponed because of the company's inability to handle the business.

WAR TAX FOR ELECTRICITY USED FOR DOMESTIC PURPOSES

Committee on Ways and Means of House of Representatives Proposes Levy—Bill Goes to Senate Committee

The committee on ways and means of the House of Representatives, in its proposed war tax bill, includes a section which, if enacted into law, will bear heavily upon electric central station service for domestic uses. Electric and telephone service under the bill would be taxed as follows:

"A tax equivalent to 5 per cent of the amount paid for electric power for domestic uses and of the amount paid for light or heat, and a tax equivalent to 5 per cent of the amount paid for telephone service by subscribers, exclusive of the amounts paid for toll or long-distance calls;

"Provided that any expense incurred by any person, corporation, partnership or association in furnishing such services or facilities for its own use shall not be subject to this tax."

No hearings were held by the House committee. The bill now goes to the finance committee of the Senate, which will hold open hearings.

"BETTER BUSINESS" AS SLOGAN OF ASSOCIATED MANUFACTURERS

President Sheppard Calls for United Action Along the Lines of Howard E. Coffin's Practically Patriotic Appeal

R. K. Sheppard, president of the Associated Manufacturers of Electrical Supplies, has issued the following letter, addressed to the members of the association:

BETTER BUSINESS—CALMNESS VERSUS HYSTERIA IN OUR MANUFACTURING COMMUNITIES

The article which Mr. Howard E. Coffin, a member of the Advisory Commission of the Council of National Defense, allowed to be published over his signature on April 19 last is so very timely and pertinent that I am sending to you this special request concerning it.

I believe that all manufacturers in our association ought to consider carefully and heed Mr. Coffin's admonitions. That none of our members may overlook his admirable article I am sending to you with this letter a copy of it. Even though you may have already seen it, I ask you to read it again.

In furtherance of practical patriotism, so necessary at this time, will you please pass on to your colleagues and to your business friends the excellent slogan:

"BETTER BUSINESS,"

which has been suggested by Mr. Robert McKean Thomas, president of the Thomas & Betts Company, New York City, for our association watchword?

SECTION AND GOVERNORS' MEETINGS

At the meeting of the wire and cable section of the Associated Manufacturers of Electrical Supplies held on April 17 at the Yale Club, New York City, the following officers were re-elected for this year: LeRoy Clark, chairman, Safety Insulated Wire & Cable Company, New York; J. Nelson Shreve, secretary, Electric Cable Company, Bridgeport, Conn.; Edward F. Sawyer, treasurer, Atlantic Insulated Wire & Cable Company, New York.

The board of governors of the Associated Manufacturers will meet on Wednesday, May 16, at the new offices of the association, 30 East Forty-second Street, New York City.

The line material section of the Associated Manufacturers met on May 4 at the association offices, New York City. The following officers were elected for the ensuing year: W. R. Williams, chairman, General Electric Company, Schenectady, N. Y.; H. L. Garbutt, secretary, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.; R. C. Buell, treasurer, Johns-Pratt Company, Hartford, Conn.

The rigid conduit committee of the interior conduit section met on April 30, at the William Penn Hotel, Pittsburgh, Pa. The next meeting will be held on June 5.

SMALL-PLANT COAL COSTS IN MIDDLE WESTERN STATES

Annual Report of Board of Public Works of Holland, Mich., Shows How Fuel Increased in Price as Year Progressed

The annual report of the Board of Public Works of the city of Holland, Mich., for the fiscal year ended March 19, 1917, shows the cost of coal. During the year the city purchased for its electric light plant 6161.75 tons at an average of $3.33 per ton. The table herewith illustrates the extent to which smaller utilities in Middle Western States have been affected.

PROGRESSIVE COST OF COAL AT HOLLAND, MICH.

Tons	Price per Ton, F.o.b. Holland	Total Cost
833.25	$2.72½	$2,370.61
3,153.60	2.85	8,987.76
42.15	2.95	124.34
55.00	3.00	165.00
286.35	3.15	902.00
514.30	3.30	1,697.19
231.05	3.40	785.57
219.30	4.65	1,019.74
331.35	5.02	1,663.38
186.55	5.27	983.12
56.60	5.32	301.11
57.00	5.50	313.50
49.94	6.00	299.70
145.30	6.40	929.92
6,161.76	Avg. $3.33	$20,542.94

War Gardens Take Place of Athletic Field

Seven acres, lying at the foot of the hill topped by Nela Park, home of the National Lamp Works, Cleveland, have been taken over by employees, especially young women, who have determined to help conserve food supply and promote the Cleveland city war garden movement.



DETROIT MEETING OF AMERICAN ELECTROCHEMICAL SOCIETY

Attendance of 200 at a Profitable Gathering—Resolutions on Water-Power Legislation and Niagara Power Legislation

The thirty first general meeting of the American Electrochemical Society, held in Detroit, Mich., from May 2 to 5, was attended by 200 members and guests, and was as good, enjoyable and profitable a meeting as any which this society, composed of members from so many different fields, has ever held. The headquarters were at the Hotel Statler, where all technical sessions were held. Edwin L. Crosby of the Detroit Edison Company was the chairman of the general local committee, and to him and to his colleagues on the committees from the Detroit Edison Company, from various automobile companies and from electric steel plants great credit is due for the careful arrangement and perfect execution of the whole program.

Investigation and Entertainment

The afternoon of Wednesday, May 2, was given over to a visit to the automobile factory of Dodge Brothers, which was particularly interesting to electrical engineers on account of the successful use of the electric japanning oven. The visit was followed by a very interesting motion-picture show relating to a Dodge car trip to the Pacific Coast and to the use of the automobile in war time. In the evening of Wednesday there was an enjoyable "get-together" subscription roadhouse dinner at West-Wood.

Thursday evening a smoker was held at the Hotel Tuller roof garden, with songs, refreshments, bulletins received by a wireless plant at work during the smoker, and a most elaborate play, "Research in Hell, a flight in two fast slides and one spiral dive, a futurist impression of the Mephistopheles electric-furnace research laboratory." It was a most elaborate affair—the joint product of the imagination and good nature of engineers for the Detroit Edison Company and from the Niagara Falls electrochemical fraternity.

For the afternoon of Friday three excursions had been arranged—a scenic automobile drive along the lake shore and through the residential districts, a visit to the Detroit Edison power houses, and a visit to the electric steel plants of the John A. Crowley Company and of the Michigan Steel Castings Company. At the former a 5-ton Groenwall-Dixon furnace is in operation and a 10-ton furnace in course of construction. The latter plant has two Heroult furnaces, one of 6 tons and one of 3 tons. Both plants get power from the Detroit Edison Company at the same rate which is charged for motor service.

For the evening of Friday a lecture by Alex Dow, president of the Detroit Edison Company, had been announced on "Electric Power from Coal," but unfortunately Mr. Dow was detained in the East and the session was called off. A theater party took its place.

A very fine and elaborate program had been arranged for the entertainment of the visiting ladies, Mrs. E. L. Crosby acting as chairman of the ladies' committee. Much credit is also due to Miss Edna J. Raybould of the Detroit Edison Company, who as secretary to the local committee was very active in looking after the correct execution of all arrangements.

The annual business session was held in the morning of Thursday, May 3. The annual reports were presented and the election of officers for the coming year was announced. Dr. Colin G. Fink of the Harrison (N. J.) works of the General Electric Company is the new president.

Water-Power Legislation and Niagara Power Legislation

The most important action of the business session was the adoption of resolutions on water-power legislation and Niagara power legislation. The former is to the effect that "in view of the mutual dependence of the futures respectively of the electrochemical industries and the development of water power in this country and the great importance of the matter to the nation as a whole the American Electrochemical Society believes that no legislation affecting water power should be enacted without giving a careful hearing to the electrochemists of the country."

The resolution on Niagara power legislation recommends "the formation of a joint commission containing representatives from both the United States and Canada, of the government engineers and of organizations interested respectively in the preservation of scenic beauty, in navigation, in electrochemistry, in power development, and so forth, and respectfully requests the administration of the United States government to take the initial steps toward the organization of such a commission, or to take such other action as may best forward the investigation urged by General Black and indorsed by the Secretary of War."

Both resolutions, which had originally been prepared by the committee on public relations and had been adopted by the board of directors, were approved and adopted unanimously by the society as a whole.

The retiring president, F. A. J. FitzGerald of Niagara Falls, then presented his very interesting and scholarly presidential address on the scope and work of the committee on public relations of the society (consisting of its past-presidents). He emphasized that no matter requires more careful consideration than that of cultivating in a democracy a true appreciation of expert advice.

Technical Sessions

The first technical session followed, and other technical sessions were held on Thursday afternoon, Friday morning and Saturday morning. In the whole twenty-seven papers were read and discussed.

The present rapid advance of the electric steel furnace was the subject of a paper by Dr. J. A. Matthews, while the practice of electric steel refining at the two Detroit electric steel plants was the subject of two papers, by R. F. Flinterman and J. L. Dixon respectively. Other electric furnace designs were discussed in papers by C. A. Buck and C. H. vom Baur, while A. A. Meyer of the Detroit Edison Company dealt in a very elaborate paper with the "electrical characteristics of electric furnaces" on the basis of many oscillograms from actual practice.

Prof. C. F. Hirshfeld of the Detroit Edison Company, in a paper on "Some Low-Temperature Electrothermic Processes," discussed a subject that should become of very great importance to central stations—that is, the substitution of electric heating for fuel heating for processes requiring comparatively low temperatures.

While the paper was chiefly restricted to two processes with which the author has had most extended experiences—electric japanning ovens and baking of cores for foundry work—a much wider field of application is manifest. The paper elicited a very lively discussion, which lasted through two sessions.

W. R. Mott of the National Carbon Company discussed very interestingly the chemistry of the flaming arc in relation to luminescence, while W. C. Brooks of the same company gave a good review of the functions, design and construction of storage batteries for automobiles. A paper by M. De Kay Thompson and L. R. Byrne dealt with the current efficiency in charging Edison storage batteries.



DR. COLIN G. FINK

With respect to electrolysis, a paper by W. E. Koerner (Harrison Lamp Works, General Electric Company) discussed the electrolytic behavior of tungsten, and a paper by M. De Kay Thompson and O. L. Mahlman on the electrolytic pickling of steel by the C. J. Reed process brought out the statement by Dr. Carl Hering that a large experimental plant using this process is in course of construction. Various electroplating papers were presented by Prof. F. C. Mathers, Prof. O. P. Watts and their co-workers.

Other papers of interest to electrical engineers were by W. W. Strong on the theory of the Cottrell electrostatic fume precipitation process, by T. T. Briggs, H. L. Pierson and H. S. Bennett on electrical endosmose and adsorption, and by T. W. Case on a cuprous oxide photochemical cell.

Work of Dr. Fink

Dr. Colin G. Fink, the new president of the American Electrochemical Society, was born in New Jersey on Dec. 31, 1881. He graduated at Columbia in 1903 and from Ostwald's laboratory in Leipzig in 1907. Upon his return to America he entered the General Electric Company research laboratory of Dr. Whitney at Schenectady and there devoted himself to the metallurgy of tungsten. His discovery of ductile tungsten was announced for the first time at the American Electrochemical Society meeting at Pittsburgh in May, 1910. He introduced the tungsten wire process at the Edison Lamp Works of the General Electric Company at Harrison in 1910, and has been connected with these works ever since as head of the research laboratory. One of the important products of his laboratory is the platinum substitute leading-in wire, a compound copper or cobalt wire with a corrected expansion coefficient (English patent No. 23,775). This wire has been in universal use for a number of years and the conservation of platinum amounts to millions of dollars per year.

NEW YORK EDISON COMPANY ACTIVE IN RED CROSS WORK

Mrs. Thomas A. Edison Honorary Chairman in Preparedness Movement—Two Organizations Formed to Help

The New York Edison Company now has two very active Red Cross organizations. One, conducted under the auspices of the New York Companies Section, National Electric Light Association, is known as Auxiliary No. 3 of the American Red Cross, and the other is the New York Edison unit of the American Red Cross. Both are under the New York County Chapter.

The auxiliary, which is supported by voluntary contributions from the electric and gas companies, is a practical working organization, and since war was declared has turned out thousands of bandages and surgical dressings. The Edison unit confines its activities entirely to instruction work. Mrs. Thomas A. Edison is honorary chairman of this organization, which has arranged courses in dietetics, home care of the sick, surgical dressings, first aid work for men and first aid work for women.

Many employees of the New York Edison Company have already enrolled in these courses, which are also open to anyone wishing to take them. The instructors in dietetics are the Misses Mary Pascoe, Margaret A. Butler and Helen M. Curtis; in home nursing, Miss Grace Woodson; in surgical dressings, Miss Mabel F. Martin; in first aid, Dr. Frank Yeomans, Dr. Edgar Johnson and Dr. Creighton Barker. The executive committee consists of the Misses Margaret A. Butler, Frances T. Collet, Helen M. Curtis, Beatrice Danne, Mabel F. Martin, M. A. Gewehr, Mary E. Pascoe, Grace Woodson, Cyril Nast and Clarence L. Law. Miss Winifred E. Black is chairman, Miss Ina J. Zimmer secretary and Miss Anne Broome treasurer. The classes are held evenings at 124 West Forty-second Street.



A RED CROSS LECTURE TO NEW YORK EDISON WOMEN

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

New Jersey Commission Reopens Telephone Case.—The New Jersey Board of Public Utility Commissioners has ordered a reopening of the New York Telephone Company case, covering an investigation of rates, to take additional testimony bearing upon the earnings and cost of operation. At the same time the board will investigate rates of the Delaware & Atlantic Telegraph & Telephone Company, operating in the Camden district. The Delaware & Atlantic company is a subsidiary of the Bell Telephone Company.

California Decision on Railway Power Contract.—The California Railroad Commission has fixed $0.0085 per kilowatt-hour as the rate for electricity sold by the San Joaquin Light & Power Company to the Fresno Traction Company for operating the latter's electric railway line, and the same rate is to apply to all other consumers of the San Joaquin company receiving service under conditions substantially similar. The rate applies to all electricity delivered after May 1, 1916. This rate was fixed by the commission in the complaint of the traction company against the San Joaquin corporation. The traction company says that the power corporation charged it rates under schedules fixed by the commission on April 6, 1916, in the San Joaquin rate cases, and that this price was too high. The power corporation stood on the commission's schedules and asked that the complaint be dismissed. Transportation of large crowds from various places of amusement on the San Joaquin River on Sundays and holidays in the summertime greatly increases the normal demand for electricity of the traction company. The traction company, says the commission in its decision, did not appear at the public hearings and did not draw attention to these unusual conditions, although the effect of the new rate increased the cost of electric service to the traction company 13 per cent, on account of the abnormal short peaks of the amusement business. The commission says that while it is not clear that the rate established for large consumers is in excess of the service to the traction company conditions may arise which would warrant the continuance of a rate less profitable on the average, and in view of the circumstances the commission restores the contract rate of 8.5 mills per kilowatt-hour, but subject to reconsideration upon the application of either party, or upon action by the commission, should service conditions of either the power system or the traction company change materially. The companies agreed that the decision should apply from May 1, 1916.

Values in Portland, Ore.—A report of the Oregon Public Service Commission on the value of the Portland (Ore.) Railway, Light & Power Company property has been issued. It fixes a value for rate making purposes of $46,862,972, or approximately $14,000,000 less than the valuation made by engineers of the company. Total value of the properties was placed at $55,307,474, of which $8,444,502 is found to be non-operating utility property. Values of the electric utility properties are declared to be $19,492,153, of which $17,689,980 is in Portland.

California Commission on Debentures.—The California Railroad Commission has authorized the San Joaquin Light & Power Corporation to sell $1,000,000 of 6 per cent ten-year debentures at not less than 95. The proceeds are for expenditures already made, for additions and betterments, or improvements planned and scheduled with the commission. The trust agreement securing the issue restricts the amount of floating indebtedness, provides for the protection of the status of the debentures, contains provisions in event of default and guards against the interposition of any additional mortgage. The company is now able to sell its bonds at approximately par, and already has a market for these debentures at 95. It will thus obtain its notes at reasonably low cost, and through the elimination of previously heavy discounts on its securities will be able to avoid the complications of a burdensome floating indebtedness. At the same time, says the commission, it is well for the corporation to hold in mind that a debenture lacks the element of permanency and will therefore in the end prove less satisfactory than some form of high-class stock issue. The commission believes that the company should have in mind some plan which may eventually permit these debentures to be converted into stock. It is the intention of the corporation to resume dividends of 6 per cent upon its preferred stock. The commission says that it can only view with satisfaction and pleasure the evidences of financial strength on the part of a public utility under its jurisdiction, particularly when such financial strength comes from a rate revision by which the consumers are permitted to share with the stockholders the benefits of public regulation. This refers to the commission's decision of a year ago which lowered electric rates, but so great has been the increase of the company's business that it reports the largest earnings in its history. The rate reductions have served to stimulate business and have increased the profits. Among the expenditures for additions and betterments are $114,000 for the completion of the Kern Canyon plant, $185,000 for completing the construction of the Henrietta substation to Corcoran, $60,000 for new substations at Merced Falls, Merced and Alpaugh, $75,000 for boilers and new circulating water-cooling system at the Bakersfield steam plant, $72,000 for transmission lines from Raymond to Merced Falls, and various other items of a similar nature to these, providing for new construction and equipment.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public-utility companies.

Expert Testimony.—The testimony of persons not possessing engineering skill or knowledge of hydraulics as to the capacity of and amount of water carried by ditches, being mere guesses, was inadmissible as expert testimony, the matter being susceptible of exact measurement, it was held by the Supreme Court of California in the case of Northern California Power Company, Consolidated, versus Waller (163 P. 214). It is the general rule that whenever possible data to establish given conditions must be introduced in evidence, and if scientific knowledge is necessary, this may be given by the opinion of experts; but, where not possible, opinions of ordinary witnesses are admissible as being the best evidence.

Right of Municipality to Order Wires Underground.—A telegraph company, though entering on use of a street under the federal post road act of 1866, may be required by the city under its police power to put its wires underground, the Supreme Court of Michigan held (192 N. W. 76). A telegraph company by use of street for poles and wires for fifteen years does not acquire a prescriptive right preventing the city under its police power to require the placing of the wires underground. It not appearing by what right an electric railroad uses a street and its trolley wire being in the middle of the street, it cannot be said the city discriminated in requiring removal of telegraph poles at the side of the street and the placing underground of the telegraph wires.

Damages for Backwater.—A court which charges the negligent permitting of logs, etc., to be and remain upon land, with a knowledge that injuries would arise by having the same submerged by water, and avers that the defendant had the authority to back this water, and shows that the injuries would not have arisen but for the backing of water, and although averring that it became defendant's duty to remove the vegetation as a matter of law, does not charge that the water was negligently backed, was held by the Supreme Court of Alabama to have made a defective charge subject to demurrer, in Burnett versus Alabama Power Company (74 S. 459). To establish negligence under an averment that defendant by means of a dam negligently caused water to back, producing injuries set forth, the dam must be shown to have been negligently or wrongfully constructed or maintained. Consequently damages to persons caused by the decay of the submerged vegetable matter involve no injury to property which is recognized by law.

Yosemite Power Company Refused Permit.—Secretary of the Interior Lane has refused the application of the Yosemite Power Company for a permit to use the Poopenaut reservoir and incidental works and rights-of-way within the Yosemite National Park.

Certificates of Merit for Inventors.—The Inventors' League has decided to grant a "certificate of merit" on inventions of its members which are submitted to a board of examiners and approved as entitled to such honors in the various branches of science and invention. Awards will be made once or twice per year as the board may direct.

Union Gas & Electric Bond Canceled.—As the Union Gas & Electric Company, Cincinnati, has refunded excess payments by patrons, with the exception of about $300, in the controversy with the city, the Public Utilities Commission has authorized the cancelation of its surety bond for $50,000 and the issue of its own guarantee until the balance is paid.

Columbus Municipal Plant May Sell Service Outside the City.—The service committee of the City Council, Columbus, Ohio, has decided to return a favorable report on an ordinance authorizing the sale of surplus energy from the municipal electric plant to persons living outside the city limits at 7 cents per kilowatt-hour. Nonresidents must assume the expense of extensions of service.

"Electrical Party" at University of Minnesota.—Students of the electrical engineering department of the University of Minnesota gave an "electrical party" recently to their friends. Of the numerous electrical exhibits the tin-can motor and the talking arc light won most attention. Other favorite "stunts" were a "bucking" motor, lightning discharge to a house and an all-electrical home; 300,000-volt insulator tests with a new Thorardson transformer were also made, showing corona and flashover. Five hundred guests were present.

Increased Operating Expenses Expected in Republic Group.—Gross earnings of the subsidiaries of the Republic Railway & Light Company, the operating headquarters of which are at Youngstown, Ohio, increased from $3,121,297 in 1915 to $3,987,616 in 1916, or 27.75 per cent. Net earnings increased from $1,247,214 in 1915 to $1,660,209 in 1916, or 33.11 per cent. The gross revenue from electric light and power business increased 37.5 per cent. The kilowatt-hour output increased 41 per cent. Harrison Williams, the president, says that substantial increase in cost of materials, particularly coal, will result in increased operating expenses for 1917. The demand for electrical energy, particularly from large power users, has developed so rapidly that work has been begun upon an extension which will increase the rated capacity of the Lowellville (Ohio) generating plant from 40,000 to 60,000 hp. This is to be completed in 1917 and it follows an increase from 20,000 hp. to 40,000 hp., completed last year.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Rate Reduction in Fargo, N. D.—Beginning May 1, the Northern States Power Company reduced the maximum electric rate in Fargo, N. D., from 9.9 cents to 8 cents net per kilowatt-hour. Other reductions were also made. The minimum monthly charge will be 75 cents instead of $1.

Telephone Company Takes Ohio Commission Into Court.—The Lima Telegraph & Telephone Company, Lima, filed suit in the Ohio Supreme Court on May 1 to test the valuation placed on its property by the Public Utilities Commission for rate-making purposes. The valuation fixed is $1,004,340, which the company contends is insufficient.

Daylight Saving in Kentucky.—An ordinance passed at Lexington, Ky., providing that the daylight-saving plan shall go into effect has aroused opposition from retail merchants. In all probability the measure will be rescinded. The merchants urged that it would not be practicable to adopt the plan unless all others in the vicinity and the country as well were to do so.

Cooking Rate in Kansas City.—The Kansas City (Mo.) Light & Power Company, in announcing its acceptance of the Public Service Commission order to reduce rates, made also a voluntary rate of 3 cents for cooking. It also announced prospective reductions in the lighting rate as the number of consumers increases. The cooking rate also will be reduced further as business grows. The company is spending $1,000,000 on new equipment for its generating stations, pending the erection of the six-million-dollar plant at Kansas City.

Municipal Ownership Defeated in Independence, Kan.—By a vote of considerably over two to one the people of Independence, Kan., decided against the installation of a municipal electric plant. The proposal was to issue $75,000 in bonds. A very aggressive campaign, led by a local newspaper, had been conducted for the plan for over a year. The first petition calling for a special election failed on account of the lack of sufficient names to make the petition legal The final petition had less than twenty names in excess of the legal requirements. When the election was called the Kansas Gas & Electric Company engaged Glenn Marston of New York to place the municipal-ownership proposal before the people from the company's point of view. Advertisements were carried daily in the leading papers, in which a detailed analysis of the size of plant which could be built for $75,000 was given.

Power Contracts of Mahoning & Shenango System.—Three large power contracts, totaling 2400 hp., have been closed by the Mahoning & Shenango Railway & Light Company, Youngstown, Ohio. One, for approximately 1500 hp., will electrify a large section of the plant of the Crescent Portland Cement Company, Crescentdale, Pa. Another, for 600 hp., will be for the entire power requirements of the Ohio Steel Products Company, Mineral Ridge, Ohio. The third, for 300 hp., will cover the requirements of a new plant of the Valley Mould & Iron Company of Sharon, Pa., which is being rushed to completion at West Middlesex, Pa.

Narragansett Company Builds Line to Westerly, R. I.—The Narragansett Electric Lighting Company, Providence, R. I., is building a 30-mile, 33,000-volt transmission line of two circuits from Apponaug to Westerly, R. I., tying the Westerly system owned by these interests into the system centering at Providence. Through connections with the New England Power Company Rhode Island and Massachusetts are now tied into a comprehensive system of high-tension transmission, and the completion of a 66,000-volt line from Clinton, Mass., to Sudbury in the Framingham district will connect the Boston Edison Company's system with the New England hydroelectric network.

Annual Report of Detroit Public Lighting Commission.—The twenty-first annual report of the Public Lighting Commission of Detroit, covering the year to June 30, 1916, made by J. T. Lynn, the president, says in part: "The number of arc lamps in operation June 30, 1916, was 9544. The average number operated throughout the year was 8795. The cost of $212,480 for arc lighting, divided by the average number of arc lamps in operation, gives the cash cost of operation and maintenance at $24.16 per year per lamp, or 12 cents per lamp less than the cost for the preceding year. It is only by the practice of the most rigid economy in the operation of the plant, by the careful purchase of supplies and by the employment of all labor in as efficient a manner as would be practiced by the best private corporations that a reduction in the cost of the lighting has annually been secured. For the ensuing year, however, there will be a decided increase in the cost of public lighting. The change from a seven-day-week to a six-day-week service for employees will cause considerable increase in the payroll. Add to this the requirements of the minimum-wage amendment to pay any employee in any class at the highest prevailing rate paid in the city and increased cost must be expected. It is such handicaps that make municipal operation of public utilities inefficient, costly and a burden to the taxpayer. The necessity of providing for fuel shortage has been forcibly brought to our attention during the recent railroad embargoes. Had it been possible to store coal during the summer months, about $30,000 would have been saved this year."

Jovian League of Toledo.—Arrangements have been made for a series of luncheons by the Toledo Jovians in order to engender enthusiasm for a campaign to obtain the next Jovian gathering for Toledo.

South Dakota Electric Power Association.—The next annual meeting of the South Dakota Electric Power Association will be held at Sioux Falls, S. D., May 13 and 19, with headquarters at Hotel Carpenter. A. H. Savage is secretary of this association.

Institute of Radio Engineers.—"Iron at Radio Frequencies" will be discussed by Prof. Michael I. Pupin, president of the Institute of Radio Engineers, at its next meeting. This meeting will be held May 16 in the Engineering Societies Building, New York City.

Iowa Electrical Contractors' Association.—The next meeting of the Iowa Electrical Contractors' Association will be held May 24 and 25 at Des Moines in conjunction with the Iowa Street Railway Association. M. T. Humphrey of Waterloo is secretary of the association.

Pittsburgh Section, A. I. E. E.—Officers of the army and the marine corps addressed the Pittsburgh Section of the American Institute of Electrical Engineers on May 8. The subjects were "The Electrical Engineer's Part in Modern Warfare," "The Marines and Their Duties" and "Army Service."

Cleveland Engineering Society.—Major P. S. Bond of the United States Engineers' Reserve Corps addressed 150 members of the Cleveland Engineering Society, following a noon luncheon, on April 27. He announced that forty or more members of the society will be asked to attend the army training camp at Fort Benjamin Harrison. Ten members of the organization now hold commissions and about thirty more have applied for them. The members have been asked to find out the work for which they are best fitted before they enlist.

New-Business Meeting, Ohio Electric Light Association.—The following program for the next meeting of the new-business co-operation committee of the Ohio Electric Light Association, at the Hotel Ohio, Youngstown, May 16, has been arranged: Address of welcome by R. T. Sullivan, general manager Mahoning-Shenango Railway & Light Company, Youngstown; "Promotion of Appliance Sales," by C. H. Felker, sales manager Columbus Railway, Power & Light Company; general discussion on what is being done in sales department to help overcome increased operating costs and the necessity of increased rates to maintain net income; luncheon address by Charles A. Leedy; "The Sale of Company Stock to Employees and Customers," by T. O. Kennedy, general manager Massillon Electric & Gas Company, Massillon, Ohio; "Electric Furnaces," by C. I. Crippen, Mahoning & Shenango Railway & Light Company, Youngstown, Ohio; inspection trip to Lowellville generating station. J. E. North of Springfield is chairman of the new-business co-operation committee.

Associations and Societies

A complete Directory of Electrical Associations is regularly printed in the first issue of each month on the next-to-last text page.

Electrical League of Cleveland.—Worcester R. Warner, president of the Warner & Swasey Company, recently addressed the Electrical League of Cleveland on the subject of astronomy.

Jovian Electric League of Los Angeles.—At the weekly luncheon on May 2 Frederic T. Woodman, Mayor of Los Angeles, spoke on "Municipal Affairs." Harry N. Sessions, first tribune of the Jovian Order, acted as chairman of the day.

American Association of Engineers.—On May 14 and 15 the American Association of Engineers will hold its third annual convention at Chicago to elect officers for the ensuing year and to consider proposed changes in the constitution.

Advertising and Selling Problems.—Elliot Reid, advertising manager of the Westinghouse Lamp Company of New York City, addressed a joint meeting of the St. Louis Jovian League, the "ad men" and the St. Louis Chamber of Commerce, at the Mercantile Club in St. Louis, May 1. Taking for his subject "Advertising and Selling Problems We Have Met," he gave valuable information gathered from experiences in connection with his work during the last few years. One of the features of his address was a description of how the monthly magazine *How I Did It*, published by his company, with salesmen as contributors, had resulted in benefits far beyond the expectations of the officers. Frank A. Beardslee, sales manager Union Electric Light & Power Company, was chairman. About 500 members of the three organizations were in attendance.

Station Operating Committee of the O. E. L. A.—The station operating committee of the Ohio Electric Light Association held its final meeting of the season at the Hotel Gibson, Cincinnati, Ohio, on April 24. F. R. Brosius of the Union Gas & Electric Company, Cincinnati, presented a paper on "Some Economies Effected in Power Stations and Savings Possible." The paper and the discussion which followed dealt with the practicability of raising the requirements for firemen. Firemen have usually been selected on the basis of physical qualifications rather than mental ones. The central station business has developed in such proportions, however, that it is now necessary in the interest of economy to engage men who have brains as well as physical endurance. H. B. Dates said that recently the private plant at the Case School of Applied Science effected a great economy by changing firemen in the plant and paying the new men double the wages of the old. H. W. Bromley, superintendent of power for the Youngstown & Sharon Street Railway Company, pointed out that plant economies may be much improved by attention to the application and grade of lubricant. At Youngstown, with a yearly output of 135,000,000 kw.-hr., the plant is operated with a lubricant expense of 0.25 mill per 1000-kw.-hr. generated. One grade of oil is used. "Watch your ash pile" was the burden of a discussion on the contention that 25 per cent of nearly every ash pile is carbon. Benjamin Greenfield, efficiency expert for the Henry L. Doherty Company, discussed the use of CO_2 recorders as a means of increasing economy. He said that if the meters receive proper attention they will give accurate results. D. L. Gaskill, secretary of the Ohio Electric Light Association, gave an impromptu talk on the value to the executive of the operating engineers. "Firebricks" was the subject of a paper by W. A. Heisel of the Charles Taylor Sons Company. He discussed the subject from the angle of the various uses of the refractories in the boiler room. The fields for silica brick, chrome brick, magnesite brick and bauxite were defined. Through a better selection and knowledge of the use of the material and through painstaking care in designing the work, particularly in furnaces where arches are employed, much trouble can be avoided. Analysis of a firebrick alone does not afford the best way to judge its suitability for the work intended, as the analysis merely shows the composition of the brick without giving any information as to its physical properties, which are usually more important than the chemical composition. Furthermore, the analysis does not reveal the way in which the impurities occur, which is very important in determining the temperature to which bricks may be subjected without danger of failure. The qualities of coal must also be considered in selecting the corresponding refractory material. At the luncheon, which was held at the Hotel Gibson, W. W. Freeman, president of the Union Gas & Electric Company, said that the association members are in a position to play an important part in the coming war crisis and that on their shoulders rests the responsibility of operation of the great industries which will feed and equip the armies of the country. H. L. Lawrence, test engineer for the American Engineering Company, Philadelphia, presented a paper on "Stoker Operation as Found in the Ordinary Plant and as It Should Be." "Pressure Drops in Superheaters and Dry Pipes" was the subject of a paper by George Coughlin, results engineer of the Toledo Railways & Light Company. He gave several reasons for the use of superheated steam in connection with steam-engine operation. Following the afternoon session, the committee members were entertained as guests of the Union Gas & Electric Company in an inspection trip to its new West End power station, which represents a total investment amounting to about five million dollars.



L. B. HERRINGTON

Men of the Industry

Changes in Personnel and Position— Biographical Notes

L. B. Herrington, recently elected vice-president in charge of operations of the Kentucky Utilities Company, is a native of Atlanta, Ga., and is a graduate of Central University of Kentucky and the Mercer University (Georgia) Law School. Mr. Herrington entered the public utility business in 1905, when he built the station at Richmond, Ky., and became president of the Richmond Electric & Power Company. Succeeding in that enterprise, in 1912 he bought and rebuilt the electric plant at Gallipolis, Ohio, which was under his management until recently sold to the Ohio Utilities Company. He and his Richmond (Ky.) associates built and operated the telephone system at Orlando, Fla. Mr. Herrington has been identified with the legal department of the Kentucky Utilities Company since its organization, looking after its franchises and municipal contracts and negotiating the purchase of several of its properties. He brings to his new executive position the training and experience of a lawyer, legislator, builder, owner and operator of public utilities. He is thirty-seven years old.

D. A. Hegerty, president of the Texas Southern Electric Company, Houston, Tex., has been elected first vice-president of the Southwestern Electrical and Gas Association. Mr. Hegerty entered the electric lighting field from the railway field, having been associated with A. Langstaff Johnson in the electrification of the street railways of Philadelphia and later being connected in an official capacity with the Hestonville, Mantua & Fairmount Passenger Railway of that city, the Norfolk (Va.) Railway Company and the Railway Companies General. For several years he was general manager of the Little Rock Railway & Electric Company and later manager of the lighting department of the New Orleans Railway & Light Company. In February, 1914, he became general manager of the Houston Lighting & Power Company, resigning in the fall of the following year to take up his present work. Mr. Hegerty is a past-president of the traffic and transportation branch of the American Electric Railway Association.

C. A. Matthews has been appointed superintendent of the power and light department of the Northwestern Ohio Railway & Power Company, Toledo, Ohio. In addition to the duties that he has assumed with this company, Mr. Matthews will continue as superintendent of the Port Clinton (Ohio) Electric Light & Power Company.

C. B. Kennedye, who was recently appointed sales manager of the Light & Development Company of St. Louis, Mo., was born at St. Louis in 1880. He was graduated from Polytechnic College, Fort Worth, Tex., with the class of 1905. During summer vacations Mr. Kennedye worked for the Fort Worth



C. B. KENNEDYE

Traction Company and the Commonwealth Edison Company of Chicago. After graduation he spent one year in the employ of the St. Louis Brass Company and then three and one-half years in the industrial power department of the Union Electric Light & Power Company of St. Louis. After that he left the utility business for a short period to act as state treasurer of Missouri for the organization of the Progressive party. With the closing of this campaign he entered the new-business department of the Light & Development Company, carrying out sales work at some of its forty-four properties under the direction of W. A. Smith, vice-president of the company. Since the death of Mr. Smith Mr. Kennedye has continued his interest in the sales department, of which he has now been made manager. Mr. Kennedye was a member of the winning St. Louis Jovian degree team which took the cup at Chicago in 1915, and was recently awarded the Vulcan degree for conspicuous work on the one-hundred-point committee of the organization.

E. T. Rowland recently resigned as sales manager of the United Illuminating Company to become new-business manager of the Continental Gas & Electric Corporation with headquarters at Omaha, Neb.

A. B. Paterson has resigned the general managership of the Meridian (Miss.) Light & Railway Company to take up the duties of bond department representative of Henry L. Doherty & Company in New Orleans and contiguous territory, with headquarters in that city.

Obituary

Louis R. Pomeroy, well known as a consulting engineer in railway and electrical fields, died suddenly at his home in Orange, N. J., on May 7. Mr. Pomeroy was born at Port Byron, N. Y., in 1857, and was graduated from the Irving Institute at Tarrytown, N. Y. He early entered the railroad field, where his work attracted considerable attention. From 1886 to 1890 he was a special representative of the Carnegie Steel Company, introducing basic boiler steel for locomotives and special forgings for railways. For nine years he was engaged in similar work with the Cambria Steel Company and the Latrobe Steel Company jointly. He then became connected with the Schenectady Locomotive Works as assistant general manager, a position he held until 1902. During the following six years he was a special representative for the General Electric Company in the railway field, this work covering the electrification of steam roads and railway shops and the general application of electricity to all railway purposes. Subsequently for two years he was assistant to the president of the Safety Car Heating & Lighting Company, leaving to become chief engineer of the railway and industrial division of J. G. White & Company. Late in 1911 he resigned to open an office in New York City as a consulting engineer. In 1914 he became associated with the United States Light & Heat Company as manager of the New York office. For the past year or so Mr. Pomeroy had again been engaged in consulting work.



LOUIS R. POMEROY

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

ENLISTMENT IN ENGINEERING CORPS AROUSES CONCERN

Manufacturers Lose Many Valuable Men from Engineering Departments and Branch Offices Because of Government's Call

Electrical manufacturers view with apprehension the daily enlistments of their men in the engineering corps. Engineering departments, of course, have been the ones to suffer most in this respect. There has been, however, a very serious depletion in the ranks of branch officers. In most instances the men who have joined the engineering corps of the army are the younger men who come within the now tentative age limits of the conscription bill.

Being men of highly trained technical ability along lines of manufacture and distribution rather than along lines of construction and field work, the manufacturers are finding it very difficult to replace them. If the government is to require these factories to build materials for war purposes, the loss of these men will, of course, be felt by it. The wisdom of taking engineers from manufacturing establishments without a more careful analysis of their value to the industry and to the government while employed in that industry is somewhat dubious.

FLASH-LAMP BATTERY MANUFACTURERS SWAMPED

Impossible to Supply Demand of Europe for Refilling Purposes—Prices for Exports Are Expected To Advance

Manufacturers of flash-lamp batteries are expecting a larger volume of business in 1917 than last year, although 1916 was the best year that has ever been experienced in the history of the trade. Domestic business keeps up strongly and is growing continually. The government has already placed some fairly large orders both for the navy and the army, and it is understood that it is making inquiries for still further shipment. Because of the great mobilization camps which will spring up for the training of the 500,000 men that this government intends to call to the colors shortly, domestic business will be greatly enhanced.

However, the really large business at the present time is that from Europe, where, owing to war restrictions on lighting, flash-lamps are having an enormous use. The allied governments have taken over sufficient production to take care of the trench and warfare trade. For domestic use, however, the United States, it is understood, is supplying 60 per cent of the volume used, England about 20 per cent, with the remaining 20 per cent going to Sweden, Spain, Denmark and other countries.

There is very little demand for cases. Practically all of the demand now is for batteries for refilling purposes. It is understood that for every battery turned out in this country there are three buyers. In other words, the demand in the market is practically three times as great as production. It is known that there are certain large jobbers in London who, if it were possible to obtain deliveries, would place to-day orders for many millions of flash-lamp batteries. Manufacturers, however, are absolutely swamped and are not in a position to take on any greater volume of business than they now are doing.

Domestic prices have not advanced, although there has been a feeling in the market that an advance may go into effect almost any time. For the export trade, however, an advance of approximately 16 per cent will go into effect in June. Prices of all materials entering into the construction of batteries have increased, and it would not be strange, therefore, if the domestic price should increase accordingly.

It has been noted that the trade is not stocking up as heavily as formerly, preferring rather to buy in smaller quantities and more often. This, it is understood, is owing to the uncertainty of the market. Jobbers and dealers do not care to stock up heavily on goods that might by any possibility decrease in value while on their shelves.

Manufacturers are finding less difficulty now, it has been noticed, in securing raw materials for production. The metals, particularly, are coming in better than since the war began.

CENTRAL STATION PLANS FOR CONSTRUCTION HALTED

Tendency Noted to Withhold Purchasing of Line and Generating Equipment Until Lower Prices Prevail

It has been noticed during the last few weeks in many sections of the country that central stations are no longer buying for new construction and developments with the same freedom that they did last year. In fact, it has now become a decided policy in many stations not to increase line or generating facilities until prices become much nearer normal. A considerable falling off in line equipment, especially poles and line hardware, has been noticed of late.

Many central stations are now loaded up to the extent of their generating capacity, and some have definitely decided not to take on new customers without placing in their way almost prohibitive restrictions. One large company in the East, it is known, has recently received a power contract necessitating a reduction in the output to other customers. It was thought advisable by this company to take such a step rather than increase generating and distribution facilities.

It is understood that there is a very large stock of line hardware and poles on hand laid in in anticipation of an increase in spring construction. This decision of the central station companies to defer betterments and additions until lower prices shall result will undoubtedly act as a severe hardship on many jobbers, as well as manufacturers, engaged in handling this class of material.

DISTRIBUTION PROBLEM OF THE ELECTRIC VEHICLE

Branch Offices Only in Very Largest Centers, Relying on Dealers in Smaller Cities, Found Best Method by Large Manufacturer

Electric vehicle manufacturers have in the past looked upon the central stations as the essential factor in the distribution of their products, but the fallacy of that kind of promotion is now evident, and manufacturers are discussing means of distribution. As the result of a broad study of this problem, the largest manufacturer of commercial electric trucks in the United States during the last three years has gradually opened up a wide field of distribution through dealers, and now has the foundation for a high-class dealer organization throughout the United States and a distribution, through foreign representation, all over the world.

The original dealer plans of this company were to exploit through central stations, acting as selling agents. It was found, however: (a) that barring two or three exceptions

they were not interested; (b) that their organizations were so large as to be unwieldy and unproductive on such a highly specialized proposition; (c) that their operation departments were not inclined to co-operate with their commercial department by using electric trucks; (d) that their commercial department was not as active as were competing gasoline truck salesmen.

The present policy of this manufacturer is to secure dealers in every city with more than 55,000 population and, other things being equal, to give preference in the following order: (a) organizations with garage facilities; (b) central stations; (c) individuals without previous electric vehicle experience whom it can train to sell.

The feeling exists that it is better business to have a good dealer in the city of Birmingham, Ala., for instance, than to try to cover that city from an office in Atlanta, for the reasons that the dealer knows most of the business men around him and can "cash in" on the disposition to patronize a brother townsman, that he is familiar with local conditions, and that he can afford to develop "prospects" patiently.

Even at the cost of a substantial discount, this company has found it to be generally to the manufacturer's advantage to sell through a dealer. In the long run it is cheaper, except in large centers, for where he can sign up a dealer for a definite number of trucks per year it steadies his production and distributes the burden of introductory selling.

For several years to come, however, this company believes that it probably will be difficult to secure in the quantity desired good electric truck dealers, because it is hard to get the prospective dealer to see that while it takes a little longer to break the ice with the electric vehicle, once the ice is broken in a locality, care being used to adapt each truck properly to its work, the reorder business on the electric will be greater and more sure than that on the gas truck.

Exploiting of the commercial electric car, especially from the standpoint of avoiding mis-sales, of course requires education as to the features of superiority shown by the commercial electric over other types of commercial vehicles, as well as a knowledge of its limitations.

In the past this has made it particularly difficult to secure effective dealers, but as time goes on and a knowledge of the characteristics of the electric vehicle becomes more broadly disseminated, this condition, it is noticed, is changing, although the decision of any company as to its policy must necessarily rest upon its own individual conditions.

It becomes evident therefore that any company in deciding the problem of securing distribution for its product should take into consideration the size and location of such distributing center and the potential business or demand for that product. Direct representation where such representation is financially profitable is apparently the best method to pursue in the very largest centers.

Conditions have now developed to the point where the policy of dealer representation in the smaller centers is effective. Undoubtedly this is primarily due to the fact that individual dealers are becoming better informed regarding the efficiency of the electric vehicle, but there is still much to be done in educating the dealer.

PRICE OF INCANDESCENT LAMPS NOT TO INCREASE

New Contracts to Be Signed on Same Terms as Last Year Except Perhaps for Metallized-Filament Lamps

Some accounts have appeared in the papers of late which would leave the impression that the price of incandescent lamps has recently been advanced. Investigation, however, shows this idea to be entirely unfounded. There have been a few slight changes in discounts, but none of these have tended to increase the price of lamps.

Not only have lamps not increased in price, but in spite of the fact that materials and labor have increased manufacturing costs considerably manufacturers are not now contemplating any increase. It is true that a number of economies of manufacture have been developed, but they have not been able to take care of the entire increase in production cost. Many of the large lamp contracts run out this month, and there is no doubt that they will be signed up for another year under the same terms and prices as for the past year.

The 50-watt tungsten lamp which was offered to the industry about two years ago at a price slightly higher than the 40-watt and 60-watt sizes has recently been lowered in price, the stipulated volume of production having been secured. When this lamp was put on the market the industry was promised that it would be placed on a par with the 40-watt and 60-watt sizes as soon as production warranted, and now all three are listed at the same price.

Since the advent of the tungsten lamp on the market the sale of the metallized-filament lamp, which up to that time was the standard lamp, has fallen off to a very great extent. Because of limitations in manufacture it has never been possible to produce this lamp for exact voltages, and therefore a peculiar system of marketing whereby certain stations used lamps of a certain measured voltage, other stations lamps of another voltage, and so on, became necessary. It was only in this way that the entire number of lamps could be used up and production costs kept to a minimum. Now, however, fewer and fewer stations are using these lamps, although the range of voltages in production remains the same. It therefore becomes necessary either to increase the voltage range per station or to break up the lamps of extreme voltage and consequently increase production costs. Should it not be possible to substitute rapidly in those stations using the metallized-filament lamp tungsten lamps for them, the second procedure would probably become necessary. In this event an advance in price would undoubtedly follow. In fact, all new contracts for the metallized-filament lamp will probably give to the manufacturer the right to increase prices during the period of the contract should production cost make it necessary. While no definite action has been taken on this, it seems probable that any increase would be limited to not more than 10 per cent in any one year.

TREND OF INQUIRIES IS TO STRENGTHEN METAL MARKET

Actual Sales Have Been Few, and Rumors Have Been Quickly Followed by Denials in Nearly All Instances

After a slump for a number of weeks, the general tone of the entire metal market is stronger. Copper, tin and lead are higher than a week ago; spelter is lower. Rumors of inquiries for large tonnages have largely been responsible for the hardening. There have been few actual sales, and for the most part the rumors have been quickly denied. With so many rumors, even though followed by denials, the old saying that where there is smoke there is pretty sure to be fire seems particularly apt.

Copper quotations for the remainder of 1917 were nominally as follows for electrolytic on Tuesday last: May, 32.75 cents; June, 31.75 cents; July, 30.25 cents; third quarter, 29 cents; fourth quarter, 27.50 cents.

NEW YORK METAL MARKET PRICES

	May 1 — Selling Prices Bid £ s d	May 1 — Selling Prices Asked £ s d	May 8 — Selling Prices Bid £ s d	May 8 — Selling Prices Asked £ s d
Copper:				
London, standard spot	130 0 0†		130 0 0	
Prime Lake	30.50 to 31.00†		31.50 to 32.50†	
Electrolytic	31.00 to 31.50†		32.50 to 33.00†	
Casting	27.50 to 28.50†		29.50 to 30.00†	
Copper wire base	36.50 to 37.50†		36.50 to 37.50†	
Lead	9.00		9.50	
Nickel	50.00		50.00	
Sheet zinc, f.o.b. smelter	19.00		19.00	
Spelter, spot	9.55 to 9.67½		9.30 to 9.42½	
Tin, Straits	58.50		59.50	
Aluminum, 98 to 99 per cent	56.00 to 58.00†		56.00 to 58.00†	

OLD METALS

Heavy copper and wire	25.50 to 26.50	26.50 to 27.00
Brass, heavy	16.00 to 16.50	16.00 to 16.50
Brass, light	12.00 to 12.50	12.50 to 13.50
Lead, heavy	7.50 to 7.75	8.00 to 8.25
Zinc, scrap	6.50 to 7.00	6.50 to 7.25

†Nominal.

Current Prices of Electrical Supplies

The prices quoted are those prevailing in standard package or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists to contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East, its nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor

B & S. Size	List, per 1000 Ft. Chicago	N. Y.
No. 14 solid	$61.00	$61.00
No. 12 solid	71.00	71.00
No. 10 solid	90.00	90.00
No. 8 solid	106.00	106.00
No. 6 solid	145.00	145.00
No. 10 stranded	95.00	95.00
No. 8 stranded	115.00	115.00
No. 6 stranded	160.00	160.00
No. 4 stranded	205.00	205.00
No. 2 stranded	266.00	266.00
No. 1 stranded	315.00	315.00

Twin-Conductor

No. 14 solid	104.00	104.00
No. 12 solid	135.00	135.00
No. 10 solid	185.00	185.00
No. 8 stranded	235.00	235.00
No. 6 stranded	370.00	370.00
No. 4 stranded	575.00	575.00

DISCOUNT PER 1000 FT.

Single-Conductor

No. 14 solid:	Chicago	N. Y.
Less than coil	+10%	Net
Coil to 1000 ft	—10%	3%
No. 12 solid:		
Less than coil	+10%	Net
Coil to 1000 ft	—10%	3%

Twin-Conductor

No. 14 solid:		
Less than coil	+10%	Net
Coil to 1000 ft	—10%	3%
No. 12 solid:		
Less than coil	+10%	Net
Coil to 1000 ft	—10%	3%

ATTACHMENT PLUGS

	Std. Pkg.	List Chicago	N. Y.
Benjamin No. 903	100	$0.25	$0.25
Hubbell No. 5406	250	.30	.30
Bryant No. 706	100	.25	.25
G. E. 50996	250	.22	.22

Discount	Chicago	N. Y.
Less than 1/5 std. pkg.:		
Benjamin No. 903	12%	10%
Hubbell No. 5406	+10%	10%
Bryant No. 706	+20%	10%
G. E. 50996	+20%	10%
1/5 to std. pkg.:		
Benjamin No. 903	20%	20%
Hubbell No. 5406	10%	20%
Bryant No. 706	Net	20%
G. E. 50996	Net	20%
Std. pkg.:		
Benjamin No. 903	44%	34%
Hubbell No. 5406	34%	34%
Bryant No. 706	30%	34%
G. E. 50996	30%	34%

BATTERIES, DRY

Each Net	No. 6 Regular Chicago	N. Y.	No. 6 Ignitor Chicago	N. Y.
Less than 12	$0.35	$0.35	$0.35	$0.35
12 to 50	.30	.30½	.30	.30½
50 to barrel	.26¼	.26	.27¼	.27
Barrel lots	.24¾	.24½	.24¾	.25

CONDUIT, METALLIC FLEXIBLE

Size, In.	Feet per Coil	List per 100 Ft. Chicago	N. Y.
5/16	250	$5.00	$5.00
⅜	250	7.50	7.50
½	100	10.00	10.00
¾	50	13.00	13.00
1	50	21.00	21.00
1¼	50	26.00	26.00
1½	25-50	35.00	35.00
2	25-50	45.00	45.00
2½	25-50	52.00	52.00

CONDUIT, METALLIC FLEXIBLE—CONTINUED

	⅜" Single Strip Chicago	N. Y.	⅜" Double Strip Chicago	N. Y.
Less than coil per 1000 ft., net	$71.25	$67.50	$75.00	$67.50
Cost to 1000 ft. per 1000 ft., net	60.00	60.00	67.50	60.00

	½" Single Strip Chicago	N. Y.	½" Double Strip Chicago	N. Y.
Less than coil per 1000 ft., net	$95.00	$90.00	$100.00	$90.00
Cost to 1000 ft. per 1000 ft., net	80.00	80.00	90.00	80.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, in.	List, per Foot Chicago	N. Y.	Size, in.	List, per Foot Chicago	N. Y.
7/32	$0.05½	$0.05½	1	$0.25	$0.25
¼	.06	.06	1¼	.33	.33
⅜	.09	.09	1½	.40	.40
½	.12	.12	1¾	.47	.47
⅝	.15	.15	2	.55	.55
¾	.18	.18	2¼	.65	.65

Per 1000 Ft. Net.	7/32 In. Chicago	N. Y.	¼ In. Chicago	N. Y.
Less than $15.00 list	$36.67	$38.50	$40.00	$42.00
$15.00 to $60.00 list	27.50	25.85	30.00	28.20
$60.00 to $150.00 list	24.75	20.57	27.00	22.44

CONDUIT, RIGID IRON

(*Card No.* 38)

Size, in.	List, per Foot Chicago	N. Y.
¼	$0.08½	$0.08½
⅜	.08½	.08½
½	.08½	.08½
¾	.11½	.11½
1	.17	.17
1¼	.23	.23
1½	.27½	.27½
2	.37	.37
2½	.58½	.58½
3	.76½	.76½

COUPLINGS AND ELBOWS

(*Card No.* 37)

Size, in.	Couplings, List, Each Chicago	N. Y.	Elbows, List, Each Chicago	N. Y.
¼	$0.05	$0.05	$0.19	$0.19
⅜	.06	.06	.19	.19
½	.07	.07	.19	.19
¾	.10	.10	.25	.25
1	.13	.13	.37	.37
1¼	.17	.17	.45	.45
1½	.21	.21	.60	.60
2	.28	.28	1.10	1.10
2½	.40	.40	1.80	1.80
3	.60	.60	4.80	4.80

	Discount, ¼ In. to ½ In. Chicago	N. Y.	Discount, ¾ In to 3 In. Chicago	N. Y.
Less than 2500 lb	3.8%	13%	6.8%	15%
2500 to 5000 lb	5.8%	13%	8.8%	15%

(For galvanized deduct six points from above discounts.)

FLATIRONS

	Chicago.	N. Y.
List	$4.50	$5.00
Discount	25%	30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List Chicago	N. Y.
3-amp. to 30-amp.	100	$0.25	$0.25
35-amp. to 60-amp.	100	.35	.35
65-amp. to 100-amp.	50	.90	.90
110-amp. to 200-amp.	25	2.00	2.00
225-amp. to 400-amp.	25	3.60	3.60
450-amp. to 600-amp.	10	5.50	5.50
600-Volt			
3-amp. to 30-amp.	100	$0.40	$0.40
35-amp. to 60-amp.	100	.60	.60
65-amp. to 100-amp.	50	1.50	1.50
110-amp. to 200-amp.	25	2.50	2.50
225-amp. to 400-amp.	25	5.50	5.50
450-amp. to 600-amp.	10	8.00	8.00

FUSES, INCLOSED—CONTINUED

Discount	Chicago	N. Y.
Less than 1/5 std. pkg.	28%	28%
1/5 to std. pkg.	38%	38%

FUSE PLUGS

3-Amp. to 30-Amp.

Per 100 Net	Chicago	N. Y.
Less than 1/5 std. pkg	$6.25	$5.00
1/5 to std. pkg.	5.25	4.50

Standard package, 500. List, $0.07.

LAMPS, MAZDA

105 to 125 Volts

Regular, clear:	Std. Pkg.	List, Each—Chicago	List, Each—N. Y.
10 to 40-watt—B	100	$0.27	$0.27
60-watt—B	100	.36	.36
100-watt—B	24	.65	.65
75-watt—C	50	.65	.65
100-watt—C	24	1.00	1.00
200-watt—C	24	2.00	2.00
300-watt—C	24	3.00	3.00
Round bulbs, 3⅛-in., frosted:			
15-watt—G 25	50	.50	.50
25-watt—G 25	50	.50	.50
40-watt—G 25	50	.50	.50
Round bulbs, 3¾-in., frosted:			
60-watt—G 30	24	.72	.72
Round bulbs, 4⅝-in., frosted:			
100-watt—G 35	24	1.05	1.05

	Discount—Chicago	Discount—N. Y.
Less than std. pkg.	Net list	Net
Std. pkg	10%	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

	Per 1000 Ft. Net—Chicago	Per 1000 Ft. Net—N. Y.
Less than coil (250 ft.)	$38.16	$35.77
Coil to 1000 ft.	28.62	27.18

LAMP GUARDS, WIRE

Per 100 Net	Chicago	N. Y.
Less than 50, Matthews 16-cp	$20.00	$20.00
Less than 1/5 std. pkg. Hubbell	28.35	29.00
Less than 36, 60-watt Loxon	25.00	25.00

OUTLET BOXES

Union Cat. No.	Black, List, per 100—Chicago	Black, List, per 100—N. Y.
101	$30.00	$30.00
102	30.00	30.00
103	25.00	25.00
106	20.00	20.00

Union Cat. No.	Galv., List, per 100—Chicago	Galv., List, per 100—N. Y.
101	$30.00	$30.00
102	30.00	30.00
103	25.00	25.00
106	20.00	20.00

Discount	Black—Chicago	Black—N. Y.	Galvanized—Chicago	Galvanized—N. Y.
Less than $10.00 list	40%	40%	35%	35%
$10.00 to $50.00 list	50%	48%	45%	44%

PIPE FITTINGS

Conduits, V.V., Unilets and Similar

Discount	Chicago	N. Y.
Less than 1/5 std. pkg.	25%	25%
1/5 to std. pkg.	32%	32%
Std. pgk.	40%	40%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

	Per 1000 Net—Chicago	Per 1000 Net—N. Y.
Less than 1/5 std. pkg.	$14.00	$15.80
1/5 to std. pgk.	13.00	14.80

Standard package, 2200. List per 1000, $20.

PORCELAIN KNOBS

Per 1000 Net	5½ N C.—Solid Std. Pkg. 3500 Chicago	5½ N C.—Solid Std. Pkg. 3500 N. Y.	Nail-it—N.C. Std. Pkg. 4000 Chicago	Nail-it—N.C. Std. Pkg. 4000 N. Y.
Less than 1/5 std. pgk.	$10.50	$11.25	$28.00	$18.00
1/5 to std. pkg.	9.75	9.00	21.50	15.00

SOCKETS AND RECEPTACLES

	Std. Pk.	List—Chicago	List—N. Y.
⅛-in. cap key socket	500	$0.33	$0.33
⅛-in. cap keyless socket	500	.30	.30
⅛-in. cap pull socket	250	.60	.60

Discount	Chicago	N. Y.
Less than 1/5 std. pkg.	List	List
1/5 to std. pkg.	15%	15%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

Perkins or Trumbull Type A.	List—Chicago	List—N. Y.
30-amp. S. P. S. T.	$0.80	$0.80
60-amp. S. P. S. T.	1.20	1.20
100-amp. S. P. S. T.	2.25	2.25
200-amp. S. P. S. T.	3.48	3.48
300-amp. S. P. S. T.	5.34	5.34
30-amp. D. P. S. T.	1.20	1.20
60-amp. D. P. S. T.	1.78	1.78
100-amp. D. P. S. T.	3.38	3.38
200-amp. D. P. S. T.	5.20	5.20
300-amp. D. P. S. T.	8.00	8.00
30-amp. 3 P. S. T.	1.80	1.80
60-amp. 3 P. S. T.	2.68	2.68
100-amp. 3 P. S. T.	5.08	5.08
200-amp. 3 P. S. T.	7.80	7.80
300-amp. 3 P. S. T.	12.00	12.00
Perkins Type B or Trumbull Type C.		
30-amp. S. P. S. T.	0.42	0.42
60-amp. S. P. S. T.	0.74	0.74
100-amp. S. P. S. T.	1.50	1.50
200-amp. S. P. S. T.	2.70	2.70
30-amp. D. P. S. T.	0.68	0.68
60-amp. D. P. S. T.	1.22	1.22
100-amp. D. P. S. T.	2.50	2.50
200-amp. D. P. S. T.	4.50	4.50
30-amp. 3 P. S. T.	1.02	1.02
60-amp. 3 P. S. T.	1.84	1.84
100-amp. 3 P. S. T.	3.76	3.76
200-amp. 3 P. S. T.	6.76	6.76

DISCOUNT

	Chicago	N. Y.
Type A, Perkins or Trumbull:		
Less than $10 list	List	List
$10 to $25 list	15%	15%
$25 to $50 list	18%	18%
Type B, Perkins, or Type C, Trumbull:		
Less than $10 list	10%	10%
$10 to $25 list	20%	20%
$25 to $50 list	28%	28%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List—Chicago	List—N. Y.
5-amp. single-pole	250	$0.28	$0.28
5-amp. single-pole, ind.	250	.32	.32
10-amp. single-pole	100	.48	.48
10-amp. single-pole, ind.	100	.54	.54
5-amp., three-point	100	.56	.56
10-amp., three-point	50	.76	.76
10-amp., 250-volt, D. P.	100	.66	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List—Chicago	List—N. Y.
10-amp. single-pole	100	$0.45	$0.45
10-amp. three-way	50	.70	.70
10-amp. double-pole	50	.70	.70

Discount	Chicago	N. Y.
Less than 1/5 std. pkg.	Net	List
1/5 to std. pkg.	15%	15%
Std. pkg.	30%	28%

SWITCH BOXES, SECTIONAL CONDUIT

C. F. Mfg. Co.	List, Each—Chicago	List, Each—N. Y.
No. 155	$0.34	$0.34
No. 160	0.60	0.60

Discount	Black—Chicago	Black—N. Y.	Galvanized—Chicago	Galvanized—N. Y.
Less than $2.00 list	40%	40%	30%	30%
$2.00 to $10.00 list	50%	50%	40%	40%
$10.00 to $50.00 list	64%	60%	52%	52%

TOASTERS, UPRIGHT

	Chicago	N. Y.
List	$4.50	$4.50
Discount	25%	25%

WIRE, ANNUNCIATOR

Per Lb. Net	Chicago	N. Y.
No. 18, less than full spools	$0.65	$0.47
No. 18, full spools	0.55	0.45

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

No.	Price per 1000 Ft. Net—Less than 500 Ft. Chicago	Less than 500 Ft. N. Y.	500 to 1000 Ft. Chicago	500 to 1000 Ft. N. Y.	1000 to 5000 Ft. Chicago	1000 to 5000 Ft. N. Y.
14	$18.00	$18.00	$16.00	$14.50	$14.00	$12.50
12	27.05	29.71	22.85	25.30	20.95	18.60
10	38.20	41.16	32.60	35.28	29.60	25.87
8	46.20	59.64	42.35	43.12	37.20	46.28
—	72.70	94.71	66.65	$1.18	59.10	59.53

WIRE, WEATHER-PROOF

Solid-Conductor, Triple-Braid, Sizes 4/0 to 8, Inc.

	Per 100 Lb. Net—Chicago	Per 100 Lb. Net—N. Y.
Less than 25 lb.	$44.50	$43.25
25 to 50 lb.	43.50	42.25
50 to 100 lb.	42.50	41.25

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Floodlight Projector

Projectors for floodlighting purposes for use with 400-watt Mazda lamps with mogul bases have been developed by the Wheeler Reflector Company of Boston. These projectors may also be used with 200-watt lamps and medium-base adapters. They are mounted on a



PROJECTOR FOR FLOODLIGHTING PURPOSES

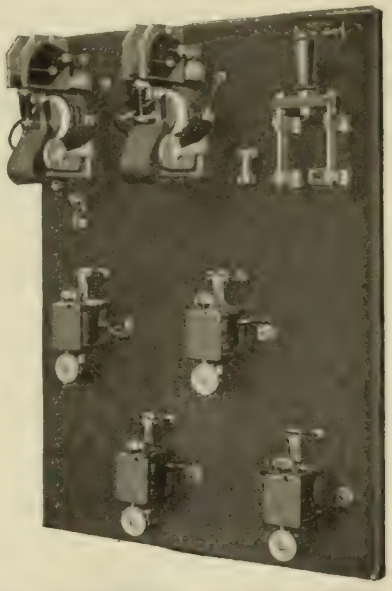
swivel and trunnion standard for convenient adjustment. The reflector is nickel-plated copper. When used with the standard 400-watt floodlighting Mazda lamp, with its concentrated filament at the focal point of the reflector, a beam of light is obtained of approximately 170,000 cp. opposite the center, with all light concentrated within a zone of 10 deg. A wider distribution of light can be obtained by setting the filament slightly in front or back of the focal point. This adjustment, however, must be kept within certain limits or a dark spot will appear in the center of the field of illumination which becomes darker as the filament is moved further out of the focal position.

Crane Protective Panels

Crane protective panels of the type shown herewith are being manufactured by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa. These panels protect crane motors operated by drum or grindstone controllers against injury due to overloads, grounds, short circuits, sudden return of power after failure of voltage, and the improper operation of the controller, and prevent the premature starting of the motors.

The panels are furnished for one to six circuits, depending upon the number of motors to be protected. On each panel are mounted two single-pole magnetic contactors, an electrical interlock for each contactor, two to seven automatic reset overload relays, and a double-pole, single-throw knife switch, together with the necessary inclosed fuses. When desired an inclosing cover is furnished, making the panel dust-proof.

The magnetic contactors are operated from a push-button station mounted in the crane cab. Owing to the electrical interlocks the contactors will not close until the starting push-button is pressed, and after closing they will not open when the push-button is released unless the contactor coil becomes de-energized by the operation of the overload relays or by the opening of the main switch. Should the cur-



CRANE PROTECTIVE PANEL THAT SERVES A TWOFOLD PURPOSE

rent in any circuit rise to a value corresponding to the setting of the relay in that circuit, the relay opens the control circuit through the shunt-operating coils of the magnetic contactors, which then open the main circuit.

When only one circuit is to be protected an overload relay is placed in each side of the line. When more than one circuit is to be protected an individual relay is placed in one side of the line of each circuit and a cumulative relay in the common side of the main circuit. Each individual relay is set to operate at the overload current value of its own circuit, while the cumulative relay is set for the integrated current value of the total load. Both sides of the line are thus protected by overload relays, and failure of the relays to operate because of grounded wires is made impossible.

Switch Plates

Porcelain-enamel switch plates which will harmonize with wall decorations are offered to the trade by the Lumi-

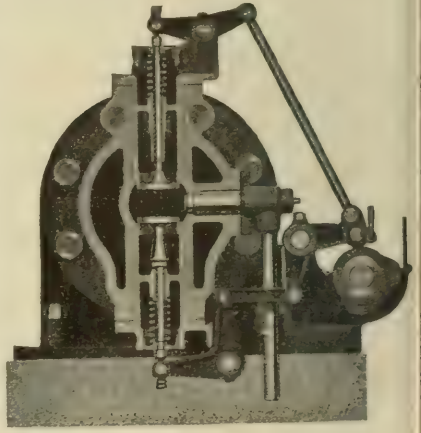


PORCELAIN-ENAMEL SWITCH PLATE

nous Unit Company, 2615 Washington Avenue, St. Louis. These switch plates are furnished in single, two-gang and three-gang types. The manufacturer calls attention to the fact that these switches are sanitary, practical and permanent.

Oil Engine

Horizontal high-compression oil engines like the one shown herewith are being built by McEwen Brothers of Wellsville, N. Y., in single or multiple units rated at 65 hp. per cylinder and up. Starting the engine is simple, it is said, as air at only 120 lb. pressure



HIGH-COMPRESSION OIL ENGINE

per square inch (84360 kg. per sq. m.) is necessary for this purpose. The dismantling of the cylinder head may be done without disturbing the camshaft bearings or valve-actuating levers. The

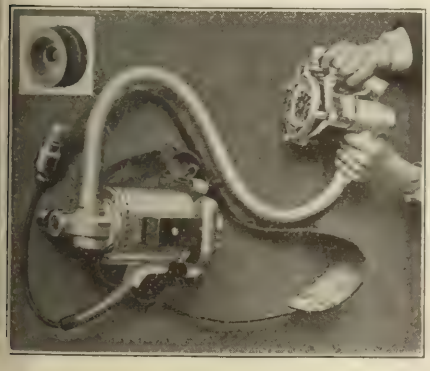
fuel pump and levers are mounted in such a manner that the cam thrust is taken up directly by the engine foundation, thus relieving the main frame of unnecessary stresses from this source. No high-compression stuffing boxes are used on the fuel pump and fuel-injection valve, case-hardened and ground sleeves being sufficient.

The air suction port and channel communicating with the air suction valve is cast integral with the main frame. The cylinder liner, which is made of hard close-grained cast iron, is pressed into the frame. It is free to expand longitudinally so that heat stresses therein are not transmitted to the frame. To prevent leakage between the cylinder head and the liner a packed tongue-and-groove joint is provided.

The piston has a cone-shaped top which is highly polished in order to reflect the heat. Six rectangular piston rings having narrow wearing surfaces are employed. The compressor furnishing the fuel injection air has two stages and is large enough to charge the tanks while the engine is running. The low-pressure valves, each in a separate cage, and the high-pressure valves, which are combined, are mounted vertically and so arranged that they may be easily removed for inspection. The output of the compressor is controlled by a throttling device on the suction side. No stuffing box is used in the fuel-valve body, a long case-hardened and ground sleeve being used instead. The latter also serves as a guide for the valve stem. The speed of the engine is regulated by varying the amount of oil supplied to the fuel nozzle. This is accomplished by varying the stroke of the fuel pump through the medium of a wedge operated by the governor. The fuel pump, which is mounted on the camshaft bearing case close to the governor, is operated by a cam. The plunger is provided with a spring return.

Concrete Surfacer

The rotary concrete surfacer shown herewith comprises a cutting tool driven through a flexible shaft by an electric motor carried by the operator.



ROTARY CONCRETE SURFACER

The driving motor is of the universal type. The cutting tool consists essentially of a disk, on which are mounted sixteen hardened-steel cutter wheels. The cutter wheels roll on the surface to be dressed in such a manner that their teeth remove the material by a chipping action. The machine is equipped with ball bearings throughout and is lubricated by one grease cup, which feeds the lubricant for the entire tool through the flexible-shaft casing. A special stone and grinding attachment is included with the standard equipment. The attachment is interchangeable with the cutting tool and is used for grinding in a mixture of cement and sand which is swabbed on the surface after the board marks and projections have been thoroughly removed by the cutting tool. This device is made by the Elevator Supplies Company, Inc., of New York City.

Electric Ranges

Attention is called by the Estate Stove Company of Hamilton, Ohio, to a number of changes recently made in its electric ranges. A triple cartridge



RANGE WITH GUTTER TO CATCH CONDENSED WATER

fuse block, mounted in a heavy sheet-iron box with hinged drop doors, is being installed under the end shelf. To catch condensed water a gutter has been provided immediately under the oven-door opening, thus preventing water running down the front. This arrangement is necessary, as considerable moisture is condensed for a short time after the energy has first been turned on for heating the oven. All terminals exposed to high temperature are made of monel metal. An improved type of oven-door latch is used, which compensates for any wear on the latch and enables the door to be held firmly closed to prevent loss of heat.

Hair-Drying Comb

An electrically heated hair-drying comb, the entire metal part of which is made of a single die casting, has recently been placed on the market. This construction permits using a flat heating element and eliminates the necessity of enlarging the back of the comb. The 30-watt heating element can be placed near the teeth of the comb, which makes for greater efficiency of heat application. The comb has an ebonized handle and 6 ft. (1.83 m.) of unbreakable cord. This device is made by the Russell Electric Company of Chicago, Ill.

Telephone Accessory

In the accompanying illustration is shown a telephone accessory having ear-tips that keep disturbing noises out of the ears while telephoning, especially

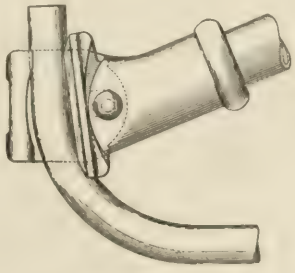


ACCESSORY FOR LONG-DISTANCE TELEPHONING

on long-distance calls. Another feature pointed out by the manufacturer is that the instrument leaves both hands free while telephoning. The device is not an attachment; therefore its use cannot be prohibited by telephone companies. To use the device the receiver is placed on the sound chamber and the ear tips inserted in the ears of the user. Adjustable branch hearing tubes are provided which may be bent so the tension between the ear-tips can be adjusted to suit the individual user. Spring wires are placed inside the branch tubes. Weilaphone, Inc., Metropolitan Tower, New York City, is the maker of this device.

Pipe Hickey

An automatic grip pipe hickey with one fixed and one automatically movable jaw is shown in the accompanying illustration. The movable jaw, it is said, utilizes for clamping all the force required to bend the pipe. The jaws are set at an angle to the handle socket and are similar at each end, thus permitting the bending of pipe from either side. The movable jaw has a bearing of 2¼ in. (5.7 cm.) in diame-



PIPE-BENDING TOOL.

ter, no strain coming on the pin, which serves only to prevent the jaw from falling out. This device is offered to the trade by the Fey Specialty Company of Detroit, Mich.

Trade Publications

CEMENT.—The Late E. Early Company of Canton, Ohio, is distributing a leaflet descriptive of its commutator cement.

MOTORS.—The Burke Electric Company of Erie, Pa., is distributing a leaflet descriptive of its alternating-current motors.

RADIATORS.—The Pelouze Manufacturing Company of Chicago has issued a leaflet descriptive of its electric radiator for bathrooms.

SWITCH PLATES.—The St. Louis Brass Manufacturing Company of St. Louis is distributing a leaflet descriptive of its porcelain enameled switch plates.

PYROMETERS.—The Brown Instrument Company of Philadelphia has prepared bulletin No. 19, descriptive of its Automatic Temperature Control Pyrometer.

WASHING MACHINES.—The Laun-Dry-Lite is illustrated and described in a booklet now being distributed by the Home Specialty Company of Cleveland, Ohio.

MOTORS.—Direct-current motors and generators for 115, 230 and 550 volts are described in bulletin 174, issued by the Crocker-Wheeler Company of Ampere, N. J.

WELDING APPARATUS.—The Bradford-Ackerman Corporation of New York City has issued bulletin 101, descriptive of Astra oxy-illuminating gas apparatus for lead burning.

TESTING SETS.—The Queen-Gray Company of Philadelphia is distributing bulletin E-6, descriptive of portable testing sets and instruments for the maintenance of lines and cables.

PROJECTORS.—Imperial floodlight projectors for protection, business and pleasure are described and illustrated in the folder now being mailed by the Crouse-Hinds Company of Syracuse, N. Y.

PORTABLE LAMP.—The Uno-Lite Company of America has issued a booklet entitled "Loading Your Limes." The booklet tells the story of the development and possible application of the Uno-Lite reading lamp.

TELEPHONE ACCESSORY. — Weilaphone, Inc., 1 Madison Avenue, New York City, has prepared an illustrated leaflet descriptive of its Weilaphone device used to increase the hearing efficiency of the telephone.

KITCHENETTE.—The National Electric Utilities Corporation, 103 Park Avenue, New York City, is distributing a leaflet descriptive of its electric kitchenette. This is a combination range for roasting, broiling, baking, toasting, boiling, etc.

INDUCTION MOTORS.—The Crocker-Wheeler Company of Ampere, N. J., has prepared bulletin 173, describing slot-bridge construction for induction motors. Open slot, semi-closed slot and magnetic slot bridge methods are described and illustrated.

POTENTIOMETERS. — Potentiometers for the measurement of "hot spots" in the electrical apparatus are described in leaflet 4324, now being distributed by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa. The principle involved is that of thermo-electric couple.

REFLECTORS.—The National X-Ray Reflector Company is distributing its April issue of Eye Comfort, published to aid advocates of good lighting. This issue includes articles on war times and floodlighting, a description of a new projector, how to floodlight the flag, eye efficiency and indirect lighting.

LAMPS.—The Cooper Hewitt Electric Company of Hoboken, N. J., is distributing an illustrated calendar in which photographs are shown of actual installations of Cooper Hewitt lamps. These installations include machine shops, cotton mills, engraving plants, motion picture studios, automobile factories, etc.

MOTORS.—Medium-sized direct-current motors and generators for general use are illustrated and described in bulletin 173, now being distributed by the Crocker-Wheeler Company of Ampere, N. J. This company has also issued bulletin No. 176, descriptive of its form R induction motor. This motor is for two-phase and three-phase, squirrel-cage type and 25-cycle.

MOTORS AND GENERATORS. — The Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., has prepared catalog No. 38, descriptive of small motors and generators. This catalog contains information on alternating-current single phase and polyphase motors, direct-current motors, fans and blowers, sewing machine motors, generators, hoisting motors, etc.

ELECTRICAL SPECIALTIES AND REFLECTORS.—Harvey Hubbell, Inc., of Bridgeport, Conn., has prepared catalog No. 6, which introduces an absolutely new idea in the listing of electrical specialties and reflectors. Working on the theory that the prospective buyer is anxious to see either a sample or an actual illustration of the device he wishes to purchase, this company has arranged in chart form all sockets, pull switches, attachment plugs, receptacles and reflectors. The chart demonstrates clearly the interchangeability of the various lines by illustrating at the side and top the component parts and at the point where the imaginary lines drawn from the component parts converge the assembled parts.

Trade Notes

THE OKONITE COMPANY, New York City, has moved its offices to the seventh floor of the Astor Trust Building, 501 Fifth Avenue.

THE WESTERN ELECTRIC COMPANY has filed notice at Trenton, N. J., of increase in its capital from $15,750,000 to $30,750,000.

THE MACBETH-EVANS GLASS COMPANY, Pittsburgh, Pa., announces that its general offices are to be in the new Chamber of Commerce Building, occupying the fourteenth floor.

THE ELECTRIC STORAGE BATTERY COMPANY, Nineteenth Street and Allegheny Avenue, Philadelphia, Pa., will build a one-story addition, 40 ft. by 75 ft., to cost $10,000. Contract for erection has been awarded.

THE BURKE ELECTRIC COMPANY of Erie, Pa., has opened a Washington branch sales office in charge of J. N. Perry at 424 Union Trust Building exclusively for United States government service during the war.

THE IMPERIAL PORCELAIN COMPANY, manufacturer of electrical porcelain specialties, Trenton, N. J., is considering the erection of a new plant near Asbury Park, to cost about $25,000. The proposed factory will be about 40 ft. by 250 ft.

FRED W. L. FULLERTON will incorporate his firm under the name F. W. L. Fullerton, Inc., and will open at 17 East Forty-second Street, New York City, a distributing business for lamps, fans and power motors, electric lighting fixtures, vacuum cleaners and power-consuming devices.

THE S K F BALL BEARING COMPANY OF CALIFORNIA, INC., has been organized in order to supply more readily the rapidly increasing demand for S K F ball bearings on the Pacific Coast. The main office of this company, under the direction of A. M. MacLaren, has opened in San Francisco at 341 Larkin Street, and at this office a large and assorted stock of bearings will be carried.

THE JOHN C. STOLPH COMPANY, Newark, N. J., manufacturer of insulating and protective varnishes, announces the completion of its Newark plant, which includes two executive offices, a new and large insulating laboratory and additions and improvements in the factory which will double its capacity. The company also announces that the Dolph Manufacturing Corporation, 39 Cortlandt Street, New York City, has been appointed general sales representative of the company, and all sales will be handled through it hereafter.

THE RATHBONE-SARD ELECTRIC COMPANY, INC., Albany, N. Y., opened its new factory for the manufacture of Acorn electric ranges on Monday, April 30. The Rathbone-Sard Company has been in the stove business for eighty-seven years, making coal stoves for cooking in the early days and then branching into the gas-stove business. Now, with the incorporation of a new branch company, the Rathbone-Sard Electric Company, Inc., the old concern takes the next step in the development of appliances for cooking. The new plant is a modern structure, 50 ft. by 200 ft. and three stories high. In this plant the range frames and ovens will be built and assembled with the electric heating units which are made at the Pittsfield Works of the General Electric Company. The building was opened with a dinner given by the officers of the new company to members of the executive staff of the Rathbone-Sard Company and the General Electric Company.

New Incorporations

THE APEX ELECTRICAL DISTRIBUTING COMPANY of Cleveland, Ohio, has been chartered with a capital stock of $25,000 by W. T. Holliday and others.

THE OLIVER-WALSTRUM ARMATURE WORKS of Birmingham, Ala., has been incorporated with a capital stock of $12,000 by S. W. Oliver, A. H. Walstrum and H. F. Walstrum.

THE GENERAL STORAGE BATTERY & REPAIR COMPANY, 1737 Boulevard, Jersey City, N. J., has been organized by Fred A. Hoefield and Edward J. Schullian to operate a local plant.

THE ELECTRIC SUPPLY & EQUIPMENT COMPANY of Charlotte, N. C., has been incorporated with a capital stock of $150,000 ($10,000 subscribed) by W. H. Martin, Jr., T. G. Lane and others.

THE WESTERN COIL & ELECTRICAL COMPANY of Racine, Wis., has been incorporated by James V. Rohan, William Mitchell Lewis and James W. Gilson. The company is capitalized at $30,000.

THE GENERAL LIGHTING & SUPPLY COMPANY of St. Louis, Mo., has been incorporated with a capital stock of $5,000 to deal in electrical supplies. The incorporators are: Michael M. Cohen, Jacob D. Cohen and Joseph Cohen.

THE FLASHLIGHT SIGNAL COMPANY of Philadelphia, Pa., has been incorporated by George C. Taggert, Pitco Rankin and Howels Kirk, all of Philadelphia, Pa. The company is capitalized at $50,000 and proposes to manufacture signal devices.

THE NO BATTERY LIGHT COMPANY of Brooklyn, N. Y., has been incorporated with a capital stock of $30,000 to manufacture no-battery flashlights. The incorporators are: Albert Lazarowitz, M. Camora and Jacob Helperen of Brooklyn, N. Y.

THE LESHER ELECTRICAL COMPANY of Dayton, Ohio, has been incorporated with a capital stock of $5,000 to deal in electrical supplies. The company will make a specialty of electric wiring and general electrical work. Chester Lesher is manager.

THE AUTOMATIC CONTROLLER CORPORATION of New York, N. Y., has been incorporated by G. G. Tusa, Thorne Foster, of Brooklyn, N. Y., and F. L. Harris of Elmhurst, N. Y. The company is capitalized at $10,000 and proposes to deal in electrical apparatus.

HATHEWAY & KNOTT of New York, N. Y., have filed articles of incorporation with a capital stock of $10,000 to do a general electrical contracting business. The incorporators are: G. C. Knott, G. L. Hatheway and J. A. Byrne, 120 Liberty Street, New York, N. Y.

THE ROCK PRODUCTS EQUIPMENT CORPORATION of New York, N. Y., has been incorporated with a capital stock of $10,000 to manufacture machinery, engines, dynamos, etc. The incorporators are: H. F. Holly, H. F. Gerdes and N. E. Betjeman, 56 Liberty Street, New York, N. Y.

MITCHELL & GRENELEE of Tuckahoe, N. Y., have filed articles of incorporation with a capital stock of $100,000 to manufacture metals, chemicals, insulation devices, etc. The incorporators are: A. M. Mitchell, 2d, Tuckahoe; J. H. Grenelle, A. N. Grenelle, 163 Lefferts Place, Brooklyn, N. Y.

HENRY A. KRIES & SONS & COMPANY, 6 West Lombard Street, Baltimore, Md., have been incorporated with a capital stock of $50,000 to manufacture heating, electric and ventilating apparatus, etc. The incorporators are: Henry A. Kries, Henry A. Kries, Jr., and Clarence A. Kries.

THE ACME STORAGE BATTERY CORPORATION of Highland, N. Y., has been incorporated by J. Phillips, F. F. Simpson and G. Kaehler, 246 West Fifty-second Street, New York, N. Y. The company is capitalized at $100,000 and proposes to manufacture and deal in storage batteries for automobiles.

THE ELECTRO METALLURGICAL SALES CORPORATION of Niagara Falls, N. Y., has been incorporated by E. P. Price, F. E. Lawton and G. C. Furness, 308 West Seventy-ninth Street, Niagara Falls. Active capital $500,000. The company proposes to deal in iron, steel, metallurgical and chemical products.

THE NATIONAL CONDUIT & CABLE COMPANY of Hastings-on-Hudson, N. Y., has been incorporated by Percy S. Williams, 539 Seventy-third Street, Brooklyn; J. W. Rhoades and Thomas M. Malone of Brooklyn, N. Y. The company is capitalized at $8,750,000 and proposes to manufacture wires, cables, electrical conductors, electrical railway, subway and conduit equipment.

New England States

OQUOSSOC, ME.—The Oquossoc Light & Power Company has been granted permission by the Public Utilities Commission to issue $10,000 in capital stock, part of the proceeds to be used for extensions.

SOUTH BERWICK, ME.—The Public Utilities Commission has authorized the Berwick & Salmon Falls Electric Company to issue $61,500 in bonds and $4,600 in capital stock, the proceeds to be used for the purchase of the water power, partly developed, now owned by the Berwick Realty Corporation, formerly part of the property of the White Mountain Paper Company.

RUTLAND, VT.—The Hortonia Light & Power Company has petitioned the Public Service Commission for permission to increase its capital stock from $150,000 to $500,000, the proceeds to be used in connection with projects already under way in Salisbury, just below the outlet of Lake Dunmore, and two others on Otter Creek, between Rutland and Vergennes.

BOSTON, MASS.—The State Gas and Electric Light Commission has granted the Eastern Massachusetts Electric Company permission to lay transmission lines through the town of Saugus for the purpose of connecting the plant of the Salem Electric Light Company with the Malden & Melrose Gas Company's plant and that of the Suburban Gas & Electric Light Company of Revere.

BOSTON, MASS.—Bids will be received by the Schoolhouse Commissioners of the city of Boston until May 18 for the erection of an addition to the William Lloyd Garrison Elementary School, George Putnam District, Hutchings and Brookledge streets, Roxbury, Boston. A deposit of $25 will be required for a complete set of plans and specifications, and one of $15 for a set of heating and ventilating or electrical plans with specifications.

BOSTON, MASS.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until May 21 for furnishing and installing weighing hoppers and trolleys, motor-driven bridges, coal valves, supporting steel work and electrical equipment in the central power plant, navy yard, Boston, Mass. Drawings and specifications (No. 2372) can be obtained upon application to the above bureau or the commandant of the navy yard named.

FALL RIVER, MASS.—The Massachusetts Waterways Commission has refused to allow the Fall River Electric Light Company to erect wires across the Taunton River, but the company may make application for another location under the power of eminent domain in a new law which goes into effect about May 1.

SPRINGFIELD, MASS.—The Turners Falls (Mass.) Power & Electric Company has awarded the general contract for its large power plant to be erected at Chicopee Junction on the Chicopee River to the Fred T. Ley Company of Springfield. The main building will be about 350 ft. x 250 ft., of reinforced concrete and brick construction, and will cost about $1,500,000. The initial installation will provide for 40,000 kw. The plans provide for an ultimate capacity of 120,000 kw.

NEW HAVEN, CONN.—The United Illuminating Company, it is reported, is contemplating extending its electrical service to the town of Trumbull.

Middle Atlantic States

BROOKLYN, N. Y.—The W. B. Perry Electric Company, 286 Livingston Street, Brooklyn, N. Y., is reported to be in the market for a two-phase, 60-cycle, 220-volt alternating current motor-generator set and a 125-kw. to 150-kw., direct current, 125-volt generator.

PARISHVILLE, N. Y.—The Public Service Commission has approved the purchase of the Parishville electric plant by Myron E. Robson from the A. Sherman Lumber Company.

POUGHKEEPSIE, N. Y.—The capital stock of the Poughkeepsie & Wappingers Falls Electric Railway Company has been increased from $750,000 to $1,000,000.

ROCHESTER, N. Y.—Bids will soon be asked for equipment of the new power house at the main sewage-disposal plant in Irondequoit. The plant will have a generating capacity of 150 hp.

STAPLETON, N. Y.—Bids will be received at the Supervising Chief Engineer's office, Room 730 Custom House, New York, N. Y., until May 24 for remodeling roads and walks, changing main entrance to grounds, providing conduit for electric ground lighting, etc., at the United States Marine Hospital at Stapleton. Specifications may be obtained at the above office.

ALLOWAY, N. J.—The citizens have voted to install an electric-lighting system in Alloway. Energy will be supplied from the Salem plant of the Electric Company of New Jersey.

CLINTON, N. J.—An electric light plant is being erected in Clinton. The plant when completed will supply electrical service in Stewartsville.

DOVER, N. J.—The New Jersey Power & Light Company has discontinued its Boonton plant and transferred the entire load to the new turbo-generating station at Dover. Transformer equipment, consisting of three 500-kw., 33,000-volt units, taken from the Boonton station, is being installed. Work has begun on the erection of a new transmission line from Landing, near Lake Hopatcong, to Netcong-Stanhope, for local light and power service.

NEWARK, N. J.—The power plant and boiler house of the Hewitt Steel Corporation, Chapel Street, Newark, was destroyed by fire on April 28, causing a loss of about $10,000. The plant, it is understood, will be rebuilt.

NEWARK, N. J.—The McGann Warehouse Company, 100 Front Street, Newark, is planning to install a repair department and electric battery charging plant in the garage to be established at 27 Lombardy Street by the company.

PATERSON, N. J.—The Board of Public Works has contracted with the Public Service Electric Company for extension of the lighting system on Main Street.

PATERSON, N. J.—The Board of Fire & Police Commissioners has authorized the installation of a new fire-alarm telegraph system at once. The Watson Electric Company, 88 Ellison Street, will have charge of the work.

TRENTON, N. J.—Preliminary surveys are under way, it is reported, by the Pennsylvania Railroad Company for equipping its lines from Trenton to Camden, and from Camden to Pemberton for electrical operation, using the overhead system.

WILDWOOD, N. J.—The City Commission is considering the installation of an electric floodlighting system on the beach front. The present lighting system along the boardwalk will be extended. William C. Hendee, director of highways, is in charge.

BEAVER FALLS, PA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 28 for changes in plumbing, gas piping, conduit and wiring and lighting fixtures in the United States post office at Beaver Falls. For details see proposal columns.

HAMBURG, PA.—An electric furnace will be installed at the new steel mill to be established by Daniel J. Driscoll and associates. The former plant of the Multiple Parts Company has been acquired and is being enlarged to accommodate the equipment.

HARRISBURG, PA.—Bids will be received by the Board of Commissioners of Public Grounds and Buildings, Harrisburg, until May 31 for supplies for the various departments as follows: Schedule D—engineering and laboratory supplies; Schedule J—plumbing and power plant supplies. Blank bond and schedules containing all necessary information may be obtained at the Department of Public Grounds and Buildings, Harrisburg.

HARRISBURG, PA.—The Public Service Commission has granted permission to the following companies to issue bonds for extensions and improvements: The United Lighting Company of Albion, $110,000; Scranton (Pa.) Electric Company, $183,000; Penn Central Light & Power Company of Altoona, $31,000; Allegheny County Steam Heating Company of Pittsburgh (stock), $220,000; Luzerne County Gas & Electric Company of Kingston, $270,000; West Penn Traction Company of Pittsburgh, $41,000, and Mercer County Light, Heat & Power Company of Greenville, $300,000.

PHILADELPHIA, PA.—The Philadelphia Electric Company has purchased a site, about 60 acres, on Petty's Island, in the Delaware River. As yet the company has made no announcement of its plans.

PHILADELPHIA, PA.—The McClintic-Marshall Company of Pittsburgh has been awarded the contract for erection of a new machine shop and electric power plant at the League Island Navy Yard, Philadelphia. The building will be 130 ft. x 325 ft.

PHILADELPHIA, PA.—The Philadelphia Electric Company has awarded the contract for the construction of its proposed new substation on Hunting Park Avenue to John R. Wiggins & Co., Otis Building, Philadelphia. The building will be of reinforced concrete, one story, 134 ft. x 135 ft.

SCRANTON, PA.—William E. Bright, receiver of the Scranton Textile Company, has been granted permission by the local court to equip the plant for electrical operation to replace the present steam power.

BALTIMORE, MD.—A new power plant will be erected by J. H. and L. A. Dockman, 32 East Montgomery Street, at their ice factory to be built at Rock Creek, for which plans are now being prepared.

BALTIMORE, MD.—In connection with the proposed improvements to be made by the Pennsylvania Railroad Company the City Council is negotiating with the company to equip its lines at the local freight terminal for electrical operation.

BLUEFIELD, W. VA.—Plans are being considered by the Appalachian Power Company for the construction of a steam-driven electric generating station on New River, between Virginian and Norfolk & Western Railways, to cost about $1,000,000. Equipment will include an 18,750-kw. turbine, three 12,000-hp. boilers, etc. Orders have been placed for turbine and boilers. As yet definite plans have not been decided upon.

BOWLING GREEN, VA.—The Bowling Green Light & Power Company, recently organized, it is reported, will erect a power station, 20 ft. x 40 ft., and install an oil engine; the cost of electric plant is estimated at $5,000; will also erect a transmission system (3 miles) at a cost of $5,000, to connect Bowling Green and Milford, Va. The company is capitalized at $10,000. L. E. Martin is president.

FRANKLIN, VA.—Improvements are contemplated to the municipal electric-light plant, involving an expenditure of about $10,000. It is proposed to change the system from direct to alternating current.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until May 21 for furnishing and installing 500 and 750-kw. turbo-generators and 2500, 3125, 3750 and 4375-kva. alternators for the various navy yards. Specifications (No. 2379) may be obtained on application to the bureau.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until May 21 for steam turbine-driven turbo and engine-driven reciprocating air compressors of capacities varying from 2500 to 8000 cu. ft. per minute. Specifications (No. 2380) can be obtained upon application to the above bureau.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until May 28 for constructing three 600-ft. steel towers with concrete footings at the United States Naval radio station, El Cayey, P. R. Plans and specifications (No. 2364) can be obtained upon application to the bureau or to the commandant of the navy yard, New York, N. Y.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 24 for furnishing and installing lighting fixtures in the United States post office at Alliance, Neb.; Elkins, W. Va.; Huntington, Ind.; Kalispell, Mont.; Newark, Ohio; Orlando, Fla.; Pottstown, Pa.; Roseburg, Ore.; Rumford, Me.; South Bethlehem, Pa.; South Boston, Va., and Vancouver, Wash. For details see proposal columns.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations the following supplies: Puget Sound, Wash., Schedule 1074—miscellaneous cable chain; Schedule 1078—eight watertight, type B annunciators, 72 vibrating bells, 75 bush buttons, 50 salvo firing buzzers, 1000 interior fittings, 25 watertight telephone jacks, 1900 sockets for instruments, lamps, keyless, wall, key; 145 spools of silk insulating tape. Norfolk, Va., Schedule 1050—two Diesel engine-driven generating sets; Schedule 1072—miscellaneous sleeves, turnbuckles, sheaves. Brooklyn, N. Y., Schedule 1072—330 watertight vibrating bells, miscellaneous searchlight carbons, 2500 porcelain attachment plugs, 500 knife switches, 50,000 two-pole wire terminals. Mare Island, Cal., Schedule 1078—miscellaneous receptacle clusters, three masthead lenses, 1600 non-watertight attachment plugs, 180 fire control telephone plugs, 250 chain-pull commercial sockets, miscellaneous baby knife, switches, etc. Philadelphia, Pa., Schedule 1064—miscellaneous ventilating fans; Schedule 1068—800 and 200 brass sockets and switches. Boston, Mass., Schedule 1072—520 rolls white muslin tape. Boston, Mass., Philadelphia, Pa., Schedule 1072—400 lb. grade A1 un-

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

at mica. Mare Island, Cal., and Puget Sound, Wash., schedule 1918 4200 non-watertight portable guards. Philadelphia, Pa., and Norfolk, Va., schedule 1921 two motor-driven sewing and paste tables with punches. Applications for proposal blanks should designate the schedule desired by number.

North Central States

CALUMET, MICH.—W. E. Smith, we are informed, is not interested in the installation of a new street-lighting system in Calumet, as reported in the issue of March 31. Mr. Smith is interested in the establishment of a lighthouse in this county.

HOLLY, MICH.—The village of Holly has accepted the proposal of the Consumers' Power Company to take over the local electric plant and supply electrical service here.

AKRON, OHIO.—The Coventry Land Company has petitioned the City Council to authorize the Northern Ohio Traction & Light Company to furnish electricity to the Firestone Park allotment. The land company states that it will install a lighting system, to cost from $22,000 to $25,000, if energy will be furnished.

BARBERTON, OHIO.—The installation of a new boiler and generating equipment, to cost $51,000 and $48,000 respectively, is under consideration by the lighting committee of the City Council.

CINCINNATI, OHIO.—The power house of the Coney Island Company at Coney Island, a river and amusement resort near Cincinnati, was damaged by fire on May 4 causing a loss of about $50,000. The company will secure electricity from the city lines for operating the lighting system and various amusement devices of the park for the present.

CINCINNATI, OHIO.—Plans for the construction of an ornamental street-lighting system in the business section of the city, to replace the arc lamps now in use, have been agreed upon by the City Council and the necessary ordinance will soon be passed, with a view of completing the work during the summer. The Council also contemplates similar improvements in the lighting system on some of the suburban streets. The service department is now preparing estimates of the cost.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, until May 22 for furnishing an exciter unit for the division of light and heat. Specifications may be obtained upon application to the office of the division of light and heat, room 204, City Hall.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City, Hall, Cleveland, until May 22 for furnishing economizers, forced and induced fans for the division of light and heat. Specifications may be obtained at the office of the division of light and heat, room 204, City Hall.

GREEN SPRING, OHIO.—The Village Council has authorized an issue of $6,500 in bonds for the purchase of the plant of the Green Spring Electric Light & Power Company to be owned and operated by the municipality.

HUNTSVILLE, OHIO.—At an election held recently the proposal to issue $2,500 in bonds for the installation of an electric-lighting system was carried.

KINGS MILLS, OHIO.—The Hamilton (Ohio) Electric Company has the contract for installing electric switchboards and other equipment in the plant of the Peters Cartridge Company at Kings Mills. The cost of the work is estimated at $25,000.

LORAIN, OHIO.—Work will soon begin on the erection of a new power plant for the Lorain County Electric Company in Lorain. The present plans provide for an initial installation of an 8000-kv. Westinghouse steam turbine and six 500-hp. Babcock & Wilcox boilers with Green chain-grate stokers. J. B. Johnson of Elyria is manager.

WATERVILLE, OHIO.—At an election held recently the proposal to issue bonds for the installation of an electric distribution system to provide electricity for street-lighting, commercial and domestic service was carried.

ASHLAND, KY.—Powell & Clarke of Ashland have been engaged as engineers for the proposed electric railway to be built from Ashland to Russell, Ky., a distance of 5 miles. The Vaughan Construction Company of Shawsville, Va., has the contract for construction of road. The railway may be extended to Greenup, Ky., 10 miles distant.

LANCASTER, KY.—The local electric-light plant, owned by Alex. Walker, it is reported, has been purchased by Bastin Brothers, who recently purchased the local electric lighting franchise. The owners contemplate improvements to the plant and establishing a 24-hour service.

SCOTTSVILLE, KY.—The name of the Scottsville Electric Light Company has been changed to the Scottsville Light & Power Company.

SOMERSET, KY.—The Southern Machinery Exchange, Somerset, it is reported, would like to receive prices (dealers') on a 300-kva., three-phase, 60-cycle, 2200-volt generator and a 200-hp. motor and a three-phase, 60-cycle transformer.

FORT WAYNE, IND.—The Fort Wayne & Decatur Traction Company has petitioned the Public Service Commission for permission to issue $100,000 in bonds, of which part of the proceeds will be used for extensions and improvements.

REDKEY, IND.—The Town Board has entered into a contract with the Muncie Electric Light Company to replace the arc lamps now in use with nitrogen lamps of 600 cp.

FREEPORT, ILL.—Extensive improvements, it is reported, are contemplated by the Illinois Central Railroad Company to its local shops, involving an expenditure of about $100,000 during the coming summer. Of this amount about $20,000 will be expended for electrical equipment and an equal amount will be spent to equip the coal chute at the shops for electrical operation.

URBANA, ILL.—Bids will be received by the University of Illinois, Urbana, until May 30 for the general contracts, heating, plumbing and electrical work on two buildings estimated to cost about $400,000. The foundations are now in. James M. White is supervising architect.

CHILTON, WIS.—The local electric-light plant, it is reported, has been taken over by the Wisconsin Public Service Company of Green Bay. The company is planning to rebuild the system and extend its electric transmission lines from Green Bay into Chilton.

MILWAUKEE, WIS.—The Kempsmith Manufacturing Company of Milwaukee, which has doubled the capacity of its plant during the last six months, is contemplating further extensions. The output of the steam power plant is now being doubled. Paul E. Thomas is president and treasurer.

OSHKOSH, WIS.—Active work will soon begin on construction of the new electric light plant of the Oshkosh Gas Company.

HASTINGS, MINN.—Bids will be received by the Minnesota State Board of Control, State Capitol Building, St. Paul, until May 15 for construction of a service building, including general contract work, heating and ventilating, plumbing and electrical work, refrigerator, elevator and kitchen equipment. Plans and specifications are on file in the office of C. H. Johnston, architect, 715 Capitol Building, St. Paul, and at the office of the superintendent of the institution. Copies may be obtained on application to the State Board of Control upon deposit of $25.

ST. CLOUD, MINN.—Bids will be received by the City Commissioner of the city of St. Cloud until May 15 for construction of a two-story fire and police station. Separate bids to be submitted on general construction, heating and ventilating, electric wiring, steel cell work, etc. Plans and specifications may be obtained at the office of Buckley & Prins, architects, 252 Plymouth Building, Minneapolis, upon deposit of $10, of which $5 will be refunded upon return of plans.

CONROY, IOWA.—The Iowa Electric Company of Marengo is installing an electric distributing system in Conroy.

SIOUX CITY, IOWA.—The Sioux City Service Company, it is reported, is contemplating the construction of a new power plant, to cost about $750,000.

SPENCER, IOWA.—At an election to be held May 14 the proposal to issue $12,000 for the installation of an electric-light plant will be submitted to the voters.

BOONVILLE, MO.—Contract has been awarded to W. J. Cochran of Boonville for the construction of power house and the erection of 600 ft. of electric transmission line, to cost $22,000, for the Kemper Military School.

LA PLATA, MO.—The question of issuing bonds for the installation of a municipal electric light plant is under consideration.

LOUISIANA, MO.—Bids will be received by the Board of Supervisors of the Riverland Levee District, Louisiana, until May 21 for furnishing and erecting any or all parts of an oil-driven pumping plant. For further information address the Jacksonville (Ill.) Engineering Company, or J. Robert Johnston, secretary, Louisiana.

MAYVILLE, N. D.—Bids will be received by Charles Brewer, secretary of the state board of regents of North Dakota, at the office of Hancock Brothers, architects, 113 Broadway, Fargo, until May 25 for construction of dormitory building on the Normal School grounds at Mayville. Separate bids to be submitted on electrical work, plumbing, heating and ventilating. Plans and specifications may be seen at the office of the architects.

LAKE ANDES, S. D.—Bids will be received by the Commissioners of Charles Mix County, Lake Andes, until May 22, for the erection of a court house at Lake Andes, to cost about $150,000. Separate bids to be submitted for heating, electric wiring, jail equipment, etc. William L. Steele, United Bank Building, Sioux City, Iowa, is architect.

LESTERVILLE, S. D.—At an election held recently the proposal to issue $8,000 in bonds for the installation of a municipal electric-lighting plant was carried. An election will soon be called to vote on a proposal to issue additional bonds.

PLANKINTON, S. D.—Bonds to the amount of $16,000 have been voted for the purchase of local electric-light plant.

REDFIELD, S. D.—Bids will be received by the board of education, Redfield, until June 2 for construction of high school building, including general work, plumbing and sewerage, heating and ventilating and electrical work. Plans and specifications may be obtained upon application to William B. Ittner, architect, Board of Education Building, St. Louis, Mo. A deposit of $20 will be required for plans covering the general work and $10 for the plans for plumbing, heating and electrical work.

BENKELMAN, NEB.—A new 30-kw. General Electric direct-current generator is being installed in the municipal electric-light and water plant. A 10,000-gal. storage tank is being erected.

COURTENAY, NEB.—Bonds to the amount of $7,000 have been authorized for the installation of an electric-light plant in Courtenay.

EMERSON, NEB.—The property of the Emerson Light & Power Company has been purchased by the Nebraska Electric Company of Cedar Rapids, Iowa. Henry Jensen is local manager.

HUMPHREY, NEB.—Plans are being considered by Frank Huthmacher, owner of the municipal electric-light plant, for the installation of an oil engine and generator.

KEARNEY, NEB.—Negotiations have been closed whereby the property and holdings of the Kearney Water & Electric Company, including electric plant, gas works, the Kearney canal and extension lines, have been taken over by the L. E. Myer Company of Chicago, Ill. Extensions, including an addition to the present plant, widening of the canal and increasing the output for extension lines, it is understood, will be made by the new owners.

BARNARD, KAN.—The town of Barnard has granted F. E. Justice of Lincoln a franchise to furnish electrical service in Barnard for a period of 20 years.

BELOIT, KAN.—Bids will be received by C. R. Herrick, city clerk, Beloit, until May 15 for improvements to water-works system, including one 200-hp. water-tube boiler and boiler room equipment, two 400-gal. per minute, 300-ft. head, horizontal, motor-driven centrifugal pumps, two 400-gal. per minute, 30-ft. head, vertical, motor-driven centrifugal pumps; also building filter and power house, coal bunkers, etc. Plans and specifications may be obtained on application to Black & Veatch, engineers, Interstate Building, Kansas City, Mo., upon deposit of $25.

MANHATTAN, KAN.—Bids will be received by H. B. Winter, architect, Manhattan, until May 16 for the construction of Odd Fellows' Home at Eureka Lake, near Manhattan, to cost from $90,000 to $100,000. Separate bids to be submitted on heating and ventilating and electric wiring.

STOCKTON, KAN.—The town officials, it is reported, are considering improvements to the municipal electric-light plant.

Southern States

GREENSBORO, N. C.—The Greensboro Supply Company, it is reported, would like to receive prices on a 400 to 500-kw., three-phase, 60-cycle, 2300-volt revolving-field alternator directly connected to a uniflow or tandem-compound Corliss engine, together with exciter, switchboard, etc.

TRENTON, N. C.—A new electric-light plant is being installed by the Brock Electric Company to supply electrical service in Trenton. Furney Brock and others are interested in the project.

CHARLESTON, S. C.—The Charleston Consolidated Railway & Lighting Company is planning to erect a transformer station, to cost about $5,000.

SPARTANBURG, S. C.—The South Carolina Light, Power & Railways Company is planning to build a street railway extension to Whitney, and also to rebuild part of its Clifton line.

PENSACOLA, FLA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until May 21 for a 200-ft. steel observation tower with electric elevator and an office building between the legs of the tower at the navy aeronautic station, Pensacola. Drawing and specification (No. 2367) can be obtained upon application to the above bureau or to the commandant of the naval station named.

ARLINGTON, TENN.—Work will soon begin on the installation of a municipal electric-light plant and water-works system in Arlington for which $15,000 in bonds have been sold. Oil engines will be used.

MERIDIAN, MISS.—Plans are being considered by John M. Dabney, mayor, for the establishment of an ice factory and cold storage plant, to cost about $75,000.

KENNER, LA.—The town of Kenner has awarded the contract for street-lighting to the Orleans-Kenner Electric Railway Company of New Orleans. Twenty-five lamps are to be erected.

CUSTER, OKLA.—The City Council is considering extending the municipal electric-lighting system to supply electricity in the farming districts.

McALESTER, OKLA.—The Choctaw Power & Light Company contemplates erecting an electric transmission line to Gowen.

OKLAHOMA CITY, OKLA.—The United States Garage Company is contemplating equipping a garage and machine shop, to cost about $50,000, of which $20,000 will be used for machinery.

CANYON CITY, TEX.—The City Council has entered into an arrangement with the Canyon Power Company for a test to be made at the city wells under which the company will furnish electricity to operate the pumps at the pumping station for 90 days to determine the cost as between the electrically operated pumps and the gasoline engines now in use.

Pacific and Mountain States

BREMERTON, WASH.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until May 28 for furnishing four 15-ton, motor-driven, traveling, revolving, hammerhead shipbuilding cranes at the navy yard, Puget Sound, Wash. Specification (No. 2374) can be obtained on application to the above bureau or to the commandant of the navy yard named.

OLYMPIA, WASH.—The Puget Sound Traction, Light & Power Company of Seattle has entered into a contract with the Olympia Light & Power Company to erect an electric transmission line from Fern Hill near Tacoma to the Boulevard road to connect with the service lines of the Olympia company. The cost of the work is estimated at $53,000.

SEATTLE, WASH.—The City Council has adopted a resolution declaring that the Sultan River project is not essential to the city of Seattle's plan for power development, and so far as the city is concerned the Sound Paper Company, which proposes to establish a paper mill and develop the water power of the Sultan River, is free to proceed with the development. The present plans of the company provide for an ultimate expenditure of $12,000,000. Scott Calhoun and S. P. Weston of Seattle are interested.

SEATTLE, WASH.—Bids opened April 27 by the Board of Works for a 13,500-hp. steam power plant at Lake Union revealed that the machinery alone will cost the city $350,000, against $187,000 paid for the machinery of the present plant of same capacity. The lowest bid for the building was $75,000, making the total minimum cost $425,000. The bond issue authorized is for $390,000 only, but there is also available for this purpose $70,000 left over in the light department fund from the last installation. Specifications will soon be issued for the proposed $3,000,000 hydroelectric plant and work on construction of same will be started as soon thereafter as legal formalities will permit.

BAKER CITY, ORE.—Plans have been completed by the Pacific States Timber Investment Company for a sawmill with a daily capacity of 1,500,000 ft. Electrically operated machinery will be installed.

HALFWAY, ORE.—The City Council has granted the Idaho Light & Power Company a franchise to furnish electricity in Halfway, and also awarded the company a contract for street-lighting for a period of ten years. The proposed transmission lines will extend from Robinette to Cornucopia.

KLAMATH FALLS, ORE.—Bids have been asked by the City Council for the construction of a municipal railway from Second Street and Klamath Avenue to a point near Dairy, 20 miles east of Klamath.

LOS ANGELES, CAL.—The American Mining & Development Company is considering the construction of an electric power plant and the installation of machinery and equipment at its property in Madera County.

LOS ANGELES, CAL.—Application has been made to the State Railroad Commission by the Southern California Edison Company for permission to purchase the electric plant of the Beverly Hills Utilities Company and to take over its franchises, at $23,347.

LOS ANGELES, CAL.—Work will begin at once on the construction of the proposed new railway shops for the Pacific Electric Railway Company at Torrence. The plans provide for 14 structures. The initial buildings will include a machine shop, an erecting plant and a paint shop, each 180 ft. x 450 ft.; a blacksmith shop, 150 ft. x 200 ft.; freight car plant, 175 ft. x 400 ft., and a power plant, 60 ft. x 120 ft. An appropriation of $1,000,000 is available for the work.

PASADENA, CAL.—An ordinance has been passed by the City Commission providing for the installation of an electric-lighting system on Lester Avenue, between Orange Grove Avenue and Rosella Drive.

SAN FRANCISCO, CAL.—The Great Western Power Company, 14 Sansome Street, has applied to the State Railroad Commission for permission to serve electricity in all parts of Plumas County not served by the Grizzly Electric Company, the Quincy Electric Light & Power Company and the Plumas Light & Power Company.

SUISIN, CAL.—The Vallejo (Cal.) Electric Light & Power Company has been granted a franchise to operate in Solano County.

CALDWELL, IDAHO.—The Caldwell Traction Company, it is reported, contemplates issuing $100,000 in bonds, the proceeds to be used for equipping its Wilder branch for electrical operation and an extension of its present system, including the construction of a loop extending through the Gem district and connecting the Lake Lowell branch with the Wilder branch.

GRANGEVILLE, IDAHO.—Work will soon begin on the construction of the proposed new dam and power house on South Fork. The original plans, calling for an expenditure of $50,000, have been enlarged and improvements costing $85,000 will be made.

LEWISTON, IDAHO.—The City Council has accepted the bid of the Washington-Idaho Light & Power Company for lighting the streets of the city and furnishing power for operating the pumping station for a period of ten years. The new contract provides for the installation of 30 ornamental lamp standards in the business district. Improvements, to cost about $15,000, will be made by the company.

OGDEN, UTAH.—Work will soon be started on the rebuilding of the electric transmission line of the Utah Power & Light Company through Ogden Canyon into Ogden Valley and also into the Eden district

RICHFIELD, UTAH.—Extensions and improvements, it is reported, are contemplated by the Southern Utah Power Company and the Beaver River Power Company, controlled by L. L. Nunn, to cost about $500,000 and which will include the construction of one new power plant and putting into operation two plants that have been out of commission for more than two years and the erection of many miles of new electric transmission lines. The new power plant of the Beaver River Power Company is to be located directly below the present plant of the company. The Southern Utah Company will erect a high-tension transmission line from Richfield to Fillmore; also a number of short lines to other sections of Sevier, Beaver and Piute Counties to supply energy to mining companies and other industries in those districts.

MESA, ARIZ.—At a special election to be held May 15 the proposal to issue $125,000 in bonds for the construction of a municipal electric-light plant will be submitted to the voters.

PHOENIX, ARIZ.—The Magna Copper Company, it is reported, contemplates the construction of a 600-kw. electric plant to supply electricity to the Water Users' Association.

LIVINGSTON, MONT.—A resolution has been adopted by the City Council providing for the installation of an ornamental lighting system on certain streets of the city, to cost about $8,000.

COLORADO SPRINGS, COL.—The El Paso County Mutual Telephone Company is contemplating extensions of its systems to Jimmy Camp, Rush, Kendrick, Truckton and other points, which will call for the erection of 75 miles of line, at a cost of about $7,000.

WINNEMUCCA, NEV.—Arrangements are being made by the Nevada Valleys Power Company of Lovelocks for the erection of a high-tension transmission line from Winnemucca to Golconda, where it will supply energy to operate pumps for irrigating purposes, and thence down the Adelaide Valley, where it will connect with the main power line that is being erected from Rochester to Battle Mountain. The company proposes to make other extensions into adjacent territory from Winnemucca.

MOCOLLON, N. M.—An option has been taken, it is reported, on the partially finished hydroelectric plant commenced by B. W. Hill and associates by Charles E. Stewart of New York, N. Y., who proposes to finish the installation.

Canada

VANCOUVER, B. C.—The City Council has received an offer of another water power from the British Columbia-Iowa Lumber Company of Vancouver. The company states that the waterfall which it controls at the head of Salmon Arm, Sechlet Inlet, would develop from 20,000 hp. to 50,000 hp. in electrical energy at a comparatively low cost. The city already holds two water-power sites under option.

BRANTFORD, ONT.—The installation of a storage battery system, at a cost of $2,000 has been recommended by the fire chief.

CHARLTON, ONT.—The electric power plant in Charlton has been taken over by the Northern Ontario Light & Power Company of Cobalt, which will operate it as part of its holdings in northern Ontario. Extensions and improvements, it is understood, will be made to the system.

HAMILTON, ONT.—The installation of a steam turbine centrifugal pump having a capacity of 10,000,000 gal. per day and an additional electric unit of same capacity for the water-works plant has been recommended by Gray & Bain, engineers of Hamilton. The cost of the proposed equipment is estimated at $103,000.

STEPHEN TOWNSHIP, ONT.—Plans are being prepared by the Hydro-Electric Power Commission of Ontario for the erection of an electric transmission line through Stephen Township.

THETFORD MINES, QUE.—The ratepayers have approved the bylaw for construction of new dam for reservoir, to cost $50,000.

THREE RIVERS, QUE.—The St. Maurice Lumber Company is contemplating the construction of a concrete dam 1080 ft. long and power house at Les Forges Rapids, Que. The plans provide for the installation of six generating units of 10,500 hp. H. S. Ferguson, 100 Fifth Avenue, New York, N. Y., is consulting engineer. R. F. Grant is local manager.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until May 18 for furnishing, under circular No. 2125, one power hacksaw, belt-driven; 11 watthour meters, six holophane reflectors, etc. Bids will also be received until May 17 for furnishing, under circular No. 2126, one electric drill, 524 compression cups, 60 oil cups, 36 carbon dies, etc. For further information address Earl L. Brown, major corps of engineers, U. S. Army, general purchasing officer.

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until May 25 for furnishing steel, steel rails, steel ties and fittings, steel tumblers, wire rope, chain, electric motor, storage batteries, etc. Blanks and information relating to this circular (No. 1144) may be obtained upon application to the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

PEARL HARBOR, HAWAII.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until May 28 for furnishing one hydro-pneumatic freight elevator, structural framework and wire mesh inclosure complete at the naval station, Pearl Harbor, Hawaii. Drawing and specification (No. 2320) may be obtained at the above office or of the commandant of the navy yard named.

1,219,294. Machine for Coiling Wire. Fioravante Giunta, New Haven, Conn. App. filed Oct. 13, 1915. Provides means for supporting the soft coils of wire as they are wound upon a drum, so that after it is vulcanized the wire will be perfectly round and the insulation uninjured.

1,224,126. Centrifugal Switch; Andrew H. Barken, Wilkinsburg, Pa. App. filed Jan. 24, 1914. Improvement.

1,224,131. Weather Cap; John C. Boyton and Chas. H. Nicherson, Cleveland, Ohio. App. filed April 20, 1914. Improvement.

1,224,147. Electric Pump Governor; Philip L. Crittenden, Edgewood, Pa. App. filed Aug. 5, 1915. Eliminate the flexible connection.

1,224,149. Transformer; Walter M. Dann, Wilkinsburg, Pa. App. filed Feb. 21, 1914. Employment of standard rolled-steel sections.

1,224,150. Arc-Suppressing Device; David C. Davis, Swissvale, Pa. App. filed June 9, 1914. Magnetic blow-out type.

1,224,160. Direct-Current Apparatus; Charles W. Girvin, San Francisco, Cal. App. filed May 12, 1913. Commutator may be employed as a part of a mechanism for generating current or of apparatus acting as a motor and employing direct current.

1,224,166. Control System for Single-Phase Motors; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Feb. 19, 1914. Automatically aiding the acceleration of a motor.

1,224,167. Control System; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed March 23, 1914. Control of alternating-current motors of the commutator type.

1,224,171. Electrodynamometer Instrument; John T. Irwin, London, England. App. filed Nov. 26, 1913. Astatic.

1,224,172. Protective Means for an Electrical Distributing System; Ray P. Jackson, Edgewood Park, Pa. App. filed July 14, 1915. Improvement.

1,224,184. Transformer Insulation; William M. McConahey, Pittsburgh, Pa. App. filed Jan. 30, 1914. Means for insulating the current-carrying windings thereof.

1,224,186. Circuit Interrupter; Joseph N. Mahoney, Wilkinsburg, Pa. App. filed Aug. 11, 1913. Contact members for oil-insulated circuit breakers.

1,224,206. Commutator Cylinder for Dynamo-Electric Machines; William S. Pyrah, Old Trafford, England. App. filed March 24, 1915. Improvement.

1,224,210. Transformer-Core Punching; Emerson G. Reed, Wilkinsburg, Pa. App. filed Dec. 26, 1913. Of such form as to insure a maximum economy of material and a reduction in the expenses of operation and in the losses of transformers.

1,224,222. Electric Switch; Louis B. Sears, Corry, Pa. App. filed Nov. 27, 1915. Push-buttons.

1,224,225. Transformer; Ferdinand Sieber, Vado Ligure, Italy. App. filed June 24, 1912. Coils are disposed one above another with layers of insulating material inserted between them.

1,224,227. Loom Fastener; Edward S. Snover, Toledo, Ohio. App. filed Sept. 5, 1916. Formed of wire.

1,224,255. Transforming System; Vern E. Alden, Wilkinsburg, Pa. App. filed March 30, 1915. Transfer energy between two systems that transmit alternating currents of unlike numbers of phases.

1,224,259. Insulator; Frank Bement and Edward A. Logan, Shrewsbury, Mass. App. filed Nov. 15, 1915. On high-tension wires to prevent leakage of the current where they engage branches of trees or buildings.

1,224,269. Fitting for Electrical Conduit Systems; David L. J. Broadbent, Southport, England. App. filed June 11, 1914. Improvements.

1,224,307. Arc-Welding Apparatus; James F. Lincoln, Cleveland, Ohio. App. filed Dec. 23, 1915. Relates to electric current generation control.

1,224,313. Thermostatic Regulator; John Nathan, Los Angeles, Cal. App. filed Feb. 8, 1915. By the expansion and contraction of a fluid.

Record of Electrical Patents

Notes on United States Patents issued on May 1, 1917

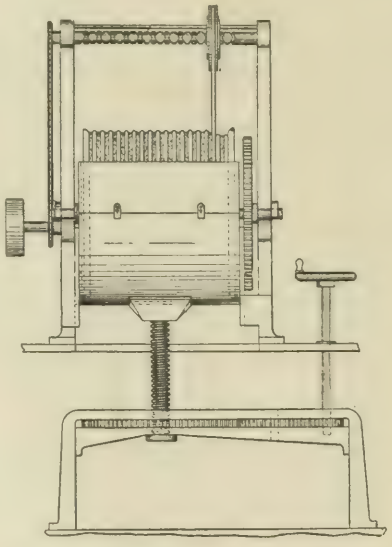
1,224,316. Means for Attaching Electrical Appliances to Conduit Outlet Boxes; John E. Parker and Daniel B. Winter, Syracuse, N. Y. App. filed July 27, 1911. New and useful means.

1,224,320. Terminal Fitting for Electric Conduits; James C. Phelps, Springfield, Mass. App. filed Oct. 2, 1914. For closing the ends of iron conduits which are used for electric wires.

1,224,326. Apparatus for Household Cooking; Andreas Saxegaard, Stavanger, Norway. App. filed May 7, 1914. Utilizes electric current.

1,224,330. Safety Device for Electrical Systems; Lester Siebenhauer, San Francisco, Cal. App. filed Sept. 27, 1915. Adapted to overcome the burning out of motors and is designed for positioning between the source of supply and the motor.

1,224,332. Electrical Protective Device; Benjamin H. Smith, Turtle Creek, Pa. App. filed March 7, 1916. Means for protecting electrical translating devices in accordance with the temperatures thereof.



1,219,294—Machine for Coiling Wire

1,334,337. Switch; Halfdan A. Steen, Norwood, Ohio. App. filed March 23, 1912. Oil switches.

1,334,370. Electrical Protective Device; Charles LeG. Fortescue, Pittsburgh, Pa. App. filed May 3, 1916. Means for protecting electrical translating devices in accordance with the temperatures thereof.

1,224,385. Means for Indicating Abnormal Temperatures in Vegetable Matter; Alfred D. Kennedy, Greenville, S. C. App. filed May 22, 1915. Within piles of cottonseed, cottonseed hulls, grains or other material subject to increase of the internal temperature to a harmful degree.

1,224,386. Lighting Appliance; Lawrence Langner, New York City, N. Y. App. filed Feb. 3, 1915. "Semi-indirect" type.

1,224,400. Electrical Protective Device; Paul MacGahan, Pittsburgh, Pa. App. filed Aug. 9, 1915. Actuated only when the load traversing a translating device is of a predetermined value.

1,224,408. Electrical Protective Device; Laurence M. Perkins, Wilkinsburg, Pa. App. filed Oct. 30, 1916. Improvement.

1,224,409. Barrier Cut-out Switch; James C. Phelps, Springfield, Mass. App. filed Nov. 19, 1915. Sectional fuse blocks.

1,224,434. Storage Battery; Theodore A. Willard, Cleveland, Ohio. App. filed May 12, 1915. Method of sealing the jar and battery box.

1,224,455. Primary Battery; George S. Engle, Cranston, R. I. App. filed May 3, 1914. Provides means for air-venting the cell.

1,224,458. Hydrometallurgy of Copper; John C. Greenway, Warren, Ariz., and Harry W. Morse, Los Angeles, Cal. App. filed June 5, 1916. Maintains a very low concentration of ferric sulphate in the electrolyte.

1,224,505. Attachment Plug; Ralph A. Schoenberg, New York, N. Y. App. filed April 22, 1916. Structural improvements.

1,224,508. Control Mechanism for Sewing-Machine Motors; Harry E. Sellers, Wausau, Wis. App. filed Feb. 5, 1916. Support for such element whereby it may be placed on the floor and conveniently connected to the treadle of a sewing machine.

1,224,518. Armature Construction for Dynamo-Electric Machines; Vincent G. Apple, Dayton, Ohio. App. filed Nov. 19, 1914. Improve armature structure.

1,224,542. Circuit Controller; William S. Henry, Rochester, N. Y. App. filed Jan. 18, 1913. Will act both as a drag and a snap-circuit controller.

1,224,576. Molding-Base Canopy Seat; Allison S. Smith, Bellaire, Ohio. App. filed May 1, 1916. Designed to receive the ends of wire-inclosing moldings.

1,224,580. Ore-Separating Machine; Herbert H. Thompson, Aldridge, and Alfred E. Davies, Hockley Heath, England. App. filed Oct. 13, 1915. Armature rotating adjacent to the ore carrier.

1,224,602. Electrical Apparatus; Alexander Churchward, Boston, Mass. App. filed April 23, 1915. Motors or generators comprising a revolving armature and a stationary field.

1,224,610. Rheostat; Matthey S. Cumner, New York City, N. Y., and Frederick W. Geissenhainer, Freehold, N. J. App. filed Dec. 11, 1914. Adapted for controlling the intensity of an electric light so as to secure the best results when the light is utilized for photographic printing from a motion picture or other film or roll.

1,224,639. Apparatus for Transforming Electrical Energy; Peter C. Hewitt, New York City, N. Y. App. filed July 1, 1905. Interrupters having a disintegrating and restrictive negative electrode such as mercury.

1,224,689. System of Electrical Distribution; Percy H. Thomas, Upper Montclair, N. J. App. filed March 29, 1913. Utilizes vapor electric rectifiers connected between the direct-current line and the alternating receiving circuits to accomplish the suppression of the current flow during the periods of wrongly directed electromotive force.

1,224,729. Rotary Converter; Lionel Fleischmann, Berlin, Germany. App. filed May 12, 1914. Method of starting.

1,224,741. Indicator and Fluid Containers; George P. Hewis, Regina, Saskatchewan, Canada. App. filed July 21, 1916. Electro-mechanical indicators for fluid containers.

1,224,827. Controller for Indicating Systems; Adolph Zeisel, Bel Air, Md. App. filed Feb. 1, 1916. Improvements.

1,224,856. Electrical Connection; William A. Chryst, Dayton, Ohio. App. filed May 13, 1912. Machines wherein a commutator and co-operating brushes are employed.

1,224,864. Portable Electric-Lamp Holder; Clarence Carson, New York City, N. Y. App. filed Feb. 24, 1915. Improvements.

1,224,881. Electric Switch and Fuse Box; Lawrence F. Kries, Baltimore, Md. App. filed Aug. 30, 1913. Designed to permit opening whenever necessary for inspection or renewal.

Electrical World

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Advantages of Interconnection

THE high price of fuel as well as of all supplies needed by central stations, the increasing market for energy and the inability to secure generating equipment promptly all indicate the necessity of interchange of electrical energy through the interconnection of contiguous generating systems. The surplus capacity of one system can then be utilized by some other system having need for it; maximum use will be made of investment and of equipment; reliability of service will be increased, and great economies will be possible. Aside from the patriotic duty to conserve the coal supply, there is the selfish duty of caring for the business and, if possible, earning dividends besides. Interconnection of distributing systems offers a timely and welcome solution to these present difficulties. It is not necessarily a war move, although that of itself is sufficient justification. In physical and electrical union there is strength, and we venture to predict that once tied together interconnected electrical generating systems will never again break up into individual units. The advantages are too great to be lightly cast aside.

Engineering Experiment Stations

WE PUBLISH in this week's issue a comparative table of the principal provisions of three bills which have been recently introduced in Congress and which have for their common object the promotion of engineering research. While it is not likely that any of these bills will come up for consideration under the present troubled conditions, each represents the result of some study and discussion, and therefore a careful analysis of the provisions of all by the engineering profession is warranted. The three bills agree in providing $15,000 annually to each state and territory for the purpose of promoting engineering research, etc., and in stipulating some form of federal control over the moneys spent. Outside of these features, the three bills differ from one another in some details. According to the Newlands bill, the engineering research station in each state would be connected with the land grant college; the Smith-Howard bill provides that the station may be connected with any state-supported engineering school or university designated by the legislature, whereas the Gronna bill specifies that laboratories, equipment and individuals of any institution of learning or research may be utilized as opportunity presents. The Gronna bill would also create a state board of research appointed by a national research board, while the other two bills provide for local supervision and authority. There are undoubtedly arguments in favor of all these plans, but since they are mutually exclusive it becomes the duty of the engineering profession to weigh them carefully to determine which best meets the needs of the profession and then to lay its unanimous opinion before Congress at an opportune time.

Nikola Tesla

THE award of the Edison medal to Nikola Tesla is most appropriate, in view of the early contribution that he made to alternating-current motors. In order to recognize that contribution, one must go back to the period, thirty years ago, when alternating-current engineering was greatly handicapped by the absence of motors capable of being installed on alternating-current circuits. Direct-current motors were well advanced, and there were many of them, particularly in America; but, except for synchronous single-phase motors and a few small series motors, the alternating-current motor was unknown. The synchronous motor was impracticable, because it had to be started and brought up to speed. Alternating current was used only for lighting. In the rivalry which then existed between the direct-current and alternating-current systems the former could claim to deliver both light and power, while the latter could deliver only light, although, with the aid of the transformer, it could do so at a relatively great economical distance.

It was at this point that Tesla invented the polyphase alternating-current system and polyphase motors, which, whether of the synchronous or of the asynchronous type, had the advantage of a definite starting torque. It is generally understood that he was not the only inventor of the polyphase motor. The same idea seems to have occurred to one or two other independent inventors in Europe. But not only was Tesla the sole American independent inventor of the polyphase motor, but he was also the only inventor of it in the whole world who had faith in it. He believed in it enthusiastically and urged its claims both publicly and privately. He built the first small polyphase motor, which behaved very satisfactorily, and he urged the building of larger ones. Much experimenting, designing and discarding had to be done before large polyphase motors could be built successfully, and the progress was slow; but Tesla's faith was unshakable and his claims were prophetic. A less enthusiastic nature might have quailed before the discouragements and have allowed success to escape.

The polyphase motor was not Tesla's only pioneer contribution to electrical progress. He was a tireless experimenter, and his experiments carried him very early into the field of high-frequency phenomena. He worked first with high-frequency alternators, or alternators

which, in 1890, were considered to give a high frequency. Later he developed the well-known Tesla induction coil, or high-frequency oscillator. With this new source he was able to demonstrate, during 1891 and 1892, in England, France and America, a number of entirely new electrical phenomena which at lower frequencies had previously been unobtainable. His lectures were given at the Royal Institution in London, the Franklin Institute in Philadelphia, and in various other places. The experimental phenomena he produced were dazzling and classical. They deservedly brought him great renown.

The high-frequency phenomena which Tesla first developed and displayed had scientific rather than practical interest; but Tesla called attention to the fact that by taking his electric oscillator, grounding one side of it and connecting the other to an insulated body of large surface, it should be possible to transmit electric oscillations to a great distance, and to communicate intelligence in this way to other oscillators in sympathetic resonance therewith. This was going far toward the invention of radio-telegraphy as we know it to-day.

For the above reasons we welcome and acclaim the award to Nikola Tesla which the American Institute of Electrical Engineers has made of its Edison medal. We of this generation are prone to forget the great efforts and the unwearying patience which have been necessary in the past to produce those results which are now the every-day electrical commonplaces of life, and it is well to signalize them, lest the next generation in its turn should forget the results of the pains and labor of this.

Reflection Factors

IN PROBLEMS of illumination the reflection factors of the surfaces with which one has to deal rise to great importance. The measurement of these factors with reasonable precision is one of the serious tasks of the photometrist, since the eye alone gives a very imperfect idea of the facts of the case. We are glad therefore to publish a particularly useful discussion of the whole matter by M. Luckiesh. The facts he presents make very evident the necessity of its scientific study, and the discussion of methods will be very welcome to those who have to meet the problem in practice. The utter incapacity of the eye to judge reflection factors has been the cause of no small amount of unmistakably bad illumination. There is an enormous difference in reflectivity between things which are really white and those which seem to be almost the same thing. The least admixture of black, or red in particular, in painting a surface may change the reflection factor by 10 or 15 per cent. Certain "warm" grays, apparently very light, may show a factor of 40 per cent or so against 0.70 or better for a dead-white surface. We may casually note that reflection factors above 0.70 are extremely rare in paints. As Mr. Luckiesh notes, values of 0.8 or nearly that are obtainable, but small changes in the medium or the pigment, or changes due to the lapse of a very little time, may knock at least 10 per cent off this figure. The special interest of Mr. Luckiesh's paper lies in his study of the photometric methods used in the investigation of ordinary surfaces which possess both specular and diffuse reflection. No substance is perfectly diffusing, and on the other hand no material is wholly without diffusing power. Unless care be taken in selecting a proper photometric method very appreciable errors may be introduced in the results. The situation is still further complicated by the effect of colored light. The reflection factor of a given surface when illuminated respectively by the north sky and by an incandescent lamp may vary in the ratio of nearly three to two, so that diffusion that proved satisfactory in the one case would give scant help in the other. Aside from these practical matters, the characteristics of surfaces showing strong mixed reflection are of no small theoretical interest, the passage from diffuse to specular reflection involving some very delicate physical problems. Mr. Luckiesh's paper is therefore doubly welcome and will, we think, lead to a more careful and searching study of practical conditions of reflection.

Progress in Prime Movers

THE abandonment of the regular convention of the National Electric Light Association will perhaps rather stimulate than diminish interest in the technical work done by the various committees. We always look forward with great interest to the report of the very able and industrious committee on prime movers, and this year's report shows no exception to the admirable record of the committee. It is difficult to pick out from this great and important mass of material those things which imperatively call for comment. At the present time the fundamental necessity is more than ever before the economical production of electrical energy, in other words raising the efficiency of generating units to the highest possible point. The onset of war conditions emphasizes with terrible force the need for fuel economy. Already it has become evident that owing to the combinations of interests which we in this country have learned all too patiently to tolerate the price of fuel to the central station and the householder alike is, without direct government interference, likely to rise to a practically prohibitive figure. The cost of coal to the consumer has shot up out of all possible sound economic relation to the conditions of supply.

The burden falls heavily everywhere, but on none quite so severely as on the central station operators, who of all those consuming fuel are the least able to recoup their losses by raising prices. The ordinary manufacturer who is hard hit promptly piles his troubles, plus 50 or 100 per cent, on the back of the consumer. The electric supply company, a public service institution under comparatively severe restraint, has not yet been able to transfer any part of its rapidly increasing burdens. Steps toward increase of efficiency in power generation are therefore of great importance, and those portions of the committee report which deal with lines of improvement are particularly interesting. More than anything else we are struck with the upward drift in the size of generating units and in the pressures and superheat employed. The committee report shows

that the average size of the turbo-generating units purchased during the past year is about 50 per cent greater than ever before. This increase is all along the line, from the biggest units to the smallest. In the former there is gain in overhead charges, in operating expense and to a small extent in efficiency, while in the smaller sizes, as is well known, the gain in efficiency is very rapid with increase of capacity. There is every possible reason for passing therefore to the larger units, even under circumstances which in ordinary times might make excess capacity of dubious value. With coal at the present prices and those likely to obtain within the next year, the economic situation changes very rapidly.

The same tendency has been displayed in the boiler and condenser units now employed. Five years ago the huge battery of boilers employed to feed one big steam turbine was so obvious a waste that it is almost impossible to see how it was tolerated even for a few years. No concession to commercial standardization was ever less justified, but time enforces lessons even on the unwilling, and to-day we find the boiler and condenser units somewhere near commensurate with the generators to which they are connected, a change which economically is thoroughly sound. Of even more interest is the very evident working toward higher pressure and superheat in steam plants. The normal pressure has thus far been limited chiefly by the normal standardized practice of boiler and piping manufacturers. It has been well understood that in going to very high pressures the costs of equipment would run immensely high. The small demand for pressures above 200 lb. to 250 lb. per square inch (14.1 kg. to 17.6 kg. per sq. cm.) has naturally discouraged development along these lines, so that everything for high pressure has been "special"—with all in the way of large prices, uncertain deliveries and difficult repairs which that word has come to imply. One cannot blame the boiler manufacturers for caution, but the penalization of special devices of all kinds in American practice is quite out of proportion to the actual needs of the case.

Meter Testing

A BRIEF article by C. A. Mullen considers the work of meter testing in a large and scattered distribution plant. Few people outside the immediate field of electric metering have an adequate idea of the care and expense incurred in the maintenance and upkeep of even the best meters. In the practice of the Ohio company here considered the testing and repairing has for the sake of economy to be done in a central laboratory and repair shop for all the twenty towns served by the utility company. Even the smallest meters average a little over 30 cents expense for testing, while the larger ones may run to $2 or more. When complaints come in frequently, and they are in every station common enough about the time the yearly lighting load begins to increase, there is a very real and by no means negligible bill to be paid by the company before satisfaction is rendered. All in all, the electric meter is, considering the conditions of its service, a remarkably accurate and durable device, but it will not run indefinitely without care, and upkeep even under favorable conditions is no small affair. The cost can be kept down only by systematic care and thorough study of the conditions. Inasmuch as the meter is the most sensitive touchstone existing between the company and its patrons, it should be kept as accurate as possible, so that neither the public nor the company shall suffer loss.

Failures in Underground Cables

IT IS generally recognized that of all the insulating materials known to man air is the cheapest when there is enough of it. The volume of air space that is utilized in the sense of being required for the insulation of a high-tension overhead three-phase transmission line is, however, so large that the cost of this air space is prohibitive in city districts. In cities it becomes absolutely necessary to cable all conductors and to place the cables or equivalent covered wires under ground. Consequently, as the land becomes built up and more densely populated, dependence has to be placed increasingly upon underground cables, leaving overhead wires to the open country. This means that more attention, care and maintenance have to be applied to high-tension cables year by year. The failure of such cables becomes a matter of increasing concern.

The causes of failure in underground cables are numerous when fully recited. They are dealt with in the article by Henry A. Cozzens, Jr., which we print this week. If we attempt to divide them into those due to carelessness on the one hand and those beyond control on the other, we may find that some of the causes are not easily fitted into either group. It is evident, however, that where sufficient care and study are devoted to the maintenance of underground cables their failures may be relatively rare. Underground cable installation, testing, repairs and maintenance form a business by themselves.

The Coming Issues

WHILE the theft of energy is not so prevalent as to make the resulting loss to a central station very large in proportion to its income, it is sufficiently common to necessitate definite steps being taken to apprehend the wrongdoers and to prevent such petty larceny as far as possible. In the next issue of the ELECTRICAL WORLD will be outlined many of the methods now being successfully employed in different localities to safeguard the light and power business against the theft of electrical energy. There will be described also a new development in street-lighting units whereby the better qualities of refractor and diffusing globe units are combined. In addition there will be the regular departments devoted to broad commercial policy, operating practice and trade conditions, with the regular prices on jobbers' supplies. In the first issue of June there will be published a number of articles which will be of unusual interest from the standpoint of public policy.

Some Causes of Underground Cable Failure

Where to Look for the Usual Sources of Trouble and Suggestions for Remedies—Effect of Mechanical Injuries, Cable Heating, Electrolysis, Dielectric Depreciation, Etc.

BY HENRY A. COZZENS, JR.

WHILE placing wires underground largely eliminates the failures familiar with overhead construction, it does not remove all interruptions from distribution systems. However, the number of failures in underground systems is less than in overhead circuits provided that the installations have been made in accordance with the best practice and the most careful workmanship.

There are no parallel cases in overhead and underground failures. With the overhead lines the failures are due chiefly to external conditions, such as the weather, and possibly to the materials used, such as faulty insulators and other equipment. With underground circuits the cause of failure is primarily faulty insulation, which is brought about by numerous conditions either external or within the cable. The faults may be divided into mechanical failures, or those caused by influences external to the cable, and electrical failures, or those which occur in the cable owing to the load or electrical phenomena on the lines. Many times during the work of reconstructing conduit lines, when the cables are of necessity unprotected, picks, shovels and other tools are driven through the sheaths, injuring the cable and at times causing burn-outs immediately. In lowering duct lines a severe strain is placed upon the cables which may cause failures.





FIGS. 1 AND 2—USE OF HAIR FELT FOR PROTECTING CABLE AT SUPPORT; CABLE SHEATH DAMAGED BY ELECTROLYSIS

When cables are trained in the manholes, if the bends where the cable leaves the duct line and follows around the wall are made too sharp, many failures will result. In standard practice the manholes for transmission cables are either made oval or square corners are eliminated so as to do away with the necessity for sharp bends. For paper-insulated cables the bend should have not less than an 18-in. (45.7-cm.) radius. In the bending tests made on the cable at the factory the cable is bent over a drum having a diameter fifteen times that of the cable. A sharp bend in a loosely wound cable will often cause the conductors to shift with respect to each other and thus change the value of the insulation resistance between conductors or to the ground, making each bend a weak spot.

If sharp bends are made at the mouth of a duct, the contraction and expansion of the cable may cause rubbing at this point, thus wearing away the sheath. Longer radius bends and the use of duct protectors will eliminate this trouble. When cables are strung on elevated structures the vibration caused by cars may result in the cables rubbing against the insulators or columns, gradually wearing away the sheath and outer insulation. The vibration also tends to crystallize the metal and destroy the cable by this action.

Among the mechanical failures, those caused by a burn-out in one cable being communicated to the others may be mentioned. The arc caused by a short circuit will generate an enormous amount of heat, which will often fuse the duct materials and extend to the other cables, causing great damage. Recently numerous methods for protecting cables in the manholes have been devised, and they successfully demonstrate that a burn-out may now be isolated to one cable, so manhole fires can be largely eliminated. The use of the balanced-relay systems with split-conductor cables and such devices as the arcing-ground suppressor have reduced the burning interval of arcs to such a low figure that the chance for damage is greatly lessened.

Cable heating may be ascribed to two sources—one internal, due to the load carried on the cable, and the other external, due to outside influence. Failures resulting from external overheating would fall into the mechanical class. Overheating of this nature is usually caused by the proximity of steam lines to heavily loaded duct lines. This condition is most often revealed in congested districts or in the neighborhood of power stations.

Usually not much attention has been given to steam lines crossing under duct lines, particularly when they are well insulated. In one instance a small steam line feeding an outlying building passed under a conduit line heavily loaded with transmission feeders. The steam line was insulated with cork, which in turn was covered with concrete in the neighborhood of the crossing. After the line had been in use for some time without any adverse conditions developing, one cable suddenly failed and several others followed in quick succession. When it was attempted to remove the cables it was found that several were securely held in the ducts. It was then necessary to break the conduit line and rebuild it with split duct at the point of failure. Dismantling the conduit line showed that the fiber duct had caved in owing to the heat and curled up in the idle ducts. In some of the ducts occupied by the cables the duct had fallen down and securely held the cable, making the removal impossible. The only remedy in such cases is to remove the steam lines where possible or to place them above the duct line and near the surface.

Failures due to electrolysis are partly electrical and partly mechanical. These failures present a peculiarly difficult problem in that they do not appear un-

til some time after the electrolytic damage has been done. The only efficient way to eliminate failures due to electrolysis is to make periodic surveys in each locality and to eliminate at once any conditions which will tend to cause current which may be on the sheaths to pass to the ground directly. In many cases it will be found that a cable is badly pitted at frequent intervals, showing apparently that the current left the sheath at joints in the tile duct. The pittings permit moisture to enter the insulation, thereby reducing the value of the dielectric resistance until the leakage becomes large enough to cause the ultimate breakdown of the cable. Cases have been reported in which cables installed on hillsides have become so corroded that the compound has drained out of the insulation through the holes in the sheath and caused failure. These instances illustrate the necessity of constant attention to electrolytic conditions and also the importance of a careful examination of the sheaths of all cables withdrawn from duct lines.

The failures which may be classed as electrical are due chiefly to the decreased dielectric strength of the insulation. This decrease may be gradual, as when caused by the aging of the cable, or it may develop suddenly, as when caused by surges or the like. Where a transmission line consists of both overhead and underground sections, lightning may cause a surge, or switching changes may result in the building up of a high voltage and frequency which will instantaneously puncture the insulation and result in a failure. Present-day protective equipment has made the transmission line much less liable to failure by surges.

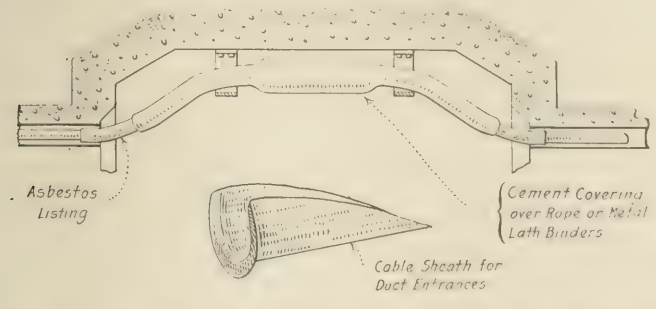
Faults due to manufacture sometimes cause failures after the cable has been installed, even though it has satisfactorily passed tests at the factory. Such failures are freakish and are not often encountered in the routine operation of cables. In one instance a cable had been tested at the factory and was later installed. Almost immediately a failure occurred, and examination showed that foreign matter in the form of a tag had become entangled in the paper during the fabrication of the cable. When the cable was coiled upon the reel this tag in no way reduced the dielectric strength, but when the cable was straightened out by installing it the insulation was weakened owing to the presence of the metal tag and failure resulted. On the other hand, cables have been known to stand up under operating conditions when more freakish conditions than this existed. In one instance a cable operated at 13,000 volts for several years with a tenpenny nail driven into the cable.

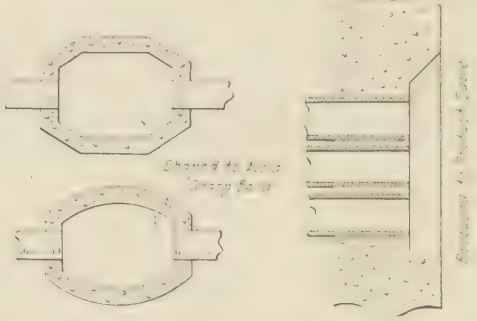
The primary cause of insulation failures in cables is the action of the heat generated in the conductors because of the copper and dielectric losses. The recent abnormal demand for service by industrial concerns, together with the shortage and high prices of the materials used in the manufacture of cables, has resulted in a considerable study of the rating of cables. This investigation will tend to bring out the factors attending the heating of cables and the relation of loading to safe operation. Formerly it was the practice to rate cables according to the area of the conductor and with no regard to the heat-dissipating characteristics of the duct lines or of the cables themselves.

Recent developments have shown that before ratings are decided a careful study should be made of the conditions under which the cable is to operate and a series of ratings should be established for individual cables under strictly local conditions. The lack of this development in the past has contributed largely to the majority of cable failures.

The following example is indicative of past conditions: Assume that an underground cable has been installed between two stations but no tests have been made to determine the rating of the new cable. The current-carrying capacity has been based purely on the copper density, allowing about 1 amp. per 1000 circ. mils of cross-sectional area. As the cable is new, the correctness of the rating seems to be established since heavy overloads may be carried with apparent safety. As time goes by, additional cables are installed to meet the increasing load demands, but no changes are made in the ratings. No reductions have been made for the summer months, neither has any account been taken of the increasing number of cables in the conduit line. Such conditions as these may continue for a number of years.

At some time, however, a cable in some manhole may be reported as being hot. The first thought that comes to mind is that the load is excessive, but investigation shows it to be normal. Inspection will often reveal the fact that the cable sheaths are warm in one manhole and normally moderate in temperature in those adjacent. Cable in this state will ultimately fail. When the sections are junked and examined the paper will generally be found to be practically free from all compound, resembling thickly oiled paper. From this evidence an explanation for the failures may be deduced. The heat generated by the losses due to the load has caused the compound to leave the high spots in the loosely wound paper cable and to flow to the low spots, or to leave the cable through holes in the sheath. Cases are known in which the sheath has been split open by this action. Since the insulation resistance depends upon the compound the paper retains more than upon the thickness of the paper, it is obvious that as the compound leaves certain sections of the cable these sec-





FIGS. 3 AND 4—METHOD OF FIREPROOFING CABLE IN MANHOLE; ARRANGEMENT TO AVOID DAMAGING CABLES ON SHARP CORNERS

tions will have a greatly decreased dielectric strength. The reduction in the resistance of the insulation will also permit the passage of leakage currents from the conductors to the sheath through the paper. The heat which is a function of the I^2R losses will increase as the currents grow larger. If this action takes place over several years, the cable finally becomes "baked out" and the failures are but a question of time.

The foregoing case is an extreme one, but it actually happens and serves to show the effect of overloading cables. Under the new methods of placing ratings, a series of temperature tests would establish a relation between sheath, manhole and outside air temperatures for various load conditions. Thus the effect of installing additional cables should be evident, and the ratings could be altered accordingly.

Another class of electrical failures includes those which occur in the joints. The chief cause of joint failures is faulty workmanship on the part of the splicer. The splices are often made under adverse conditions of cramped space and under atmospheric conditions which are much more detrimental to the insulating of the cable than those which would be encountered in the factory. This class of failures may be considerably reduced by the employment of first-class splicers. Very reliable men are engaged in this class of work. The use of standard specifications and individual packages containing the exact amount of the proper materials for each type of joint has eliminated to a large degree the joint failure and has made the joint the strongest part of the cable.

Possibly no item bears as much relation toward the proper analyzing of cable failures as the maintenance of suitable records. Various companies have adopted standard forms which are filled out following a cable failure and which comprise a record of the conditions existing at the time of the failure and give on the reverse side a story of the methods used in locating and repairing the fault. Many times the correct cause cannot be assigned at the moment, but the data given will be a great aid in an investigation. These forms when filed will give a historical record of the cable.

Measurement of Reflection Factor

Importance of Knowing Coefficient of Reflection, Conditions Which Make Its Determination Difficult, and How Some of These Obstacles May Be Overcome

BY M. LUCKIESH

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THE necessity for determinations of reflection factor[1] is not hypothetical; it really exists. Data on this subject are of use in lighting and therefore are of interest in connection with wall-papers, paints and other materials. The covering power of paints can be determined by ascertaining the reflection factor. The influence of solvents, varnishes, etc., can also be determined in this manner. For example, after an ordinary yellowish board had been painted with two and three coats of dull-white high-purity paint it showed reflection factors of 0.77 and 0.80 respectively by the method described later in connection with Fig. 5. After the paint mixture had been changed so that one-sixth of the volume of each coat consisted of boiled linseed oil the factors were reduced to 0.74 and 0.77 respectively. This reduction is due both to the yellow color of the oil and to the decrease in the concentration of the pigment. Varnish possessing a yellowish tint reduces the reflection factor of a white painted surface very appreciably, sometimes as much as 10 per cent for fairly high-grade varnish. Many other uses for data on reflection factors are found by persons interested in the physics of pigments, light, etc. It is hoped that some attention will be given to this subject and that an agreement as to method will result. In the absence of a standardized method of measurement for reflection factor it is advisable to specify all conditions of measurement. For general measurements the writer has concluded to use the methods illustrated in Figs. 4 and 5 except in special cases. In these methods the specimens are illuminated diffusely from light sources of uniform brightness subtending approximately 180 deg. solid angles. Therefore they receive luminous flux from sources of minimum brightness per unit of illumination.

The chief elements which make the measurement of reflection factor difficult and even uncertain are: (1) the character of the reflecting surface; (2) the location of the source of illumination; (3) the solid-angular extent of the light source; (4) the spectral character of the illuminant; (5) the method of photometry. The last two elements are of interest only with colored surfaces, but they are almost always encountered in the measurement of reflection factor. It is the object of the following discussion to show the influence of these and various factors which make such measurements uncertain.

Different kinds of reflecting surfaces that are met in practice are represented in Fig. 1. The widely different characteristics shown make it difficult to standardize a method of measuring reflection factor or even to develop one that will be universally acceptable and equitable. Whenever possible it is advantageous to have a diagram available which will permit a graphic comparison of certain characteristics of objects or of certain data so that the relations may be readily visualized. This has been difficult to do with respect to reflection factor, but in Fig. 2 is shown a scheme for representing surfaces exhibiting either diffuse or specular reflection or both.[2] The diagram is satisfactory for surfaces the reflection from which does not depart too far from the perfect types of reflection. It is based upon the definition of reflection factor given by the Illuminating Engineering Society, which reads, "the ratio of the total luminous flux reflected by a surface to the total luminous flux incident upon it." It appears

[1] "Reflection factor" is used in place of "coefficient of reflection" to conform with the recent recommendation of the Illuminating Engineering Society.

[2] M. Luckiesh, "Light and Shade," 1916, page 19.

to the writer that this definition would be more generally useful if the word "total" were eliminated, because the definition could then be used universally.

EFFECT OF LOCATION OF LIGHT SOURCE

Usually the measurement of reflection factor involves the measurement of the brightness of the specimen relative to that of a standard surface having a known reflection factor. For illustration consider that an ordinary brightness photometer is being used for this purpose. If L in the left-hand diagram of Fig. 3 represents the position of a small source of light and P that of the brightness photometer, determinations of diffuse reflection factors can be made by means of brightness measurements under known illumination intensities with a fair degree of accuracy if the reflecting characteristics of the surfaces approximate perfectly diffuse reflection. As the position of P varies, the results change somewhat relatively to each other if the approximation to diffuse reflection is not sufficiently close. Although the accuracy of this method is sufficient for many practical purposes, it cannot be accepted in the general case as a precision method.

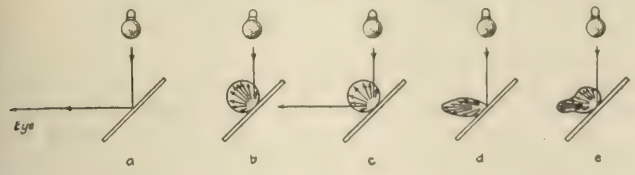


FIG. 1—CHIEF REFLECTING CHARACTERISTICS ENCOUNTERED IN PRACTICE

Regular or specular reflection, *a*, is exhibited by a mirror such as polished silver or a plain glass surface. No perfect diffusely reflecting surfaces are encountered. However, this type of reflection, *b*, is exhibited fairly well by dry white powder such as zinc oxide and magnesium sulphate or by blotting paper. Some glazed surfaces exhibit these two kinds of reflection simultaneously almost as perfectly as represented in *c*. An excellent example of this character can be made by placing a thin sheet of clear glass upon a sheet of blotting paper. By varying the reflection factor of the latter or by superposing smoked glasses of various densities various proportions of the two kinds of reflection—specular and diffuse—can be obtained. Sand-blasted glass and metallic surfaces, also gilded and "aluminized" surfaces, exhibit a spread reflection such as *d*. Calendered white paper and some varnished surfaces exhibit a combination of approximate diffuse and specular reflection represented by *e*.

If this diffusely reflecting surface is assumed to have a glazed or varnished coating, another difficulty arises. It is obvious that if the photometer P and the small light source L occupy positions as shown in the right-hand diagram of Fig. 3, the photometer will measure not only the brightness due to diffuse reflection but also that due to specular reflection. If the glazed surface is fairly plane optically, the brightness as viewed under this condition will depend partially upon the brightness of the light source because a brightness due to the reflected image of the light source is superposed on the "diffuse" brightness and no true measurement of the diffuse reflection factor is obtained. In fact, the diffuse brightness depends upon the illumination of the surface, or the flux density, and the "specular" brightness is really the brightness of the image of the light source, which depends upon the intrinsic brightness of the light source. Determined by method *f* (Fig. 3), the reflectivity will evidently be somewhat less for a glaze-coated diffusely reflecting surface than for the same surface without the glazed coating. Various attempts were made to determine this difference by varnishing one of two identical diffusely reflecting gray surfaces, but difficulties were encountered which introduced uncertainties. Grays were experimented with because the effect of the glazed surface is more predominant than with surfaces having high reflection factors. Of course, the varnish coating alters the original reflecting characteristic, which made it advisable to abandon these experiments without attempting to overcome other difficulties. The effect can be demonstrated by superposing a thin sheet of clear glass on a diffusely reflecting surface, although, optically, this condition is not the same as that resulting from varnishing or otherwise polishing the surface.

EFFECT OF SOLID-ANGULAR EXTENT OF LIGHT SOURCE

In the Nutting reflectometer[3], which is an ingenious and very satisfactory instrument for considerable practical work of this character and even for precision measurements of diffuse reflection factor, the specularly reflected image of the light source (a diffusing plate of ground opal glass) enters in the measurements in the case of a glazed surface. However, for ordinary surfaces, such as wall-papers and varnished and flat pigments, this factor is often negligible in practice. The theory of this instrument has been presented by Nutting. The optical paths into the photometer from surfaces D and S are shown in Fig. 4. It may be seen that the specularly reflected image of the light source does not escape the photometer as is indicated by the broken line. A difference of 4 per cent has been found between the reflection factor of a glazed white cardboard determined by this method and that shown in *f* (Fig. 3). Inasmuch as there are various factors to consider and as the object of this study was not to establish precision measurements but to make a general survey, this difference can be considered only as the order of magnitude of the difference. However, for many ordinary surfaces, the differences in the results obtained by these two methods, which involve extremely different distributions of luminous flux, are very small. Where the accuracy can be within a few per cent of perfect these two methods may be considered to give

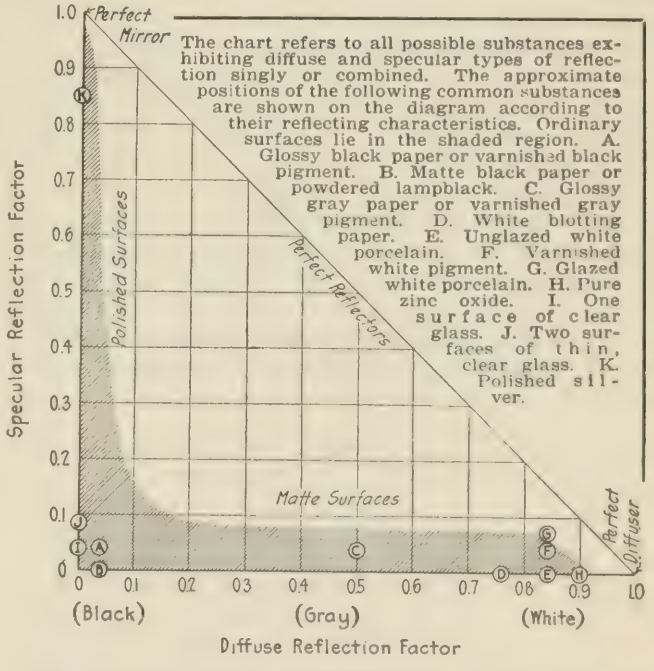


FIG. 2—DIAGRAMMATIC REPRESENTATION OF REFLECTION FACTORS

[3]P. G. Nutting, *Transactions I.E.S.*, Vol. VII, 1912, page 412.

approximately the same results for surfaces reflecting a greatly predominant portion of the light diffusely.

Simple Method Employing Diffuse Illumination

From a practical viewpoint it appears, in general, to be more equitable to determine reflection factors under diffuse illumination. The simple apparatus required for this purpose can be readily made (see Fig. 5). With a standard diffusely reflecting surface available, determinations of reflection factor can be made with the apparatus shown by inserting a brightness photometer in hole *H* and comparing the brightness of the standard and specimen under constant illumination. One precaution is necessary, namely, the diaphragm must not be quite horizontal, or the hole must not be vertically over the orifice in *D;* otherwise a reflected image of the photometer tube and hole *H* will be observed on viewing glazed surfaces. It is obvious that the diaphragm *D* must be very thin; or light coming to the specimen in nearly a horizontal direction must be eliminated; otherwise the edge of the opening in the diaphragm will cast a shadow. An opal glass hemisphere used in a similar manner is satisfactory. It appears to the writer that this simple method has certain practical advantages for ordinary work that allows the use of an ordinary portable photometer and permits illuminating the specimen diffusely.

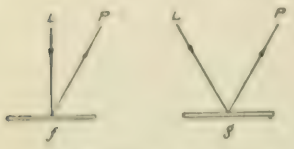


FIG. 3—EFFECT OF RELATIVE POSITIONS OF LIGHT SOURCE AND PHOTOMETER

Photometer *P* measures only the diffusely reflected light with the arrangement shown in *f* and both the specularly and diffusely reflected light with arrangement *g*.

Numerous measurements have been made to compare these methods, but the object was not to study the precision attainable, so that few data will be given. In general, for fairly diffusely reflecting surfaces the various methods of measurement gave approximately the same results (within a few per cent) when the reflection factors were greater than 0.4 or 0.5. Using a white blotting paper as a standard in each case, the results obtained for the reflection factor of a polished opal glass by methods *f* (Fig. 3), Fig. 4 and Fig. 5 were respectively 0.57, 0.56 and 0.54. For gray surfaces having reflection factors as low as 0.2 the differences were considerably greater, but it was not certain that these surfaces (which were painted) were uniform. An extreme case which illustrates the influence of a glazed surface involved a calendered black cardboard. The reflection factor determined by the method illustrated in Fig. 5 was about twice as large as that determined by method *f* (Fig. 3). Owing to polarization the result obtained with such a specimen by means of the instrument devised by Nutting is considerably in error. This error can be eliminated by using a photometric attachment which does not possess polarizers, for these are not a basic part of Nutting's suggestion.

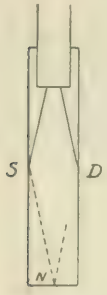


FIG. 4—OPTICAL PATHS IN NUTTING REFLECTOMETER

This instrument involves two infinite planes—one the light source *D* and the other surface *S*, the reflection factor of which is to be determined. The planes are made approximately infinite by the highly reflecting inner surface of the ring *N*, which for practical purposes is made of polished nickel. The distribution of luminous flux represents approximately diffuse illumination. Another method of considering the flux is to assume that surface *S* receives nearly a maximum amount of luminous flux per unit of area from a light source of nearly minimum brightness.

Although it appears that other methods than those using the integrating sphere will serve the practical requirements of reflection-factor measurements, when used properly and described completely, the sphere should be considered in precision measurements and in a study for the purpose of standardizing a method. The use of a sphere can be modified in many ways, but a simple method consists of illuminating a surface *S* (Fig. 6) by means of a powerful beam of luminous flux *B* and of determining the reflection factor by measuring the relative amount of luminous flux reflected as compared with that reflected from a surface having a known reflection factor. The comparison may be made by means of relative-brightness measurements of a diffusing glass attached to the photometer *P*, which is in the shadow of *S*. If the inner surface of the sphere possesses a high reflection factor, an approach to diffuse illumination is obtained. The question of the angle of the surface *S* is one to be settled before such a method becomes a standard.

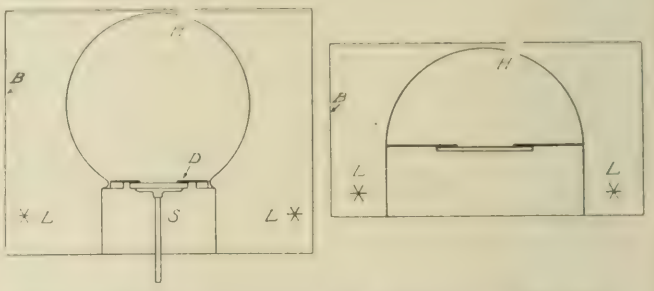


FIG. 5—SIMPLE APPARATUS FOR MEASURING REFLECTION FACTOR UNDER DIFFUSE ILLUMINATION

An opal glass globe, such as is used in lighting fixtures, is mounted inside a box *B* on a wooden standard surrounded by four or more light sources *L* located symmetrically. The box is painted white inside. Secured to the bottom of the globe is a thin opaque diaphragm *D* with a central orifice. The specimens to be tested are pressed against the under side of this orifice by means of the adjustable stand *S*. Holes *H* are provided in the box and globe so that a brightness photometer may be inserted therein and the reflection factor of any specimen determined under this practically perfect diffuse illumination by comparing its brightness with that of a standard diffusely reflecting surface. An opal-glass hemisphere like that shown at the right of Fig. 5 may be used in a similar manner.

Mathematical optical theory affords little help at present in determining reflection factors since it applies only to perfectly diffuse and specular reflection. Doubtless it could be applied to perfect spread reflection and therefore to combinations of specular, diffuse and spread reflection, but such applications would be too laborious and uncertain for general work.

Effect of Spectral Character of Illuminant

Occasionally there appear data on the reflection factors of colored surfaces with no attendant descriptions of the spectral character of the illuminant or of the method of photometry and with no indication of the influence of these factors. These factors are vitally important in such determinations. Only for perfect diffusely reflecting neutral surfaces is the reflection factor invariable regardless of any condition of quality or distribution of luminous flux. The general neutral surface has a reflection factor which depends upon the distribution of illumination and upon other factors already described. Owing to the unsettled condition of the subject color-photometry, it may be said that it is impossible to state what the reflection factors of colored

surfaces are. However, as has been indicated in the preceding text, other elements involved in the measurements of reflection factor are also quite as unsettled.

To illustrate the influence of the spectral character of an illuminant upon the reflection factors of colored surfaces, determinations were made under the illumination obtained with an overcast sky and under that obtained with a tungsten lamp operating at 7.9 lumens per watt.[1] A few of the results are given in Table I. The ratios of the reflection factor for tungsten light to that for skylight are presented in the last column. These measurements were made by an experienced observer by means of the direct-comparison method. The

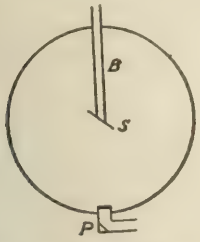


FIG. 6—INTEGRATING SPHERE MODIFIED FOR DETERMINING REFLECTION FACTOR

A beam of light flux B is incident on surface S. The reflection factor of S is determined in terms of a standard by means of photometer P by the method of substitution.

results are comparable as relative values notwithstanding the possible unacceptability of the method of photometry. At least, the data show the folly of reporting the reflection factors of colored surfaces without including the conditions under which the tests were made.

Effect of Method of Photometry

Notwithstanding the excellent work which has been done on the problem of color-photometry, no method has yet been accepted universally for the photometry of colored brightnesses such as are encountered in general in the measurement of reflection factor. The direct-comparison and flicker methods yield different results in extreme color-difference photometry, so that the choice of a method is of importance here. The author has found that the ratio of a red to a green brightness may differ, by these two methods, by as much as nearly 100 per cent. This difference can be reduced by restricting the size of the photometric field and by other precautions. However, the outstanding difference is considerable as indicated in Table II. In this table the ratios of the value determined by the direct-comparison method to that obtained by the flicker method are presented in the last column. These determinations were made under the approved conditions of fairly small photometric field and moderately high illumination intensity. They show that the method of photometry is an important factor. These data should only be considered as showing the magnitude of the differences obtained by the two methods. Apparently the relative values change with various conditions of illumination and field size in various ways not readily predicted or explained at present.

Some Optical Characteristics of Surfaces

The reflection from ordinary media is a combination or the conglomerate result of many individual reflections and refractions from minute surfaces. The individual particles, fibers, surfaces, etc., may be quite transparent, yet as a whole the surface may reflect light diffusely. A piece of glass may be transparent but when ground into a powder it appears white or diffusely reflecting. A white blotting paper made up of minute translucent fibers separated by air spaces reflects diffusely owing to myriads of reflections and refractions which break up the wave front and eventually send rays back in all directions. Such a surface reflects ordinarily about 0.75 of the incident luminous flux. However, when saturated with water the surface appears gray by contrast with the dry specimen because the reflection factor is now reduced to about 0.5. In the latter case the air spaces have been replaced by water of higher refractive index than air, and as a consequence the amount of luminous flux reflected at each surface is considerably reduced and the substance has become more transparent, as is readily seen. In a similar manner varnish changes the reflecting characteristic of a surface, and colored surfaces when varnished sometimes appear of a purer color.

TABLE I—EFFECT OF SPECTRAL CHARACTER OF LIGHT ON REFLECTION FACTOR OF COLORED SURFACES

Color of Reflecting Surface	Reflection Factor		Ratio
	Overcast Sky	Tungsten Lamp	
White	0.75	0.75	1.00
Red-purple	0.16	0.23	1.44
Red	0.21	0.31	1.48
Orange	0.38	0.48	1.26
Yellow	0.60	0.65	1.08
Green	0.32	0.24	0.75
Blue	0.13	0.09	0.69
Violet	0.14	0.12	0.86

A glazed colored surface reflects two components—one, specularly, from the surface, which is in most cases practically unchanged in quality or spectral character, and another, more or less diffusely, which has been altered in spectral character owing to the selective absorption of the pigment. Some metals—for example gold—appear decidedly colored even at the critical angle of specular reflection, and many other surfaces exhibit a variation in color near this critical angle. Interference phenomena sometimes cause changes in color with variations in the angle of incidence. These most interesting aspects of reflection and of colors are touched upon to show how intricate the reflection of radiant energy is and as a consequence the measurement of reflection factor.

TABLE II—RELATIVE BRIGHTNESSES OF DIFFUSELY REFLECTING COLORED SURFACES UNDER CONSTANT ILLUMINATION (BY THE TWO METHODS)

Color of Illuminated Surface	Relative Brightness		
	Flicker (a)	Direct Comparison (b)	Ratio (b/a)
White	0.75	0.75	1.00
Red	0.13	0.12	0.92
Orange	0.26	0.23	0.88
Yellow	0.59	0.59	1.00
Green	0.31	0.36	1.16
Blue	0.21	0.22	1.05

The author acknowledges the assistance of H. H. Kirby in obtaining the data and making the illustrations for this paper.

[1] M. Luckiesh, "Color and Its Applications," 1915, page 168.

Characteristics of Standard Inclosed Fuses—II

Results of an Investigation of Suitable Construction Materials, Performance of Fuses Under Different Operating Conditions, and Effect of Size, Kind and Amount of Filler on Operation

By Walter Arthur

COMPARATIVE ratings of standard inclosed fuses made of different metals, and the effect of the shape of the fusible element and the amount, character and size of the filler pellets on the sensitiveness of the fuses, were subjects discussed on page 456 of the March 10 issue of the ELECTRICAL WORLD. In this article, which concludes the subject of characteristics of

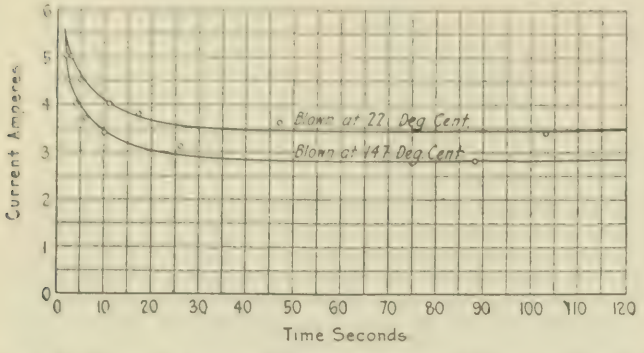


FIG. 3—CURVES SHOWING EFFECT OF INITIAL TEMPERATURE ON TIME OF FUSE BLOWING

standard inclosed fuses, are taken up the effect of length, diameter and heat conductivity of the fuse case, location of the fusible element, temperature of surrounding air, initial temperature, indicator wires, etc. Considerations necessary in testing fuses are also pointed out in this article.

The heat conductivity of the inclosing case has an influence on the time-blowing of fuses, but no data are at hand to enable the determination of the relative conductances of cases of different materials. It is obvious, however, that a wholly metal or porcelain case would conduct heat more rapidly than fiber cases. A greater conductance would tend to increase any errors due to this cause. The same may be said to be true of heat capacity.

The length and diameter of the fuse case is of considerable significance in so far that there is a certain minimum length and diameter beyond which we can go without materially affecting the results. At the same time there is a certain maximum length and diameter beyond which we cannot hope to go and improve the results. The regularity of the time-blowing is influenced by the length of the case, by the conductance of the heat along the fusible element to the caps on the ends of the case; and this is never the same in any two fuses. The greater the length of the case the less this influence. On a very short fuse the case often becomes quite hot with a current which would easily be normal for the rating on a longer fuse.

Location of the Fusible Element

The location of the fusible element in the filler is one of the very important factors which influence to large extent the regularity of the operation of fuses. If this element be in the center of the filler or is equally insulated on all sides, the irregularities from the heat losses are not noticeable, except those occurring by conduction of heat through the fusible element to the caps on the ends. If, however, the fusible element is not equally insulated on all sides, a greater loss of heat will occur than in those fuses having the elements correctly located. This loss increases the time of blowing under any given load.

If the fusible element be very near the wall of the case, that side will become very much hotter than the other. And if the fuse be of several amperes, the fiber case may be charred or even burned. To insure regularity of operation the fusible element should be equally insulated on all sides, which is usually the case if it be in the center of the filler and the filler be equally settled down on all sides.

Effect of Temperature of the Surrounding Atmosphere

The flow of heat from one point to another is quite dependent upon and directly proportional to the difference in temperature between the two points, as may be seen from the formula,

$$W = \frac{(T - t)A}{RL}$$

where W = watts of heat flowing, T = temperature of the hotter side, t = the temperature of the cooler side, A = cross-section of area transmitting the heat, R = resistivity of the insulating material, and L = thickness of insulation. This formula is applicable to the behavior of fuses when blown at different temperatures. The higher the temperature the sooner will the fusible element reach its melting point and be blown. The influence of this factor would be appreciable in a few

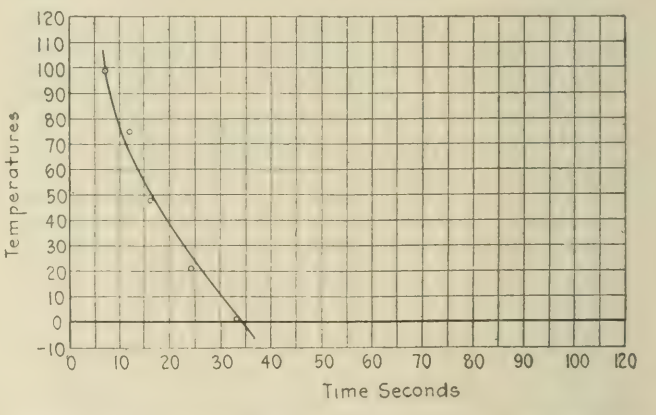


FIG. 4—CURVE SHOWING THE EFFECT OF INITIAL TEMPERATURE ON TIME OF BLOWING FUSES WHEN USING A CONSTANT CURRENT OF 3.7 AMP.

instances. In case a fuse was placed in an atmosphere subject to a wide range of temperature it would change its rating to a considerable extent. With changes which ordinarily occur in a shop or factory it would not be appreciable.

In Fig. 3 the effect of blowing two sets of fuses,

made exactly alike, at two different temperatures is shown. The first one was blown at room temperature (22 deg. C.) and the second at 147 deg. C. The curves show in graphic form the relative changes produced by this change in temperature. The change of 125 deg. C. caused a lowering of the rating of about 0.5 amp. on a 3-amp. fuse. The curves are not different in shape but parallel throughout. Fig. 4 illustrates the behavior of fuses when blown with the same current of 3.7 amp. but at different temperatures.

TABLE VI—FUSES MADE IN THE FACTORY WHICH SHOW THE EFFECT OF INDICATOR WIRES ON THE BLOWING POINT

Wires—zinc; indicator wires—4-mil calorite; filler—pellet-lime, 10 per cent passing 20 mesh; cases—fiber, 0.5 in.x1 1/8 in.; fuse rated as 1 amp.

Without Indicator Wires			With Indicator Wires		
Current in Amp.	Time in Sec.	Average Time	Current in Amp.	Time in Sec.	Average Time
7.0	2	3	7.0	5	4
	4			4	
6.5	7	10	6.5	11	22
	10			30	
	9			25	
	15				
			6.3	125	45
6.3	35	19		28	
	30			5	
	15			37	
	7			30	
	7				
			6.1	90	90
6.1	17	39			
	9		6.0	53	84
	50			15	
	65			150	
	35			115	
6.0	45	55	5.5	450	450
	70				
	55				
	55				
	50				
5.5	300	240			
	240				
	180				

Effect of Indicator Wires

In Table VI is shown the effect of indicator wires upon ordinary fuses made in the factory. These fuses had the pellet-lime filler and ordinary zinc wires. The normal rating of this fuse without the indicator wires was about 5 amp. When provided with 4-mil calorite wires for indicators an increase in rating of about 0.25 amp. was observed.

Cadmium Ribbon Fuses

Table VII gives the time-blowing points of a number of cadmium ribbon fuses. These were made with the usual fiber cases and silicic acid filler. This so-called silicic acid filler is not properly silicic acid (H_2SiO_3) but silicic acid that has been dehydrated by the simple process of drying, leaving only SiO_2 which is silica. The silicic acid used in these fuses was obtained from Merck & Company of New York and is known as wet process silicic acid.

In filling the fuse case of 0.5 in. by 1 15/16 in. (1.27 cm. by 4.92 cm.) by pouring in the loose material and tapping it down to about two-thirds of its original volume, an average of about 0.778 gram is necessary. Table VIII gives the results of weighing the filler from twenty-one fuses made in the factory which had been filled with silicic acid in the ordinary manner. It will be noted that there are no great variations from the average, and these are not sufficient to cause any irregularity of the time-blowing points.

TABLE VII—SHOWING THE CARRYING CAPACITIES OF FUSES MADE FROM DIFFERENT SIZED CADMIUM RIBBONS

Filler—silicic acid; indicator wires—4-mil calorite, cases—fiber, 0.5 in.x1 1/8 in.

2x24-Mil Ribbon		2x38-Mil Ribbon		2x56-Mil Ribbon	
Current in Amp.	Time in Sec.	Current in Amp.	Time in Sec.	Current in Amp.	Time in Sec.
3.5	3	5.5	2	6.5	3
	3				
			4	6.0	5
3.2	3	5.0	4		4
	4				
		4.5	7	5.5	9
3.0	6		7		8
	6				
		4.1	13	5.0	16
2.8	14		17		17
	13		18		18
	16		11		
				4.8	20
2.7	29	3.8	28		25
	24		25		19
	32		25		19
	27		28		
			25	4.6	28
2.6	28				21
	33	3.6	40		29
	35		53		30
	28		45		28
			65		
2.5	96		48	4.4	60
	76				57
	80	3.5	60	4.2	47
			80		54
2.4	145		65		150
	155				84
	138	3.4	190		113
	130		120		96
			180	4.0	185
			100		155
			180		113

Testing of Fuses

The correct testing of fuses after they have been made is an exceedingly important matter. In order to get a correct idea of the rating of the fuse it must be tested over quite a range of currents, from the current which blows the fuse at a few seconds to the current which blows it in several minutes. In all of the data given the testing was done by placing the fuse in series with an ammeter and a variable resistance. After properly adjusting the resistance the current was sent through the fuse, and by the means of a stop-clock reading to seconds the time necessary to open the circuit was noted. By making several "blowings" at each current tried and getting an average time, most of the errors and irregularities which might come in were eliminated. In all of the curves given the points were obtained from averages of several blowings.

TABLE VIII—WEIGHTS OF SILICIC ACID FILLER ORDINARILY TAPPED INTO FUSES, 1/4-IN. INTERNAL DIAMETER AND 1 1/8-IN. LENGTH

Filler was weighed after the fuses were blown, but free from pieces of metal. (Fuses were of zinc ribbon 2x50 mils.)

	Weight in Grams		Weight in Grams
First fuse	0.810	Twelfth fuse	0.760
Second fuse	0.710	Thirteenth fuse	0.820
Third fuse	0.750	Fourteenth fuse	0.730
Fourth fuse	0.791	Fifteenth fuse	0.765
Fifth fuse	0.770	Sixteenth fuse	0.780
Sixth fuse	0.769	Seventeenth fuse	0.766
Seventh fuse	0.796	Eighteenth fuse	0.834
Eighth fuse	0.820	Nineteenth fuse	0.766
Ninth fuse	0.765	Twentieth fuse	0.768
Tenth fuse	0.876	Twenty-first fuse	0.767
Eleventh fuse	0.730		

Average, 0.774. Extremes, 0.86 0.710

TESTING METERS ON OHIO SYSTEM

Method of Work Employed, System of Keeping Records Used and Cost Involved

BY C. A. MULLEN

Testing meters on the Ohio Service Company's system presents quite a different problem from that experienced by the average central-station company because at the present time twenty towns along 85 miles of transmission lines are being served, the largest number of meters in any one town being around 1200. A laboratory and repair shop is maintained in the general office building at Coshocton for testing and repairing all ordinary electrical equipment used by the company.

New meters are shipped from the manufacturers direct to the laboratory, where they are tested and numbered serially regardless of the towns, districts or routes in which they will eventually come to be installed. Ten meters are tested in series, a 110-volt load up to

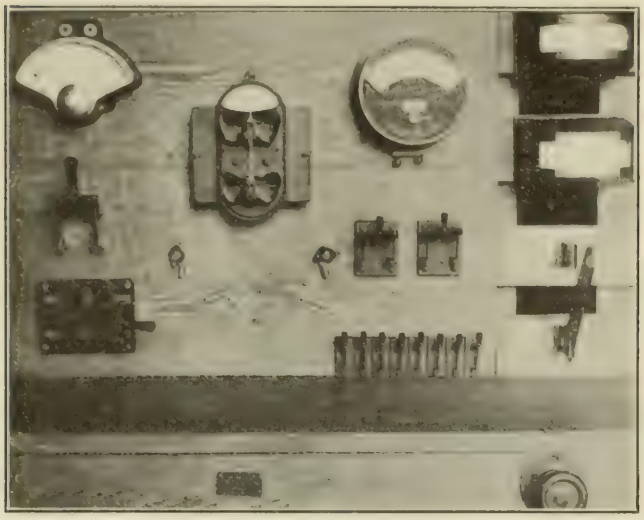


FIG. 1—TESTING BENCH FOR METERS RATED ABOVE 25 AMP. RANGE OF CURRENT 0 AMP. TO 600 AMP.

25 amp. being provided. The average cost of unpacking, testing, numbering and repacking the meters is $8.42 a hundred. The cost of packing varies considerably with different makes of meters. For testing meters above 25 amp. rating the type of bench shown above is used. Loads from zero to 600 amp. are obtained by a low-voltage loading transformer.

Each district office is provided with a voltmeter, a

METER ACCURACIES OBSERVED

Per Cent Accuracy	Per Cent of Meters Tested: Light Load	Full Load
Over 120	0.04	0.04
110-120	0.15	0.55
104-110	0.59	1.10
102-104	4.00	5.00
98-102	71.00	82.00
96- 98	8.50	6.10
90- 96	5.40	2.46
80- 90	3.60	1.60
Below 80	5.22	0.92
Not recording	1.50	0.23

rotating standard and a phantom loading device, other instruments being obtained from the laboratory when needed. It is, of course, out of the question to keep a meter-man in each town, so a lineman, or whoever is most available in that particular office, is employed to read, install and test meters in connection with answering complaints. Periodic tests are conducted by experienced meter-men whose headquarters are at the laboratory. When on regular work, or when remaining in one town a week or more, these men pay their own

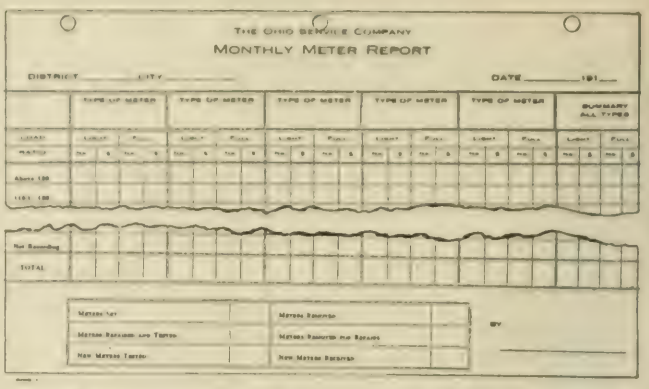


FIG. 2—MONTHLY METER REPORT USED BY EACH DISTRICT

expenses except railroad fare. No installation tests are made on small meters, but on power meters of 50 kw. or more a test and inspection of the meter and connections is made immediately by the testing department. Periodic testing is carried on as follows: Residence meters, every three years; commercial and small power meters, once a year; meters rated at 50 kw. or over, every three months; switchboard meters, every three months. For convenience a 110-volt load is used in testing service meters up to 25 amp. rating. For larger sizes a portable phantom load is used. The table herewith gives the result of testing about 5000 meters for the first time, showing the percentage of total number of meters tested in the class between 110 and 120 per cent, 104 and 110, 102 and 104, etc.

The average cost of testing residential, commercial and small power meters is 30.45 cents each. This includes all charges except interest and depreciation of

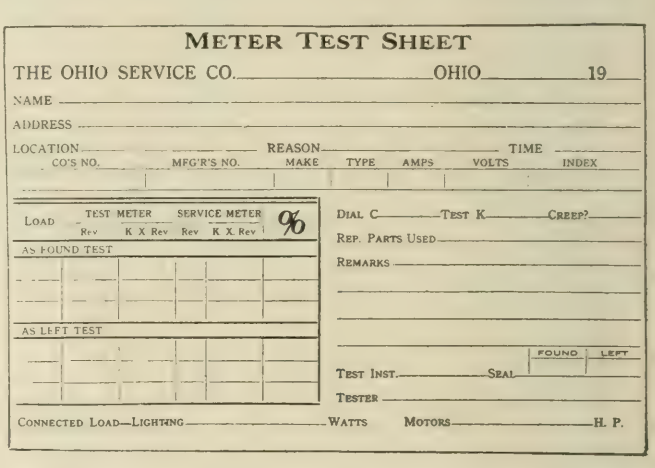


FIG. 3—FORM USED AS A REPORT OF TEST ON SERVICE METERS

testing equipment. The cost of testing large power meters is $2.08 each. This charge includes railroad fare, automobile and hotel expenses of the tester.

The Ohio Service Company has found it necessary to use several forms to save time, and to keep its records in proper condition. For outside testing the form shown in Fig. 3 is used. This is made in duplicate,

the original being kept by the district superintendent, and the data on the copy transferred to the meter record card. On one side of the meter record card is space for six test records. The other side is devoted to data taken from the name plate of the meter, its location, and information regarding removals. A brief report is made at the end of the week on a special form, and at the close of the month the meter tests are separated, classified, and the results made into the form of the monthly report shown in Fig. 2.

For the calculation of demands another form is used. As this test requires the inspector to remain on the premises all day, counting meter revolutions every two hours, he generally has about six hours to spare. This time is utilized in making a complete survey of the plant and its equipment, operating methods, number of employees, contemplated growth, change of machinery, etc., the data being written in narrative form.

A regular schedule of inspection is also carried on by this department. Insulation resistance tests, other outside resistance measurements, and oil and glove tests are made.

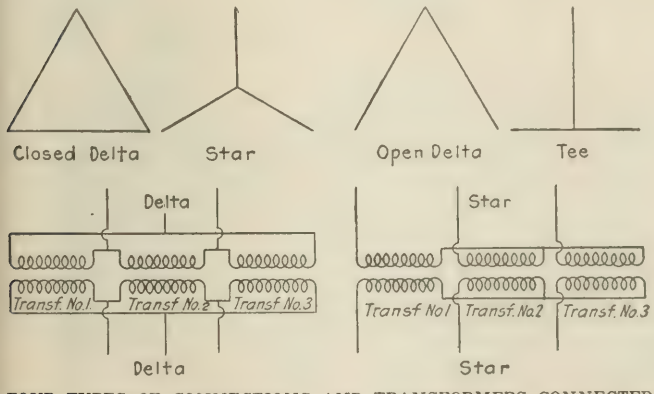
THREE-PHASE CONNECTIONS

Merits of Various Connections That Are Commonly Employed with Transformers

BY R. E. UPTEGRAFF

Four different three-phase transformer connections, shown sectionally herewith, are in common use. With the closed-delta and star connections four combinations of primary and secondaries are available—delta-delta, delta-star, star-delta and star-star.

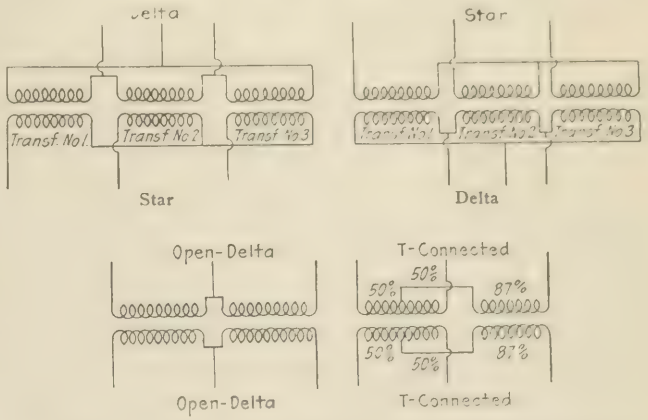
The delta-delta connection is most commonly used, first, because if one of the units become disabled the other two may be used in open-delta at 57.7 per cent of the original rating of the bank, thus avoiding a complete shutdown. Also with unbalancing of the load better balancing of voltage will be maintained than in any of the other combinations, because the phases are connected so they will help each other. Again, if the impedances of the transformer are slightly different, then each transformer will share the load according to



FOUR TYPES OF CONNECTIONS AND TRANSFORMERS CONNECTED IN DELTA-DELTA AND STAR-STAR

its impedance in order that the voltage in all phases shall be alike. If, however, one of the transformers is slightly off ratio or if a third harmonic exists in the wave form of the supply circuit a useless or circulating current will flow around the windings. The amount of this current will depend on the impedance of the transformers and the magnitude of the third harmonic or amount of off ratio, as the case may be. This current, of course, heats the windings and does no good.

The star-delta and delta-star combinations are used chiefly where it is desired to step up to a high-voltage principally for transmission, the star connection being used for the high-voltage winding and the delta connection for the low-voltage winding. As is generally



DELTA-STAR, STAR-DELTA, OPEN-DELTA AND T CONNECTIONS

known, the voltage of each transformer for star connection is only 57.7 per cent of the line voltage; therefore if the neutral point is grounded the whole system will have a ground stress of only 57.7 per cent of the line voltage. As a result lighter insulation can be used for transformer parts and also for the line, thus permitting cheaper construction. The grounded neutral in the star connection allows a third harmonic current to flow over the lines and between neutral points, which is undesirable.

The star-star connection is seldom used owing to the fact that the neutral points can shift, thus throwing a higher voltage than normal on one transformer. Furthermore, a short-circuit could occur on one of the transformers which would cause a rise of voltage (as much as 173 per cent of normal) in the other two that might burn them out in a short time. The star-star connection has one advantage, however, in that transformers of different design or make can be operated together, the only possible harm due to difference in impedance or ratio being a slight unbalancing in voltage.

The open-delta and T connections have but one advantage, this being that only two units are required for three-phase transformation. The open-delta connection has the disadvantage of poorer regulation on one phase than on the other two. There is also a relative loss in transformer capacity. For example, if E is line volts and I the line current, then the three-phase power is $EI\sqrt{3} = 1.73\ EI$. Since the voltage in each transformer is E and the current I, then the total available single-phase capacity is $2\ EI$, but the three-phase capacity is $1.73\ EI$ or a difference of $0.27\ EI$ or 15.5 per cent less.

The T connection has the disadvantage of having different amounts of windings in the two transformers, that is, 86.6 per cent in one and 100 per cent in other, with the 86.6 per cent winding connected to the middle point of the 100 per cent winding. Furthermore, the windings on the 100 per cent transformer must be interlaced in order that unbalancing shall not occur. Special transformers are therefore required, which is not desirable. The T connection also loses 7.3 per cent in capacity since the available single-phase capacity is $1.866\ EI$ and the three phase $1.73\ EI$.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

CAUSES OF MEGGER TROUBLES

Locomotive Smoke Mixed with Dew Causes Low Reading—Trouble in Megger Remedied by Cleaning

Some difficulty was experienced recently on a line of the Southern Wisconsin Power Company in trying to test insulators in the morning when there was a heavy dew or when there was a heavy frost. Under these conditions none of the insulators appeared to have more than 500 megohms resistance, and the needle of the megger would never come to rest but would constantly move back and forth over a range of 50 megohms. This action, it was pointed out recently by G. C. Neff, Prairie du Sac, Wis., in a paper read to the Madison branch of the A. I. E. E., is probably due to the fact that the line parallels a railroad and the smoke from the locomotives causes a deposit to form on the insulator which, when moistened with water, forms a conductor. No trouble was found in testing insulators immediately after a summer shower, for this apparently washed the insulator clean.

When the line was about half tested the megger failed to operate properly, not more than 200 megohms being indicated on open circuit. The trouble was found to be caused by carbon and copper dust which had been worn from the brushes and collector rings and had formed a high-resistance circuit inside the megger. The trouble was removed by cleaning.

While the testing of insulators with a megger is a simple operation, Mr. Neff concludes it is very important that the man in charge of the testing party should be wide awake, have considerable electrical knowledge and have good judgment, otherwise many good insulators may be condemned.

PROVIDING COMMUTATING POLES

Necessity of Making Allowances When Incorporating New Features of Design into an Existing Old Machine

BY E. C. PARHAM

Where the clearances are such as to permit it, non-commutating-pole machines may be converted into commutating-pole machines, but the proposition is considerably simplified if the mechanic or the engineer who is doing the job has a quantitative idea of what he is doing. The owner of a machine shop had for a long time been driving his shop shafting by means of a commutating-pole motor that had given absolutely no trouble. The capacity of his shop was becoming too small, so he decided to get another motor and to divide the work between them. He bought a second-hand motor of the same size and of the same general type as the motor that he had, but the second-hand motor had no commutating poles. As its connected load included a heavy grindstone, there was some sparking when starting, so the owner decided to convert the motor into a commutating-pole machine.

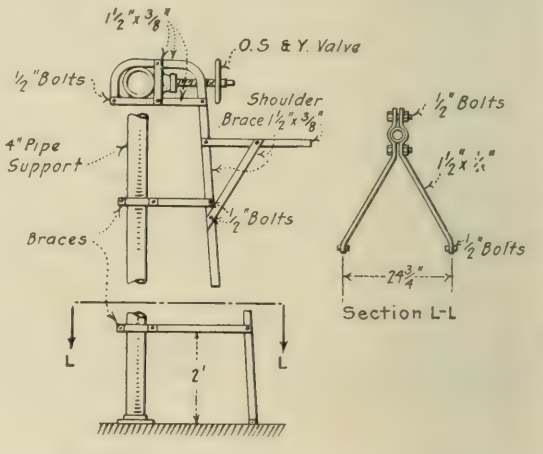
He disassembled one of the commutating poles of the older machine, measured the dimensions of the pole pieces as well as the number of turns and size of wire of the winding, and noted the manner of machining the frame to receive the pole pieces. The job was carefully executed, but after everything was installed and connected sparkless commutation could not be obtained. An expert who was then called in determined that increasing or decreasing the number of turns on the commutating poles effected no improvement. The desired results were obtained by shimming the commutating pole pieces 1/32 in. (0.79 mm.).

PROVIDING ACCESS TO VALVES

Construction of Ladder Equipped with Shoulder Brace Which Facilitates Operation of Large Valves

BY T. W. REYNOLDS

Where an overhead valve must be operated frequently or emergency access thereto is important it is advisable to provide a fixed iron ladder equipped similar to the one shown in the accompanying sketch. The shoulder brace is an advantage and a necessity where valves of large size are to be quickly opened or shut. The piping at the valve should be carried on an adjustable pipe support secured to the floor by a bolted flange and to the



LADDER WITH SHOULDER BRACE TO FACILITATE OPERATING OVERHEAD VALVES

pipe by a ½-in. (1.27-cm.) bolt. The sides of the ladder and its shoulder brace may be made of 1½-in. by ⅜-in. (3.8-cm. by 9.5-mm.) wrought iron and the rungs of ¾-in. (1.9-cm.) rods, 24 in. (60.9 cm.) long, on 15-in. (38.1-cm.) centers. The ladder and shoulder straps should be well braced and bolted and ample radius should be provided for the shoulders

COST OF LINE MATERIALS

Data of Interest Recently Compiled by a Small Massachusetts Company

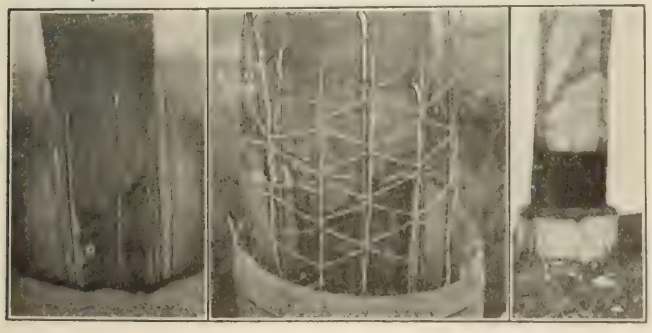
From data recently prepared by the Amesbury (Mass.) Electric Light Company covering 13,200-volt line material costs since Jan. 1, 1917, the following extracts are printed. The figures reflect the present high levels of equipment prices among small companies. Besides being interesting in connection with making estimates they have record value:

Quantity	Items	Cost
158	30-ft. poles, chestnut, B	$726.80
24	35-ft. poles, chestnut, B	146.40
20	40-ft. poles, chestnut, B	165.00
8	45-ft. poles, chestnut, B	88.00
8	50-ft. poles, chestnut, B	136.00
287	2-pin cross-arms (special)	172.20
4	4-pin cross-arms	5.00
8	8-pin cross-arms	17.20
15,223 lb.	No. 2 bare H. D. copper wire	5,147.04
373 lb.	No. 4 bare S. D. copper wire	137.67
381 lb.	No. 2 bare stranded copper wire	137.16
532 lb.	No. 2 W. P. wire	146.83
500 ft.	½-in. 7-strand guy wire	7.50
5,250 ft.	5/16-in. 7-strand guy wire	89.62
850 ft.	7/16-in. 7-strand guy wire	15.45
50	No. 58,160 line wire protectors	209.87
100	No. 2 copper splicing sleeves	32.67
90	6-ft. anchor rods	53.10
19	Anchor planks	7.60
356 ft.	12-in. by 2-in. spruce planking	15.24
10 gal.	Creosote	6.00
4	600-kw., 13,200/2200-volt transformers	7,550.00
6	300-amp., 13,200-volt choke coils	229.50
2	3-phase, 13,200-volt lightning arresters	752.00
6	300-amp. 13,200-volt disconnecting switches	60.00
Setting	200 poles (by contract)	3,770.00

REINFORCING POLES

Method and Cost of Reinforcing 259 Poles That Had Been in Service for Seventeen Years

Red-cedar poles which had been in service for nearly seventeen years were recently reinforced with concrete by the Puget Sound Traction, Light & Power Company. The line is 7 miles (4.2 km.) long and is a main power line serving the American Smelting & Refining Company's plant at Tacoma, Wash. The accompanying illustration shows how the reinforcing was placed around the pole. First the earth around the ground line was removed. Then iron rods with the ends bent at right angles were driven into the poles around the weakened section as shown and expanded-metal strips wrapped around the rods. After a piece of sheet metal had been placed inside the hole around the pole butt to serve as a form the concrete was poured. About seven rods were used on each pole. The cost of reinforcing the 259 poles on this line cost was $2,355.14, making the total cost per pole $9.10 and the material cost per pole $3.59. The table shown herewith gives the total and unit amount of each kind of material used, the total and unit cost thereof as well as the labor cost. K. C. Schluss is superintendent of power and equipment.



STEPS IN PROCESS OF REINFORCING POLE

COST OF REINFORCING 259 POLES WITH CONCRETE

	Amount	Total Cost	Amount per Pole	Cost per Pole
Material:				
No. 1 iron rods	1575	$362.25	6.1	$1.40
No. 2 iron rods	443	126.92	1.7	0.49
Expanded metal	300 pieces	63.60	1.16 pieces	0.246
Sand	53 yd.	78.23	0.205 yd.	0.304
Pea gravel	99 yd.	158.32	0.382 yd.	0.612
Cement	474 sacks	241.69	1.83 sacks	0.933
Tools, etc.	.....	160.38	.....	0.633
Labor:				
Hauling (including rent of wagon)	.....	183.92	.....	0.71
Reinforcing	.....	931.81	.....	3.59
Moving poles	.....	12.90	.....	0.05
Guying	.....	10.94	.....	0.042
Cleaning up	.....	13.00	.....	0.05
Miscellaneous	.....	11.18	.....	0.043
Total	.....	$2,355.14	.....	$9.10

DETERMINING LOSSES IN IDENTICAL MACHINES

Description of Method by Which an Auxiliary Machine Is Used as a Booster to Supply the Copper Losses

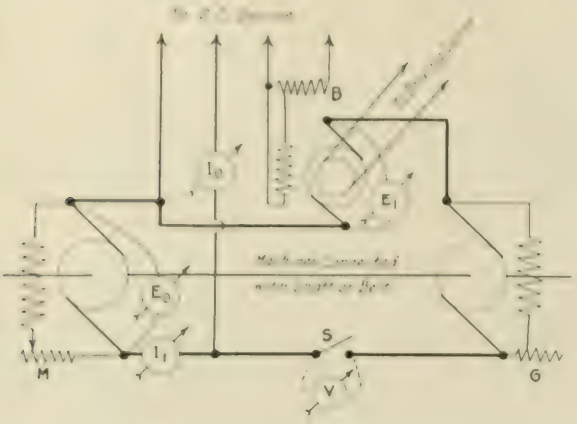
BY GUSTAV E. JANSSON

If the losses of two identical machines are to be measured, they can be determined in a very simple manner, provided that a third machine of ample current-carrying capacity to act as booster is available. The machines should be connected as shown in the accompanying diagram, using two voltmeters and ammeters. Switch S is left open at the start, and the field rheostats M and G adjusted until the correct speed and voltage are obtained. The no-load power output equals I_0E_0. Neglecting the small copper losses, the iron and friction losses in each machine will be $W_0' = \frac{1}{2}W_0 = \frac{1}{2}E_0I_0$. Switch S is now closed, taking care that the right polarity and potential are obtained. This is assured by connecting a voltmeter across the switch S and adjusting the rheostat G until the potential across the switch becomes zero. After the switch S is closed rheostat G should be adjusted until normal current is read at I_1. The booster should then be started and G and B regulated until I_1 = normal current + $I_0/2$. I_0 is kept constant so that only the no-load losses are supplied directly from the line while the copper losses are supplied by the booster. If the losses at different loads are wanted, I_1 is calculated from kw. $\times$ 1000/E and regulated for this value + $\frac{1}{2}I_0$. I_1, I_0, E_0 and E_1 may then be read and recorded as is shown in the table herewith.

FORM OF TEST RECORD

Load	$I_1+I_0/2$ Calcu.	I_1 Read	I_0 Read	E_0 Read	I_2 Calcu.	E_1 Read	N Read	Y% Calcu.
0	0	....	Constant	Constant	0	....	Normal	....
¼	....	....	....	....	....	....	Normal	....

It should be kept in mind that the rheostat G must be regulated to keep the speed N constant. I_0 must also be maintained constant, the booster supplying the copper losses. $W = EI_a$ where $I_a = I_1 - I_0$. Assuming that



CONNECTIONS EMPLOYED WHEN MEASURING MACHINE LOSSES

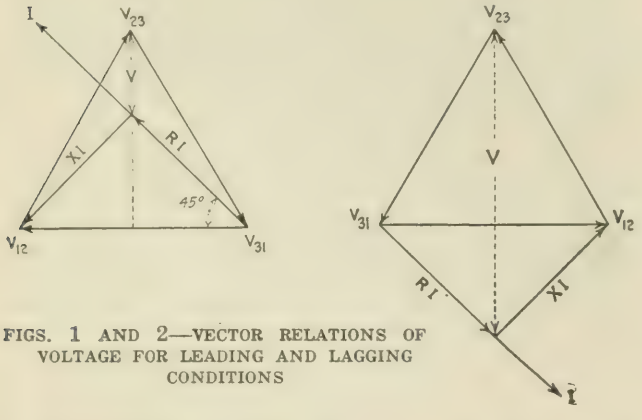
the armature resistance R is equal in both machines ($W'_c = I_2 \times W_c = I_2 E_1 I_2$), then the efficiency y in per cent equals $(I_1 \times E_0) \times 100 \div (I_1 \times E_0 + W'_c + W'_0)$.

DETERMINING PHASE ROTATION

Resistors and Reactors Used with Voltmeters to Determine Rotation of Phase Vectors

BY W. V. LYON

For determining the phase rotation in a three-phase circuit, that is, to ascertain whether or not the line voltage between mains 1 and 2 leads or lags the voltage between mains 2 and 3, the writer has found the scheme shown in the accompanying illustrations useful and convenient. It consists of a non-inductive resistor and a low-resistance reactor of the same ohm value connected in series between two of the mains. The magnitude of the voltage between the third main and the junction of these two units indicates the phase rotation. Mark the mains 1, 2 and 3 as in Fig. 3. Connect the free terminal of the resistor to main 1 and the free terminal of the reactor to main 2. Measure the voltage from their junction to main 3. If this voltage



FIGS. 1 AND 2—VECTOR RELATIONS OF VOLTAGE FOR LEADING AND LAGGING CONDITIONS

is approximately 37 per cent of the line voltage, the voltage between mains 1 and 2 leads the voltage between mains 2 and 3. If the voltage is approximately 137 per cent of the line voltage, however, the voltage between mains 1 and 2 lags the voltage between mains 2 and 3.

The proof of this fact is simple. Refer to Figs. 1 and 2. Assume that the line voltages are equal. The interior angles of the voltage triangles are then 60 deg. Any ordinary unbalancing of the line voltages would affect the voltmeter reading but little. The current should be at least ten times as much as the voltmeter takes on full scale deflection. If this be the case the voltmeter will read not more than 2 per cent less than the stated values. In the proof it is assumed that the voltmeter current is negligibly small.

Let V_{12} lead V_{23} as shown in Fig. 1. If the resistor and reactor have the same resistance value in ohms, the current will lag the voltage from 1 to 2 by 45 deg. The voltmeter reading, V, will be

$$V = (0.866 - 0.50) \times \text{line voltage}$$
$$= 0.37 \times \text{line voltage.}$$

If V_{12} lags V_{23}, as shown in Fig. 2, the voltmeter reading is

$$V = (0.866 + 0.50) \times \text{line voltage}$$
$$= 1.37 \times \text{line voltage.}$$

In order that the device may be used on circuits of

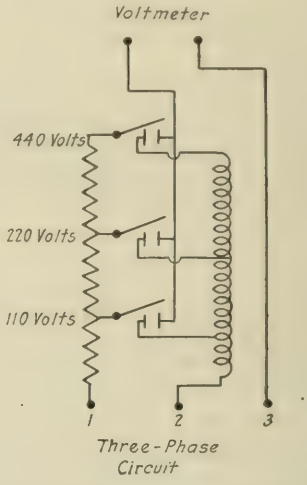


FIG. 3—CONNECTIONS OF RESISTOR, REACTOR AND VOLTMETER

different voltages switches should be provided as shown in Fig. 3. For example, when it is to be used on a 220-volt circuit the switch marked 220 volts should be closed and the other two left open. By properly choosing the ohm values of the units, the current may be kept constant and the same accuracy obtained at the different voltages without excessive heating loss.

Maintenance of Standby Equipment

According to Don D. Morgan, superintendent of generation and transmission for the Pacific Light & Power Corporation, considerable trouble is experienced because of leaky valves and flanges and corrosion of standby steam equipment. Trouble with superheaters has been eliminated to a considerable extent by providing drips from them to the regular drip system. Temperature variations and corrosion have been found to be the cause of the leaky pipes and valves. Emergency operation of reserve equipment is very inefficient, owing to the lack of experience of the men who are called in to work for only short periods at infrequent intervals.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

INCLUSION OF SWITCHES IN ADVERTISED WIRING PRICES

Comparative Wealth of Communities or Districts Is Held to Be the Controlling Factor in This Connection

In a discussion before a recent convention Fred H. Scheel of Joliet, Ill., said that with his company local conditions govern the number of switches that are included in advertised prices of house wiring. In the poorer communities few if any switches are included in the flat price because it is desired to bring the advertised price down to the minimum point. In the high-class residence districts as many switches as possible are always included in the advertised price. In such cases it is usually the policy to include switches for the more important rooms in the house.

PREDOMINATING CENTRAL STATION LAMP POLICY

Answers to Questionnaire Sent Out by N. E. L. A. Lamp Committee Show Policies of Companies Grouped According to Number of Customers

This year's report of the lamp committee of the National Electric Light Association, Frank W. Smith chairman, reveals in addition to the regular statistics on lamp sales, developments in the manufacture and characteristics of incandescent lamps and recommendations, some very pertinent discussion on the continued use of carbon lamps, besides making a very important contribution in the form of a report on current practices in the merchandising and free renewals of incandescent lamps. The report is still in the hands of the committee, but it is expected that it will be ready for distribution in the near future.

In the matter of lamp policy the committee feels that it is incumbent upon it to again emphasize the importance of member companies keeping a close supervision over the supply of incandescent lamps to their customers, and repeats the statement made in previous reports, that so far as may be possible customers should be provided with full and complete information as to lamp development and that the highest grade of lamps it is possible to obtain be made available. From time to time a canvass has been made by the committee in order to present the methods followed by member companies in handling the lamp situation.

This year this work was undertaken by a sub-committee, and a presentation is made which is the result of that investigation. The aim has been to obtain full and complete information from member companies as to their exact practice, and with that thought in mind questionnaire blanks were sent to the entire Class A membership of the association.

Four hundred and forty-one replies were received, representing 40 per cent of the member companies. Replies were received from every state in the Union, a number from the Dominion of Canada, and one from the Territory of Alaska. The maximum number of replies from any one state was forty-two (New York), the

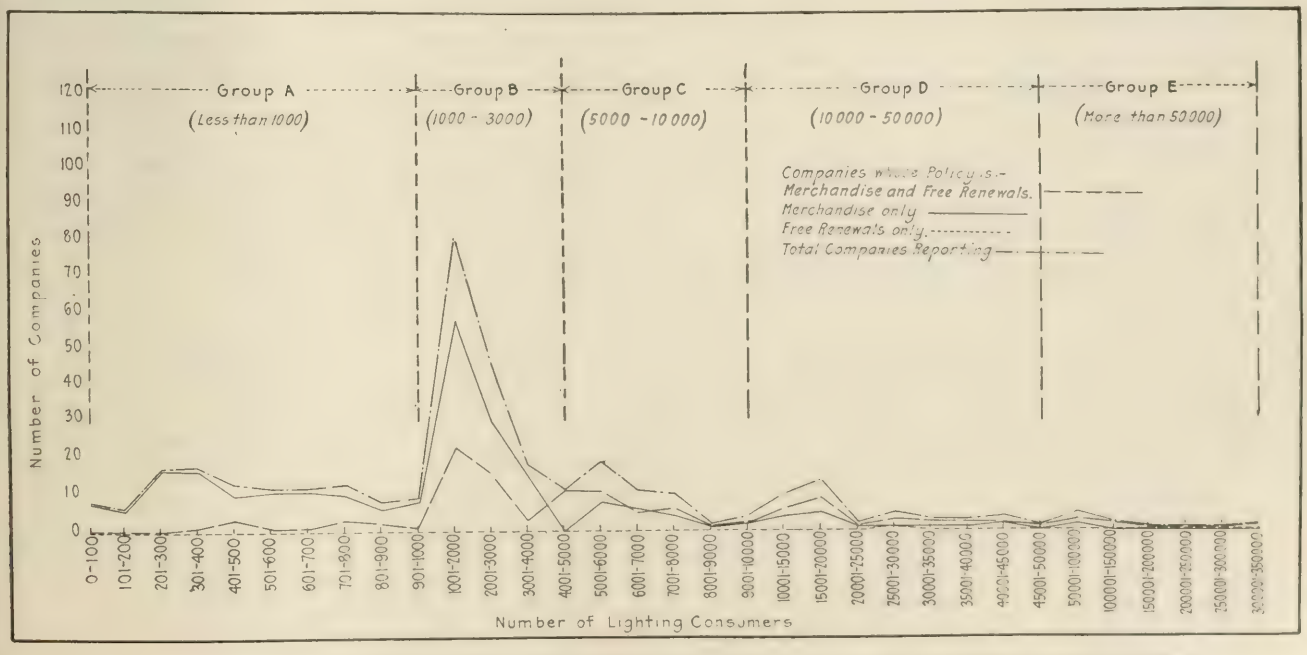


CHART SHOWING RELATIVE SIZES OF COMPANIES THAT REPLIED TO LAMP COMMITTEE QUESTIONNAIRE

Summary of replies according to company lamp policy: Free renewals only—A, 0; B, 0; C, 1; D, 1; E, 1; indeterminate, 0; total, 3. Merchandising only—A, 112; B, 116; C, 23; D, 16; E, 2; indeterminate, 0; total, 269. Free renewals and merchandising—A, 15; B, 56; C, 25; D, 28; E, 8; indeterminate, 0; total, 132. Do not handle lamps—A, 4; B, 12; C, 2; D, 3; E, 0; indeterminate, 13; total, 34. Give renewals and make lamp service charge—A, 0; B, 0; C, 0; D, 2; E, 2; indeterminate, 0; total, 4.

average per state eight, while seventeen states returned replies in excess of this average. It may therefore be assumed that any conclusions reached from the replies received are representative of the membership.

The replies were divided into four classes which were found, from the information furnished, to be the basic policies by which lamps are handled, namely, those companies which merchandise only, those which merchandise and furnish free renewals, those which furnish free renewals only, and those which do not handle lamps in any manner. The replies were then grouped under five subdivisions according to the number of lighting customers served—Group A, 1000 or less; Group B, 1001 to 5000; Group C, 5001 to 10,000; Group D, 10,001 to 50,000, and Group E, more than 50,000.

After a very detailed analysis of all replies received it was found possible to present the final answer in the form of a chart or table shown herewith, which is divided into three main divisions, namely, the merchandising policy of those companies which merchandise only, the merchandising policy of those companies which merchandise and furnish free renewals as well, and the free-renewal policy of those companies which merchandise and furnish free renewals.

Under each of these headings five subdivisions are shown similar to the grouping previously referred to as to number of lighting customers served. The policy and practice as represented by the majority of companies in each group was considered to be the predominating policy or practice within that group (number of lighting customers served). For example, assuming that it is desired to learn the predominating policy of those companies supplying 1000 lighting customers or fewer who merchandise only, it will be found that the majority merchandise Mazda lamps only, sell lamps at list prices, do not allow special discounts in event of quantity pur-

CHART SHOWING PREDOMINATING LAMP POLICY OF CENTRAL STATIONS IN THE UN

		Merchandising Policy of those Companies which Merchandise Only						Merchandising Policy of those Companies which Merchandise and Give Free Renewals						Free Renewal Policy of those Companies which Merchandise and Give Free Renewals					
	See foot-note (*)	A	B	C	D	E	Total	A	B	C	D	E	Total	A	B	C	D	E	Total
General policy	Merchandise lamps	Yes						Yes						Not applicable					
	First installations free	Not applicable						Not applicable						No					
	Renewals free	Not applicable						Not applicable						Yes					
	Sell other lamps than those supplied free	Not applicable						Not applicable						Yes					
Kind of lamp or combination of kinds	Merchandised	Mazda	Mazda	Mazda	Mazda	Mazda	ϕ	Mazda and Gem	(a)	Mazda, Gem & Carbon	Mazda and Gem	Mazda, Gem & Carbon	Mazda and Gem	Not applicable					
	Supplied free on first installation	Not applicable						Not applicable						Gem	Gem	Gem	Gem	ϕ	Gem
	Supplied free on renewals	Not applicable						Not applicable						Gem	Gem	Gem	Gem	Mazda, Gem and Carbon	Gem
Prices of lamps	Merchandising prices	List	List	Below list	List	List	List	List	List	Below list	List	Below list	List	Not applicable					
	First installation prices	Not applicable						Not applicable						List	List	Below list	List	At cost	List
	Prices of lamps other than those supplied free	Not applicable						Not applicable						List	List	Below list	List	Below list	List
	Special prices for certain sizes of lamps	Not offered						Not offered						Not applicable					
	Credit for the return of old lamps or stubs	Not allowed						Not allowed						Not applicable					
	Special discounts in event of quantity purchases	Not allowed	Allowed	Allowed	Allowed	Allowed	Allowed	Not allowed	Allowed	Allowed	Allowed	Allowed	Allowed	Not applicable					
Guarantees and claims	Guarantees against defects in merchandised lamps	Not given	Not given	Not given	Given	Given	Not given	Not given	Given	Not given	Given	Not given	Not given	Not applicable					
	Claims for replacements of merchandised lamps on account of defects are recognized within	Reasonable time	Reasonable time	Reasonable time	Short life	Average life	Reasonable time	Ten days	Reasonable time	Reasonable time	Reasonable time	Reasonable time	Reasonable time	Not applicable					
Miscellaneous	Record of the average life of lamps supplied on free renewal	Not applicable						Not applicable						Not kept					
	Electrical supply stores, hardware stores, etc. in the community	Sell lamps						Sell lamps						Not applicable					
	Other electric lighting companies in the community	Do not sell lamps						Do not sell lamps						Do not sell lamps					
	Of all the lamps used by consumers in the community the company replying supplies approximately	91–100%	71–80%	71–80%	61–70%	91–100%	Not obtainable	91–100%	71–80%	91–100%	81–90%	91–100%	Not obtainable	91–100%	71–80%	91–100%	91–100%	91–100%	Not obtainable
	Sales policy results in a	Gain						Gain						Not applicable					
	Inspection service of consumers' premises	Not applicable						Not applicable						Not maintained					
	Post-cards, etc., to be used for requests for inspection of installation or for renewals	Not applicable						Not applicable						Not provided					

*A, 1000 or less; B, 1001 to 5000; C, 5001 to 10,000; D, 10,001 to 50,000; E, 50,001 or more. ϕImpossible to determine predominating policy. (a) Indeterminate:—Replies evenly divided between "Mazda and Gem" and "Mazda, Gem and Carbon." (b) Indeterminate:—Replies evenly divided between "Identification" and "No identification." (c) Indeterminate:—Replies evenly divided between "Over counter" and "Messenger and over counter." (d) Indeterminate—Replies evenly divided between "Electric" and "Gasoline." (e Indeterminate:—Replies

chases, do not give guarantees against defects, recognize claims for defects made within reasonable time, deliver over counter, also make deliveries by company's wagons (gas cars being used), provide no means of identification for delivery men, install lamps on customers' premises if requested of deliverymen, supply 91 to 100 per cent of all the lamps used by consumers in the community.

The information discloses among other details that 61 per cent of companies reporting merchandise only, that 31 per cent merchandise and furnish free renewals, four companies make a service charge for lamp installations and renewals, two supply free renewals only and do not merchandise or sell lamps. The remaining thirty-four companies do not handle lamps in any manner.

Of those companies merchandising and furnishing free renewals as well (31 per cent), twenty-three companies are still furnishing exclusively carbon lamps on first installation or renewal, and while the majority of these companies fall within the three groups supplying 10,000 lighting customers or fewer, eight are within the group supplying 10,001 to 50,000 customers.

With respect to the use of the Gem lamp in this group of 31 per cent supplying free lamp renewals and merchandising, eighty-three companies, or 60 per cent, are using this type of lamp for first installation or renewal, the larger part of which fall within the group supplying 10,000 customers or fewer, and by far the largest number within the group between 1000 and 5000 customers. There are, however, seventeen companies using this type of lamp within the group from 10,000 to 50,000 customers.

The point is emphasized that this chart is a résumé of the information at hand and under the several items of policy and practice gives the predominating methods as determined by the replies received.

TATES AND CANADA, 1917, GROUPED ACCORDING TO NUMBER OF LIGHTING CONSUMERS

		Merchandising Policy of those Companies which Merchandise Only						Merchandising Policy of those Companies which Merchandise and Give Free Renewals						Free Renewal Policy of those Companies which Merchandise and Give Free Renewals					
	See foot-note (*)	A	B	C	D	E	Total	A	B	C	D	E	Total	A	B	C	D	E	Tota
Conditions controlling free renewals	Minimum wattage of lamps supplied on free renewals:																		
	Mazda			Not applicable						Not applicable				ϕ	ϕ	40	250	50	40
	Gem			Not applicable						Not applicable				30	30	20	30	30	30
	Carbon			Not applicable						Not applicable				60	10	10	10	10	10
	Maximum wattage of lamps supplied on free renewals:																		
	Mazda			Not applicable						Not applicable				ϕ	500	500	500	1000	500
	Gem			Not applicable						Not applicable				100	100	100	100	100	100
	Carbon			Not applicable						Not applicable				60	120	ϕ	120	50	120
	Number of renewals supplied at one time or during a given period			Not applicable						Not applicable							Unlimited		
	Percentage of lamps required to fill a consumer's sockets which is supplied as an emergency on the first installation			Not applicable						Not applicable				ϕ	None	None	None	ϕ	None
	Return of old lamps or stubs to get free renewals			Not applicable						Not applicable							Necessary		
	Identification of old lamps or stubs to get free renewals			Not applicable						Not applicable				Not necessary	Not necessary	Necessary	Necessary	Necessary	Necessary
	Means of identification of old lamps			Not applicable						Not applicable				Not identified	Not identified	(b)	Etching	Etching	Etching
	Identification of customer			Not applicable						Not applicable				Not required	Required	Required	Required	Required	Required
	Special requests for the delivery of lamps			Not applicable						Not applicable							Complied with		
Delivery of lamps	Means of delivery	Over counter	Over counter	Over counter	Delivery wagon and over counter	ϕ	Over counter	Over counter	(c)	Delivery wagon and over counter	Delivery wagon and over counter	Delivery wagon messenger and over counter	Delivery wagon and over counter	Over counter	Delivery wagon and over counter	Over counter	Delivery wagon and over counter	Delivery wagon, messenger and over counter	(h)
	Least number of lamps delivered at one time for first installation or free renewals			Not applicable						Not applicable							One		
	Kind of delivery wagon	Gas	Gas	Gas	Gas	(e)	Gas	Gas	Gas	Gas	(d)	Gas	Gas	Gas	Gas	Gas	Electric	Electric and horse	Gas
	Means of identification of delivery men	Not identified	Not identified	(f)	Not identified	Not identified	Not identified	Not identified	Badges	Badges	Badges	Badges	Badges	Not identified	Badges	Badges	Badges	(i)	Badges
	Lamps are installed by	Delivery men if requested	(g)	Customer	Customer	Customer	Customer	Delivery men if requested	Customer	Delivery men	Customer	Customer	Customer	Delivery men	Delivery men	Delivery men	Delivery men	Customer	Delivery men
	Delivery wagons transport	Lamps and other articles						Lamps and other articles	Lamps and other articles	Lamps and other articles	Lamps and other articles	Lamps only	Lamps and other articles	Lamps and other articles	Lamps and other articles	Lamps and other articles	Lamps and other articles	Lamps only	Lamps and other articles
	Tests of lamps are made	In consumer's presence						In consumer's presence						Question not asked					

evenly divided between "Electric" and "Horse." (f) Indeterminate:—Replies evenly divided between "Badges" and "Not identified." (g) Indeterminate:—Replies evenly divided between "Customer" and "Delivery men." (h) Indeterminate:—Replies evenly divided between "Over counter" and "Delivery wagon and over counter." (i) Indeterminate—Replies evenly divided between "Badges" and "Uniforms, badges and caps."

ADVANCE IN TECHNICAL THEORY AND PRACTICE

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AN EASILY ADJUSTABLE ELECTROSTATIC VOLTMETER

Portable Instrument for Measuring Very High Voltages Such as Are Used in Electrostatic Fume and Dust Precipitation

BY E. R. WOLCOTT

Western Precipitation Company, Los Angeles, Cal

IN THE electrical precipitation of dust and fume it is often desirable to measure high voltages with apparatus which is easily adjusted and readily transported. To meet these requirements a modified form of the Kelvin guard-ring voltmeter described in the ELECTRICAL WORLD of May 13, 1916, has been developed.

As shown in Fig. 1, the lower part of the instrument contains the attracted disk *D*, which forms one pan of a balance beam. The insulating support for the upper plate is removable at the base, and the whole packs readily in a flat box and is easily put together for use or packed for transport.

In order to operate the screw *S* is adjusted so that the upper surface of the disk *D* is flush with the upper surface of the guard ring *G*—that is, so that the pointer of the balance registers zero while a 500-milligram weight rests at *W*. This weight is then removed, whereupon the disk *D* falls slightly—that is, until the beam makes contact at *T*. The plate P is then connected to the high-voltage line, while it is some distance from the guard ring *G*; it is then lowered by means of the knurled head and ratchet, which unwinds a silk string until the disk *D* is attracted so as to again be just flush with the guard ring *G*—that is, so that the pointer on the beam indicates zero. The distance between the plates is then read from the scale by the indicator *I*. This, however, is usually marked to read volts directly.

Since the electrostatic attraction is measured by comparison with the attraction of gravity, if the mass of the weight at *W* and the area of the disk *D* are known, the relation between the voltage *e* and the distance *d* between the plate *P* and guard ring *G* can be expressed as follows:

$$e = 300\, d \sqrt{\frac{8\pi m g}{\pi r^2}}, \text{ where}$$

e = volts in electromagnetic units;
d = the distance between the plate *P* and guard ring *G* in cm.;
m = the mass of weight added at *W* in grams;
g = the acceleration of gravity = 980.6;
r = the radius of the disk *D* in cm.;
300 = the constant of transformation from electrostatic to electromagnetic units.

If m = 500 milligrams, and r = 1.5 in. = 3.8 cm., then when d = 1 cm.,

$$e = 300 \sqrt{\frac{8 \times 0.5 \times 980.6}{14.5}} = 4935 \text{ volts per cm.}$$

The diameter of the plate *P* and the guard ring *G* should be larger than the maximum distance to which they are separated. In the instrument shown in the illustration, the diameter of the plate *P* was 10 in. and it

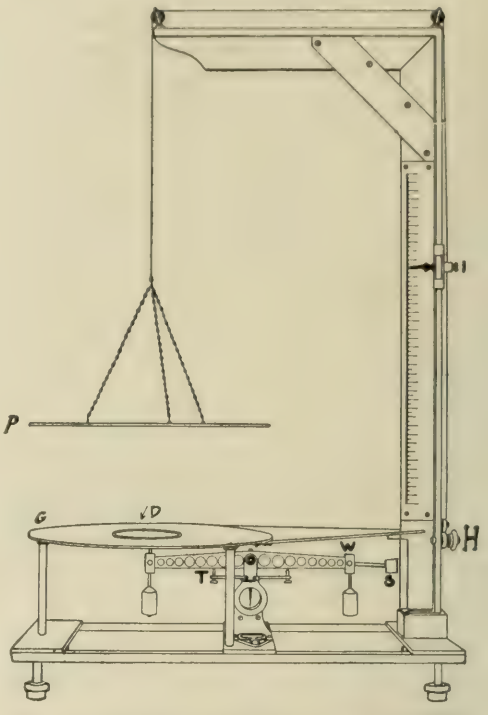


FIG. 1—PORTABLE ELECTROSTATIC VOLTMETER

W—weight. *S*—screw. *D*—disk. *G*—ring. *T*—stop. *P*—plate. *H*—knurled head. *I*—indicator.

was used to measure 100,000 volts—that is, about 20 cm. distance between the plate *P* and guard ring *C*.

The accuracy of the instrument depends upon that of the beam, which is readily constructed as to permit of readings within 1 per cent.

Generators, Motors and Transformers

Contact Resistance of Carbon Brushes.—R. CZEPEK.—An account of tests made with the object of elucidating the character of the processes taking place at the contact between brush and commutator. Two brushes were placed on the commutator of a rotary converter, the commutator being short-circuited by winding copper binding wire around it. The voltage was measured between the slip rings of the rotary converter and either brush, the currents and voltages being recorded by an oscillograph and measured by meters and voltmeters. The supply was direct current or alternating current or slowly fluctating direct current. The tests were made at constant brush pressure, constant current density and constant commutator speed. The resistance at the contact may be regarded as a combination of the resistance of a solid conductor and of an arc. On this

account the voltage-current characteristic rises quickly at low currents and then at a slower and slower rate as the current is increased. When fed with alternating current the contact resistance exhibits a hysteresis effect on account of the great sensitiveness of the contact to temperature changes. This is revealed in a number of dynamic characteristics showing the variation of the voltage across the contact, and of the contact resistance, over complete cycles of currents. As the electrodes have very different heat conductivities the hysteresis loops generally change their direction of rotation with a change of the cathode. Also the voltage in the direction from commutator to brush is generally greater than in the reverse direction. Thermo-electric effects are also noticeable, arising from unequal warming of the electrodes. The direction of the thermo-electric voltage depends on the material of which the brush is composed.—From *Archiv f. Elektrot.*, abstracted in *Science Abstracts*, Section B, March 31, 1917.

Lamps and Lighting

High-Vacuum Mercury-Vapor Pump.—CHARLES T. KNIPP.—The diffusion pump of Gaede has stimulated a number of new designs of high-vacuum pumps. The author describes a design made wholly of glass as an improved high-vacuum high-speed mercury-vapor pump (Fig. 2). The bulb to be exhausted and trap are fused to *B*, while the tube *E* is attached to the supporting or rough pump. The mercury vapor rising from the lower bulb, which is heated in a sand or heavy oil bath, streams up through the short tubes *P* and *O* and is deflected downward through an annular throat by an umbrella *N*. The issuing mercury vapor at once condenses on the water-cooled surface of the enveloping tube, and the gas that comes from *B* is forced mechanically downward from the lower edge of *N* along the cooled surface of the condensing chamber. This accumulated gas is removed through the lateral tubes *bb*, which unite at the top and form the exhaust tube *E*, all being enveloped by the water jacket *XY*, as shown in the figure. This construction keeps the mercury, which collects at the ring-seal 3, cool, and thus removes the objection that mercury vapor having an upward velocity would enter the annular condensing chamber. A small opening shown at 3 serves as a valve which allows the accumulated mercury to pass, yet owing to surface tension maintains a perfect seal. The short tube *P* is inserted to shield the hot mercury vapor streaming up from the boiler from condensing on the surfaces at 3. The upper end of *P* telescopes loosely into the lower end of *O*, while the lower end is secured by the ring-seal 1, having also a small valve opening in it through which the mercury passes back into the boiler. By making the upper end of *P* conical, condensed mercury vapor is caught in the annular space formed and automatically seals the space *PO* from the cavity just outside of *P*. The cold mercury collected at the ring-seal 3, and the adjacent water-jacket, thus have but little opportunity of cooling the hot stream of mercury vapor passing up through *PO*, and furthermore, the temperature gradients between the ring seals 1 and 2, and 3, and *bb* are not abrupt; hence there is no danger of the glass cracking. This construction very much simplifies the glass-blowing, since the tube throughout the process is kept perfectly symmetrical.—*Phys. Review*, April, 1917.

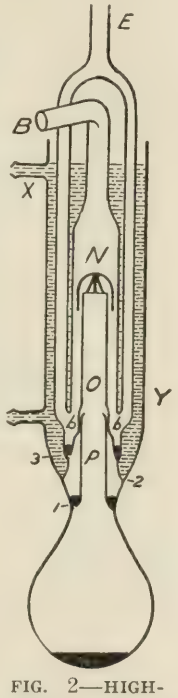


FIG. 2—HIGH-VACUUM PUMP

Generation, Transmission and Distribution

Calculation of Transmission Lines.—B. GUERSCHINOVITCH.—In the predetermination of a transmission line not only the present conditions but probable future extensions have to be taken into consideration. The author describes a method of calculating a transmission line for a three-phase system. He first determines the minimum cross-section s of a conductor which permits the transmission of a given power at a certain voltage (the transmission loss in this case just equaling the power). He then considers a large section $S = n\,s$ and determining n in such a way that the power loss in transmission is a given percentage a of the transmitted power. The relation between n and a is determined and given in a diagram. He then discusses the determination of a cross section $S = n\,s$, for which the value of n is such that the sum of the power loss in the transmission line and the amortization of the copper becomes a minimum. The results of the calculations are given in algebraic form and in a series of diagrams. The same method can be applied for single-phase transmission and direct-current transmission and the diagrams given in the article can be used for such purpose.—*Revue Gen. de l'Elec.*, April 7, 1917.

Installations, Systems and Appliances

Limitation of Short-Circuit Currents.—G. KLINGENBERG.—It has been shown by Binder and Biermanns that the very large currents due to short circuits give rise to great mechanical strains that are produced so quickly that the most rapid-acting circuit breakers afford insufficient protection. The short-circuit currents in "the greatest steam-driven generating station of the world, at Golpa," have been limited in magnitude as follows: The station transmits 60,000 kw. over a distance of 25 km. (15 miles) at 80,000 volts besides supplying 30,000 kw. at 6000 volts in the more immediate neighborhood. Eight turbo-generators of 22,500 kva. each at 6000 volts are installed. The first portion of the supply is furnished by four generators over two lines of masts with two circuits each (in all $2 \times 2 \times 3$ conductors). The conductors on each line of masts can carry the total load with increased losses in case of emergency. The maximum short-circuit current of the alternators is fifteen times the normal current. If the four alternators were paralleled in the usual way, a maximum short-circuit current of 135,000 amp. would have been possible. On this account their direct connection in parallel has been completely avoided and the paralleling has been arranged for behind the 80,000-volt transformers, the reactance of which limits the short-circuit currents that can flow. The number of transmission circuits was chosen equal to that of the generators and their transformers so that the circuits might not have to be connected in parallel at the generating station, and provision is made for the possibility of subdividing the 80,000-volt busbars so that each generator may feed

one of the four transmission circuits, which may be connected in parallel at their loaded ends, thus adding the line reactance to the path of a short circuit taking place on the consumers' installation. In a diagram of connections the four generators are shown each supplying a step-up transformer through a current-limiting reactance; each transformer can supply either or both of a pair of 80,000-volt busbars, and each line can be connected to either or both of these busbars. Each pair of busbars is subdivided by a link with switches at either end into two portions, each of which is associated with two of the four transmission lines and two of the alternators. The links may be connected together by coupling switches. A local supply of power at 6000 volts can be given by the same generators through a second set of current-limiting reactive coils of such a magnitude that there is no danger in connecting the generators in parallel through them at a system of duplicate busbars. By the above arrangements and by exercising great care in the insulation of the machines it has been possible to carry out the installation without any over-voltage protective devices, and no disturbances from over-voltage have been experienced even in heavy thunderstorms.—From *Elek. Zeit.*, Dec. 14, 1916; abstracted in *Science Abstracts*, Section B, March 31, 1917.

Electrophysics and Magnetism

Change of Resistance in Light.—T. W. CASE.—The author has made a systematic search for substances which show a change of resistance when exposed to light. The apparatus used consists essentially of an arc lamp and a variable-speed water motor mounted upon a concrete base. The water motor drives a disk which has fifteen sectoral openings, and so serves rapidly to interrupt the beam of light produced by the arc and brought to focus upon the substance under observation. Lead wires run from this substance to an Ayrton shunt, connected to a three-step audion amplifier. High-resistance receivers can be inserted in any one of these steps, and if any photoelectric action is produced by the interrupted beam of light, a distinct note is heard in the receivers. The results of the author's research are given in a long table. Two specimens which show remarkable action are acicular crystals of bismuth sulphide (bismuthinite) and a granular lead antimony sulphide. The resistance of a piece of the latter 1 mm. by 10 mm. reduces about 5000 per cent from the value in the dark in dull sunlight at an applied potential of 110 volts. If the substance be actually heated up, either by exposure to heat or passing a current which slowly heats the substance, then the resistance is gradually lowered, but this is a slow process. All of the photo-active sulphides show the quick light reaction in the red part of the spectrum. Both the bismuthinite and the lead antimony sulphide give fine results when used as a transmitter in a photophone system, using a manometric flame for transforming the voice variations into light variations. The voice reproduction is very clear and loud.—*Phys. Review*, April, 1917.

Electrochemistry and Batteries

Aluminum.—A review of the international aluminum industry. The demand for aluminum has increased greatly during the last few years. While the German, Swiss, French and British works have had difficulty in extending greatly under war conditions, the aluminum industry in the United States has made enormous progress. It is estimated that the present capacity of the aluminum production throughout the world is 100,000 tons per year, and if the schemes in process of execution are taken into consideration the capacity will rise to 150,000 tons in the near future, of which the United States and Canada will produce 75,000 tons, France 20,000 tons, Switzerland and Germany 20,000 tons, Great Britain 12,000 tons, Norway 16,000 tons, and Italy 7000 tons. Such a large production would prevent excessive prices of aluminum, but it is questioned whether sufficient supply of alumina, bauxite, cryolite, etc., will be on hand in time to produce such an output.—London *Elec. Review*, March 30, 1917.

Units, Measurements and Instruments

Automatic Device for Charging Electroscope.—L. KOLOWRAT.—An illustrated description of a convenient automatic device for charging a sensitive aluminum-leaf electroscope for laboratory and field work with radioactive minerals. As shown in Fig. 3, it consists

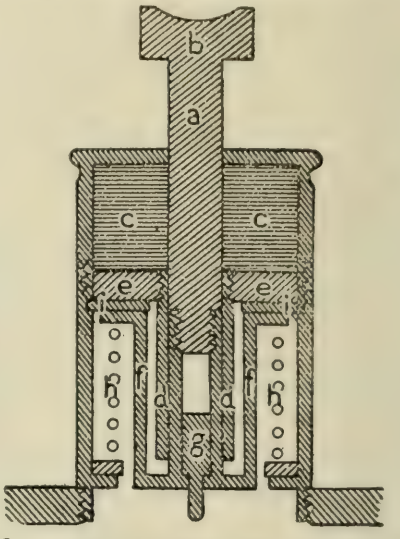


FIG. 3—AUTOMATIC DEVICE FOR CHARGING AN ALUMINUM-LEAF ELECTROSCOPE

essentially of an ebonite rod *a* which, while being pushed down by means of the button *b*, is rubbed against cloth placed at *c*—*e.g.*, in form of a pile of perforated disks. During the subsequent motion the charge thus produced is collected on the fixed brass tube *d*, insulated by the ebonite collar *e*. This tube remains, on the other hand, in permanent connection with the piece *ff*, consisting of two coaxial cylinders and moved together with *a*. When the rod is at the end of its path a small finger *g* lightly touches the support of the leaf to be charged. By releasing the pressure on *b* the spring *h* brings the rod to its original position, simultaneously connecting *f* with the brass disk *i*, and consequently with the electroscope case. The dimensions being chosen consistent with the capacity of the leaf support, things are easily adjusted so as to produce a convenient deflection of the lead with a single push of the button. A good plan is to overcharge the leaf a little and to keep the button down until the system has discharged itself to the desired point, which is readily attained owing to the leak through the ebonite parts of the charging device.—*Philos. Mag.*, April, 1917.

Scientific and Industrial Research

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Conducted by PROF. VLADIMIR KARAPETOFF
Cornell University

RUPTURING CAPACITY OF LARGE OIL SWITCHES

Apparent Lack of Information on This Subject Is Due to the Lack of Systematization of Data That Has Prevailed

BY M. S. DIAMANT

Rice Institute, Houston, Tex.

Referring to the remarks of P. H. Chase, Public Service Electric Company, New Jersey, in the April issue of the Research Section in regard to the lack of data on rupturing capacity of oil switches and the factors that determine the rating, it seems to the writer that the trouble is not so much with lack of data as with lack of systematization of data. Only very large manufacturing concerns and some operating companies are able to conduct tests on oil switches, since the kva. capacity required for such investigations is enormous. Considerable sporadic work has been done along this line, but theory and scientific study still seem to be in the development stage, and will continue to be so long as there is lack of information regarding transient phenomena and other factors which vitally affect the operation of all switches. Until more is learned about the theory of this kind of apparatus, no approximate predeterminations of performance can be made without recourse to long and expensive tests. The results of actual tests cannot always be generalized, and hold only for the cases considered.

Reducing Hazards from the Use of Household Electrical Appliances

The wide and rapidly extending use of electrical appliances for industrial and domestic purposes has brought the attention of the Underwriters' Laboratories to the necessity of requiring the manufacturers of portable apparatus, like electric pressing irons, small motors, cooking and heating appliances, to construct or equip them so that fire hazards from the careless use of such appliances will be minimized. Devices of this nature are often installed without instructions or supervision from inspection authorities and are almost invariably used by inexperienced persons.

Dana Pierce of the Underwriters' Laboratories has recently made the point that it should be possible to embody in the construction of these appliances features which would minimize the liability of misuse or remove the fire hazards. Such inventions and applications would fill a great need and would undoubtedly be welcomed by manufacturing interests, insurance and inspection authorities of states and municipalities, and by the general public.

Summary of Investigations, Available Apparatus and Research Suggestions

SUBJECTS BEING INVESTIGATED (RESEARCH WORK REPORTED SINCE APRIL 21)

ALTERNATOR.
Armature reaction studied by means of oscillographic records.—*Carnegie Institute of Technology, Alex. Jay Wurts.*

COAL.
Lignite, utility of grades available in Manitoba for the manufacturer producing gas for power and domestic purposes.—*Public Utilities Commission (Manitoba), George L. Guy and Mr. McNair.*

CONTROL.
Arrangements for controlling electrical power at any frequency.—*University of Southern California, August Hund.*

ELECTROMAGNETIC WAVES.
Absorption of.—*Carnegie Institute of Technology, Alex. Jay Wurts.*

GENERATORS.
Induction type, operation and efficiency of small units.—*Throop College of Technology, Pasadena, Cal., R. W. Sorensen and C. E. Baker.*

HEAT CONDUCTIVITY.
Insulating paint.—*University of Missouri, A. C. Lanier and M. P. Weinbach.*

INSULATORS.
(1) Depreciation on transmission lines. (2) Development of a portable outfit for testing insulators after removing from transmission lines.—*Throop College of Technology, Pasadena, Cal., R. W. Sorensen.*

MEASUREMENTS.
High voltage.—*Carnegie Institute of Technology, Alex. Jay Wurts.*
Magnetic flux density, permeability and copper and iron losses up to any desired frequency.—*University of Southern California, August Hund.*
Efficiency of arc oscillations of the first, second and third type, with the view to increasing the output of oscillations of the first type.—*University of Southern California, August Hund.*
Rating of coils with special reference to those used in high-potential high-power transformers.—*University of Southern California, August Hund.*

PHASE TRANSFORMATION.
Vector relations in the Taylor system.—*Carnegie Institute of Technology, Alex. Jay Wurts.*

TRANSFORMERS.
Theoretical design.—*Carnegie Institute of Technology, Alex. Jay Wurts.*

TRANSFORMER OIL.
The megger as a means of determining the condition of transformer oil.—*Throop College of Technology, Pasadena, Cal., R. W. Sorensen.*

TRANSMISSION.
Iron wire, mechanical and electrical tests, including inductive effect of power current in iron wires adjacent to telephone wires.—*University of Oklahoma, L. W. W. Morrow.*

APPARATUS AVAILABLE FOR RESEARCH PURPOSES

CARNEGIE INSTITUTE OF TECHNOLOGY.
(1) 200,000-volt, 60-cycle, 100-kva. transformer; (2) 10-kw., 500-cycle radio station with 700-ft. aerial and equipped with vacuum-valve receiving sets for both spark sets and sustained-wave reception; (3) three-element oscillograph with complete photographic attachment; (4) railway motor flywheel set with hand and electro-pneumatic control; (5) variable-frequency generators ranging from 25 to 600 cycles; (6) large-current testing transformers with regulator control.—*Alex. Jay Wurts.*

UNIVERSITY OF WASHINGTON.
(1) An artificial transmission line with adjustable constants (see A. I. E. E. *Proceedings*, August, 1916); (2) Drysdale-Tinsley alternating-current potentiometers; (3) 200,000-volt, 20-kw. transformers.—*Prof. C. E. Magnusson.*

SUGGESTIONS FOR RESEARCH

CHARACTERISTICS OF SHORT-CIRCUITED ALTERNATOR.
Referring to Prof. A. H. Forman's work on the armature reaction of an alternator, mentioned in the April issue of the Research Section, I should like to make the following suggestions: (1) By means of two full-pitch exploring coils placed on the field system, with the coil sides coinciding with the axis of the pole and the geometrical interpolar axis respectively, investigate the flux pulsations under load and under sustained short circuit and compare the results with the pulsations obtained under no load. From investigations made by the writer it appears that with no load the space oscillations and pulsations in intensity of the air-gap flux wave are larger than when the machine is run idly as a synchronous motor. (2) By means of full-pitch exploring coils placed at the top and bottom of the armature slots, determine whether the emfs. induced in the upper coils are smaller than those induced in the lower ones. (3) The extent to which concentrated-turn exploring coils or single conductors will give a reliable indication of the actual flux distribution. This last-mentioned investigation is advisable since the time rate of change of the B-curve would only be proportional to the emf. measured, provided it is entirely motional. Variational emf. is bound to occur, owing to oscillations and pulsations of flux. In connection with Professor Forman's work it would also be interesting to know the extent to which the armature current under two-phase and single-phase sustained short circuit approaches the ideal sine wave.—*M. S. Diamant, the Rice Institute.*

RADIO DETECTORS.
The writer is impressed with the necessity of developing some suitable detector for radio work which will be better than the apparatus available at present for the purpose. The audion is a very remarkable device but is erratic in perform-

ance. Further study of the audion to increase its sensitiveness and stability would also be of great practical value. Another line of research which should prove of considerable value would be the study of electric arcs under pressure such as exist in oil switches.—*Ernest J. Berg, Union College.*

MISCELLANEOUS

(1) Investigation of noise in rotating machines, analysis of causes and means of prevention. (2) Study of commutation under rapidly varying peak-load service, particularly where reversal with dynamic braking or plugging is required. (3) Heat flow and dissipation of heat with special reference to direct ventilation in rotating machines. (4) Leakage of high-reactance transformers employing magnetic shunts. (5) Heat flow through conducting and insulating materials, including varnishes, paints, and built-up materials.—*A. C. Lanier, University of Missouri.*

DEVELOPING NATURAL RESOURCES

Plans Outlined by Scientific and Industrial Research Committee of the A. S. C. E., Manitoba Branch

By George L. Guy

Public Utilities Commission, Manitoba

As a result of the present war conditions the Manitoba branch of the American Society of Civil Engineers has organized a scientific and industrial research committee to organize and develop the natural resources in industry and science. At present this committee is listing all available research laboratories in its jurisdiction, also all men engaged in scientific and engineering pursuits and the qualifications of each man in his particular line of research or engineering. After organization is completed a study will be made of the requirements of the Province of Manitoba as regards manufactured articles, and more especially imports, with a view to supply all local demand for such material and, if possible, to provide for export, if it can be economically accomplished.

Purdue Trustees Approve Organization of Engineering Experiment Station

According to C. F. Harding of Purdue University, the faculty has been very much encouraged to enter research work by the recent action of the board of trustees of this institution in approving the organization of an engineering experiment station. This station will be employed for the supervision of engineering research. Arrangements have also been made by the board of trustees for the extension and equipment of a high-voltage laboratory, in which pressures as high as 500 kv. can be obtained.

Necessity of Shop and Laboratory Facilities

Many engineers who wish to do private research work find it difficult to secure suitable shop facilities for constructing models and apparatus. For this reason the writer is inclined to believe that a few suitably conducted shops, possibly with private laboratory facilities, would not only be highly appreciated by many engineers but could be made profitable.—*Jay Grant De Remer, New York.*

H. W. Buck, president of the American Institute of Electrical Engineers, in a letter to the ELECTRICAL WORLD, says: "I do not know of any matter of more importance to the future of electrical engineering than the research work which seems to be in the spirit of the times."

FEATURES OF THREE CONGRESSIONAL BILLS ON SCIENTIFIC AND INDUSTRIAL RESEARCH

GRONNA BILL. (Senate 7037—Dec. 5, 1916)

Object:
Promotion of engineering and industrial research.

Where or how:
Through national, state and territorial research boards, utilizing laboratories, equipment and individuals of any institution of learning or research within the state or territory.

Purpose:
To aid in the promotion of engineering research, industrial progress and scientific investigations, and the distribution among the people of the resulting useful and practical information, and to aid in developing the natural resources of the United States as a measure of industrial and military preparedness.

Scope of work:
Engineering, chemical, physical and economic problems connected with water supply, sewerage, disposal of wastes, flood protection, drainage and irrigation of lands, transportation, lighting and heating, development of power, manufacture of materials, marine architecture, etc.

Bulletins to be published:
At least one every year.

Annual appropriation:
$10,000 for each state and territory and $15,000 for the expenses of the National Board.

General supervision rests with:
Secretary of Commerce and a national board of engineering and industrial research.

Local supervision and administration of the moneys rests with:
The state or territorial research board, to consist of five engineers or scientists engaged in the development of engineering and industrial science and appointed by the national board. First consideration to be given nominations by the presidents or chancellors of the several institutions of higher learning in the state or territory concerned receiving public aid, the presidents of at least two other institutions of higher learning maintaining technical departments, the governing board or committee of at least one technical society or association of state-wide or territorial character, and the governing boards or committees of not less than four engineering societies or associations of national character.

Authorization and co-ordination of research:
The executive committee of the national board to pass on each subject for research submitted by state boards.

Annual report:
State and territorial boards to report to the Secretary of Commerce; copy to be sent to each of the other boards, to Secretary of Commerce, to each member of the national board, and to the Secretary of the Treasury of the United States.

NEWLANDS BILL. (Senate 4874—March 9, 1916)

Object:
To establish experiment stations in engineering and in other branches of mechanic arts.

Where or how:
In connection with the land grant college in each State or territory.

Purpose:
To aid in acquiring and diffusing among the people useful and practical information on engineering and to promote the scientific investigation and experiments respecting the principles and applications of the mechanic arts.

Scope of work:
To conduct original researches, to verify experiments and to compile data; also to conduct researches, investigations and experiments in connection with materials of engineering, water supplies, sewage purification, disposal of wastes, flood protection architecture, road building, transportation, manufacturing, public utilities, etc.

Bulletins to be published:
At least once in six months.

Annual appropriation:
$15,000 to each state and territory.

General supervision rests with:
Secretary of the Interior.

Local supervision and administration of the moneys rests with:
The land-grant college itself.

Authorization and co-ordination of research:
General supervision by the Secretary of the Interior.

Annual report:
Each station to report to the Governor of the state or territory in which it is situated. Copy to be sent to each of the other stations, to the Secretary of the Interior and to the Secretary of the Treasury of the United States.

SMITH-HOWARD BILL. (Smith Bill, Senate 983—April 6, 1917; Howard Bill, H. R. 2611—April 10, 1917)

Object:
To establish engineering experiment stations for the promotion of engineering and industrial research.

Where or how:
In connection with some state-supported engineering school or university having a department of engineering.

Purpose:
To aid in the promotion of engineering and industrial research and distribution among the people of the resulting useful and practical information; to aid in developing the natural resources of the United States as a measure of industrial and military preparedness.

Scope of work:
Same as Newlands bill and, in addition, to make tests and investigations in any or all branches of engineering, manufacturing and the industries; aeronautics; and those bearing on the public welfare of the people.

Bulletins to be published:
At least once in twelve months.

Annual appropriation:
$15,000 to each state, territory and the District of Columbia and, in addition, $25,000 to the Bureau of Standards for Supervision and co-operation.

General supervision rests with:
Secretary of Commerce through the Bureau of Standards.

Local supervision and administration of the moneys rests with:
The station itself.

Authorization and co-ordination of research:
Supervision by and co-operation with and through the Bureau of Standards.

Annual report:
Each station to report to the Governor of the state or territory in which it is situated. Copy to be sent to each of the other stations, to the Secretary of Commerce and to the Secretary of the Treasury of the United States.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

ASSOCIATED MANUFACTURERS ACT ON WAR REVENUE TAX

Will Accept Without Demur the Decision Ultimately Reached, but Recommend English Plan—H. B. Crouse Elected President

At the meeting of the board of governors of the Associated Manufacturers of Electrical Supplies held in New York on May 16 the following telegram was sent to the finance committee of the United States Senate and the United States Chamber of Commerce:

"The board of governors of the Associated Manufacturers of Electrical Supplies, representing substantially this entire industry, at its regular meeting to-day in New York unanimously passed the following resolution and directed that a copy be sent to the finance committee of the United States Senate and to the Chamber of Commerce of the United States:

"Resolved, that without departing in any way from its attitude of co-operation with the government in its effort to cope with the present situation and while accepting without demur the decision ultimately reached, the opinion of this board is that the principle upon which the English government bases the assessment of so-called excess profit taxes is superior to that embodied in present United States legislation from the viewpoint of equity, simplicity and continuing business activity.

"H. B. CROUSE, president."

Mr. Crouse was elected president at the meeting. He succeeds Robert K. Sheppard, the first president, whose desire was that the organization be kept representative and democratic by rotation in the chief executive office. Mr. Crouse is president of the Crouse-Hinds Company, Syracuse, N. Y.

A. W. Berresford, Cutler-Hammer Manufacturing Company, Milwaukee, Wis., was elected vice-president. J. W. Perry, H. W. Johns-Manville Company, was re-elected treasurer. Charles K. Dustin, the general secretary, was re-elected.

CLOSE OF CAMPAIGN FOR 1917 "WIRE-YOUR-HOME TIME"

Preliminary Reports to Society for Electrical Development Indicate Success of Movement, Notwithstanding Adverse Conditions

Tuesday, May 15, marked the close of the "wire-your-home time" campaign held during the last six weeks throughout the country.

Preliminary reports received by the Society for Electrical Development indicate that in spite of adverse conditions, such as increased labor and material costs and correspondingly increased wiring prices, as well as scarcity of equipment, the event was a marked success. Several cities have already stated that they obtained even more business than the record during last year's "wire-your-home month." The society's committee, of which G. M. Sanborn of Indianapolis is chairman, will announce the winners in the prize contest on or about June 15.

TURBINE ORDER PLACED AGGREGATING 200,000 KW.

Brady Interests, to Meet Power Requirements, Allot Contracts to General Electric Company

The Brady interests have placed within the last few days an order for turbines totaling 200,000 kw. rating. The order was placed with the General Electric Company. This is stated to be the largest single order for turbines ever placed.

SUCCESSFUL STOCK SALE BY UNION COMPANY OF ST. LOUIS

Customers Buy $500,000 of a New Issue of 7 Per Cent Preferred Shares in One Week

In one week the Union Electric Light & Power Company of St. Louis sold to its consumers $500,000 of a new issue of 7 per cent preferred stock. This result was achieved without solicitation on the part of the company and solely by newspaper advertisement. Four successive advertisements were in the series.

A Safe 7% Stock for Our Customers Only

We want a large number of our customers to become our active partners.

We therefore offer, TO OUR CUSTOMERS ONLY, 5,000 $100 shares of Union Electric 7% preferred stock—at par for cash; at 102 on time payments.

Union Electric has authorized an issue of $8,040,000 of 7% preferred stock to provide funds for future extensions of the business. Of this amount $1,000,000 has been issued with the approval of the Public Service Commission of Missouri. The remainder will be issued from time to time, the Commission approving, as extension funds are required. The $500,000 here offered is one-half of the above $1,000,000 issue.

Terms of sale:

(a), for cash at the Company's sales offices at $100 a share, to earn 7%.

(b), on a 10-payment installment plan at $102 a share, to earn 6.86%.

Installments to be paid monthly—$10.20 on each share—with Electric Service bills.

The Company to pay buyers of stock 5% interest, credited quarterly on the first day of January, April, July and October, on installment payments.

Buyers to have the option to withdraw all installments paid, with interest credited, on 10 days notice, any time before full amount has been paid.

Stock certificate to be issued to buyer when final payment is made.

OFFER LIMITED TO OUR CUSTOMERS ONLY.

Not more than 20 shares to be sold to any customer.

This stock has the same voting power as the Company's common stock. It is preferred as to dividends and distribution of assets. It is redeemable by the Company at 105. Preference as to dividends is not cumulative.

The physical value of the Company's property far exceeds the outstanding bonds and preferred stock.

The Company's net earnings each year since 1907, after paying bond interest, have been seven to twelve times as large as the sum needed to pay 7% on its outstanding preferred stock.

Owing to its progressive and liberal policy, the Company's business is rapidly and healthfully growing.

THE COMPANY'S SECURITIES ARE NOT "WATERED," AND UNDER STATE REGULATION NEVER CAN BE.

This 7% preferred has therefore virtually the security of a good bond, with the higher earning power of a good stock.

This offer seems certain to be taken up quickly. The rule is: First come, first served. If you are a customer, and want a part of the lot, up to 20 shares, better get in line early.

The Electric Company

UNION ELECTRIC: Main Office—12th and Locust
Branches: 4912 Delmar; 3028 N. Grand; 3012 S. Grand
SIX OFFICES IN THE COUNTY

WAR REVENUE TAX ON ELECTRIC ENERGY FOR DOMESTIC USES

Discussion Before Senate Finance Committee by Representatives of Public Service Corporation and Southern Utilities Company

The United States Senate finance committee is conducting hearings on the war revenue tax bill, which is designed to produce $1,800,000,000. The hearings are being divided into groups and, for the most part, are as brief in their details as the bill itself, which, consisting of only fifty-four pages, is the greatest tax measure ever introduced into any legislative body in the world.

When the hearing on "public utilities," as a group, was called, Edmund W. Wakeley, Public Service Corporation of New Jersey, and Z. V. Taylor, representing the Southern Utilities Company, appeared. They discussed different phases of the bill, as reported to the House by the House ways and means committee.

It is the general understanding in Washington, especially in administration circles, that the war tax bill will be framed in the Senate finance committee very nearly in the form in which it will become a law, irrespective of what the House ways and means committee reported in the bill. It is also the general understanding in Washington that there will be weeks of debate in committee and possibly in the Senate on some of the proposals contained in the bill, although there is also a general belief that the statesmanship and patriotic purpose of the industries of the country in responding to tax requirements which are hitting all industries, under the bill, will certainly not be less than can be found in Congress.

President Wilson began on Tuesday night at the White House a series of conferences designed to straighten out opposing interests on all war legislation, and the war revenue tax bill, it is understood, will engage much of his attention for some time, as it is certain there are many inequalities in it. For one thing, there has been a disposition to criticize the bill on the part of each special interest. It is not doubted in administration circles in Washington that each special interest desires to shoulder its share of the coming burden, however; but in some cases there is a belief that some interests have not adequately presented their views to the Senate finance committee. This, it is stated, can still be done in letters to Senators and Representatives who have charge of framing the bill.

The examination of Mr. Wakeley and Mr. Taylor at the hearing before the Senate finance committee proceeded upon the following lines, as stenographically reported:

STATEMENT OF EDMUND W. WAKELEY

Mr. WAKELEY. Mr. Chairman, I did not hear the chairman call the electric light and power companies.

The CHAIRMAN. We have just been discussing those.

Mr. WAKELEY. Not Section e. I only want thirty seconds, just to ask a question.

The CHAIRMAN. What is it you want to take up?

Mr. WAKELEY. Electric light and power. I did not hear any announcement of that section, which you will find at the bottom of page 20:

"e. A tax equivalent to five per centum of the amount paid for electric power for domestic uses."

I simply want to ask the committee to clear up what they mean by that word "domestic." We do not know whether that means domestic as distinguished from foreign, domestic as distinguished from manufacturing, or domestic as distinguished from public or municipal. It would be in the interest of clearness if the word "domestic," at the top of page 21, should be made clear.

STATEMENT OF Z. V. TAYLOR

Mr. TAYLOR. Mr. Chairman, a gentleman addressed you a moment ago for thirty seconds on Section e. Did I understand that that closed the discussion as to that particular section?

The CHAIRMAN. No; it did not. I said he could have five minutes.

Mr. TAYLOR. I would like to have two minutes. It seems as if the purpose of this, as I read it, is to pass this tax on, as some one has said, to the consumer. About that we have nothing to say. It seems that the object of the draftsman of the bill was to exempt the companies furnishing this service from any further tax other than the taxes that have been imposed generally in the bill, and it appears to me that he had this in mind when he drew this provision:

"Provided, That an expense incurred by any person, corporation, partnership or association in the furnishing of such power, light, heat or telephone service for its own use shall not be subject to this tax."

I am not clear in my own mind what "for its own use" means. Is "for its own use" the purpose for which the corporation was organized in distributing it or is it for its own use as it is consumed?

Senator SMOOT. You are a man, perhaps, who has been interested in the generating of electricity?

Mr. TAYLOR. Yes, sir.

Senator SMOOT. You know what it means, and we all know what it means. It means for that amount of electric power that is used by the company for the purpose of their own private use.

Mr. TAYLOR. And not for the purpose of resale?

Senator SMOOT. Certainly not.

Mr. TAYLOR. Then, gentlemen, it seems that this is quite a burdensome tax, and I will ask you to give me just about a moment on that.

In addition to all the war taxes that are levied on these corporations, to say that they shall pay 5 per cent, practically, of their gross revenue is indeed quite a hardship, for the electric light and power business is different from almost any other in that it takes $5 expenditure in capital to get $1 in gross revenue. When you take from the gross revenue 5 per cent as a tax upon this particular industry it does seem to me that it is a hardship indeed.

Senator THOMAS. I wish you would point out some item of tax here that is not burdensome.

Mr. TAYLOR. That would be difficult for any one.

Senator THOMAS. I think it would.

Mr. TAYLOR. But why should this particular industry be burdened more than any other corporation? I seem to have made myself clear at least.

The CHAIRMAN. We are much obliged to you. I think we catch your point.

The Sub-section e, in Section 500 of the bill, alluded to, begins the list of taxes on electrical industries, such as power, light, heat, telephones, etc. The Sub-sections a, b and c deal with other public utilities, such as street railways, express, etc. In broad terms, the taxes proposed under Sub-section e, etc., are as follows:

A tax of 5 per cent for electric power for *"domestic"* uses and of the amount paid for light or heat; a tax of 5 per cent of the amount paid for telephone service by subscribers exclusive of the amounts paid for toll or long-distance calls, provided that any expense incurred by any person, corporation, partnership or association in furnishing such power, light, heat or telephone service for its own use shall not be subject to this tax; a tax of 5 cents upon each dispatch, message or conversation of any telegraph or telephone line for which a charge of 15 cents or more is imposed. The latter provision is that only one tax shall be imposed no matter how many lines are used.

HIGHER RATES FAVORED BY OHIO NEW-BUSINESS MEN

Ways of Increasing Gross or Decreasing Expenses Considered—Power Schedules Raised—Help the Government Loan

The usual discussions dealing with details of selling had little part in the convention of the new-business men of the Ohio Electric Light Association at Youngstown, May 16. The thoughts of delegates were centered on the problem of maintaining satisfactory net revenues by increasing gross or decreasing expenses or both.

The ideas used for increasing gross revenue are numerous. Connected loads are being checked to catch heretofore disregarded increases on systems where the demand is taken as a percentage of the connected load; demand meters are being installed in places where other and less accurate methods prevailed before; short-term power contracts are written in preference to long-term contracts with the expectation that better rates may prevail a short time hence.

But none of these things nor the savings in operation which are being effected are sufficient to stem the tide, and a strong tendency toward increasing rates is very obvious. In fact, several companies have filed schedules for increases with the Ohio commission. These will be effective within less than two months and in nearly all cases will affect medium and large power business and in some cases commercial lighting business. No increases in residential rates seem immediately necessary.

The general policy in these increases is to let the prevailing rate per unit of energy stand and to effect the increase by wiping out prompt payment discounts, by increasing the hours' use of demand on the first and second steps of demand and energy schedules, by changing from connected load to demand basis for fixing service charge, and by inserting and enforcing coal clauses.

The amount that rates must be raised is an open question, but the prevailing idea is to make the entire change to the higher rate level at one step and thus avoid the disturbances which gradual increases would foment.

Increases specifically mentioned will amount to from 1.8 to 5 mills per kilowatt-hour on power contracts.

Opinion on the advisability of effecting economies at the expense of commercial departments was divided. Some companies have reduced forces as much as 50 per cent; others are curtailing publicity expenditures.

There is a solid group, however, which is preaching "business as usual" to its communities and is setting itself up as an example, feeling that a few hundred dollars saved by cutting sales forces is a small item compared with the impression created. The sentiment of this group of properties was well expressed by T. O. Kennedy of the Massillon Electric & Gas Company, who said that the present economy wave is temporary.

Mr. Kennedy added that the government's war financing need not be alarming if it is carried quickly to a conclusion. Pending completion of the government financing private financing will be difficult, but with the government loan placed it will be possible to sell utility securities. He urged each man to speed the government's financial program.

Three papers were presented. C. H. Felker, Columbus, analyzed ways and means of promoting appliance sales. The discussion showed a marked tendency by central stations to favor forced promotion of appliance business involving minimum additional investment.

T. O. Kennedy, Massillon, related experiences in selling $125,000 of the company's stock to employees and the public. Several companies are planning campaigns.

C. I. Crippen, Youngstown, discussed commercial aspects of the electric arc furnace load.

MEDAL OF HONOR AWARDED BY INSTITUTE OF RADIO ENGINEERS

Given to Edwin H. Armstrong for Work in Connection with Regenerative Amplification and Oscillation by Means of Vacuum-Tube Relay

The "medal of honor" of the Institute of Radio Engineers, described and illustrated in the issue of the ELECTRICAL WORLD for May 5, 1917, page 864, has been awarded for 1917 to Edwin H. Armstrong for his work in connection with regenerative amplification and oscillation by means of the vacuum-tube relay.

The specific publications on the basis of which the award is made were printed in the ELECTRICAL WORLD for Dec. 12, 1914, and in the *Proceedings* of the Institute of Radio Engineers for September, 1915. The full development on which the award was based was specifically included in the latter publication and has found important application in the field.

SUBSCRIPTIONS TO THE NATION'S "LIBERTY LOAN"

Westinghouse Electric & Manufacturing Company Takes $2,500,000, Bell Companies $5,000,000, and H. M. Byllesby & Co. $500,000

Among the subscriptions announced to the great "liberty loan" of the government are the following:

Westinghouse Electric & Manufacturing Company, $2,500,000, one-half to be bought in New York and one-half in Pittsburgh. The company has made arrangements whereby its 30,000 employees may subscribe.

Operating companies of the American Telephone & Telegraph system, $5,000,000.

H. M. Byllesby & Company, $500,000.

MOBILIZATION OF UTILITIES IN GREATER NEW YORK

Chairman Straus of Public Service Commission Calls Meeting of Operators to Bring About Effective Co-operation

Chairman Oscar S. Straus of the New York Public Service Commission, First District, called a meeting of public utility representatives on the afternoon of May 17 to formulate plans for active and effective co-operation in measures made necessary by the war.

Illuminating Engineering Society Convention

After careful consideration of the national emergency, the council of the Illuminating Engineering Society decided on May 10 to abandon the 1917 annual convention. The committee on papers was instructed to proceed with the arrangements for the convention papers and discussions. These will be published in the *Transactions*.

NIKOLA TESLA BECOMES THE RECIPIENT OF EDISON MEDAL

Presentation of Award for Early Original Work and Tributes to the Inventor—New A. I. E. E. Officers

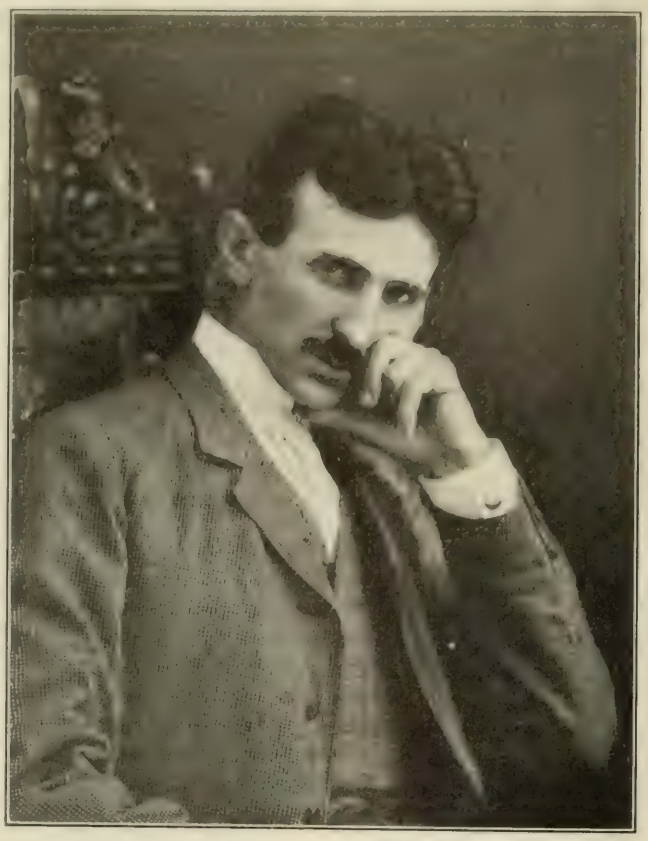
Presentation of the Edison medal to Nikola Tesla and formal report upon the newly elected officers were the announced features of the annual meeting of the American Institute of Electrical Engineers in New York on the evening of May 18.

As stated previously in the ELECTRICAL WORLD, the Edison medal is presented to Mr. Tesla for "early original work in polyphase and high-frequency electric currents." Dr. A. E. Kennelly as chairman of the Edison medal committee outlined the origin and purpose of this honor and gave a brief history of past awards.

Charles A. Terry, whose subject was a presentation of historical facts regarding the Tesla patents, contributions to the arts, etc., said in part:

MR. TERRY'S TRIBUTE TO TESLA

"It is the God-given desire to accomplish and to give that has produced the Michael Angelos, Galileos, the Sir Christopher Wrens, the Livingstones, Newtons, Franklins, Westinghouses, Edisons and scores of other makers of history—men whose names we retain in affectionate remembrance because they earnestly responded to the call from within and by patient toil conceived thoughts and discovered things of value which they promulgated for the benefit of their fellow men. Twenty-nine years ago this month there was presented before this Institute a paper of unusual import. It is entitled 'A New System of Alternate-Current Motors and Transformers.' The author, Nikola Tesla, was then only thirty-one years of age and had been for only four years a resident of this country. His early life was spent near his birthplace not far from the eastern Adriatic coast. His father, a Greek clergyman, and his mother, herself of an inventive mind, secured for their young son a comprehensive training in mathematics, physics and philosophy. At the age of twenty-two he had completed his studies in engineering at the Polytechnic School in Grätz and also a course in the University of Prague, and in 1881 he began his practical work at Budapest. In 1883 he was at Strasbourg, engaged in completing the lighting of a newly erected railway station. Shortly after finishing this undertaking he came to the United States.



Nikola Tesla

"Throughout all these years his desire had been to find an opportunity to demonstrate the truth of a conviction which became fixed in his mind while studying direct-current motors in school at Grätz in 1878. The conviction was that it should be possible to create a rotating magnetic field without the use of commutators. While at Strasbourg Tesla had succeeded in producing the rotation of a pivoted iron disk placed in a coil traversed by alternating currents, a steel bar being projected into the coil in the neighborhood of the disk. His conception of the reason for this rotation at that time was that a lag occurred in the subsidence of the magnetism of both the disk and the steel bar between successive current waves, and that the mutual repulsions caused the disk to revolve. By some fortunate process of reasoning he conceived while in Budapest in 1882 that by using two or more out-of-phase alternating currents respectively passing through geometrically displaced coils it would be possible to develop his long-sought progressively shifting magnetic field.

"Lack of funds and facilities for working out his theory compelled still further postponement, but in 1885 Tesla had the good fortune to interest men of means in a direct-current arc light which he had devised, and subsequently a laboratory was equipped for him in Liberty Street, New York, and here at last he found opportunity to demonstrate the correctness of his long-cherished theory. In 1887 he was able to exhibit to his business associates and to Prof. William A. Anthony, whose expert opinion they sought, motors having such progressively shifting fields without the use of commutators as he had foreseen nine years before.

"Having thus demonstrated the correctness of his theory and the feasibility of its application, it remained for Tesla to work out various practical methods of applying the principle, and the rapidity and wonderful way in which he surrounded the entire field of constant-speed, synchronous, induction and split-phase motors is beautifully set forth in his paper of May 18 and in the numerous patents issued May 1, 1888, and succeeding years, covering the forms of electric motors, which have since become the almost universal means for transforming the energy of alternating currents into mechanical energy.

"It is somewhat difficult to eliminate from our minds the developments of the last thirty years which have now become every-day features of the electrical industry and to realize the meagerness of the then existing knowledge of alternating-current phenomena. The com-

mercial use of alternating-current systems of distribution was then scarcely two years old. The Gaulard & Gibbs system of series transformers had been used abroad in a limited way for a slightly longer period, but the multiple-arc system based upon the so-called 'Stanley rule,' which initiated the great development of the present system, was not put in practical operation in the pioneer Great Barrington plant until March, 1886. It was then recognized that while the alternating current possessed wonderful possibilities for electrical distribution for lighting purposes, two almost necessary devices were lacking to render it a complete success, one a meter, the other a power motor. Prof. Elihu Thomson promptly devised a successful form of meter, the motive portion of which comprised a laminated field and armature, the coils of the latter being periodically close-circuited during revolution by a commutator. To fill the demand for a power motor, however, the most promising device then suggested was a series commutator motor with laminated field and armature cores, but no satisfactory results had been obtained. Such was the situation when Tesla's achievement was announced in the Institute paper to which reference has been made.

"Among the first to recognize the immense impor-



tance of Mr. Tesla's motors were Mr. Westinghouse and his advisers, T. B. Kerr, Mr. Byllesby, Mr. Shallenberger and Mr. Schmid, and Mr. Westinghouse secured an option which shortly resulted in the purchase of the patents, thus bringing under one ownership the alternating-current transformer system of distribution and the Tesla motor. It is interesting to note here that Mr. Shallenberger had about two weeks before the publication of the Tesla patents independently devised an alternating-current meter the principle of operation of which was that of the Tesla motor, and whatever might have been Mr. Shallenberger's natural disappointment upon finding himself thus anticipated, he at once recognized that to Mr. Tesla belonged the honor of being the first to solve the great fundamental problem of an alternating-current motor. A warm friendship between these two men began at once and continued through Mr. Shallenberger's life, and Mr. Tesla rejoiced to accord to Mr. Shallenberger full credit for the latter's brilliant work in producing what is now the standard meter for alternating currents.

"Owing in a measure to the circumstance that the then prevailing rate of alteration of the alternating-current system was 16,000, the commercial introduction of Tesla motors was somewhat retarded during the first few years, that rate being found less adapted to the motor work than a lower rate. To-day, however, wherever alternating-current systems are used Tesla motors abound. Without such motors the alternating-current system would have remained seriously restricted in its use.

"It will be appropriate to refer to the opinion of Judge Townsend of the United States Circuit Court, rendered in August, 1900, from which I quote the following: 'The Tesla discovery for which these patents were granted revolutionized the art of electrical power transmission, as well demonstrated in the record from both judicial and scientific standpoints.' "

Mr. Terry went on to enumerate Tesla's experimental work in connection with wireless transmission of power and the control of the movements of torpedoes and boats, as well as his contributions in the field of the Roentgen ray, his various electrical inventions, and the bladeless steam turbine for which commercial success is hoped.

B. A. Behrend, in a tribute to Tesla, said:

Tribute of B. A. Behrend

"By an extraordinary coincidence, it is exactly twenty-nine years ago, to the very day and hour, that there stood before this Institute Nikola Tesla, and he read a description of his great discovery of the generation and utilization of polyphase alternating currents. He left nothing to be done for those who followed him. His paper contained the skeleton even of the mathematical theory.

"Three years later, in 1891, there was given the first great demonstration, by Swiss engineers, of the transmission of power at 30,000 volts from Lauffen to Frankfort by means of Mr. Tesla's system. A few years later this was followed by the development of the Cataract Construction Company, under the presidency of our member, Edward D. Adams, and with the aid of the engineers of the Westinghouse company. It is interesting to recall here to-night that in Lord Kelvin's report to Mr. Adams, Lord Kelvin recommended the use of direct current for the development of power at Niagara Falls and for its transmission to Buffalo.

"The basis for the theory of the operating characteristics of Mr. Tesla's rotating-field induction motor, so necessary to its practical development, was laid by the brilliant French savant Prof. André Blondel, and by Professor Kapp of Birmingham. It fell to my lot to complete their work and to co-ordinate—by means of the simple 'circle diagram'—the somewhat mysterious and complex experimental phenomena. As this was done twenty-one years ago, it is particularly pleasing to me, upon the coming of age of this now universally accepted theory—tried out by application to several million horsepower of machines operating in our great industries—to pay my tribute to the inventor of the motor and the system which have made possible the electric transmission of energy. His name marks an epoch in the advance of electrical science. From that work has sprung a revolution in the electrical art."

President H. W. Buck was scheduled to present the medal to Tesla.

Election of Officers

The newly elected officers, who were the directors' nominees, are: President, E. W. Rice, Jr., Schenectady, N. Y.; vice-presidents, Frederick Bedell, Ithaca, N. Y.; John H. Finney, Washington, D. C., and A. S. McAllister, New York; managers, Walter A. Hall, West Lynn, Mass.; E. H. Martindale, Cleveland, Ohio; William A. Del Mar, New York, and Wilfred Sykes, Pittsburgh, Pa.; treasurer, George A. Hamilton, Elizabeth, N. J.

TAX US ON NET PROFITS BUT LET POSTAL RATES ALONE

James H. McGraw Sets Forth Willingness of Publishers to Pay Full Share of War Cost—Injustice of Proposed Post Office Increase

Under the title of "Our Turn to Be Regulated" we printed some months ago an editorial putting before our readers the unfairness of a proposed increase in second-class postage rates then before Congress as the Randall bill. Congress voted down the measure at this time as unsound. The proposed change in second-class rates is now before Congress as a part of a war revenue measure, proposed this time not to increase the revenues of the Post Office Department, but in the form of a tax on publishers to raise funds to carry on the war. That the provisions of the bill may be understood and that the fight which the publishers are making on this unfair and drastic tax may not be misconstrued as unpatriotic, we print below a letter from James H. McGraw, president of the McGraw-Hill Publishing Company, Inc. The publishers of the ELECTRICAL WORLD wish to meet their obligations as citizens and be taxed on net profits, but they do object to a revenue bill which not only takes the fruit but kills the tree.

To Our Editors:

I don't want to be misunderstood in writing this letter. Our company will pay its full share of the cost of the war we have just entered. Moreover, I believe that our organization can meet any emergency that comes to it and that it can absorb by extra effort and extra watchfulness new burdens put upon us. Certainly, as publishers we have had to meet many drastic situations with the increased costs of paper, ink and printing, and general operating costs rising.

But we have about reached the limit, and the proposed increase of more than 300 per cent in the cost of mailing our periodicals is a blow at our ability really to perform the service which it is the business of our kind of papers to perform.

The ten engineering and business journals which make up our properties are read each week by half a million men in our industries. When I think of our business I think of our readers. We start with them. Our fundamental strength lies in helping them do their work. We have an important place in the present crisis in the industries which each of our papers represents. We have made papers of serious purpose, journals which do more than report news and informing technical material. Ours is the function of leadership in our industries—a leadership which comes from close contact with our respective fields and the willingness to take direct responsibility for the advance of our industries.

A HEAVY HANDICAP

The proposed postal increase will seriously handicap us in this work. I wish our editors would make this clear to their respective fields. We need to have our reasons for opposing the postage increase fully understood so that any plans later necessary to meet the outcome of the present legislation will not be misconstrued.

The new tax measure as proposed assesses heavy penalties on the publishing business. First we are subject to a war tax on net profits and individual income. To this we do not object. We realize that the costs of carrying on the war must be assessed on going business. But the proposed legislation singles out and penalizes the publishers especially as users of the government post office machinery. Drastic increases in second-class postage and first-class postage vitally affect our business. Last year our company paid $75,000 for second-class postage. Under the proposed increases we will have to pay anywhere from 250 per cent to 364 per cent more proportionally, depending upon the journals. On the average we would be required to pay three times $75,000 for second-class postage alone. Moreover, the proposed increases in first-class postage will increase our present postage by $35,000.

I pass over the business facts briefly. The fact that the proposed increase will wipe some publishers out of business is well known. I pass over the fact that the increase has been voted down before as unsound. I pass over the fact that the drastic postage increase if put through makes impossible the chance for taxable profits and so defeats its very purpose. I pass over these obviously big facts because of what to me seems a deeper and more significant fact—a misconception of the purposes of technical and business journalism on the part of our Congressmen.

READY TO SERVE THE GOVERNMENT

I need only point to our papers to-day to explain what I mean. Our journals to-day stand ready as an arm of the government to put the needs of the government before our industries. The National Council of Defense and the groups of business men on advisory boards recognize the value and ask for the assistance of the business press in furthering the government's plans. We are glad to do it. We have taken the initiative to make closer co-operation possible, so that every thinking man in the industry may know what he can do and how he can do it. And then the government turns about and imposes a tax that means the complete demoralization of the present machinery of mailing their needed information to our industries.

At a time when the technical and business press have a supreme opportunity for service to their readers, and when they are actively working for the nation's good in spreading the news and detail knowledge of how to meet this great crisis in our government, one branch of our government, unthinkingly we must believe, makes that service impossible or restricts its usefulness. At a time when every man in every industry should be getting an understanding of his personal work in his industry, the government which is calling him cuts the wire that takes the message to him.

I repeat, we stand ready to do our share in meeting war taxes. We also want our function understood. The reader finds in the editorial pages of our technical and business papers how he can get the thing done he most needs to do—the editors report and interpret for him the news and technical advance of the industry. The reader finds in the advertising section machinery and appliances which will help him get the thing done—the manufacturers tell him.

Some journals make phrases that urge to action. They have their place. Our journals have the opportunity to show how to put plans into action. No more important task faces the nation.

Let us have our industries and our government understand us better that we may serve to better purpose.

JAMES H. MCGRAW.

LOS ANGELES POWER CONTRACT BETWEEN CITY AND COMPANIES

Terms of Agreement Covering Sale of Distributing Systems and Energy and Temporary Operating Arrangement—Third Company Invokes Court

The City Council of Los Angeles passed a resolution on April 30, 1917, in connection with an agreement to purchase the distributing systems of the Southern California Edison Company and Pacific Light & Power Corporation in Los Angeles, and the making of a contract for the purchase of power service by the city with the companies for a period of thirty years.

Resolution of City Council

After a preamble recounting the agreement on terms of purchase and the temporary operating agreement between the Board of Public Service Commissioners of the city and the companies and their approval by the citizens' committee of fifty, the resolution sets forth that the city and the board are authorized to execute the agreements as soon as practicable after authorization by the voters, and after such other steps as are required by the charter.

The passing of the resolution marks the conclusion of a series of strenuous and tedious negotiations which have extended over a period of eight months. The particulars of the agreement referred to in the resolution are given in the summary hereunder.

Contract for Sale of Distributing Systems

There are two agreements, first, the main contract providing for the sale of the distributing systems of the Southern California Edison Company and the Pacific Light & Power Corporation to the city, and, second, the purchase of electrical energy by the city from the power companies for a period of thirty years.

This contract provides that the price of the electric distributing systems of the two companies in the city shall be $8,270,000, together with the Railroad Commission's valuation of Westgate district, recently annexed, and the companies' expenditures for extensions and betterments since Jan. 1, 1917; also this amount includes severance damage of $1,145,000, less a deduction on the basis of $21,600 per annum as the result of lessening of said severance damage by the operation of the distributing systems under the temporary agreement. [The temporary agreement is given later in this article.—Eds.]

The purchase price will be subject to further deduction for certain properties outside of the city of Los Angeles included in the price, properties which the companies have decided to retain in order that the city's operations may be confined strictly to within the city limits. Payment for the distributing systems as herein outlined is to be made in cash on or before July 1, 1919.

Contract for Sale of Energy

The city of Los Angeles will purchase from the power companies for a period of ten years all the electrical energy which the city shall require for distribution for all purposes within its corporate limits in excess of the electrical energy which the city may generate from the use of water power at plants now or hereafter owned or controlled by the city; provided that during the ten-year period the minimum annual purchases by the city from the power companies will correspond to a maximum yearly demand of 25,000 hp. at an annual load factor of at least 36 per cent.

"Maximum yearly peak demand" is defined as the average of the three maximum peak loads of fifteen minutes' duration each occurring at any time during the year. The schedule of rates to be charged by the power companies for energy supplied to the city is based entirely upon load-factor conditions.

If the city should acquire new territory by annexation or consolidation, it will not extend its municipal electric distributing system into such added territory or furnish electric service therein unless the company owning and operating the electric distributing system in such territory shall, upon demand of the city, refuse to sell such system to the city for such compensation as shall be fixed by the Railroad Commission.

The city agrees that during a period of fifteen years it will sell to the power companies all or any part of such surplus electrical energy as it may generate at a fair and reasonable price to be agreed upon between the city and the power companies or fixed by the Railroad Commission. The city shall be at liberty to wholesale to others only such part of such surplus energy as the power companies do not purchase. The power companies agree not to sell energy in Los Angeles to other corporations without the consent of the city, except to railroad corporations for their own use.

For an additional period of twenty years the city agrees to purchase from the power companies and the companies agree to sell to the city all electrical energy required by the city for distribution for all purposes within the corporate limits of the city in excess of the electrical energy generated at the plants now or hereafter owned or controlled by the city for the generation of electrical energy from the use of water power, at fair and reasonable rates to be fixed each five years by agreement of the parties or by the Railroad Commission; provided that the rates so fixed shall not be more than would be the total cost to the city, including interest charges, of providing itself with such additional electrical energy by the construction of generating plants in addition to the water power plants. Such cost is to be determined by the Railroad Commission.

It is provided further that the city retains the right and option at any time after the first ten-year period of contract, and after such determination of cost to the city by the Railroad Commission, to terminate the agreement, only, however, with the assent of two-thirds of the qualified voters voting on the question at either a general or special election held at any time after eight years and upon giving the power company two years' notice in writing.

Before the final execution of the agreement referred to in the foregoing resolution, it would be necessary to amend the charter in the city, and this would require the approval of the State Legislature. The Legislature adjourned recently and will not reconvene until Jan. 1, 1919. Consequently the city could not actually take over the electric distributing systems of the two companies until the early part of 1919—about twenty months hence.

Temporary Agreement

In the meantime the city has completed a power plant with an installed capacity of 22,500 kw. In order that

the city may immediately market the power developed by this first plant, a temporary agreement was entered into by the city with the two companies dated April 30, 1917, the gist of which is as follows:

1. From May 1, 1917, to July 1, 1917, the companies' systems are to be operated on behalf of and for the account and benefit of the city. At the option of the city, the period may be extended two years beyond July 1, 1917, subject to the right of cancellation by the city on three months' notice to the companies. The extension of the period is to be upon resolution of the Board of Public Service Commissioners of the city, approved by a two-thirds vote of the Council, and the cancellation is to be upon the vote of the Public Service Commission, approved by a majority vote of the Council, or by a majority vote of the people under the initiative or otherwise.

2. The companies will distribute the city's electrical energy over their lines to consumers within the city, and furnish all additional electrical energy necessary, subject to a minimum of 25,000 hp., at 36 per cent annual load factor. Rates for company energy are to be the same as in the main contract already described.

3. The maintenance and extensions of the distributing systems and the conduct of the business hereunder shall be subject to a supervising board, consisting of two representatives from the city and two representing companies. If a majority cannot agree, they may select a fifth as arbiter, or on important matters refer to the Railroad Commission.

4. The companies are to have charge and control of all matters pertaining to operation of the distributing system, making all collections from consumers. It is not the intent that the powers of the board of control shall go to the extent of hiring or discharging employees, fixing of salaries or such details of operation.

5. From the amounts collected from consumers the companies will retain as compensation the following:

(a) Interest at the rate of 8 per cent per annum on the purchase price for the distributing systems, namely, $8,270,000, plus the cost of extensions and betterments after Jan. 1, 1917.

(b) Interest at the rate of 6 per cent per annum from May 1 on $130,000 of the severance damage as a result of rendering plant capacity idle. (The remainder of the severance will not have occurred.)

(c) Actual cost of operation and maintenance, including taxes and licenses.

(d) For electrical energy furnished by the companies.

(e) Depreciation allowance at the rate of 3.36 per cent per annum.

The remainder of such collections from consumers shall be paid to the city and a plan is provided under which these payments will be made daily upon estimates to be adjusted monthly.

It is provided, however, that in case the purchase price of the distributing systems be paid by the city within the time and in accordance with the provisions set forth in the purchase agreement, the city shall, at the time of making payment of such purchase price, be entitled to a credit on such purchase price of an amount equivalent to one-fourth of all sums payable to the companies for interest as outlined in (a).

6. The depreciation allowance shall constitute a depreciation fund which is held in trust by the companies and will bear interest at the rate of 4 per cent per annum, accruing for the benefit of the fund. All necessary replacements may be made from such fund. In the event that the city finally purchases the property, the balance remaining in the depreciation fund shall go to the city, but if the properties are not purchased by the city the depreciation fund shall belong to the companies.

7. The city agrees not to parallel the companies' lines during the period of this temporary agreement.

Immediately following the execution of the temporary agreement the two power companies commenced distributing through their systems the power generated by the hydroelectric plant owned by the city of Los Angeles. Appearances seem to indicate that the plan will work out satisfactorily to both parties to the agreement.

However, the third power company in Los Angeles, the Los Angeles Gas & Electric Corporation, has not been a party to the two agreements herein referred to, and immediately following the execution of the temporary agreement this corporation filed an action in the Superior Court requiring the city to show cause why it should not be restrained from continuing the operation of the temporary agreement. The case will probably be set for trial on the question of whether the city shall be restrained from alleged violation of the charter. The arguments in the writ are:

1. That the contract violates the city charter, which forbids the sale, transfer or lease of the aqueduct power without a two-thirds vote of the people.

2. That it violates the section of the charter which requires that the city shall call for bids for the purchase of anything of more than $500 value.

3. That it violates the terms of the public utilities act, which forbids the merger or lease of the property of the two power corporations with the city of Los Angeles without the approval of the State Railroad Commission.

4. That it violates that section of the State constitution which forbids the lenling of the city's credit to any person, firm or corporation because the city guarantees the payment of bills of the two power corporations under the operating agreement.

In the meantime the Southern California Edison Company and Pacific Light & Power Corporation have filed an application with the State Railroad Commission for a determination of whether or not the temporary operating agreement is subject to the commission's jurisdiction, and if the commission determines that it has jurisdiction it is asked to pass immediately upon the validity of the agreement.

LOS ANGELES NOW SERVED BY MEANS OF AQUEDUCT POWER

Private Companies Are Distributing City Energy and Paying City About $2,200 Daily—Bond Election to Be Postponed

Since May 1 power generated on the Los Angeles aqueduct has been turned into the city systems of the Southern California Edison and the Pacific Light & Power companies, which have served as the city's distributing agents. This is being done under the terms of the temporary agreement printed on this page.

At the outset the daily proceeds which the city realized from energy delivered to the power companies were about $2,300, of which the Edison company handled about $1,500 and the Pacific Light & Power about $800. Mayor Woodman proposed that $12,500 be set aside each week from the proceeds to meet interest and sinking fund requirements on the power bonds. He expects that at this rate it will be possible to reduce taxes to be collected by the city for the coming fiscal year about 11 per cent. The Mayor, the city legal department and the City Council on May 9 seemed to agree that it would be well to delay the $12,000,000 power bond issue until later in the year, perhaps September, instead of submitting it on June 5.

AMERICAN CAPITAL IN AUSTRALIAN COMPANY

Lee, Higginson & Company Purchase of Bonds of Melbourne Electric Company, They Hope, Will Be Followed by Others

A block of $1,250,000 of 6 per cent general mortgage convertible bonds of the Melbourne (Australia) Electric Supply Company, Ltd., was purchased recently by Lee, Higginson & Company, bankers of New York and Boston.

The investment of American capital in an electric utility located so far away as Australia is so unusual that Lee, Higginson & Company were asked whether they regard the transaction as an isolated case or as the forerunner of others. In reply they write to the ELECTRICAL WORLD:

"We purchased this issue of bonds because we believed that it afforded an opportunity for the safe investment of American capital at a rate of interest much higher than prevails in this country for loans of similar security. The transaction did not represent the acquisition of any stock interest at all.

"It has long been our practice to seek issues of bonds which we considered amply secured and which net a fair return for the investor. In doing this it has been necessary at times to go to far distant points, and in some fields we might almost be considered as pioneers.

"Some fifteen or twenty years ago we began buying issues of public utility companies in the Far West which yield more attractive rates on the money invested than properties of similar earning power in the East. It took years of education, however, before the investing public here was willing to buy securities of companies so far afield. Many of the issues which we brought out then, and which we sold with comparative difficulty, are now underlying bonds of large well-known companies, whose junior securities are so well known that it is hard to realize that people a few years ago had hesitated in their purchase.

"The continuation of the war, together with the British treasury regulation prohibiting almost entirely the raising of new capital within the British Isles, caused a situation in regard to companies that had originally been financed in London of which we thought advantage should be taken by the American investor. The Melbourne company had an enviable record of earnings and its reputation was high. English capital had originally been readily available to it, and if it had not been for the coincidence of the war we never would have had the opportunity to buy this issue.

"You may be interested to know that this offering was remarkably well received here. Although brought out at a time when the investment bond market in this country was poor, the issue was oversubscribed in two days and was disposed of at once at a good premium.

"We hope this will be only one of many similar transactions. The English investor has long been regarded as a keen judge of securities, and ordinarily he is satisfied with a lower rate of interest on his money than are we in this country. It is therefore a distinct opportunity for us to be able to buy the securities with which he is familiar and of which he approves at rates of interest better than we are accustomed to receive."

The bonds were offered to the public at 96.75 and interest, yielding 6.75 per cent interest. They are convertible into either preference or ordinary stock.

MOTION PICTURES EFFECTIVE IN IMPRESSING SAFETY WORK

Underwriters' Laboratories Develop Films for Use by Electrical Inspectors and Others to Promote Care in Fire Prevention

The Underwriters' Laboratories have provided themselves with a supply of motion pictures for use by electrical inspectors and others in safety publicity work. These pictures are available without charge to officials, organizations and individuals co-operating in the maintenance of suitable standards of protection against fire and accident. While the pictures include other subjects than electrical testing, there is enough of this to make them suitable for electrical men. There are shown tests on switches and sockets, wires, cords, conduits and fuses, and various other things employed in domestic and industrial applications of electricity.

It is not undertaken, of course, to show all of the tests that the Underwriters make on any given product; the pictures cover only parts of the work that could be photographed rather easily and that have been found to be interesting to the layman as well as the engineer. A typewritten lecture is furnished when it is desired. This lecture can be used to describe the various scenes on the films as they are projected, and there is also suitable matter for use by the lecturer in leading up to the pictures.

The laboratories have other motion pictures which are of a non-technical, human-interest sort, and these are likewise available for meetings arranged for safety publicity. One of these is a two-reel feature and the other a three-reel picture. The two-reel film was made for the laboratories by the Essanay Film Manufacturing Company. Co-operation of the Chicago Bureau of Fire Prevention and Public Safety and the Chicago fire and police departments made it possible to include scenes which cannot be obtained for commercial films. The other of these two subjects was obtained through the courtesy of the New York City fire department.

Applications for the pictures may be made to the Chicago, New York, Boston or Pittsburgh offices of the Underwriters' Laboratories.



MOTION PICTURES THAT AID IN THE SAFETY MOVEMENT

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Potomac Electric Power Bonds Authorized. The Public Utilities Commission of the District of Columbia has authorized the issue of $1,047,500 Potomac Electric Power Company general improvement 6 per cent debenture bonds. The company is ordered to sell the bonds "at the highest obtainable price under such conditions of sale as may be approved by the commission." The order also provides that the certificate of authority "is not to be construed as a certification by this commission of the sufficiency of the security for the said bonds or for any bonds issued by this company, but is understood to mean that the company may apply, and is required under the penalties prescribed in the public utilities law of the District of Columbia to apply, the proceeds from the sale of the said bonds to the purposes specified in the order."

Avoid Economic Waste in Service Extensions.—In a case arising from an application by a consumer at Tamagua for gas service from the Eastern Pennsylvania Light, Heat & Power Company the Public Service Commission of Pennsylvania holds: "The mere fact of having corporate rights and authority to exercise the same within a borough is not in and of itself a sufficient and compelling reason, under all circumstances and conditions, why a public service company should be required to extend its service to any portion of the town on the application of a prospective consumer within the borders of the municipality. There should appear in the petition for the proposed extension of facilities some evidence that the service desired contains some elements of remuneration within a reasonable period of time, and that if granted, it would not prove chiefly or wholly an economic waste."

Modification in San Joaquin Case.—The California Railroad Commission has issued an order modifying the rates, rules and regulations of the San Joaquin Light & Power Corporation. More than a year ago the commission decided the San Joaquin case. The modifications follow a proceeding initiated by the commission on its own motion to rectify informal complaints made by consumers and by the company The main issues were concerned with the price to be paid and the method of payment by the company for transformers which the commission ordered it to buy from consumers, and with the effect of the use of maximum-demand meters and the price to be charged by the company for off-pumping-season service for agricultural consumers. The commission now fixes uniform prices to be paid for the various types to all consumers. The basis is the price that the company would be compelled to pay for transformers at present, new, less depreciation at the rate of 5 per cent a year. Cost is to be determined as installed on the consumer's pole. Depreciation is based upon an assumed average life of twenty years. Six per cent interest is to be paid until final payment. The company from May 1 last year to Feb. 20 of this year bought 1280 transformers, or 37 per cent of the 3542 owned at the first date by the power users. The commission now orders higher prices than those proposed by the company for transformers not considered by it to be standard. Another controversy adjusted by the commission was as to the effect of the use of maximum-demand meters. Another cause of complaint was in regard to a rate for pumping for domestic uses during the off irrigation season, and the present order provides such a reasonable rate. Other matters connected with revenue for rural service and with pumping service are adjusted.

Rates in Quincy Decided by Illinois Commission.—In the case affecting the Quincy Gas, Electric & Heating Company the Illinois Public Utilities Commission has rendered a decision, some of the main points of which are: The company was ordered to set aside annually $12,000 to meet accruing depreciation in its gas properties and $25,000 annually to meet accruing depreciation in electric properties. No valuation of properties was announced. No rate of return was announced. The commission's rates differ somewhat from certain compromise rates which the company offered about a year ago, in that the commission's gas rates are higher than the company's tender, whereas the commission's electric rates are somewhat lower than the company's offer. Although the total reduction in the company's revenue amounts to about $34,000 annually on a basis of the existing rates, there is not such a saving to the consumers on a basis of the compromise rates. The rates announced by the commission will probably produce an annual revenue of $10,000 less than the company's compromise offer. The company has accepted the rates and agreed to place them in effect as of May 1, 1917. The new schedule of electric rates is as follows: Residential lighting—For the first 25 kw.-hr. used per month, 9 cents per kilowatt-hour; for all over 25 kw.-hr., 6 cents; minimum bill per month per meter, 75 cents. Commercial lighting—For the first thirty hours' use of the maximum demand, 9 cents; for the next thirty hours' use, 6 cents; for all over sixty hours' use, 3 cents; minimum bill per month per meter, $1. Alternating-current power service—For the first 15 kw.-hr. used per month for each horsepower of demand, 6 cents; for the next 1000 kw.-hr., 2 cents; for the next 1000 kw.-hr., 1½ cents; for the next 14 000 kw.-hr., 0.75 cent; for all in excess of above, 0.54 cent; minimum bill per horsepower, 75 cents. The total annual reduction in electric revenue is estimated at $26,000.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public-utility companies.

Review of Commission Findings.—It was not intended that the courts should interfere with the public service commissions or review their determinations further than is necessary to keep them within the law and to protect the constitutional rights of the corporations over which they are given control, according to the Appellate Division of the New York Supreme Court (164 N.Y.S. 310).

Right of Utility to Acquire Public Land.—Lands, although acquired by a public commission, if not acquired for public use, are still subject to condemnation, it was held by the Appellate Division of the New York Supreme Court (164 N.Y.S. 430). The law providing that forest preserves shall be forever kept wild forest land, applying only to "lands now owned or hereafter acquired, does not affect the right of a public service corporation or of the State to acquire the lands."

Right of Property Owners Regarding Tree Trimming.—While the owner of property in front of which trees are grown and standing has only a qualified or limited interest in them, an interest subject and subordinate to the rights of the city to trim and remove the trees whenever the public interests require such action, if a person injures such trees without lawful right or authority, the owner can recover such damages as he may be able to show he has suffered by reason of any depreciation in the value of his property occasioned by the injury to the trees, the District Court of Appeal, Third District, California, held (164 P. 35). Cities and towns are empowered, as agents of the State, to grant to public utility corporations, such as those engaged in the distribution of water, gas, electricity or the transmission of telegrams, etc., the right to use the streets in a reasonable manner. A telegraph company did not subject itself to an action for damages when it cut the branches of trees growing in front of city property along a sidewalk to clear its wires to prevent interference with their proper operation. A telegraph or telephone corporation, in trimming or severing the branches of trees to prevent contact of wires therewith, can do no more than is necessary for the proper and efficient working of wires without subjecting itself to civil liability for damages. In an action by property owners against a telegraph company for damages caused by the company cutting off the branches of trees in front of plaintiffs' property to clear its wires, the burden was on plaintiffs to show either that it was entirely unnecessary to remove any branches from the trees or that the company removed more than it had to.

Old Edison Building Defense Headquarters.—The old building of the Commonwealth Edison Company, Chicago, 120 West Adams Street, has become the headquarters of the Illinois Council of National Defense. The use of the building has been donated for this purpose by Samuel Insull, chairman of the Illinois council.

Awards by Franklin Institute.—The Franklin Institute of Philadelphia, through its committee on science and the arts, has made awards of medals to the following for papers published in its *Journal* for 1916: Ulric Dahlgren, professor of biology, Princeton University; George A. Rankin, late of the Geophysical Laboratory, Carnegie Institution, Washington, D. C.; Prof. A. E. Kennelly, F. H. Archard and A. S. Dana, Massachusetts Institute of Technology, Cambridge, Mass.; John D. Ball, late of the General Electric Company, Schenectady, N. Y., and Dayton C. Miller, professor of physics, Case School of Applied Science, Cleveland.

Earnings of Ontario Power Company.—The report of the Ontario Power Company, Niagara Falls, Ont., and the Ontario Transmission Company, Ltd., for 1916, eliminating inter-company payments, shows total sales of power of $2,396,277, less $531,007 for purchased power, or $1,865,270. Government rental was $105,560, leaving gross earnings of $1,759,710. Operating expenses were $233,108; to the net earnings of $1,526,602 there was added $140,162 other income, making a total of $1,666,764. Insurance, taxes and refunding expenses aggregated $185,348; from the balance of $1,481,416 there was deducted $932,718 interest, the surplus earnings therefore being $548,698.

War Relief for British Professional Classes.—Lewis B. Stillwell has received from Major Leonard Darwin, chairman of the Professional Classes War Relief Council of Great Britain, a letter expressing in behalf of the council appreciation of the contributions of American engineers. Mr. Stillwell is treasurer of the fund for which subscriptions were solicited by the circular issued on March 10, 1917, signed by seventy-six representative members of national engineering societies in this country. The Farmers' Loan & Trust Company, New York, states that the subscriptions to May 11 aggregated $11,793. This sum has been contributed by 1154 engineers. Mr. Stillwell expresses the hope that, "in view of the fact that we are now actually at war as allies of our British friends, those who have not hitherto contributed will act promptly in aid of this worthy and urgent cause." Major Darwin wrote in his letter: "In the interests of your own country, and in order to safeguard the civilization of the world, you also have been compelled to join this terrible strife, and I am certain that, though our beneficiaries would have been deeply grateful to you in any case, yet it is far pleasanter for them to receive this succor from the hands of an ally. All of them and all of us will ever remember America's help in the hour of our need."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Electrical Equipment and Machinery in Sao Paulo.—United States Consul Charles L. Hoover, Sao Paulo, Brazil, writes that the development of the electrical industry in the two states at present included within the Sao Paulo district—Sao Paulo, except Santos, and Paraná—is well advanced, and all the larger cities, even some of the villages, have modern plants which generate electrical energy for both light and power. Sao Paulo, a modern city of 500,000 inhabitants, has a hydroelectric plant which generates 16,000 kw.

Bird's Nest in Arc Lamp in Cincinnati.—Recently C. G. Stander, an employee of the Union Gas & Electric Company of Cincinnati, found that English sparrows had built a nest in an arc lamp. The top of the lamp had been broken so that the birds found a warm place for a home. Evidently the nest which they built was occupied through most of the winter. The birds picked the wires and this interfered with but did not stop the illumination. Attention was thus called to the lamp, and investigation showed the presence of the nest, which had been built so as to fill part of the interior. The birds had not been harmed by their experience.



W. D'A. Ryan Presented with Loving Cup.—W. D'A. Ryan has been presented by the people of San Francisco with a silver loving cup as a token of appreciation of his work in lighting the exposition and creating the "Path of Gold" on Market Street. The cup, purchased through popular subscription, is surmounted by two small replicas of the artistic standards of the "Path of Gold" lighting system and stands upon a base of California redwood burl. Upon the face of the cup is inscribed, "To D'Arcy Ryan in recognition of his genius in lighting the Panama Pacific International Exposition and the 'Path of Gold.' Presented by the people of San Francisco by popular subscription." The presentation was made at a luncheon on May 9, presided over by John S. Walter, president of the Downtown Association, and attended by about 200 business men. Among the speakers were Charles C. Moore, president of the exposition; John A. Britton, vice-president and general manager Pacific Gas & Electric Company, and Edward L. Nolan, chairman of the supervisors' lighting committee.

Electric Plant in Bocas del Toro.—The government of Panama has authorized the Municipal Council of Bocas del Toro to contract a loan with a domestic banking house for $20,000, to be used for the purpose of establishing an electric lighting plant.

Centralization of Ownership in Germany.—An article on "Long-Distance Supply of Electricity in Germany," from United States Consul Charles S. Winans, Nuremberg, dated Dec. 29, 1916, quotes a report by Wilhelm Beck, Steglitz, which concludes: "Through the uniform electrical supply of whole countries a compensation in the demand for power will be assured, with the possibility of utilizing all plants more uniformly and economically than before, when many local works at times had excessive demands made upon them while at other times they had to supply only a small quantity of energy. Regardless of other savings in a comprehensive organization of electrical production and distribution, one may not, from the standpoint of political economy, disregard the circumstances that our natural sources of power and land resources will not be squandered by careless working, but will be exploited in a productive and suitable manner for the general welfare of the country at large."

Wisconsin Commission Exhibit at State Electrical Convention.—At the recent convention of the Wisconsin Electrical Association the engineers of the Railroad Commission conducted an exhibit for the commission. The regular inspectors' conference was made to coincide with the convention date, and practically all of the commission's technical force was on hand to show the operating men about the exhibit. A chart gave the commission's service rating in per cent for every gas and electric company. This percentage is determined for every plant according to a plan of grading worked out by the commission, based on adherence to the commission's operating rules. One group of curves in the exhibit was designed to show the necessity of installing all meters indoors. It indicated the harmful effect of temperature changes on the accuracy of many different types of meters. Other curves showed the extent of errors in master meters sent to the commission for test. To show that the rotating standard is not the last word in accuracy, there were set up a potentiometer with primary standards, a galvanometer and a tuning-fork timing device. There was also shown a shop standard that could be used for checking the master meter or rotating standard. Three types of graphic meters were displayed. One display consisted of three current transformers and curves showing operating characteristics of each. About the room were groups of photographs and placards. J. N. Cadby, engineer of the commission, who had charge of the exhibit, stated that at no time during the convention did the exhibit lack interested visitors. It proved, he said, of mutual value to the commission and the plants because of its educational characteristics.

Pennsylvania Electrical Contractors' Association.—The annual convention of the Electrical Contractors' Association of the State of Pennsylvania will be held at Philadelphia, June 19, 20 and 21.

Dallas Electric Club and Jovian League.—L. A. Ott, vice-president, was in charge of a meeting of the Dallas Electric Club and Jovian League on May 7. E. E. Rossler is the secretary of the association.

The Society for Electrical Development, Inc.—A meeting of the Society for Electrical Development, Inc., was held on May 8 at the office of the society in the Engineering Societies Building, 29 West Thirty-ninth Street, New York.

Illuminating Engineering Society.—The application of artificial illuminants in black and white and color photography was described by John H. Powrie before the New York Section of the Illuminating Engineering Society on May 10.

San Francisco Electrical Development and Jovian League.—At the May 9 meeting of this association W. W. Hanscom described advances in wireless telegraphy, outlining the methods used and the remarkable degree of success which has attended recent improvements.

Dealer Help Service Furnished by Manufacturers.—William H. Easton of the Westinghouse Electric & Manufacturing Company spoke on the subject of "Dealer Help Service Furnished by Manufacturers" before the Technical Publicity Association, New York City, on May 10, being followed by Z. M. Hyer, manager of the United Electric Shop, who spoke from the standpoint of the dealer. The subject of conventions and convention exhibits was discussed by Carroll H. Dunning.

Cincinnati Electric Club Elects Officers.—On April 16 the Electric Club of Cincinnati elected the following officers for the ensuing year: President, J. A. Breet, district manager Westinghouse Electric & Manufacturing Company; first vice-president, L. T. Milner, district manager Western Electric Company; second vice-president, T. E. Wickham, secretary and treasurer Union Gas & Electric Company; secretary and treasurer, O. B. Marsh, manager Federal Sign System (Electric) Company; board of directors, T. J. Creaghead, president Creaghead Engineering Company; Walter A. Draper, vice-president Cincinnati Traction Company, and W. J. Hanley, district manager General Electric Company.

Electrical Supply Jobbers' Association of the Pacific Coast.—The regular quarterly meeting of this association was held at Del Monte on April 26, 27 and 28. A paper on merchandising which was presented by A. W. Childs at the recent Riverside convention of the N. E. L. A. was read and discussed in detail. The question of how best to handle slow-moving stock received careful consideration, and there was also a debate on the question of adopting a uniform vacation period. This last subject is one of considerable importance in effecting economies and is the logical successor to the agreement about suspending business between 12 and 1 o'clock, which the association members recently approved and which resulted in a considerable saving to those indorsing it.

Associations and Societies

A complete Directory of Electrical Associations is regularly printed in the first issue of each month on the next-to-last text page.

New York Section of the A. S. M. E.—The development of the poppet-valve steam engine, with special reference to its present status in the United States, was the subject of an address made on May 8 by Siegfried Rosensweig before a New York meeting of the American Society of Mechanical Engineers.

Kansas City Jovian League.—The Jovian Electric League of Kansas City held a rejuvenation May 7 at which nine candidates were initiated, the program being under the direction of J. F. Bratney and F. L. Funsten, first and second tribunes. The Electric League was well represented at a dinner May 8 in honor of the city-planning conference, more than 1500 persons, representing about twenty organizations, being present.

Southwestern Illuminating Society.—The Southwestern Illuminating Society was organized in Kansas City, Mo., recently, and now has a membership of eighteen firms, including all but one firm showing fixtures or concerned with lighting. So far only Kansas City firms have been invited to join, but the society expects to extend its scope beyond that city. Meetings are held on the first and third Thursdays of each month. The society was organized to develop the industry in the Kansas City section, raise its standards, and educate the men in the business as well as the public. It is believed that the firms themselves have not fully appreciated the opportunities of illumination and what each might do to enhance its dignity and importance. The first definite work taken up has been the educational propaganda with reference to costs. The members contribute their own experience in estimating jobs and keeping accounts. Firms have discovered that they were supplying fixtures at less than cost, and others that they were selling items at about cost, without any charge for service or handling, let alone interest or profit on investment. Eventually a credit interchange bureau will be established. The educational committee is now working out its program for the further help of members and for a series of steps toward the education of the buying public in illuminating matters. This committee consists of R. O. Fritz, E. W. Cowan, Albert Jacobson and Henry C. Forster. The officers of the society are: President, John J. McGee; vice-president, W. T. Flippen; secretary, A. S. Viner, and treasurer, S. P. Russick.

Pittsburgh Section, A. I. E. E.—The May meeting of the Pittsburgh Section of the American Institute of Electrical Engineers was held on May 8. Modern warfare was the principal topic of the evening.

Annual Convention of New England Section of the N. E. L. A.—The ninth annual convention of the New England Section of the National Electric Light Association will be held at New London, Conn., Sept. 11 to 14 inclusive.

Electrical Contractors' Association of Massachusetts.—The next annual meeting of the Electrical Contractors' Association of Massachusetts will be held in September at Worcester, Mass. Further details of this meeting will be announced later.

Schenectady Section of the A. I. E. E.—J. B. Taylor addressed the Schenectady Section of the American Institute of Electrical Engineers on May 4 on the subject of "Acoustical Engineering and a Review of the Characteristics of Noise, Speech and Musical Sounds." This lecture was illustrated and some demonstrations were made.

Electrical Development and Jovian League of San Francisco.—At the May 2 meeting of this association Prof. Ira W. Howerth of the University of California gave a talk on the industrial significance of university extension courses. This subject has received the careful consideration of the league, and a committee has been appointed to arrange for extension courses on cost accounting, correspondence, etc., which are expected to be of considerable benefit to the members at large.

New Jersey Electrical Merchants' Association.—On May 4 the jobbers and dealers of New Jersey formed an organization to be known as the New Jersey Electrical Merchants' Association, with officers as follows: President, S. H. N. Agens, Agens & Company, Newark; vice-president, Meyer Rutkin, Newark; secretary, I. Joffre of Silk City Electrical Supply Company, Paterson; treasurer, Abraham Beller, Eastern Electrical Supply Company, Newark. The executive committee consists of O. Frederick Rost of the Newark Electrical Supply Company and M. Rutkin and Samuel Forster of the Star Electrical Supply Company, Newark.

St. Louis Jovian Luncheon Meeting.—Under a plan recently adopted by the St. Louis Jovian League—to turn some of its meetings over to different firms in the city—the Union Electric Light & Power Company had charge of the luncheon meeting on May 8. Short addresses were given by the heads of the electric-service companies' different departments, who described methods of operation and recited various experiences. Among those who spoke were C. S. Ruffner, vice-president; L. H. Egan, general manager; Herman Spoehrer, secretary and treasurer; John Hunter, chief engineer of power plants; J. R. Portnell, distribution engineer; H. W. Eales, electrical engineer; C. E. Michel, office sales manager, and John Abbink, advertising manager. Frank D. Beardslee, general sales manager of the company, presided as chairman.

N. B. Bertolette succeeds A. P. McCarthy as local manager for the Philadelphia Suburban Gas & Electric Company at Coatesville, Pa.

A. P. McCarthy, Coatesville, Pa., local manager for the Philadelphia Suburban Gas & Electric Company, has been appointed to a similar position for the company at Pottstown.

James M. Wakeman, general manager of the Society for Electrical Development, has been confined to his home with appendicitis. At the time of going to press the doctors were hopeful that no operation would be necessary.

E. H. McHenry has retired from business, the engineering firm of McHenry & Murray having been dissolved with the mutual consent of the partners. Before forming the partnership in 1913 Mr. McHenry was vice-president of the New York, New Haven & Hartford Railroad Company in charge of engineering, maintenance and construction work, including the original electrification of the road between New York and Stamford and the extension to New Haven now completed.

G. D. Longmuir, who has been connected with electric lighting interests in various positions of responsibility in the State of Washington for a number of years, has entered business for himself, being one of the incorporators of the Reliance Electric Company, Tacoma, Wash. Mr. Longmuir rose from electrical engineer to general manager of the property at Prosser, Wash., and when the property was taken over by the Pacific Power & Light Company he remained as manager. Later he was transferred to Pasco, Wash., as district manager for the company in the Columbia River valley.

E. M. Harvey of Chicago was recently appointed electrical engineer of the Eastern Wisconsin Electric Company at Sheboygan, Wis., succeeding Carroll H. Shaw, who resigned to become chief engineer of the Minnesota Utilities Company at Chisholm. Mr. Hervey is a graduate of the Massachusetts Institute of Technology and has had an extensive experience in electrical work, having in recent years been with the Chicago Sanitary District as assistant construction superintendent in the electrical department. He has also spent three years with the city of Chicago as electrical engineer.

T. Norman Jones, Jr., has been appointed assistant general manager of the Virginia Railway & Power Company, in charge of the properties in Norfolk, to succeed E. C. Hathaway, resigned. Mr. Jones was born in Richmond, Va., in 1882 and was educated at the University of Virginia. He was associated with the McKay Engineering Company and the United Electric Light & Power Company, Baltimore, and in 1906 entered the employ of the company with which he is now connected as mechanical and electrical engineer. In 1907 he took charge of operation of the Richmond & Chesapeake Bay Railway, returning to the Virginia Railway & Power Company in 1911 as chief engineer of railways, which position he held until his recent promotion.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

Maxwell C. Maxwell, formerly superintendent of power and plant and of the tool machine department of the Yale & Towne Manufacturing Company, Stamford, Conn., has been appointed assistant general superintendent of that organization.

Alfred S. March, New Brunswick, N. J., has become a member of the Board of Public Utility Commissioners of New Jersey, in accordance with recent appointment by Governor Edge, effective May 1, succeeding John J. Tracy, Jersey City, whose term of office has expired.

P. D. Kline has resigned as general manager of the Ogden (Utah), Logan & Idaho Railway Company and is now manager of the La Crosse (Wis.) district of the Wisconsin-Minnesota Light & Power Company, which is operated by the American Public Utilities Company of Grand Rapids, Mich. Mr. Kline was associated with Ogden railway interests for four years, joining the Ogden Rapid Transit Company in February, 1913, as general superintendent. Shortly afterward he became general manager of the system, and when a year or so later the company was merged with the Logan Rapid Transit Company into the Ogden, Logan & Idaho Railway Company he became general manager of the new company. Prior to going to Utah Mr. Kline was general superintendent of the Falkenau Electrical Construction Company of Chicago, where he had full charge of all field construction. In that capacity he installed several large railway systems, lighting systems and a number of large power stations.

Douglas H. McDougall of the Toronto (Ontario) Power Company was elected fourth vice-president of the National Electric Light Association at the recent two-day meeting in New York City. Mr. McDougall is very prominent in Canadian electrical activities, being president of the Canadian Electrical Association and treasurer of the Electrical Development Company, the Toronto & Niagara Power Company and the London (Ont.) Electric Company. Mr. McDougall was born in Toronto in 1874. In 1893, after experience in the United States in accounting work, he returned to Toronto as treasurer of the Electrical Development Company of Ontario, Ltd., taking charge of the finances of this company. In 1908 this company was leased to the Toronto Power Company, and Mr. McDougall was appointed assistant to the general manager until, in 1911, the Toronto company purchased the entire stock of the Toronto Electric Light Company and Mr. McDougall was appointed assistant to the manager of the enlarged organization.

Charles E. Fasoldt, Rensselaer, N. Y., has been appointed engineer in charge of power lines of the United Traction Company, Albany, succeeding H. J. Childs, resigned.

Joseph B. Stewart, Jr., has been recently appointed assistant to the general manager of the Mahoning & Shenango Railway & Light Company and subsidiary companies, with headquarters at Youngstown, Ohio.

Harold R. Wilbur, Lambertville, N. J., has been appointed state manager for the National Utilities Company, operating properties at Lambertville, Newton and Dover, N. J. He has heretofore been local manager for the Lambertville Public Service Company.

H. E. Brandli, formerly general manager of the Citizens' Gas, Electric & Heating Company at Mount Vernon, Ill., recently sold by H. L. Doherty & Company to the Frye interests, succeeds Major A. B. Paterson as general manager of the Meridian (Miss.) Light & Railway Company. Mr. Brandli was at one time superintendent of lighting of the Ottumwa (Ia.) Railway & Light Company, going from there in the summer of 1912 to Minot, N. D., as manager of the Consumers' Power Company. A year later he became connected with the Mount Vernon property.

William Spencer Murray, as a result of the dissolution of the engineering firm of McHenry & Murray, New Haven, Conn., with the mutual consent of the partners, will hereafter devote his entire time and attention to the interests of the Housatonic Power Company, New Haven, of which he is president. Mr. Murray up to May 1, 1913, when the firm of McHenry & Murray was formed, was electrical engineer for the New York, New Haven & Hartford Railroad Company in the electrification of its New York division. From that time on he was engaged by the railroad in a consulting capacity to direct all of the road's new electrification work. Mr. Murray was born at Annapolis, Md., Aug. 4, 1873. In 1895 he was graduated from Lehigh University and was employed by the Westinghouse Electric & Manufacturing Company, resigning in 1901 to engage in engineering work in Boston. In 1905 he was engaged by the New York, New Haven & Hartford. It was on his recommendation that a single-phase system was adopted for the electrification. This was the first single-phase electrification of any consequence in this country and was the basis for a wide discussion at the time in engineering circles. The success of the system, however, is attested by its enlargement from Stamford to Hartford and beyond.

Obituary

John P. Vollmer, one of the telephone pioneers, died at his home in Lewiston, Idaho, recently in his seventy-first year, Mr. Vollmer, it is understood, built the first telegraph line in Idaho in 1876, and a year or two later built and operated the first practical Bell telephone line on the Pacific Coast.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

PROSPECTS OF WAR FOR ELECTRICAL MANUFACTURERS

German Concerns, Despite Loss of Most Lucrative Market, Have Greatly Increased Earnings and Dividends

Electrical manufacturers, there is no use denying, are to-day very much worried over the future. War has always been associated with disaster, poverty and deficits, not with profits. Business now is excellent, but there is a question concerning how long it will remain good. Nor can there be any doubt that on account of this fearfulness the trade is beginning to react, and there is the possibility that a great reduction in business may result.

That war, however, is to-day of a different nature from what it was in our grandfathers' and great-grandfathers' time there is no disputing. It takes a couple of men working at home to keep one man in the trenches. Business is created, and practically all industries feel a greater demand for their products.

So far as the electrical manufacturers are concerned, the past year and a half has proved sufficiently that big business is a natural adjunct of modern war. True that war was waged in Europe, and the United States was not a party to it. Still, there is probably none that will admit that, even at their worst, conditions in the United States will begin to be so bad as those to be found to-day in Germany. Undoubtedly there war is at its worst. None the less, the German electrical manufacturers have prospered. Their earnings have made remarkable increases and their dividends have been larger, this in spite of the fact that the most lucrative market the German manufacturers had—namely, the export market—was closed to them on the outbreak of hostilities.

In the following extract from the Jan. 3 issue of the *Frankfürter Zeitung* American electrical manufacturers will undoubtedly find much food for thought:

"More than any other German large-scale industry, the electrical industry was already characterized, before the war, by enormously extended works and by a carefully organized financial system which spread its net over half the globe. The industry thus became one of the strongest of the pillars on which German industrial expansion rested, but, because of its international interests, it offered many points of attack in a time of crisis like the present. Yet the industry has not only withstood the onslaughts made upon it but has actually improved its financial position. The remarkable nature of this achievement becomes apparent when it is borne in mind that the industry is cut off from some of its important foreign interests, that these very interests have been endangered by a ruthless policy of persecution, and that the industry has been almost completely deprived of a branch of its activity which is vital to it, namely, its export trade.

"The industry has achieved its successes by reconstructing itself for purposes of war work. The enormous factories, with their exemplary organization and their hosts of skilled workers and technical specialists, have become indispensable centers of war activity.

"But while the net profits have been high, the dividend rates have not been commensurate with them. This is due:

"(1) To the very large sums required for war relief to workers;

"(2) To the need for heavy reserves to cover factories abroad, foreign securities and foreign claims;

"(3) To the necessity for laying by sufficient sums to make good the wear and tear of machinery which the war has worked at exceedingly high pressure, and

"(4) To maintain the strong financial position of the industry, which alone will enable it to organize itself on a fresh peace basis and to win back the spheres of influence at present attacked by the hate-engendered business policy of Germany's enemies.

"It is of the utmost importance for the economic position of Germany after the war that large-scale industries like the electrical industry should make far-sighted provision for the future. The disparity between the net profits and the dividends actually paid to shareholders in the electrical industry is really evidence of strength. In the case of the twenty companies in the accompanying table (having an aggregate capital value of approximately $182,000,000), the net profits rose from 77,465,000 marks (approximately $19,370,000) in 1913 to 84,461,000 marks (approximately $21,115,000) in 1914 and 103,627,000 marks (approximately $25,900,000) in 1915. The amounts written off in each of these years were respectively 27,864,000 marks (approximately $7,000,000), 35,758,000 marks (approximately $8,940,000), and 49,000,000 marks (approximately $12,250,000). The average dividends appear in the table, which also gives some further details for the years 1913, 1914 and 1915.

Companies	Capital	Dividends, Per Cent 1915	1914	1913
Allgemeine Elektricitäts-Gesellschaft	$46,000,000	12	11	10
Siemens-Schuckertwerke	22,500,000	10	10	7½
Bergmann Elektricitäts Werke A.-G.	11,937,500	10	5	5
Elektricitäts-Lieferungs A.-G.	7,500,000	10	10	12
Rheinische Schuckertgeschellschaft	2,750,000	5	5	5
Brown Boveri A.-G., Mannheim	2,250,000	10	5	5
Rheinisch-Westfalisches Elektricitätswerke, A.-G.	12,500,000	8	8	8
Kraftubertagungswerke Rheinfelden A.-G.	3,000,000	8	8	8
Deutsch-Ueberseeische Elektricitäts A.-G.	37,500,000	6	5	11
Hamburgische Elektricitätswerke A.-G.	6,875,000	5	11¾	8½
Elektricitäts A.-G., formerly H. Poege, Chemnitz	1,125,000	15	7½	4
Sachsenwerk, Dresden	1,125,000	18	10	8
Accumulatoren-Fabrik A.-G., Berlin-Hagen	3,000,000	20	18	20
Hartmann und Braun	425,000	12	8	10
Voigt und Haffner	1,250,000	12	8	12
Julius Pintsch A.-G.	4,500,000	8	8	8
Felten und Guilleaume-Carlswerk A.-G.	13,750,000	11	8	8
Hackethal Kabelwerke	1,400,000	22	16	16
Deutsche Kabelwerke	1,337,500	6	6	8
Kabelwerks Rheydt	1,250,000	30	18	12
Total	$181,950,000	10.4	9.35	9.12

EFFECT OF ELECTRIC RANGE PRICES ON THE MARKET

Observations on the Situation Existing Between Manufacturers and Central Station Companies, with Constructive Ideas for Future Advances

That electric range promotion has received a setback there can be no doubt. Just wherein the mistake lies it is difficult to decide. But it is plain that the error was made, because its effects are so apparent. These effects are manifested in the unanimous central station opinion that range prices are too high, while the same impression is not held regarding the prices of other electrical products which have "gone up." In fact, the same men who condemn in loudest language the increasing prices in electric ranges will find plenty of justification for advancing prices of other products, even though they are selling both lines of goods. This seems, therefore, evidence that the range manufacturers have erred. It does not mean necessarily that they have erred in increasing their prices. The advances may be entirely justifiable. But if advances were necessary they made a mistake in not adequately explaining to their central station customers why a range with a given number of pounds of iron, copper, insulating material and resistance wire

should advance a certain degree in price automatically with the advance in the price of its materials.

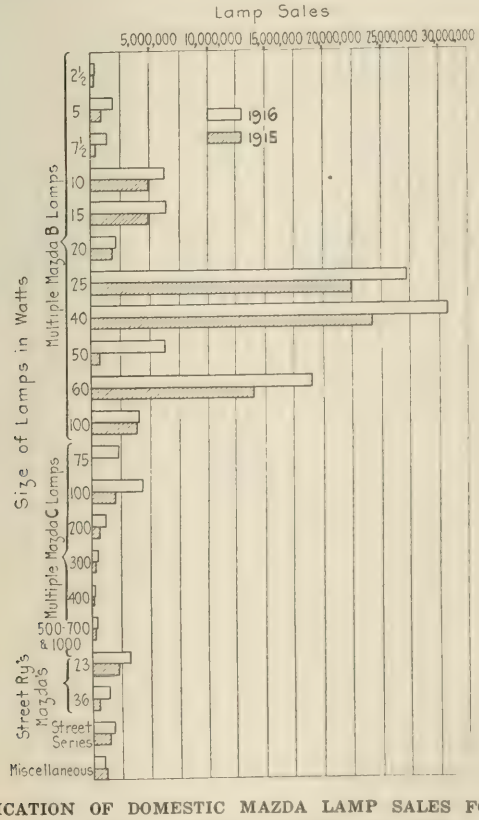
One or the other of these two is the big mistake which has been made. If a further blunder is to be avoided, close co-operation between the manufacturers and the central station will undoubtedly have to be effected so that in the future advances can be made without disrupting the entire retail plan of merchandising. It should be possible, in fact, if the co-operative arrangement were properly handled, to make any necessary advances beneficial to the business of the central station instead of detrimental as they have been heretofore.

One practical way of accomplishing this purpose, and one that has strong support, would be the announcement of price increases further in advance of the date on which the raise is to be effective. This would give central stations a chance to get their house in order. Time is required for that, because it actually takes at least thirty days to plan intelligently and prepare for a good central station selling campaign. Each price advance could be made the occasion for a "buy-before-the-price-goes-up" retail campaign. Then the wavering "prospects" will be won, whereas with the present plan they are lost. This idea is successful in automobile sales; it has proved its worth in vacuum cleaner sales. There seems to be no real reason why it should not be used as the basis of establishing closer co-operation between the range manufacturers and the central stations.

INCANDESCENT LAMP SALES TOTAL 154,000,000 IN 1916

Inncrease of 31 Per Cent in Domestic Sales Over Previous Year—40-Watt Size Is Still That in Greatest Demand

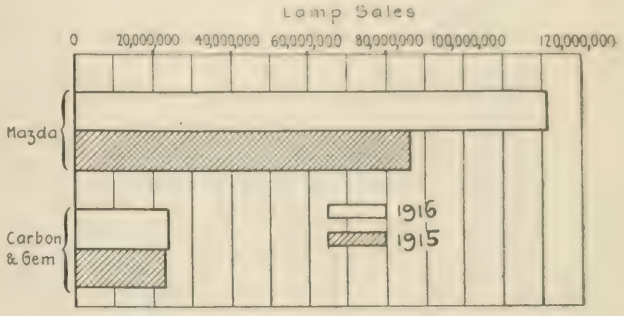
As has been frequently shown in these pages, incandescent lamp sales reached tremendous totals in 1916. Domestic sales in 1916 were 145,000,000, which is 31 per cent,



CLASSIFICATION OF DOMESTIC MAZDA LAMP SALES FOR 1915 AND 1916 ACCORDING TO TYPE AND SIZE

or 35,000,000 lamps, greater than 1915 sales. In addition, over 9,000,000 incandescent lamps were exported in 1916, making total sales for last year of 154,000,000 lamps, in comparison with 116,000,000, the total number of sales that was recorded in 1915.

Of the total 1916 sales, slightly more than 129,000,000 were tungsten-filament, and the remaining 25,000,000 were carbon and graphitized-filament lamps. In 1915, 92,000,000 tungsten-filament lamps and 24,000,000 carbon and graphitized-filament lamps were sold. It would therefore seem



DOMESTIC LAMP SALES FOR 1915 AND 1916 CLASSIFIED ACCORDING TO FILAMENT

from these figures that the sale of carbon and graphitized-filament lamps increased slightly in 1916.

The 40-watt size tungsten lamp for multiple-circuit use continues to be in greatest demand, the 1916 domestic sales of this size being 30,700,000, compared with 24,200,000 in 1915. The next largest domestic sale was in the 25-watt size, of which 27,200,000 were sold in 1916 and 22,400,000 in 1915. The 50-watt size is coming into more general use, the sales having jumped from 708,000 in 1915 to 6,300,000 in 1916.

Almost 9,000,000 gas-filled units were sold in 1916, against slightly more than 3,000,000 in 1915. The 100-watt size has the greatest sale, 4,330,000 being sold in 1916.

There are shown graphically in the accompanying diagram the 1916 and 1915 domestic sales of tungsten lamps, classified according to sizes, and also the tungsten and carbon lamps.

METAL PRICES STIFFEN

Buying Has Slackened Off, Awaiting Action of Warring Governments

Since the report of last week prices of various metals have generally stiffened. Buying has slackened off, but it is anticipated that there will be some large buying for future delivery before long. The lead market showed probably the greatest activity of the week.

Copper buyers have been keeping away from the market, and on going to press the general undertone was one of listlessness. Every one seems to be waiting to find out what European governments and the American government intend doing.

Nominal quotations of electrolytic copper on Tuesday were: May, 32.50 cents; June, 31.50 cents; July, 30.5 cents; third quarter, 29 cents; fourth quarter, 28 cents.

NEW YORK METAL MARKET PRICES

	May 8 Selling Price Bid	May 8 Selling Price Asked	May 15 Selling Price Bid	May 15 Selling Price Asked
Copper:	£ s d		£ s d	
London, standard spot	130 0 0		130 0 0	
Prime Lake	31.50 to 32.50†		32.00 to 33.00	
Electrolytic	32.50 to 33.00†		32.25 to 32.75	
Casting	29.50 to 30.00†		30.87½ to 31.12½	
Copper wire base	36.50 to 37.50†		36.50 to 37.50	
Lead	9.50		9.50	
Nickel	50.00		50.00	
Sheet zinc, f.o.b. smelter	19.00		19.00	
Spelter, spot	9.30 to 9.42½		9.30 to 9.55	
Tin, straits	59.50		66.00	
Aluminum, 98 to 99 per cent.	56.00 to 58.00†		56.00 to 58.00†	

OLD METALS

Heavy copper and wire	26.50 to 27.00	27.00 to 28.00
Brass, heavy	16.00 to 16.50	17.00 to 18.00
Brass, light	12.50 to 13.50	13.00 to 14.00
Lead, heavy	8.00 to 8.25	8.50 to 8.75
Zinc, scrap	6.50 to 7.25	6.50 to 7.25

†Nominal.

Current Prices of Electrical Supplies

The prices quoted are those prevailing in standard package or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists to contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List, per 1000 Ft. Chicago	N. Y.
No. 14 solid	$61.00	$61.00
No. 12 solid	71.00	71.00
No. 10 solid	90.00	90.00
No. 8 solid	106.00	106.00
No. 6 solid	145.00	145.00
No. 10 stranded	95.00	95.00
No. 8 stranded	115.00	115.00
No. 6 stranded	160.00	160.00
No. 4 stranded	205.00	205.00
No. 2 stranded	266.00	266.00
No. 1 stranded	315.00	315.00

Twin-Conductor

No. 14 solid	104.00	104.00
No. 12 solid	135.00	135.00
No. 10 solid	185.00	185.00
No. 8 stranded	235.00	235.00
No. 6 stranded	370.00	370.00
No. 4 stranded	575.00	575.00

DISCOUNT PER 1000 FT.

Single-Conductor

No. 14 solid:	Chicago	N. Y.
Less than coil	+10%	Net
Coil to 1000 ft	—10%	3%
No. 12 solid:		
Less than coil	+10%	Net
Coil to 1000 ft	—10%	3%

Twin-Conductor

No. 14 solid:		
Less than coil	+10%	Net
Coil to 1000 ft	—10%	23%
No. 12 solid:		
Less than coil	+10%	Net
Coil to 1000 ft	—10%	3%

ATTACHMENT PLUGS

	Std. Pkg.	List Chicago	List N. Y.
Benjamin No. 903	100	$0.25	$0.25
Hubbell No. 5406	250	.30	.30
Bryant No. 706	100	.25	.25
G. E. 50996	250	.22	.22

Discount	Chicago	N. Y.
Less than 1/5 std. pkg.:		
Benjamin No. 903	12%	12%
Hubbell No. 5406	+10%	10%
Bryant No. 706	+20%	List
G. E. 50996	+20%	List
1/5 to std. pkg.:		
Benjamin No. 903	20%	20%
Hubbell No. 5406	10%	10%
Bryant No. 706	Net	15%
G. E. 50996	Net	15%
Std. pkg.:		
Benjamin No. 903	44%	40%
Hubbell No. 5406	34%	34%
Bryant No. 706	30%	28%
G. E. 50996	Net	28%

BATTERIES, DRY

Each Net	No. 6 Regular Chicago	No. 6 Regular N. Y.	No. Ignitor Chicago	No. Ignitor N. Y.
Less than 12	$0.35	$0.35	$0.35	$0.35
12 to 50	.30	.30	.30	.30
50 to barrel	.26¼	.28	.27¼	.29
Barrel lots	.24¾	.24	.25¾	.25

CONDUIT, METALLIC FLEXIBLE

Size, In.	Feet per Coil	List per 100 Ft. Chicago	List per 100 Ft. N. Y.
5/16	250	$5.00	$5.00
⅜	250	7.50	7.50
½	100	10.00	10.00
¾	50	13.00	13.00
1	50	21.00	21.00
1¼	50	26.00	26.00
1½	25-50	35.00	35.00
2	25-50	45.00	45.00
2½	25-50	52.00	52.00

CONDUIT, METALLIC FLEXIBLE—CONTINUED

	⅜" Single Strip Chicago	⅜" Single Strip N. Y.	⅜" Double Strip Chicago	⅜" Double Strip N. Y.
Less than coil per 1000 ft., net	$75.00	$75.00	$78.75	$82.50
Cost to 1000 ft. per 1000 ft., net	63.75	61.50	71.25	75.00

	½" Single Strip Chicago	½" Single Strip N. Y.	½" Double Strip Chicago	½" Double Strip N. Y.
Less than coil per 1000 ft., net	$100.00	$100.00	$105.00	$110.00
Cost to 1000 ft. per 1000 ft., net	85.00	85.00	95.00	100.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, in.	List, per Foot Chicago	List, per Foot N. Y.	Size, in.	List, per Foot Chicago	List, per Foot N. Y.
7/32	$0.05½	$0.05½	1	$0.25	$0.25
¼	.06	.06	1¼	.33	.33
⅜	.09	.09	1½	.40	.40
½	.12	.12	1¾	.47	.47
⅝	.15	.15	2	.55	.55
¾	.18	.18	2¼	.65	.65

Per 1000 Ft. Net.	7/32 In. Chicago	7/32 In. N. Y.	¼ In. Chicago	¼ In. N. Y.
Less than $15.00 list	$36.67	$55.00	$40.00	$60.00
$15.00 to $60.00 list	27.50	24.50	30.00	27.00
$60.00 to $150.00 list	24.75	21.50	27.00	23.50

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

(Card No. 38)

Size, in.	Conduit, List per Foot Chicago	Conduit, List per Foot N. Y.
¼	$0.08½	$0.08½
⅜	.08½	.08½
½	.08½	.08½
¾	.11½	.11½
1	.17	.17
1¼	.23	.23
1½	.27½	.27½
2	.37	.37
2½	.58½	.58½
3	.76½	.76½

Size, in.	Couplings, List, Each Chicago	Couplings, List, Each N. Y.	Elbows, List, Each Chicago	Elbows, List, Each N. Y.
¼	$0.05	$0.05	$0.19	$0.19
⅜	.06	.06	.19	.19
½	.07	.07	.19	.19
¾	.10	.10	.25	.25
1	.13	.13	.37	.37
1¼	.17	.17	.45	.45
1½	.21	.21	.60	.60
2	.28	.28	1.10	1.10
2½	.40	.40	1.80	1.80
3	.60	.60	4.80	4.80

	Discount, ¼ In. to ½ In. Chicago	Discount, ¼ In. to ½ In. N. Y.	Discount, ¾ In to 3 In. Chicago	Discount, ¾ In to 3 In. N. Y.
Less than 2500 lb	3.8%	6%	5.8%	8%
2500 to 5000 lb	6.8%	9%	8.8%	9%

(For galvanized deduct six points from above discounts.)

FLATIRONS

	Chicago.	N. Y.
List	$4.50	$5.00
Discount	25%	30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List Chicago	List N. Y.
3-amp. to 30-amp.	100	$0.25	$0.25
35-amp. to 60-amp.	100	.35	.35
65-amp. to 100-amp.	50	.90	.90
110-amp. to 200-amp.	25	2.00	2.00
225-amp. to 400-amp.	25	3.60	3.60
450-amp. to 600-amp.	10	5.50	5.50
600-Volt			
3-amp. to 30-amp.	100	$0.40	$0.40
35-amp. to 60-amp.	100	.60	.60
65-amp. to 100-amp.	50	1.50	1.50
110-amp. to 200-amp.	25	2.50	2.50
225-amp. to 400-amp.	25	5.50	5.50
450-amp. to 600-amp.	10	8.00	8.00

FUSES, INCLOSED—CONTINUED

Discount	Chicago	N. Y.
Less than 1/5 std. pkg.	28%	28%
1/5 to std. pkg.	38%	32%

FUSE PLUGS

3-Amp. to 30-Amp.

Per 100 Net	Chicago	N. Y.
Less than 1/5 std. pkg	$6.25	$5.00
1/5 to std. pkg.	5.25	4.50

Standard package, 500. List, $0.07.

LAMPS, MAZDA

105 *to* 125 *Volts*

Regular, clear:	Std. Pkg.	List, Each—Chicago	List, Each—N. Y.
10 to 40-watt—B	100	$0.27	$0.27
60-watt—B	100	.36	.36
100-watt—B	24	.65	.65
75-watt—C	50	.65	.65
100-watt—C	24	1.00	1.00
200-watt—C	24	2.00	2.00
300-watt—C	24	3.00	3.00
Round bulbs, 3½-in., frosted:			
15-watt—G 25	50	.50	.50
25-watt—G 25	50	.50	.50
40-watt—G 25	50	.50	.50
Round bulbs, 3¾-in., frosted:			
60-watt—G 30	24	.72	.72
Round bulbs, 4⅜-in., frosted:			
100-watt—G 35	24	1.05	1.05

	Discount—Chicago	Discount—N. Y.
Less than std. pkg.	Net	Net
Std. pkg	10%	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

	Per 1000 Ft. Net—Chicago	Per 1000 Ft. Net—N. Y.
Less than coil (250 ft.)	$37.52	$35.17
Coil to 1000 ft.	28.14	26.73

LAMP GUARDS, WIRE

Per 100 Net	Chicago	N. Y.
Less than 50, Matthews 16-cp	$20.00	$20.00
Less than 1/5 std. pkg. Hubbell	28.35	23.80
Less than 36, 60-watt Loxon	25.00	3.15 doz.

OUTLET BOXES

Union Cat. No.	Black, List, per 100—Chicago	Black, List, per 100—N. Y.
101	$30.00	$30.00
102	30.00	30.00
103	25.00	25.00
106	20.00	20.00

Union Cat. No.	Galv., List, per 100—Chicago	Galv., List, per 100—N. Y.
101	$30.00	$30.00
102	30.00	30.00
103	25.00	25.00
106	20.00	20.00

Discount	Black—Chicago	Black—N. Y.	Galvanized—Chicago	Galvanized—N. Y.
Less than $10 00 list	40%	35%	35%	27%
$10.00 to $50.00 list	50%	42%	45%	37%

PIPE FITTINGS

Condulets, V.V., Unilets and Similar

Discount	Chicago	N. Y.
Less than 1/5 std. pkg.	10%	10%
1/5 to std. pkg.	20%	20%
Std. pkg.	30%	30%

PORCELAIN CLEATS—UNGLAZED

2 *and* 3 *Wire*

	Per 1000 Net—Chicago	Per 1000 Net—N. Y.
Less than 1/5 std. pkg.	$14.00	$15.80
1/5 to std. pkg.	13.00	14.80

Standard package, 2200. List per 1000, $20.

PORCELAIN KNOBS

Per 1000 Net	5½ N.C.—Solid Std. Pkg. 3500 Chicago	5½ N.C.—Solid Std. Pkg. 3500 N. Y.	Nail-it—N.C. Std. Pkg. 4000 Chicago	Nail-it—N.C. Std. Pkg. 4000 N. Y.
Less than 1/5 std. pkg.	$10.50	$24.30	$28.00	$21.50
1/5 to std. pkg.	9.75	12.15	21.50	16.00

SOCKETS AND RECEPTACLES

	Std. Pk.	List—Chicago	List—N. Y.
⅛-in. cap key socket	500	$0.33	$0.33
⅛-in. cap keyless socket	500	.30	.30
⅛-in. cap pull socket	250	.60	.60

Discount	Chicago	N. Y.
Less than 1/5 std. pkg.	List	List
1/5 to std. pkg.	15%	15%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

Perkins or Trumbull Type A:	List—Chicago	List—N. Y.
30-amp. S. P. S. T.	$0.80	$0.80
60-amp. S. P. S. T.	1.20	1.20
100-amp. S. P. S. T.	2.25	2.25
200-amp. S. P. S. T.	3.48	3.48
300-amp. S. P. S. T.	5.34	5.34
30-amp. D. P. S. T.	1.20	1.20
60-amp. D. P. S. T.	1.78	1.78
100-amp. D. P. S. T.	3.38	3.38
200-amp. D. P. S. T.	5.20	5.20
300-amp. D. P. S. T.	8.00	8.00
30-amp. 3 P. S. T.	1.80	1.80
60-amp. 3 P. S. T.	2.68	2.68
100-amp. 3 P. S. T.	5.08	5.08
200-amp. 3 P. S. T.	7.80	7.80
300-amp. 3 P. S. T.	12.00	12.00
Perkins Type B or Trumbull Type C:		
30-amp. S. P. S. T.	0.42	0.42
60-amp. S. P. S. T.	0.74	0.74
100-amp. S. P. S. T.	1.50	1.50
200-amp. S. P. S. T.	2.70	2.70
30-amp. D. P. S. T.	0.68	0.68
60-amp. D. P. S. T.	1.22	1.22
100-amp. D. P. S. T.	2.50	2.50
200-amp. D. P. S. T.	4.50	4.50
30-amp. 3 P. S. T.	1.02	1.02
60-amp. 3 P. S. T.	1.84	1.84
100-amp. 3 P. S. T.	3.76	3.76
200-amp. 3 P. S. T.	6.76	6.76

DISCOUNT

Type A, Perkins or Trumbull:	Chicago	N. Y.
Less than $10 list	Net	List
$10 to $25 list	15%	15%
$25 to $50 list	18%	18%
Type B, Perkins, or Type C, Trumbull:		
Less than $10 list	10%	10%
$10 to $25 list	20%	20%
$25 to $50 list	28%	28%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List—Chicago	List—N. Y.
5-amp. single-pole	250	$0.28	$0.28
5-amp. single-pole, ind.	250	.32	.32
10-amp. single-pole	100	.48	.48
10-amp. single-pole, ind.	100	.54	.54
5-amp., three-point	100	.56	.56
10-amp., three-point	50	.76	.76
10-amp., 250-volt, D. P.	100	.66	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List—Chicago	List—N. Y.
10-amp. single-pole	100	$0.45	$0.45
10-amp. three-way	50	.70	.70
10-amp. double-pole	50	.70	.70

Discount	Chicago	N. Y.
Less than 1/5 std. pkg.	+20%	Net
1/5 to std. pkg.	Net	15%
Std. pkg.	30%	28%

SWITCH BOXES, SECTIONAL CONDUIT

C. F. Mfg. Co.	List, Each—Chicago	List, Each—N. Y.
No. 155	$0.34	$0.34
No. 160	0.60	0.60

Discount	Black—Chicago	Black—N. Y.	Galvanized—Chicago	Galvanized—N. Y.
Less than $2.00 list	25%	40%	20%	30%
$2.00 to $10.00 list	25%	50%	20%	40%
$10.00 to $50.00 list	25%	60%	20%	52%

TOASTERS, UPRIGHT

	Chicago	N. Y.
List	$4.50	$5.00
Discount	25%	Net

WIRE, ANNUNCIATOR

Per Lb. Net	Chicago	N. Y.
No. 18, less than full spools	$0.65	$0.42¼
No. 18, full spools	0.55	0.41¼

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

	Price per 1000 Ft. Net—Less than 500 Ft. Chicago	Less than 500 Ft. N. Y.	500 to 1000 Ft. Chicago	500 to 1000 Ft. N. Y.	1000 to 5000 Ft. Chicago	1000 to 5000 Ft. N. Y.
No.						
14	$18.00	$18.00	$16.00	$14.50	$14.00	$12.50
12	29.89	28.35	25.62	24.30	21.35	17.82
10	41.51	39.27	35.58	33.66	29.65	24.68
8	60.13	56.49	51.54	48.42	42.95	33.51
—	82.20	89.57	75.35	76.80	68.50	56.36

WIRE, WEATHER-PROOF

Solid-Conductor, Triple-Braid, Sizes 4/0 to 8, Inc.

	Per 100 Lb. Net—Chicago	Per 100 Lb. Net—N. Y.
Less than 25 lb	$45.00	$40.25
25 to 50 lb.	44.00	39.25
50 to 100 lb.	43.00	38.25

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

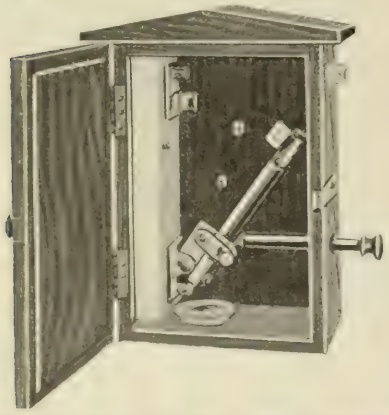
Welding Operator's Shield

A shield for welding operators that is very light, being constructed of aluminum and wood fiber, and which is supported entirely on the head of the operator, has been developed. The operator can easily open and close the door containing the colored glasses, thus making it convenient for him to examine his work without removing the shield. When the door is opened there is still a glass, protecting the eyes from any flying particles. The construction of the shield prevents the possibility of glare or reflection from the side or rear. An apron of fireproof material protects the chest of the operator from the arc. The Favorite Manufacturing Company of Columbus, Ohio, makes these shields.

Fuse Box

A combined disconnecting switch and fuse box for use on distribution lines operating at pressures up to 6600 volts, and carrying 1 amp. to 100 amp., has been developed by the Fisher-Chase Manufacturing Company of Columbus, Ohio. The switch is inclosed in a wooden box which has an arc-discharge relief hole of porcelain in the bottom. By means of a wooden pull-rod on one side of the box the switch can be operated without opening the door. The leverage on the switch-arm end of the pull rod is very short and permits quick closing and separation of contacts, thus minimizing the possibility of arcing without the use of springs. Melting and welding across the terminals is practically impossible because of the widely separated poles.

With the construction employed it is



DISCONNECTING SWITCH AND FUSE BOX

possible for a lineman, after inserting a new fuse, to close the door before closing the switch, thus avoiding the possibility of a fuse blow-out in his face, which might occur if the circuit was overloaded when the fuse was inserted. Delay in determining whether a fuse is blown is eliminated since the paper indicator which blows out of the arc-discharge hole when the fuse blows can be seen without climbing the pole. Furthermore, on three-phase installations where one fuse is broken mechanically or otherwise inspection may be made without interfering with the customer's installation, as the load may be supplied over the two intact circuits.

Automatic Feed-Water Regulator

An automatic feed-water regulator which controls the flow of water into the boiler by the height of the water line is shown in Fig. 1. It is manufactured by the Kitts Manufacturing Company of Oswego, N. Y. The float which is used in the feeder column and the alarm column will not collapse or give trouble from leakage, it is claimed. It is counterbalanced by a brass weight. When the water reaches a certain level

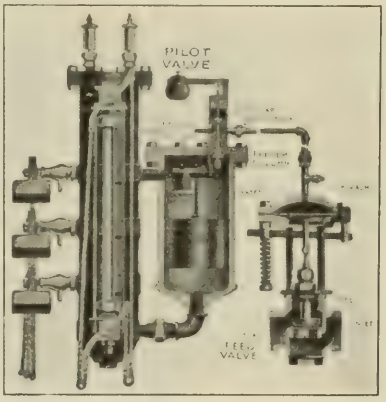


FIG. 1—AUTOMATIC FEED-WATER REGULATOR

the buoyancy of the water lifts the float, which in turn opens the pilot valve, admitting pressure on the diaphragm feed valve and thereby closing it. When the water line begins to lower, the float lowers, closing the pilot valve and opening the exhaust port, thereby relieving the pressure from the diaphragm feed valve and allowing it to open. By this operation the water is kept at or near the second gage cock, which is in the proper place.

The pilot valve may be removed for repairs at any time, as the automatic check under the cover prevents the escape of steam. The seats and disks of the pilot valve and feed valve can also be renewed when necessary. The accompanying meter chart shows how nearly a continuous flow of water is obtained by using this automatic feed-water regulator.

In order to secure good results from an automatic feed-water regulator it is very essential that the pumps be properly governed. A high excess pressure part of the time and a low excess pressure at other times should be

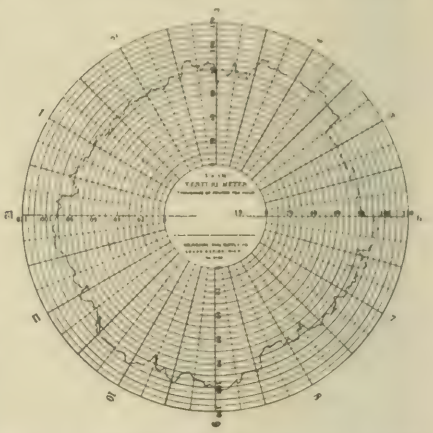


FIG. 2—CONTINUOUS FLOW OF WATER OBTAINED BY USE OF REGULATOR

avoided. Excess pump governors are usually built like scales of the differential type. The slightest variation in the pumping pressure is almost instantly compensated for so the pressure on the feed line to the boilers remains practically the same, no matter what the load is. Should the pressure on the boiler change very suddenly for any reason, the excess pumping pressure will automatically change accordingly.

Headstock Motor for Woodworking Lathes

The Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., is now marketing a line of headstock motor equipments for small woodworking lathes. The motors take the place of the cone pulleys and belts required on belt-driven woodworking lathes. The face plates are mounted directly on the motor shaft. Different speeds are obtained by adjusting the speed of the motor by means of a controller mounted in the leg of the lathe. The controller also permits dynamic braking. By this method of drive the quality of the work may be improved and the production may be greatly increased, as the operator is enabled to use exactly the right speed for the particular piece of work in hand.

Each equipment consists of a motor and a controller especially designed for this service. For alternating-current circuits a special four-speed ball-bear-

ing motor is furnished that can be mounted on the top of the lathe. The design of the motor frame permits removal of either end bracket and excludes all dust and foreign substances. The feet are cast integral with the brackets, giving maximum rigidity to the motor. The ball bearings take end thrust in either direction.

For direct-current circuits an adjustable-speed, commutating-pole, shunt-wound motor is furnished, giving speeds by field control over a range of from 600 to 3000 r.p.m. It is mounted in the same manner as the alternating-current motor and resembles it in general construction.

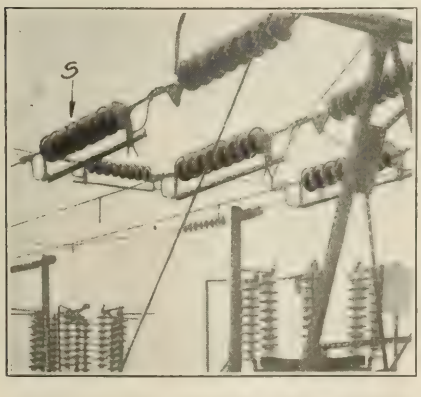
In starting the motor the line switch must be turned to "on," but a simple mechanical device makes it also necessary to have the speed adjustment handle in the first or low-speed position. Protection against low voltages and overloads is afforded by relays, which open the line circuit and stop the motor.

Resistance Material

A plastic molding compound made from the anhydrous resin which results when dry phenol reacts with dry hexamethylenetetramine has been developed by the Redmanol Chemical Products Company of Chicago. It is said that this material has a permanent color and surface brilliance which are not impaired by age. It contains no ingredients which affect brass inserts or other metal parts harmfully. The molded products made by this company have high tensile strength, high electrical resistance and are unaffected by solvents, oils, cleaners, heat or moisture, the manufacturer declares. The compound is furnished in rods, tubes, sheets, granular form, plastic form, impregnating liquids, laminated plates and transparent blocks.

Disconnecting Switches

A convenient type of high-voltage disconnecting or sectionalizing switch is the suspension form. An unusual installation on the roof of a power house supplying a 110,000-volt system is shown herewith. The suspension switch



HIGH-VOLTAGE DISCONNECTING SWITCH

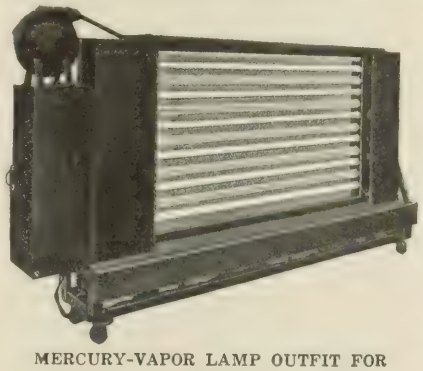
consists of eight disk insulators bridged by a horizontal truss blade provided with contact guides and locks to prevent the switch falling open accidentally. The method of installing the switch is indicated at *S*, the same scheme being employed when switches are to be installed in the main transmission lines. This particular form of switch, which has a wide application on high-voltage lines, is manufactured by the Delta-Star Electric Company of Chicago.

Shop-Lighting Fixtures

Several types of fixtures for illuminating sewing machines have been developed by E. I. Van Doren of Troy, N. Y. These fixtures can also be used for all classes of individual lighting, as for machine-shop and bench practice. The shade, which is supported from the arm of the fixture, not only stiffens the socket but also projects the light directly upon the work, shading the light from the operator's eye. One type is made for single-stand sewing-machine illumination and is equipped to allow conduit to enter at the bottom of the fixture; another is for conduit over the table serving two machines, and a third type is for two machines with attachment plugs under the table. Fixtures are made for lathe and bench work in machine shops.

Lamp for Rotogravure Printing

For use in connection with the making of rotogravure prints the Cooper Hewitt Electric Company of Hoboken,



MERCURY-VAPOR LAMP OUTFIT FOR PRINTING

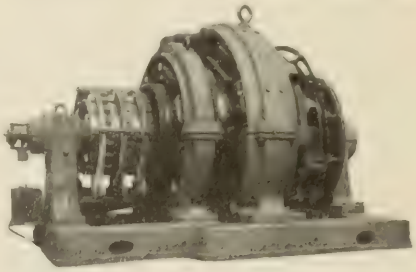
N. J., is marketing a special lighting outfit, one being shown herewith. It consists of six 67-in. (170-cm.), 7-amp. mercury-vapor tubes mounted in a stand, the auxiliaries with shifters being mounted at the end of the stand beneath the blower. The outfit is generally used with a printing frame on each side.

One-Piece Socket

A one-piece socket which may be quickly wired has been placed on the market by J. I. Paulding of New Bedford, Mass. The sockets are made with standard interiors, enabling the wiremen to connect them quickly. An all-porcelain shell slides over the interior and is locked in place by the key shaft. By removing the key a keyless socket is obtained, so that the device combines in one a key, a keyless and a lock socket.

Synchronous Booster Rotary Converter

Synchronous booster rotary converters manufactured by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., consist of a shunt-wound rotary converter in combination with an alternating-current generator mounted on the same shaft with the



MACHINE WHICH GIVES RELATIVELY WIDE, AUTOMATIC OR NON-AUTOMATIC VARIATION IN DIRECT-CURRENT VOLTAGE

rotary converter and having the same number of poles. By varying the field excitation of this alternating-current generator the alternating-current voltage impressed on the rotary converter proper can be increased or decreased as desired. The direct-current voltage delivered by the converter is thereby varied accordingly.

Standard synchronous booster rotary converters are wound for 270 volts direct current, with a range of 240 to 300 volts, and for the desirable and usual converter ratings of 500 kw. and above, both for 25 and 60 cycles. As previously stated, the direct-current voltage range can be made of any desired value by properly proportioning the booster generator capacity. For extreme voltage ranges special booster converters are required. It is rarely practicable to obtain more than 15 per cent buck or boost. The standard variation is a total range of 20 per cent, that is, 10 per cent below and 10 per cent above the average voltage for which the converter is designed. This range is obtained by a boosting generator with a capacity of 10 per cent of that of the converter.

Compared with the transformer or induction regulator method of voltage regulation the booster rotary converter method has the following advantages, it is claimed: There is only one unit, which requires minimum floor space and cable connections. This simplifies installations as there are no connections to make between several pieces of apparatus. The booster converter has rugged characteristics. With induction regulators dangerous forces may be developed between the stator and the rotor, if the converter is connected to the alternating-current line while out of step.

Compared with the so-called regulating-pole or split-pole converter method of regulation, the synchronous booster rotary converter possesses higher efficiency, particularly at the lower voltages, and has better commutation, particularly at the maximum voltage and at the maximum load.

Trade Notes

FRANK CONNELL, secretary and treasurer of the Altima Engine Company, Erie, Pa., died on April 28.

THE McINTOSH & SEYMOUR CORPORATION, Auburn, N. Y., has changed its New York office from 50 Church Street to 149 Broadway.

W. J. McDOWELL has resigned from the sales force of the Walker Vehicle Company to rejoin the sales force of the General Motors Truck Company at Chicago.

VAUGHN & MEYER, consulting engineers, have moved their offices from the Majestic Building, Milwaukee, to the Security Building in the same city.

WORLD'S SALESMANSHIP CONGRESS.—The second annual session of the World's Salesmanship Congress will be held at Detroit from June 10 to 14.

GEORGE W. NEEF has taken charge of the Eastern management of the John H. McGowen Company of Cincinnati, Ohio, with offices at 50 Church Street.

THE NATIONAL FIBRE & INSULATION COMPANY, York Lynne, Del., has awarded a contract for the erection of a one-story addition to its plant.

THE GENERAL ELECTRIC COMPANY is moving its New York office from 30 Church Street to the Equitable Building, 120 Broadway, where it will occupy the entire twentieth floor.

THE GENERAL ELECTRIC COMPANY has had plans prepared for a new brick and reinforced-concrete plant to be erected on Lillie Street, Newark, N. J. The structure will be four-story and basement.

THE BENJAMIN ELECTRIC MANUFACTURING COMPANY, Chicago, Ill., has announced the removal of its sales and publicity promotion department to the administration suite at 130-132 South Sangamon Street.

THE ELECTRICAL EQUIPMENT ASSOCIATION, 216 Judge Building, Salt Lake City, Utah, has been formed by Arthur Purdon. The company will represent the Electrical Engineers' Equipment Company of Chicago.

THE FEDERAL ELECTRIC COMPANY of Pittsburgh, Pa., manufacturer of switch boxes, outlet boxes, cabinets, push buttons and receptacle plates, has just appointed S. Robert Schwartz & Brother, at 729-31 Broadway, New York City, as its Eastern agents.

T. E. WEBSTER, it is announced, has become vice-president of the R. H. Beaumont Company, builder of conveying and hoisting systems, of Philadelphia, and has identified himself with the sales department. Mr. Webster was associated with the Link Belt Company for twenty-five years and for the last twelve years was manager of its Pittsburgh office.

FRANK M. HAWKINS, since 1897 managing representative of the New York territory of the Crouse-Hinds Company, has retired from detail sales work and engaged in the broader activity of looking into business possibilities abroad. For a while Mr. Hawkins will investigate the Cuban and other southern foreign markets. After the war is over he contemplates a tour of Europe to study conditions preliminary to the development of a market abroad for the Crouse-Hinds products.

THE S K F BALL BEARING COMPANY, Hartford, Conn., and the Hess-Bright Manufacturing Company of Philadelphia have joined interests, and the affairs of the two companies will be administered by a recently formed New York Corporation, the S K F Administrative Company, 1 Wall Street. B. G. Prytz has been elected president of the administrative company. Simultaneously, Budd D. Gray of the Hess-Bright Company has resigned as president of the Philadelphia company and will become technical adviser to the new corporation. Mr. Prytz was elected to succeed Mr. Gray as president of the Hess-Bright Company. The S K F Administrative Company is extending the manufacturing facilities of both the Philadelphia and Hartford plants, and the demand for the company's products continues to be so far in excess of the present supply that it has been considered advisable to make additions immediately both to the S K F and the Hess-Bright factories. Closer co-operation between the two companies was greatly facilitated by the action of the American Hess-Bright stockholders in buying out the German minority interest in the Hess-Bright Company shortly before the break with Germany, whereby all the stock came into American hands.

THE REMMERT ELECTRIC COMPANY of St. Louis, which maintains branches in Chicago, Kansas City and Springfield, has closed a lease with the Plankinton Arcade Company, Milwaukee, for a main rotunda store space for a period of five years.

THE DUQUESNE ELECTRIC & MANUFACTURING COMPANY is the new name recently adopted by the Service Supplies & Equipment Company. Rosemont Building, Pittsburgh, Pa., as specialists on new and second-hand electrical equipment and electrical repair work. The Duquesne Electric & Manufacturing Company has opened a large repair shop at East Liberty, Pa., with sales offices in the Rosemont Building, Pittsburgh, under the same management.

New Incorporations

THE ADAIRVILLE (OHIO) LIGHTING COMPANY has been incorporated with a capital stock of $12,000 by R. B. E. Brian, J. E. Russell and R. W. Russell.

THE C. L. WALTON LIGHTING COMPANY of Scales Mound, Ill., has been incorporated with a capital stock of $2,500 by C. S. Walton, Richard Rogers and T. Walton.

THE PARAMOUNT ELECTRIC COMPANY of Cleveland, Ohio, has been incorporated with a capital stock of $5,000 by Benjamin Stern, A. E. Fromholz, Herman L. Castle and others.

THE SNOHOMISH POWER COMPANY of Seattle, Wash., has been incorporated with a capital stock of $1,000,000 by George H. Tilden, William H. Wynn, Jr., and H. W. Bunker.

THE BOWLING GREEN (VA.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $10,000 to operate a light and power plant. L. E. Martin is president, and B. F. Borkey, secretary, both of Bowling Green.

THE ODESSA (TEX.) LIGHT & POWER COMPANY has been chartered by R. M. Henderson, W. F. Bates and W. H. Rhoades. The company is capitalized at $4,000 and proposes to construct and operate an electric-light and power plant.

THE STERLING ELECTRICAL CORPORATION of Cleveland, Ohio, has been incorporated with a capital stock of $250,000 by Roy M. Hall, W. H. Fahrenbach, C. E. Edson, P. Hess and Antonio Longoria.

THE PERFECT FUSE COMPANY of Buffalo, N. Y., has been chartered with a capital stock of $10,000 to do a general and electrical contracting business. The incorporators are W. N. Pierce, J. Franklin and B. C. Candee of Buffalo, N. Y.

THE COMMERCIAL ELECTROLYTIC CORPORATION OF CALIFORNIA of Los Angeles, Cal., has been chartered with a capital stock of $100,000. The directors are: F. E. Stevens, John McWilliams, Jr., R. T. Laughlin, J. R. Mason and E. F. Wehrle.

THE MUNICIPAL POWER & LIGHT COMPANY of Shawnee, Okla., has been incorporated with a capital stock of $3,000 by Sinclair Mainland of Oshkosh, Wis.; W. S. Arnold of Chicago, Ill., and Edward Howe of Shawnee.

THE HUBBEL ELECTRIC COMPANY of Rockford, Mich., has been chartered by H. L. Hubbel, J. R. Gale and J. J. Waterson. The company is capitalized at $15,000 and proposes to manufacture and deal in electrical apparatus and equipment.

THE HOLLAND (MICH.) LIGHT & SPECIALTY COMPANY has been incorporated by A. H. Landmehr, J. P. Kolla, O. P. Neptrum and others. The company is capitalized at $35,000 and proposes to manufacture and sell lighting systems.

THE MULLIKEN (MICH.) ELECTRIC LIGHTING COMPANY has been incorporated by James H. Henskey, C. A. Trimble, W. J. Ramsey and others. The company is capitalized at $3,000 and proposes to supply electricity for lamps and motors in Mulliken.

THE PORTABLE ELECTRIC SEARCHLIGHT COMPANY of Boston, Mass., has been chartered with a capital stock of $40,000. The officers are: N. B. Kneass Brooks of Wellesley, Frank M. Lawrence of Cambridge, treasurer, and Damon E. Hall of Cambridge, clerk.

THE AUTOMATIC ELECTRIC CROSSING & GATE COMPANY of Philadelphia, Pa., has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $500,000 to manufacture electrical safety devices for railways. The incorporators are: F. R. Hansell, George H. B. Martin and S. C. Seymour, all of Philadelphia, Pa.

THE ACME ELECTRIC WORKS of Norfolk, Va., has been incorporated with a capital stock of $50,000 to deal in electrical supplies. W. E. Thomas is president and J. H. Hare secretary, both of Norfolk, Va.

THE ADAMS & GENTER SALES CORPORATION of Salt Lake City, Utah, has been incorporated with a capital stock of $5,000 to deal in electrical appliances. The officers are: John N. Adams of Logan, president; A. L. Genter of Salt Lake City, Utah, vice-president; Paul H. Genter of Logan, secretary.

THE COLUMBIA X-RAY & ELECTRIC CORPORATION of New York, N. Y., has been chartered by C. E. Kramer, R. and B. L. Spitzer, 254 West Seventy-second Street, New York, N. Y. The company is capitalized at $20,000 and proposes to manufacture X-ray machines and electric therapeutic machinery.

THE WATEREE ELECTRIC COMPANY, 75 Montgomery Street, Jersey City, N. J., has been incorporated by Walter C. Parker, David C. Phillips and Alexander M. Sands, Jr. The company is capitalized at $7,500,000 and proposes to acquire water rights, operate electric-lighting and power plants and engage in manufacturing and agricultural pursuits.

Trade Publications

SOCKETS.—Pass & Seymour of Solvay, N. Y., are distributing a leaflet descriptive of their porcelain angle caps and sockets.

RANGES.—The Estate Stove Company of Hamilton, Ohio, has prepared catalog No. 10, descriptive of its electric ranges.

SURFACER.—The Berg Rotary Concrete Surfacer is illustrated and described in a bulletin recently issued by the Elevator Supplies Company, Inc., of New York City.

SOLENOID BRAKES.—Automatic solenoid brakes and solenoids are illustrated and described in bulletin No. 48,900, now being distributed by the General Electric Company of Schenectady, N. Y.

MOTOR-GENERATOR SETS.—Small battery-charging outfits for charging ignition and lighting batteries are described and illustrated in a leaflet now being distributed by the General Electric Company of Schenectady, N. Y.

GRIDS.—Bulletin No. 58,329A, descriptive of frame parts and CR 9042 grids for type IG resistors, is now being mailed by the General Electric Company of Schenectady, N. Y. This company has also prepared bulletin No. 44,406A, descriptive of its ventilated commutating-pole railway motor.

VALVES AND FITTINGS.—The Edward Valve & Manufacturing Company of Chicago has prepared its 1917 catalog, No. 6, covering a full line of cast-steel, forged-steel and bronze-bodied globe valves and blow-off valves. Atmospheric relief valves, unions, fittings, etc., are also mentioned.

INSULATORS.—The Electrose Manufacturing Company of Brooklyn, N. Y., has prepared a bulletin descriptive of its insulators. This bulletin includes extracts from articles which have appeared from time to time in various trade papers in which Electrose insulators were mentioned.

OIL ENGINES.—High-compression oil engines are described and illustrated in a bulletin now being distributed by McEwen Brothers of Wellsville, N. Y. This oil engine is a horizontal, four-stroke-cycle type high-compression engine, operating on the Diesel principle and adapted to burn any kind of heavy crude oil or residue.

INSULATORS.—A report rendered to the Electrose Manufacturing Company on a high-voltage test of Electrose insulated connectors for W. S. Barstow & Company is being distributed by the Electrose Manufacturing Company of Brooklyn, N. Y. These tests were made by the Electrical Testing Laboratories.

GEAR SHIFT.—"What Motor Car Distributors Are Doing" is the title of a large mailing folder distributed by the Cutler-Hammer Manufacturing Company of Milwaukee, maker of the "C-H Magnetic" gear shift. What this device is doing for the Premier is told by means of excerpts from letters, telegrams, newspaper and magazine articles, etc. Reasons for the adoption of the C-H gear shift as regular equipment are also cited. Among the photographs reproduced is one showing Miss Rochester in the Premier which she drove up the court house steps at San Antonio, Tex. Another shows C. H. Davis of Denver with one arm tied to his side, in which condition he drove through the congested section of Denver for six hours, starting and stopping at crossings and to take on passengers, manipulating the "C-H Magnetic" gear shift buttons and steering with the right hand.

New England States

BIDDEFORD, ME.—The York County Power Company has petitioned the Public Utilities Commission for authority to issue $100,000 in bonds, of which $48,000 is to be used for extensions contemplated and the remainder to reimburse the company for improvements recently completed.

PORTLAND, ME.—The Thomas Laughlin Company has contracted with the Cumberland County Power & Light Company for electrical energy to operate its plant. Steam power is now used.

YARMOUTH, ME.—Arrangements have been made whereby the Yarmouth Lighting Company will secure energy from the Cumberland County Power & Light Company of Portland. Work will begin at once by the Cumberland company on the erection of electric transmission lines across the county to connect with the lines of the Yarmouth company.

PENNACOOK, N. H.—The Public Service Commission has granted the Concord (N. H.) Electric Company authority to purchase the property of the Pennacook Electric Light Company for $60,000.

RUTLAND, VT.—Work has begun on the erection of a new 44,000-volt electric transmission line for the Rutland Railway Light & Power Company between the Mendon power station and the substations in Rutland, West Rutland and Castleton, to be completed about July 1. This will necessitate doubling the output of the Castleton substation and an addition to the generating equipment at the plant of the Pittsford Power Company. The new equipment at the Castle substation will consist of a 500-kw. rotary converter; a 750-hp. water wheel will be installed at the Pittsford Power Company's plant.

BOSTON, MASS.—Bids will be received by the schoolhouse commissioners of the city of Boston until May 22 for furnishing electric motors in the Boston Trade School, Parker and Archibald Streets, Boston, Mass. Proposal blanks may be obtained at the office of the commissioners, Room 1009, City Hall Annex.

BROCKTON, MASS.—The City Council is considering a proposal submitted by the Edison Electric Illuminating Company of Brockton for lighting the streets of the city, which provides for the installation of ornamental lamps in the business district, including Center Street, at no additional expense.

FALL RIVER, MASS.—The Fall River Electric Light Company has petitioned the Massachusetts Gas and Electric Light Commission for permission to erect electric transmission lines over the Taunton River at a point 1800 ft. north of its Fall River plant, just south of the Slade's Ferry Bridge. The proposed line will extend through Somerset, Swansea and Seekonk to the Rhode Island line. The commission recently refused the company permission to erect a line across the river at another location.

SOUTHBRIDGE, MASS.—The Stephen Richard Company, cutlery manufacturer, is contemplating extensions to its plant and power equipment.

SPRINGFIELD, MASS.—The Turners Falls (Mass.) Power & Electric Company has petitioned the Waterways Commission for authority to suspend cable wires over the Connecticut River from the Agawam side of the city.

WATERTOWN, MASS.—Bids will be received at the Watertown Arsenal, Watertown, Mass., until May 23, for furnishing miscellaneous supplies, including dry cells, etc., during the year ending June 30, 1918. Further information may be obtained on application to the commanding officer, Watertown Arsenal.

WATERTOWN, MASS.—Bids will be received at the Watertown Arsenal, Watertown, until May 23, for construction of an erecting shop, tunnel and coal-conveying apparatus and alterations and additions to the smith shop, power house and coal pocket, including plumbing and heating and railroad track. Further information may be obtained upon application to the commanding officer.

WESTFIELD, MASS.—The Turners Falls (Mass.) Power & Electric Company has applied to the Selectmen for permission to erect an electric transmission line from the Easthampton town line across Hampton Plains to the power station of the local division of the Springfield Street Railway Company, and thence along the Westfield River bank to the town of Agawam.

WOONSOCKET, R. I.—The Manufacturers' Power Company, which furnishes power and steam to the Nyanza and Samoset Mills, has purchased land at Second Avenue and River Street, for the purpose of building a coal pocket for its power plant on Singleton Street.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

NEW HAVEN, CONN.—A petition has been presented to the municipal committee on street lighting by the residents of Grand Avenue asking that ornamental lamps be installed on Grand Avenue from State Street and Railroad Avenue. The residents of Orange Street, from Chapel to Elm, have petitioned for a better lighting system on that thoroughfare.

Middle Atlantic States

ALBANY, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 6 for remodeling two hydraulic mail lifts, etc., in the United States custom house and post office, Albany, N. Y. For details see proposal columns.

BINGHAMTON, N. Y.—The installation of the first two generator units for the new power house of the Binghamton Light, Heat & Power Company is nearly completed, and it is expected that within the next three weeks the 3500-kw. unit with two boilers and necessary auxiliaries will be ready to place in operation. Preparations are being made to begin work on the excavations for foundation for the third unit.

BROOKLYN, N. Y.—The Public Service Commission has approved an award of the Brooklyn Rapid Transit Company to Angelo Pasquini of New York City for the construction of the new Ridgewood substation to be used in connection with furnishing energy to operate the Fourteenth Street-Eastern Parkway and other new rapid transit lines in Brooklyn and Queens at $59,900. The building will be located on Gates Avenue, near Wyckoff Avenue, Brooklyn.

BUFFALO, N. Y.—The Buffalo General Electric Company, the New York Telephone Company, the Federal Telephone Company and the International Railway Company will be asked to place their wires on Virginia Street underground before the work of paving the street is undertaken.

CORNING, N. Y.—The bill to incorporate the Lamoka Electric Water Corporation of Corning and giving it power to develop the water power of Mud Creek has been passed by the Legislature. The company, it is reported, proposes to construct a dam near Savona and a canal and pipe line from Wayne to Lake Keuka, on the west shore of which a power house is to be erected between Grove Springs and Keuka.

GOVERNOR'S ISLAND, N. Y.—Bids will be received at the office of the quartermaster, Eastern Department, Governor's Island, N. Y., until May 25, for construction, including plumbing, heating and electric wiring, of a brick six-set officers' quarters at Governor's Island.

HORNELL, N. Y.—Preparations are being made for the installation of an ornamental street-lighting system. The Hornell Electric Company will bear the cost of laying the wires underground and the city will pay for the ornamental standards. The system throughout the city will be changed and arc lamps discarded.

ITHACA, N. Y.—Work has begun on the erection of the electric transmission line of the Cayuga Power Corporation from Portland Point to Peruton, thence to Groton, where the company has a contract to supply energy to the plant of the Corona Typewriter Company. As soon as material can be secured the transmission line will be extended to Freeville and to Dryden to furnish electrical service to those towns. The Cayuga corporation is negotiating with the village of Groton for the purchase of the municipal plant.

NEW YORK, N. Y.—Bids will be received by the Interborough Rapid Transit Company at the office of the chief engineer, 165 Broadway, New York City, until May 24, for completion of the passenger station electric-lighting and electric heating systems for portions of the Seventh Avenue line, routes 4 and 38; Pelham Bay Park branch of the Lexington Avenue line, route 5, section 15, and routes 19 and 22, sections 1 and 1-A, Lexington Avenue line, route 5. Drawings, proposal blanks, etc., may be obtained at the above office. George H. Pegram is chief engineer.

WATERTOWN, N. Y.—The Black River Traction Company contemplates an extension of its traction system to the Maxim munition plant in Water Street.

WOODBRIDGE, N. Y.—The Murray Electric Light & Power Company of Monticello is contemplating extending its electrical service to Woodbridge.

YONKERS, N. Y.—The City Council is considering the installation of 400 ornamental lamp standards, equipped with five-lamp clusters.

CALDWELL, N. J.—Bids will be received by the committee of public buildings of the Board of Freeholders of the county of Essex, Essex County Court House, Newark, until May 23 for additions and alterations in the power plant at the Essex County Penitentiary, Caldwell, N. J., as follows: (1) For boilers, stack and breeching; (2) engine, generator and switchboard. Plans and specifications may be seen at the office of Runyon & Carey, consulting engineers, 845 Broad Street, Newark, N. J.

HOBOKEN, N. J.—Bids will be received by the Board of Education of Hoboken until May 29 for construction of a new public school house to be erected at Adams and Fifth Streets, including electrical work, heating and ventilating. John J. Fagan, 95 River Street, Hoboken, is architect.

HOPEWELL, N. J.—The Borough Council has authorized the installation of a gas engine equipment to replace the oil engine now in use.

JERSEY CITY, N. J.—The City Commission is considering an application of the Great Atlantic & Pacific Tea Company for permission to build a conduit line for electric wires from its building on First Street to the plant of Edward V. Hartford, Inc., on Morgan Street.

LAKEWOOD, N. J.—Plans are being considered by the Lakewood & Seacoast Railway Company for the construction of its proposed extension from Lakewood to Point Pleasant.

LAMBERTVILLE, N. J.—The Board of Public Utility Commissioners has granted the Lambertville Public Service Company permission to issue securities for $430,000, the proceeds to be used for extensions and improvements.

NEWARK, N. J.—Bids will be received at the office of the board of education of Newark until May 21 for construction and completion of addition to the Madison school house, including general construction, plumbing, heating and ventilating, electrical work, lighting fixtures and vacuum cleaning system. Blank proposals and further information may be obtained at the construction department of the board, fourth floor, City Hall. R. D. Argue is secretary.

PERTH AMBOY, N. J.—A bond issue of $50,000 has been approved by the Board of Aldermen for the completion of the commercial system of the municipal electric-light plant. Arrangements will be made to furnish commercial service in the business and other districts of the city.

ALBION, PA.—The Public Service Commission has granted the United Lighting Company permission to issue $110,000 in bonds, the proceeds to be used for extensions and improvements.

BETHEL, PA.—The Blue Mountain Electric Company of Bethel is extending its electric transmission lines to Freystown.

COATESVILLE, PA.—The City Council has awarded the Chester Valley Electric Company a contract for furnishing energy to operate the municipal water-works pumping station.

EASTON, PA.—The Pennsylvania Utilities Company of Easton has closed a 10-year contract with the Warren Manufacturing Company to furnish energy to four of the paper mills of the company at Milford, Warren, Hughesville and Riegelsville, N. J., which will require about 3500 hp. in motors. To serve this consumer a double circuit 33,000-volt transmission line will be erected from Easton.

GREENVILLE, PA.—The Public Service Commission has granted the Mercer County Light, Heat & Power Company permission to issue $300,000 in bonds, the proceeds to be used for payment of the new plant recently completed in Greenville, also for the one at Kinsman, and also for other extensions contemplated.

KINGSTON, PA.—The Public Service Commission has authorized the Luzerne County Gas & Electric Company to issue $270,000 in bonds, the proceeds to be used for extensions and improvements.

PHILADELPHIA, PA.—The Philadelphia Drying Machine Company is planning to erect a power plant, about 35 ft. by 40 ft., one story high, at its proposed new factory on Westmoreland Street. Contract for building has been awarded.

SCRANTON, PA.—The Scranton Electric Company has been granted permission by the Public Service Commission to issue

$184,000 in bonds for extensions to its system.

SKIPJACK, PA.—Arrangements have been made by the borough committee for the installation of a new street-lighting system.

SKELTON, PA.—The Public Service Commission has approved the contract between the Harrisburg (Pa.) Light & Power Company and the borough of Skelton for street lighting. Under the terms of the contract the company will replace the arc lamps now in use with incandescent lamps.

TOPTON, PA.—Application for charters for three new electric companies for Topton, Maxatawny and Rockland has been made by S. R. Eschenauer of Reading, V. S. Martin of Topton, and W. J. Mattern of Reading.

DUNBAR, W. VA.—The Dunbar Company has been incorporated with a capital stock of $1,000,000 to build an industrial city, mainly for the employees of the Bethlehem Steel Company at Sparrows Point. The plans provide for land developments, constructing sewer system, laying the water mains, installing electric-lighting system, building several thousand dwellings, etc. Howard H. Benton, president of the Roland Park (Md.) Company, Frederick W. Wood of Bethlehem Steel Company of Sparrows Point, Henry R. Walker of South Bethlehem, Pa., and others are interested in the project.

BARBOURSVILLE, W. VA.—The Barboursville Water & Light Company, recently incorporated, has acquired the municipal electric-light plant. The company would like to receive prices on insulated wire. A. E. May, H. E. Love and W. G. Shipe are among the incorporators.

WILLIAMSON, W. VA.—The Wigarb Mining Company would like to receive prices on coal-mining machinery and electrical equipment. C. M. Gateso of Williamson is manager.

NORFOLK, VA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until May 28 to furnish and install one 80-ton bridge crane, one or more 10-ton bridge cranes, one 5-ton bridge crane, four 5-ton wall cranes, and five 2-ton electric hoists and hand-power travel bridge cranes in the new foundry at the navy yard, Norfolk, Va. Drawings and specification (No. 2388) can be obtained on application to the above bureau or to the commandant of the navy yard named.

NORFOLK, VA.—W. T. Gregory, 501 Law Building, Norfolk, it is reported, would like to receive prices on two electric elevators for store building.

RICHMOND, VA.—The Administrative Board has instructed John E. Butler, building inspector, to advertise for bids for building an addition to the municipal electric plant under plans prepared by Carneal & Johnston. The cost of the improvements is estimated at about $25,000. Bids will be received until May 25.

WASHINGTON, D. C.—The Southern Railway Company has authorized the erection of two copper telephone circuits between Spencer and Atlanta, a distance of 314 miles. The work will be done under the supervision of the superintendent of telegraph at Charlotte, N. C.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Various, Schedule 1116—miscellaneous cotton insulating tape, miscellaneous rubber insulating tape; Schedule 1098—72,450 batteries, suitable for flashlights, 18,800 flashlights without batteries; Schedule 1115—miscellaneous acid etched globes, miscellaneous prismatic reflectors; Schedule 1111—miscellaneous turbo-generating sets; Schedule 1114—miscellaneous weatherproof sockets. Las Animas, Col., Schedule 1103—one electrically operated dishwashing machine, one electrically operated potato peeler. Philadelphia, Pa., Schedule 1108—one 21-in. motor-driven upright drill, one double, 12-in., motor-driven grinder. Application for proposal blanks should designate the schedule desired by number.

North Central States

HOWELL, MICH.—The City Council has decided to install ornamental lamps on all paved streets in the city, for which bids will soon be asked.

MONROE, MICH.—The City Commission has granted the Detroit (Mich) Edison Company a franchise to construct and operate an electric-lighting system in Monroe. Under the terms of the franchise the company is to purchase the municipal electric-light plant and furnish electrical service here.

MULLIKEN, MICH.—The Mulliken Electric Light Company, recently incorporated, is contemplating supplying electrical service to Mulliken. The company is capitalized at $3,000.

FORT HURON, MICH.—The Port Huron Gas & Electric Company has submitted a proposal to the City Commission for lighting the streets of the city for a period of either five or seven years. The company proposes to install new lamps to replace those now in use.

CANTON, OHIO.—The installation of an electric-lighting system on Woodland Avenue has been authorized by the City Council, and contracts for it will soon be awarded.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, until May 29, for fiber conduit. Bids will also be received at the same time and place for a locomotive crane. Proposals will also be received at the same time for service switches for the division of light and heat. Specifications may be obtained upon application to the office of division of light and heat, room 204, City Hall.

COLUMBIANA, OHIO.—The Ohio Gas & Electric Company of Lisbon has presented a proposal to the City Council offering to purchase the local municipal electric plant and to supply electricity for all purposes.

DAYTON, OHIO.—Right of way is being secured by the Dayton Power & Light Company for the erection of a tower transmission line from Gunnersville to Xenia, a distance of about 15 miles.

EAST PALESTINE, OHIO.—The City Council is considering a proposal submitted by the Ohio Gas & Electric Company of Lisbon to take over the municipal electric plant. The company offers to pay $30,000 for the plant and agrees to expend $25,000 for improvements to the system as soon as it is turned over.

SALEM, OHIO.—Preliminary steps have been taken by the Salem Lighting Company for extensions and improvements to its plant, including the installation of new boiler equipment, to cost about $10,000.

WILLOUGHBY, OHIO.—The Cleveland, Painesville & Eastern Railroad Company has petitioned the Public Utilities Commission for permission to issue $68,000 in bonds, the proceeds to be used for extensions and improvements to its system.

YOUNGSTOWN, OHIO.—Several large power contracts have been closed by the Mahoning & Shenango Railway & Light Company for furnishing electric energy to industrial plants. One is with the Ohio Steel Products Company of Mineral Ridge, a new fabricating industry, calling for approximately 600 hp.; another calling for 1500 hp. for the Crescent Portland Cement Company's plant at Crescentdale, which will require the erection of a transmission line crossing the Beaver River near the plant; the third is with the Valley Mould & Iron Company of Sharon to furnish about 300 hp. at its new plant now being erected at West Middlesex, Pa.

FRANKFORT, KY.—An ordinance has been adopted by the City Council requiring the Kentucky Traction & Terminal Company to replace the wooden poles now in use on parts of Main and St. Clair Streets with ornamental steel poles; also the electric and telephone companies to place their wires in underground conduits along these thoroughfares.

LOTHAIR, KY.—The Kentucky River Power Company of Hazard, which has recently completed a large power plant in Lothair, is planning to erect electric transmission lines into the Lott's Creek field to furnish electricity to coal-mining companies in that district.

MAYSVILLE, KY.—Cochran Brothers, who last winter contracted for equipment for a large power plant, have asked for bids for construction of a power house. The plant, which will be equipped for three-phase, 60-cycle, 2300-volt current, will furnish energy to the January & Wood Company cotton mills, the Maysville Gas Company, which will change its system from two to three-phase, and to the Maysville Street Railroad & Transfer Company. The system will be operated by a company yet to be formed. It is expected to have the plant in operation by Jan. 1, 1918.

RICHMOND, KY.—Contract has been awarded by the Richmond Water & Light Company for improvements to its reservoir.

WHITESBURG, KY.—The electric-light franchise recently sold by the City Council was purchased by W. C. Daniels of Monica, who will start work at once on construction of a plant, to cost about $30,000. The proposed plant will also furnish electricity to several coal-mining corporations starting developments in the immediate section of the city. Local transmission lines will be extended.

SOUTH BEND, IND.—The capital stock of the Indiana & Michigan Electric Company has been increased from $3,500,000 to $,000,000.

SULLIVAN, IND.—The Terre Haute, Indianapolis & Eastern Traction Company of Indianapolis has been granted permission by the County Commissioners to extend its electric transmission lines to the mines of the Vandalia Coal Company.

WARSAW, IND.—The Public Service Commission has granted the Winona Electric Light & Water Company permission to sell $85,000 in bonds.

DEKALB, ILL.—Bids will be received by the city of DeKalb for the purchase of 64 General Electric 6.6-amp. luminous magnetite arc lamps, now in service, on its boulevard lighting system. For details see proposal columns.

GALESBURG, ILL.—The stockholders of the Galesburg Railway, Lighting & Power Company have voted to increase the capital stock of the company from $3,500,000 to $4,000,000.

PARIS, ILL.—The installation of a new electric-lighting system in the business district is under consideration by the Board of Local Improvements.

SCALES MOUND, ILL.—The C. L. Walton Lighting Company, recently incorporated with a capital stock of $2,500, is planning to furnish electrical service here.

SHERRARD, ILL.—The State Public Utilities Commission has given to the Sherrard Power System, recently incorporated, permission to purchase the local electric-lighting system owned by D. W. Bowen. The company is capitalized at $36,000 and proposes to furnish electricity for lamps, heaters and motors in Sherrard and Pre-emption.

MARINETTE, WIS.—Work will soon begin on the construction of a hydroelectric development on the Brule River, just below the junction of Brule and Paint Rivers, by the Twin Falls Power Company.

MILWAUKEE, WIS.—The Standard Oil Company, Germania Building, is contemplating the construction of a garage and repair shop, 90 ft. by 140 ft., two stories and basement, at Walker and Barclay Streets, to cost complete about $27,000. The plans provide for a steam power plant and a 70-ft. stack.

NEENAH, WIS.—Steps have been taken by the residents of Neenah and Menasha to secure funds for the installation of an ornamental lighting system on Nicolet Avenue, the dividing line between the two cities.

WAUPUN, WIS.—Plans are being considered for the installation of an ornamental lighting system on Main Street. Vaughn & Meyer of Milwaukee, are engineers.

IRONTON, MINN.—Bids will be received by the Village Council until June 5 for the construction of a village hall and jail, including general contract, heating and plumbing and electrical work. Nelson & Beautow of Perham are architects.

LANESBORO, MINN.—Bids will be received by J. Solberg, clerk of school board of the independent school district 158, Lanesboro, until May 25 for construction of school building. Separate bids to be submitted on general construction, heating and ventilating, plumbing, and electrical work. Plans and specifications are on file in the office of G. L. Lockhart, Endicott Building, St. Paul, Minn.

PRINCETON, MINN.—Negotiations are under way, it is reported, between the City Council and the St. Cloud Power Company for the purchase of the municipal electric-light plant.

SUNRISE, MINN.—Plans have been prepared by J. C. Jacobson, Security Building, Minneapolis, for the installation of an electric-light plant for the Sunrise Milling Company.

BURLINGTON, IOWA.—The erection of several transmission lines this year, it is reported, is contemplated by the Burlington Railway & Light Company. One of the proposed lines will connect Burlington with Mediapolis, Morning Sun, Wapello and Winfield; another line will be erected from Burlington to Middletown. Energy will be supplied from the plant at the Keokuk dam to the cities and towns north of Burlington.

HUMBOLDT, IOWA.—The Northern Iowa Gas & Electric Company has been granted franchises to erect and maintain electric distribution lines on certain roads and highways in Humboldt and Palo Alto Counties by the Board of Railroad Commissioners.

LITTLE ROCK, IOWA.—Bonds to the amount of $15,000 have been issued for the installation of a municipal electric-light plant.

JOPLIN, MO.—The City Council is considering calling an election to submit to

the voters the proposal of the Empire District Electric Company offering to take over the municipal electric-light plant.

KANSAS CITY, MO.—The Kansas City Railways Company is considering the construction of a one-story substation, to cost about $7,000.

ST. JOSEPH, MO.—The St. Joseph Railway, Light, Heat & Power Company has closed a contract with Morris & Company, packers, under which the St. Joseph plant of the packing concern will abandon their own electric plant and purchase energy from the street railway company. Plans, it is reported, are being considered by the St. Joseph company for the construction of a new power plant, to be located on the river front, not far from the stockyards.

SPRINGFIELD, MO.—The Federal Light & Traction, which controls the Springfield Railway & Light Company, is reported to be negotiating for the purchase of the local power plant of the Frisco Railroad Company.

VANDALIA, MO.—Contract has been awarded by the Walsh Fire-Clay Products Company to the Unit Construction Company, St. Louis, Mo., for the construction of a power plant.

COURTENAY, N. D.—At an election held recently the proposal to issue $7,000 in bonds for a municipal electric-light plant was carried.

WASHBURN, N. D.—Preliminary surveys have been made by E. D. Jackson of St. Paul, Minn., engineer, for the construction of an electric power plant at Butumina, 6 miles distant. A company has been organized, with a capital stock of $150,000, to operate the system. It is proposed to furnish electricity in Washburn, Turtle Lake, Denloff, Goodrich and other towns in this district.

BELLE FOURCHE, S. D.—A company has been organized under the name of the North Star Electric Railway Company to build an electric railway from Belle Fourche to Dickinson, via Scranton. The construction of an electric power plant is contemplated in connection with the project. F. E. Duba is interested.

GREELEY, NEB.—Plans are being considered for the installation of an electric-light plant in Greeley, to cost about $15,000. P. A. Johansen of Anita is reported interested in the project.

ARCADIA, KAN.—The City Council is considering the erection of an electric transmission line to Pittsburg to secure electricity for distribution in Arcadia.

ARGONIA, KAN.—The Western Sumner Light & Power Company of Argonia and the Tri-County Light & Power Company of Norwich have applied to the Public Utilities Commission for permission to operate in and near the towns of Norwich, Milton, Viola, Mayfield and Argonia. W. L. Jones of Argonia is manager of both companies.

DOUGLAS, KAN.—At an election to be held May 22 the proposal to issue $5,000 in bonds for the installation of an electric-lighting system will be submitted to the voters.

MARYSVILLE, KAN.—The Marysville Light, Power & Water Company, it is reported, contemplates extensions to its local distribution system.

MEDICINE LODGE, KAN.—Harry Dobson and J. N. Tincher, owners of the local electric plant, have submitted a proposal to the town of Sharon, offering to erect an electric transmission line from Medicine Lodge to furnish electrical service in that town.

Southern States

ROANOKE RAPIDS, N. C.—Contract has been awarded by the Roanoke Mills Company for construction of warehouses and 50 tenement cottages; contract will soon be awarded for an additional mill building, 542 ft. by 158 ft., to cost about $100,000, and for boiler house and reservoir. Contracts have also been placed for all machinery, costing $530,000, and will include 23,184 spindles, to be equipped for electrical operation. Later 700 wide looms will be installed. Energy will be secured from the transmission system of the Roanoke Rapids Power Company.

FELLSMER, FLA.—At an election to be held May 21 the proposal to issue $20,000 in bonds to purchase or construct an electric-light plant and ice factory will be submitted to the voters.

CUMBERLAND SPRINGS, TENN.—Plans are being considered by L. Motlow of Tullahoma for the construction of a hydroelectric plant to supply electricity for lighting hotel and 65 summer homes. It is proposed to build a concrete dam 300 ft. by 34 ft. and 21 ft. thick.

JACKSON, TENN.—Bids will be received by H. M. Harris, commissioner of public utilities, until May 24, for furnishing material for an ornamental lighting system, consisting of approximately 100 standards with wiring and accessories. For details see proposal columns.

DOTHAN, ALA.—Plans, it is reported, are being considered for a hydroelectric development in Dothan. T. M. Espy and W. L. Lee are reported interested.

OZARK, ARK.—Plans are being considered for improvements to the local electric-light plant. A. Littleton is manager.

SILOAM SPRINGS, ARK.—Two new boilers of 150 hp. each are being installed in the municipal electric-light and water plant to replace the boilers now in use.

PONCHATOULA, LA.—The property of the Ponchatoula Ice Company has been purchased by the Hammond (La.) Ice, Light & Bottling Company. Improvements will be made to the local electric system and a 24-hour service established. A new ice factory, it is understood, will be built.

COLLINSVILLE, OKLA.—Improvements are contemplated to the municipal electric-light plant, including the installation of new machinery, to cost about $14,000.

HEALDTON, OKLA.—The Consumers' Light & Power Company has purchased four additional lots in Healdton, on which it will erect a substation. The company proposes to supply electricity here over a high-tension line from its Ardmore plant.

POND CREEK, OKLA.—Plans are being considered for the erection of an electric transmission line to Enid to secure electricity for distribution in Pond Creek.

AUSTIN, TEX.—Plans are being considered for placing the electric wires underground in the business district.

PORT ARTHUR, TEX.—The installation of an ornamental lighting system in Port Arthur is under consideration.

Pacific and Mountain States

COUPEVILLE, WASH.—A small electric-light plant is being installed by C. H. Coates & Son to supply electricity to neighboring farms.

INDEX, WASH.—The City Council has passed an ordinance providing for the construction of a municipal electric-light and power plant. G. N. Miller, engineer, of Seattle, will have charge of the work.

OLYMPIA, WASH.—To provide heavier power lines to the shipyards in Olympia, the Olympia Light & Power Company is putting new cross-arms on all poles on Main Street, to the end of the fill, and running wires. Additional energy will be brought from Tacoma.

SEATTLE, WASH.—Plans for the equipment of the new Sedro Woolley Hospital at the Veterans' Home at Retsil provide for a power house, to cost $35,000.

SEATTLE, WASH.—Contracts have been awarded by the Board of Public Works for machinery for the addition to the Lake Union steam power plant at a cost of $378,435, as follows: Charles C. Moore & Company of Seattle for all equipment, with the excention of the main turbine unit and exciter unit, at $231,035, and the Allis-Chalmers Company of Milwaukee, Wis., for the turbine unit and exciter unit, at $147,400.

SEATTLE, WASH.—The City Council has granted the Western Union Telegraph Company a franchise to construct and operate both overhead and underground wires and all apparatus necessary for furnishing private connections for messenger service, time service and ticker service and for local connections for long-distance telephone service. This is similar to the franchise granted the Postal Telegraph Company and in both cases supplemental to the general franchise under which the two companies operate.

SEATTLE, WASH.—The City Council has instructed J. D. Ross, superintendent of lighting, and L. B. Young, superintendent of water, to proceed with attempts to seal the leaks in the masonry dam at Camp 2, on Cedar River, source of light and water supply of the city of Seattle. W. D. Freeman, city purchasing agent, has been authorized to purchase one pumping outfit for use on fresh water sluicing, consisting of one or two pumps, directly connected to a 500 to 650-hp., 22,000 to 25,000-volt, two-phase, 60-cycle induction motor. The pumping unit is to have a capacity of from 3500 to 4000 gal. per minute against approximately 400-ft. head.

SEATTLE, WASH.—Bids will be received at the office of the general purchasing agent, Alaskan Engineering Commission, Seattle, Wash., until May 28 for furnishing one portable coal elevator and unloader. Copies of circular may be obtained upon application to the above office, the Alaskan Engineering Commission, United States Custom House, Portland, Ore.; United States Custom House, San Francisco, Cal.; United States Reclamation Service, 505 Tramway Building, Denver, Col.; Bureau of Mines, Fortieth and Butler Streets, Pittsburgh, Pa., United States Reclamation Service, 802 Federal Building, Chicago, Ill., and Alaskan Engineering Commission, Washington, D. C. C. E. Dole is general purchasing agent.

EUREKA, CAL.—The Hammond Lumber Company, the Pacific Lumber Company and the Charles Nelson Company, all of San Francisco, have purchased a tract of land adjoining the Hammond Lumber Company's plant in Eureka, on which they propose to erect a shipbuilding plant and a sawmill, to be equipped with electrically operated machinery.

LONG ISLAND, CAL.—At an election to be held on May 22 the proposal to issue $8,000 in bonds for the installation of an electric-lighting system will be submitted to the voters. Energy will be purchased from the Phillipsburg (Kan.) Mill & Elevator Company.

OAKLAND, CAL.—The Board of Education has voted to increase the foundry and electrical shop equipment of the Technical High School.

ORANGE, CAL.—The Santiago Orange Growers' Association of Orange has voted to appropriate $100,000 for the erection of an icing and pre-cooling plant for Eastern shipment. The proposed plant will include an ice-manufacturing department, refrigerating plant, blower system, ice-conveying apparatus and other equipment.

SAN DIEGO, CAL.—Application has been made to the State Railroad Commission by the San Diego Consolidated Gas & Electric Company for permission to erect an electric transmission line from Oceanside to San Juan Capistrano to furnish electricity at the latter place.

SAN FRANCISCO, CAL.—The State Railroad Commission has refused to grant the Yosemite Power Company of La Grange the use of the Poopehaut reservoir and other works and right of way in Yosemite National Park.

BOISE, IDAHO.—High-tension transmission lines will be erected by the Idaho Power Company in the near future to the Boulder and Jarbidge mining districts. Owners of the Demming group have contracted for 500 hp. The line will be extended from Silver City to Boulder, a distance of 15 miles. The line to the Jarbidge district will be erected from the Thousand Springs plant to the new district, a distance of about 80 miles.

BONNERS FERRY, IDAHO.—The Bonner Water & Light Company is contemplating improvements to its plant. A. H. Featherstone is proprietor.

BINGHAM, UTAH.—The Utah Power & Light Company is contemplating the installation of ornamental lamps on Main Street.

PHOENIX, ARIZ.—Residents of the Higley District have formed Electric District No. 2 of Maricopa County, for the purpose of securing electrical service.

ST. JOHNS, ARIZ.—The Board of Supervisors has granted Gustav Becker a franchise to furnish electricity in Apache County. Electrical service will be furnished in Springerville, Eager and Round Valley.

Canada

ALLISTON, ONT.—The ratepayers on May 7 approved a by-law authorizing an appropriation of $32,000 to take over the electric-light plant of the Alliston Electric Light Company, and for improvements to the system for the purpose of distributing energy to be supplied by the Hydro-Electric Power Commission of Ontario.

BALA, ONT.—The contract for the installation of an electric plant and street-lighting system has been awarded to Grant & Thorpe of Peterboro.

Miscellaneous

EL CAYEY, P. R.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 5 for the erection of radio buildings, including two wood-frame quarters, one receiving building and one power house, complete with electric lighting, water, plumbing, sewer system, etc., at the high-power radio station at El Cayey. Drawings and specifications No. 2389 can be obtained upon application to the above bureau or to the commandant of the navy yard, New York, N. Y.

1,224,82[illegible]. Electric Motor. Ferdinand Beyer, Charlottenburg, Germany. App. filed Jan. 25, 1915. So constructed that the speed-torque characteristics of such a motor can be modified in order to meet particular service conditions, especially those required for driving spinning machinery.

1,224,9[illegible]. Electrical Connector; Harry A. Dougan, Detroit, Mich. App. filed May 11, 1916. Two members are made relatively movable longitudinally of the structure to bring these members in either of two alternative relations.

1,224,966. Electrical Distribution Means; Edmund O. Schweitzer, Chicago, Ill. App. filed Nov. 26, 1915. Distributing block in combination with a long hollow metallic pole, the block being arranged to be inserted into the upper end of the pole to form a plug therefor and simultaneously to act as a means for connecting the overhead conductors and for enabling any of the overhead conductors to be connected with conductors contained within the interior of the pole.

1,224,970. Lineman's Shield. Frank K. Singer, Pittsburgh, Pa. App. filed Nov. 3, 1916. Comprising a tube of flexible insulating material.

1,224,971. Multiple-Service Connection. John T. Skinner, Lawrence, Kan. App. filed April 24, 1915. Serves not only as an incasement for the terminal connection bar disposed therein, but also as an insulator therefor.

1,224,983. Electric Regulator; Thomas S. Watson, Milwaukee, Wis. App. filed April 9, 1915. Provides a regulator for maintaining approximately constant the voltage on a regulated circuit operating at a voltage lower than that of the circuit from which it is supplied.

1,224,986. Apparatus for Charging Storage Batteries; David H. Wilson, Ridgewood, N. J. App. filed Sept. 16, 1916. Reduces the charging current to a very low degree to allow the gases created by the charging to be dissipated, after which the current may again be increased to a high degree.

1,224,987. Attachment Plug; Robeson B. Wolcott, East Cleveland, Ohio. App. filed Aug. 30, 1915. Can be readily wired.

1,225,014. Electrical Testing Apparatus. Caleb J. Conner, Coatesville, Pa. App. filed Nov. 6, 1915. Arrangement of non-inductive resistances and a galvanometer whereby to indicate approximately the point in an electrical circuit at which a fault, such as a ground, short circuit or the like, may exist.

1,225,051. Portable Electric Lamp; Henry M. Peters, Chicago, Ill. App. filed July 6, 1916. Improved means for holding a shade thereon so that shades of various types may be interchangeably employed upon the lamp base as occasion may require.

1,225,052. Process for Treating Organic Compounds by Electrolysis; Alfred Piguet, Basel, Switzerland. App. filed Dec. 31, 1915. Improved method.

1,225,096. Motor Controller; Charles W. Yerger, Milwaukee, Wis. App. filed Oct. 28, 1913. In connection with electric elevators.

1,225125. Electric Cable Clamp; Monroe Guett, Hartford, Conn. App. filed April 24, 1913. Used for securing the end of a cable within a receptacle such as a wall casing in which an electric switch or some similar mechanism is to be installed.

1,225,127. Connector for Circuit Wires; Lewis W. Heath, Hastings, Mich. App. filed Aug. 2, 1915. Means by which the circuit wires may be quickly and effectively connected and as readily disconnected.

1,225,147. Insulation; Fred M. Locke, Victor, N. Y., App. filed Sept. 4, 1914. Glass or porcelain of high silica content to prevent cracking from sudden changes of temperature.

1,225,175. Apparatus for Generating Electricity; Sylvanus A. Reed, New York, N. Y. App. filed Jan. 16, 1914. Relates to the production of electricity directly from the oxidation of fuel in a battery or cell containing a fused electrolyte and requiring a heater or furnace to maintain fusion.

1,225,194. Arc-Light Electrode; Robert P. Walker, Cleveland, Ohio. App. filed Dec. 3, 1912. Novel way of arranging the end of the conducting wire in cored carbons.

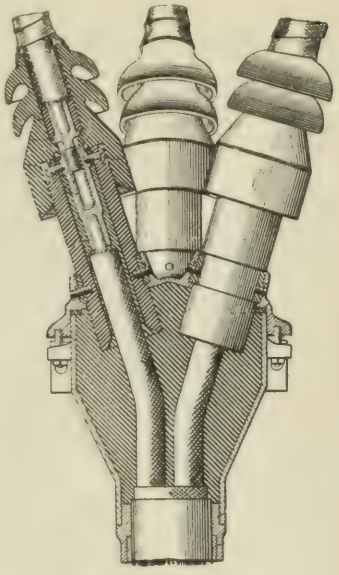
1,225,227. Rheostat; Charles W. Dunham, Edgewood Borough, Pa. App. filed Feb. 17, 1917. Including a biased bridging contact member of such a character that when traversed by current the biasing means for the member will be unaffected by such current, thereby insuring the proper functioning of the biasing means.

1,225,284. Automatic Electric Generating Apparatus; Chester F. Strong, Des Moines, Iowa. App. filed Sept. 15, 1913. When the current being used or discharged by the apparatus is unusually heavy, the internal-combustion engine will be automatically started.

1,225,293. Automatic Electric Generating Apparatus; Chester F. Strong, Des Moines, Iowa. App. filed Nov. 8, 1912. Employs an internal-combustion engine, a dynamo-electric machine adapted to operate either as a motor or a dynamo, and a storage battery, together with automatically actuated elements.

1,225,297. Connector and Connection for Storage Batteries; Theodore A. Willard, Cleveland, Ohio. App. filed July 16, 1915. Improvement.

1,225,298. Connector and Connection for Storage Batteries; Theodore A. Willard, Cleveland, Ohio. App. filed July 16, 1915. Construction overcomes many of the difficulties attending the use of tapered plug connectors heretofore employed on storage batteries.



1,225,299—Pothead Connector

1,225,299. Pothead Connector; Paul F. Williams, Chicago, Ill. App. filed March 15, 1910. Constructional features are such as to render the assembly thereof a simple matter.

1,225,300. Connecting Device for Electric Conductors; Paul F. Williams, Chicago, Ill. App. filed Dec. 11, 1911. Improvement of the design of cable potheads, particular reference being had to the inlet and outlet structures.

1,225,306. Electric Battery; Raymond C. Benner and Harry F. French, Fremont, Ohio. App. filed Oct. 22, 1915. Dry cell.

1,225,312. Speedometer; Allen A. Canton, New York, N. Y. App. filed May 17, 1913. Electrically operated.

1,225,330. Magneto; Otto Heins, New York, N. Y., and Charles M. Wild, Springfield, Mass. App. filed March 1, 1916. Magneto for high-speed engines and particularly a magneto that can be driven directly from the crankshaft of a six-cylinder or a twelve-cylinder four-cycle engine.

1,225,337. Separable Attachment Plug; Walter C. Jones Chicago, Ill. App. filed Jan. 21, 1913. Comprises two body portions separably connected.

1,225,346. Gravity-Battery Electrode; Patrick T. MacNamara, New York, N. Y. App filed April 6, 1916. Larger contact surface and greater electrical contact with the solution.

1,225,357. Variable-Resistance Device; Roy E. Reed, Ripon, Wis. App. filed Nov. 13, 1916. Improvements.

1,225,366. Joint for Electrical Conductors; Charles B. Schoenman, Wilkinsburg, and Ralph M. Houch, Swissvale, Pa. App. filed Sept. 11, 1916. Improved.

1,225,368. Method of Making Resistance Elements; Melvin L. Severy, Arlington Heights, Mass. App. filed Jan. 15, 1914. The shape, direction, and inclination of the resistance curve can be controlled according to this invention.

1,225,373. Method of Electric Welding; Roland D. Thomson, Schenectady, N. Y. App. filed Aug. 21, 1916. Pressure applied by means of a rolling or sliding contact.

1,225,388. Electromagnetic Switch; Joseph L. Woodbridge, Philadelphia, Pa. App. filed Feb. 6, 1915. Operated by a coil responsive to the voltage across a given circuit.

1,225,391. Attachment Plug; Ernst G. K. Anderson, Chicago, Ill. App. filed April 10, 1913. Separable.

1,225,411. Electric Lighting Fixture; Albert Cohn and Louis H. Debs, Chicago, Ill. App. filed Dec. 1, 1916. Pedestal lamp.

1,225,433. Detachable Contact Plate; George W. Gilmore, Alliance, Ohio. App. filed Sept. 14, 1915. May be readily detached from the support provided and replaced as desired.

1,225,457. Combination Coil and Condenser for Dynamos; Charles T. Mason, Sumter, S. C. App. filed Jan. 7, 1916. Positioning of the condenser nearer the primary winding of the coil than has heretofore been accomplished.

1,225,460. Insulator Wall Bracket; James B. McCarthy, Birmingham, Mich. App. filed March 31, 1916. Improvements.

1,225,491. Portable Electric Lamp; Adolph C. Recker, Oakville, Conn. App. filed Nov. 8, 1916. Improvement.

1,225,509. Electric Welding; John A. Seede, Niskayuna, N. Y. App. filed Jan. 9, 1914. Supplying a control circuit, with a resistance member having two adjustable portions and providing means for supplying current through one adjustable portion of the resistance at no load and through a different adjustable portion as soon as the load is thrown on the circuit.

1,225,525. Outlet Box and Support Therefor; Oliver T. Sweet, St. Louis, Mo. App. filed May 25, 1914. Form the main body of the box from a single piece of sheet metal.

1,225,526. Electrical Receptacle; George B. Thomas, Bridgeport, Conn. App. filed April 1, 1914. Adapted to receive plug devices of the well-known Edison-base type.

1,225,534. Electrical System; Richard Varley, Englewood, N. J. App. filed April 27, 1915. Wherein a high-tension flow or discharge of current is effected at a current-using instrumentality such as a spark gap or the spark plug of a cylinder of an internal-combustion engine.

1,225,553. Electrical Conduit; Chauncey W. Abbott, Auburn, N. Y. App. filed June 22, 1914. Metal moldings.

1,225,580. Electric Switch; Harry E. Clifford, Cambridge, Mass. App. filed May 29, 1913. Oil.

1,225,587. Protecting Means for Transmission Systems; Elmer E. F. Creighton, Schenectady, N. Y. App. filed May 14, 1913. Mounts an arcing ring on the insulator carrying the conductor and connects this ring to the mast or tower through a resistance member so that the total resistance offered to a discharge from or to that conductor is of approximately the critical value.

1,225,614. Conduit Connector; Henry R. Gilson, Baden, Pa. App. filed Feb. 21, 1916. Two-part conduits.

1,225,631. Portable Electric Water Heater; Clarence E. Hinkle, Roswell, N. M. App. filed Dec, 13, 1916. Improvements.

1,225,639. Method and Means of Voltage Control; Svend E. Johannesen Pittsfield, Mass. App. filed Jan. 3, 1913. Automatically controlling the voltage on a circuit in any predetermined desired manner irrespective of the load changes.

1,225,686. Electric Controller; Harry F. Stratton, Cleveland, Ohio. App. filed Sept. 9, 1915. Improvements.

1,225,687. Electromagnetic Apparatus; Harry F. Stratton, Cleveland, Ohio. App. filed March 8, 1917. For controlling the acceleration of alternating-current motors from standstill to normal running speeds.

Record of Electrical Patents

Notes on United States Patents issued on May 8, 1917

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The Theft of Energy

HOW to deal with the customer who deliberately steals energy is sometimes a troublesome question. A company does not like to keep in the courts with complaints, nor is it disposed to tolerate the existence of marauders on its system. As a rule energy stealing is comparatively frequent in large cities and rather rare in small places. Possibly there is no more difference in this respect than in the case of some other varieties of crime, but the fact is that the station working in a large city keeps theft down only at the cost of considerable vigilance. A discussion in our columns this week gives a useful clue to some of the indirect methods employed to restrict thieving without constantly rushing into courts. Fortunately, detection in such theft is almost certain. No considerable amount can be obtained surreptitiously without making a discrepancy between installation and meter reading evident to employees of the company, and those who attempt this fraud usually try it on a scale big enough to insure detection. Any suspicious case is run down so easily with a pole meter that the guilty can be caught very promptly.

Of even greater importance, perhaps, than the detection of the thief is the discovery of his confederates. Energy is not often stolen without the collusion either of an employee of the supply company or of a contractor who, for example, connects a garage or other outbuilding outside the meter. To catch the instigator of the crime is important, and sometimes under pressure of impending prosecution the information can be wrung from the thief himself. Usually there is no difficulty in getting adequate compensation for the energy actually stolen, but prevention rather than remedy is the thing most needed. Generally the laws are effective enough and the rest lies with vigilance.

Watching Costs and Rates

EXTRAORDINARY operating costs are having an effect upon rate-making which may be far-reaching. Many reports to the Electrical World tell of revised schedules for power rates. Back of the higher rates which companies are promulgating are higher costs which cannot be overcome by any superior operating methods yet devised. These expenses will not be dissipated by critical analysis. They affected financial results in 1916, in some cases seriously; they are having a profound effect upon current operations; they will influence the future to an extent that no one can foretell. If present conditions are to be regarded as a fair index of what the coming years hold, the rates of all central stations generating energy by steam will be altered.

An indication of the necessities which the companies face is given by the decision of the Cleveland Electric Illuminating Company. By the action of this company power rates for large consumers are raised 20 per cent. Great industrial activity and car shortage have fallen heavily upon properties in the Central West. It is not a question of recouping; it is a matter of protecting against excessive costs in the present acute demand and in the future. Old conditions of operating cost are revised for both central station and isolated plant. Both have to accept the war-time cost basis. Central station conservation is more essential than ever before, but the proud figures of low cost at the switchboard are no longer where they were.

Experiences in the last year are likely to cause a reconsideration of the entire problem of bulk supply and resale for the operation of what should be the largest consumers of the ultimate great central station—the railways. A fractional increase in unit cost is substantial when the margin is small. It may destroy the margin or make it so slight that a contract is no longer justified. In future contracts of this character the companies will be prudent if they take into account the possibility of a repetition of the present expensive contest with the coal situation.

Correlation of Commercial Bodies

OUT of the sagebrush and deserts of Arizona, Nevada and New Mexico and from the fertile fields of California has come many a vision. Indeed, only a dreamer could see the relationship of snow-capped mountains and deep canyons to a distant civilization, and only a pioneer could have the hardihood to interpret the dream. Fortunately, many of the electrical dreamers and pioneers still live to see the fruition of their labors, and it was a happy coincidence that the Pacific Coast Section of the National Electric Light Association should have its first convention in the immediate vicinity of the early work of those daring engineers. Under so great an impetus it is but natural that the section should grow by leaps and bounds. Its membership includes practically all of the operating companies in the states of California, Arizona, Nevada and New Mexico and represents invested capital of close to half a billion dollars, possibly one-sixth of the total electric utility investment of the country, with a gross revenue last year of $50,000,000. In the territory there are seventy-three hydroelectric plants and thirty-one steam plants, with an aggregate rating of over 1,250,000 hp. —the total connected load approximating 2,000,000 hp. —7500 miles of high-tension transmission lines and 25,000 miles of distribution lines to supply about

525,000 consumers. Despite the wide expanse of territory and the scattered 4,000,000 population, no other section of the country can boast of greater diversity of electric application, larger ratio of meters per inhabitant, lower rates for energy and more economical generating costs.

The first convention of the Pacific Coast Section of the N. E. L. A. is now a matter of history, but the seed of a rather extraordinary situation which developed at Riverside during the meeting has begun to take root and may eventually result in a more comprehensive handling of the affairs of the electrical industry on the Pacific Coast at least. In attendance at Riverside were a large number of manufacturers, jobbers and dealers who contributed not a little to the success of the convention. They could not, however, participate in the proceedings, and it was felt that the attitude of the manufacturer, jobber or dealer who in the deliberations of the industry is obliged to sit on the outside while those representing other branches sit within cannot be so productive of good as if all sat together and conferred on each phase of the whole problem. Here, then, is the germ of a larger and bigger organization of which the central stations will be a part and in which they will have their own deliberations. So far, outside of the Society for Electrical Development, no attempt has been made to correlate the activities of the various commercial electrical organizations, although many have been suggested. Possibly the Pacific Coast can work out such an organization which may serve as the nucleus for a larger and national body. If the stress of war conditions should bring this about, it would be a great blessing.

Keep Your Reflectors Clean

THE loss of light due to dirty reflectors is a very much larger item in illumination than most people realize. Persons interested in the general discussion of the subject will find Mr. Kegerreis' paper on the subject extremely suggestive. The theory of the matter in its approximate form is rather simple, the chief difficulty in its application being the determination of the experimental constants which vary so greatly from place to place, and probably from time to time at the same place, that accurate estimates are difficult. Perhaps the chief moral to be drawn from the discussion is that in the design of fixtures greater attention should be paid to facility of cleaning than is now common. At the present time when a large proportion of interior lighting is provided by indirect and semi-indirect fixtures the losses from lack of cleanliness are greater than formerly. Dust on the outside of a shade looks badly but is not particularly serious from the standpoint of illumination. Turn that shade, be it translucent or opaque, upside down and let the dust accumulate on the inside on the reflecting surface and the results at once become serious. Everything that raises the cost of cleaning raises the cost of illumination, either in labor or in electrical energy, if the fixtures are neglected. Fortunately with modern lamps the cost of energy is relatively small, but the lighting installation is usually designed on the theory that it will be kept in first-class average condition while the fixtures may be such as to reduce the light output by a third or a half after a comparatively short time. Hence any complaint of poor illumination should be investigated from the standpoint of cleanliness of the fixtures as well as from that of lamp renewals and proper voltage supply.

Increasing Efficiency Through Superheat

IN DISCUSSING the tendency toward higher steam pressures in steam station practice last week we commented on the conservatism of boiler manufacturers in treating all high-pressure appliances as "special," with the usual result that such appliances command higher prices and are surrounded with all the uncertainties and difficulties of delivery and repair common to special goods. For this there is not much excuse; but there is even less excuse for the extreme conservatism in the matter of superheating that has held even up to the present time. A few years ago it was almost impossible to get a reasonable amount of superheating in American steam apparatus. A call for bids involving 200 deg. or 250 deg. Fahr. (93 deg. to 121 deg. C.) of superheating was almost invariably met by a long-winded letter to the effect that "Our chief engineer does not consider it wise to attempt more than 125 deg. Fahr. (52 deg. C.) at the outside. Anything beyond this must be regarded as uncertain and dangerous practice for which there is no good precedent," and this in face of the fact that double the figure named had been customarily in use for some years past almost anywhere abroad.

Time has broken down even the conservatism of the unready, and, as the N. E. L. A. report shows, big stations are drifting to superheat of 250 deg. Fahr. (121 deg. C.) and pressures of not less than 250 lb. (17.6 kg. per sq. cm.). Indeed, there is a strong tendency to work to even higher pressures. The boiler makers are conservative as usual, blandly throwing cold water on the high-pressure proposition. They are talking in just the same terms now that they used regarding 250-lb. (17.6 kg.) pressures ten years ago, and whether with any better reason remains to be seen. There is undoubtedly a point, as boiler engineers well know, beyond which increase in economy does not pay the overhead charges. At just what figure this is reached, particularly when one considers high superheat as an alternative, no one can as yet say, but with the terrific increase in the cost of fuel it is certainly up to designing engineers to find out exactly this thing and to do it at once. It may be that 250 lb. to 300 lb. (17.6 kg. to 21.1 kg. per sq. cm.) pressure with high superheat is the figure of maximum economy, or that figure may lie 100 lb. or 200 lb. (7 kg. or 14 kg.), or as many degrees, higher. The drift of thought in engineering practice, however, is perfectly clear. It is working steadily toward maximum thermo-dynamic efficiency obtained by the use of big units and by the employment of the greatest feasible temperature range in the prime mover. Ten or 15 per cent saving in the coal bill with

coal at $2 a ton ($2.20 per metric ton) is not worth a very heavy expenditure. With coal at anywhere from $5 to $10 a ton ($5.50 to $11 per metric ton) the situation changes with appalling rapidity, and all our previous notions must be revised. The encouraging feature of the situation is that some of the boiler makers are facing the problem courageously, despite the timidity of others, and under the stress of necessity the demand for improvement may be promptly met. Certain it is that fuel conditions demand a higher degree of efficiency than has ever been before attempted, and these conditions, thrust upon us by temporary stress, are, if experience may be taken as a guide, more than likely to acquire permanence.

Cheap Hydroelectric Power

AS OUR readers know, electrical energy is about the only thing which has steadily fallen in average price through a period of unexampled inflation in the cost of necessities. In a very suggestive article Mr. Hoar brings forward the optimistic proposition that it is going to be practicable to reduce power rates from hydroelectric plants still further and thus to extend a helping hand to growing industries while gaining profitable business for the supply companies.

In considering any such question it must be fully realized that our present conditions are highly abnormal. We have to deal not only with the ordinary growth of manufacturing but with industries which directly or indirectly depend immediately on the existence of war conditions and upon the industrial changes which these may bring about even after the termination of hostilities. Mr. Hoar very properly lays emphasis on the special characteristics of such industries, especially the feature of unknown permanence which renders them less desirable customers than the ordinary classes.

It is undoubtedly true, as he indicates, that in some cases very low rates can be made profitably to certain consumers, but we do not see how, under present conditions, power prices can take a strong downward tendency. The expenses of supply companies are steadily increasing. With copper at 30 to 40 cents and aluminum jacked up to nearly equivalent figures, with electrical machinery at considerably enhanced prices, labor calling for greater returns, and coal for auxiliary service frequently held at exorbitant figures, the product of the central station cannot be expected to fall in price.

While it is absolutely correct, as Mr. Hoar shows, that in many instances very low figures by the horsepower-year or some equivalent method have been charged with profit to the supply company in the past, it is equally true that many a station with long-term contracts of this kind has found itself very gravely handicapped in taking on more profitable business, particularly after the point is reached where auxiliary steam power must be used more and more. During the early stages of development in a hydroelectric property before the peak load has reached the full capacity of the station, costs of operations are almost independent of the load and consequently power supplied even at a very low rate is a temporary advantage. It is not a far-sighted policy, however, to load up a station for the sake of temporary benefits at a price which, at a later stage of operations, will inevitably prevent the sale of power at a rate adequate to allow for the considerable use of auxiliary steam.

The true criterion of equitable rate for large blocks of power is not the effect of the total payments in helping out running expenses at the beginning, but the final effect of the particular load proposed on the load factor and the diversity factor of the plant. A large and steady customer may be very advantageous or exactly the reverse according to the relation of his load requirement to the general service of the station. Far too great attention has been paid in the past to quantity demand, and far too little to the relation of the demand in point of time and quantity to the general service. The maximum demand method of reckoning, now fortunately lessening in popularity, was and is a dangerous source of error in that no account is ordinarily taken of the time relations of the maximum. A maximum demand of 1000 kw. between 3 and 6 o'clock in the morning is a very different proposition from the same quantity between 3 and 6 o'clock in the afternoon, and the difference tells most vitally in the case of hydroelectric plants with limited capacity.

The moral seems to be that each case must be considered by itself, and provision should be made in station practice and in commission rulings for such study of individual conditions as shall show whether a large consumer of power can be, or cannot be supplied profitably from a given system.

The Coming Issues

UNTIL recently, it is surprising to say, comparatively few factory managers have appreciated the value of adequate illumination in their plants. In many cases the lighting equipment has been looked upon only as an aid to night work and production during the dark hours of winter. If adequate illumination is not furnished the efficiency of workmen will be decreased, the product developed will not be of the best quality, production will be reduced, accidents will be more prevalent, etc. In an article to be presented next week, C. E. Clewell will point out other reasons why factory owners should give more attention to lighting. In addition he places a dollar-and-cents value on good lighting and shows how the expenditure for adequate lighting equipment can be more than offset. Some very convincing arguments for better illumination will also be presented which have been collected from factory workers, foremen and managers. The subjects treated should be of interest to central station companies in developing their lighting service business. Unusual interest attaches to the monthly compilation of central station revenue and output, which will be published in the issue of June 2. Many conflicting influences affect business in different sections of the country and the gradual development of these will be revealed authoritatively by the ELECTRICAL WORLD statistics. The characteristics of and field for different types of oil engines will be discussed in the second issue of June.

How to Detect and to Deal with Electricity Thieves

Methods and Practices That Central Stations in Every Part of the Country Have Found Valuable in Making Collections and in Stopping the Theft of Electric Energy

IF A man steals electricity his chance of being detected is splendid—about 100 per cent sure. Furthermore, it is very sure that he will pay in full for the energy stolen. An inquiry conducted by the ELECTRICAL WORLD shows that while there is leniency among central stations generally in the matter of demanding full legal prosecution of the electricity thief, there is absolutely no disposition to let him escape without paying well for the service he used

In fact, the canvass of the situation indicates that about 20 per cent of the companies which have thievery to deal with favor full legal action, while the remaining 80 per cent for various reasons favor collecting money from the malefactor without process of law. Where prosecution is favored it is usually a last resort, adopted in a territory or a community where to stop increasing depredations examples must be made of those who are caught. Such situations rarely arise in the smaller cities. In fact, companies in cities of 10,000 population and less have but few cases of energy stealing to deal with and can usually adjust matters satisfactorily with the culprit outside the courts. When it is necessary to resort to the law, however, some companies find themselves more fortunately situated than others in that adequate statutes are provided in some states and are not in others. In many states, because of the wording of the laws, it is difficult to secure sufficient evidence to guarantee conviction.

Methods Followed in the Far West

There seems to be a particularly effective law against stealing energy in the Far West. From this region one company writes: "In this city of 300,000 people we collected $1,014 from eighty-seven offenders in 1916; we obtained ten convictions and lost only one case (a woman) after three trials. It is our practice, if the offender is willing to pay for the energy plus a charge for special inspection, to collect our money and drop the case. If he denies his guilt and refuses to pay, he is arrested and tried in the police court, the prosecution being carried on through the corporation counsel's office." Another Pacific Coast company which has tried diplomacy and cash settlements with no lasting effect now arrests and prosecutes everyone caught stealing energy. The company's own attorneys, getting permission from the prosecuting attorney, handle the cases. The usual fines have been $25 and costs, or $42. In some cases fines of $50 and costs were obtained. One Coast concern serving a large territory has a policy of prosecuting energy thieves to the full extent of the law.

Because of the knowledge of the public that there is little chance of injury from wires carrying electricity for lighting, there has been a gradual increase in thefts of energy on this company's lines. About a year ago it decided, therefore, upon a strenuous campaign against these offenders. Now not only are these cases prosecuted but a full account of each case is published in all daily newspapers. When the campaign was started the attention of the courts was called to the fact that energy thefts were on the increase. The courts co-operated with the company by increasing the penalties. It had previously been the practice of the courts to fine the offenders a sum from about $10 to $25, but recently fines as high as $300 were assessed. In one case after the court assessed a fine of $300 a civil suit was brought for the energy used and the full amount of judgment was awarded as prayed for, $278 plus costs. This case cost the offender, after he had paid his fine, the cost of energy and his attorney's fees, approximately $800. In another case recently an offender was given a straight jail sentence of three months, which he served, in addition to being compelled to pay $78 for the energy stolen. Both of these cases, as well as many others, were given widespread publicity through the newspapers, with the effect that there are now very few cases of energy theft.

How to Conceal a Pole Meter from a Suspect

Other companies deem it advisable "to make a peaceful settlement with the customer." The practice in such cases as outlined by one company is to send at least two employees to the premises in question and remove whatever has been done to tamper with the circuit. This is done if possible in the presence of the consumer, who later is notified to call on the company's general agent. If he refuses to call, he is further notified that unless he calls within a specified time he probably will have to call at the police station. Invariably he calls. The matter is talked over and he receives an opportunity to settle with the corporation for all of the energy which it is figured has been stolen. He is advised to make the settlement in order to save himself the publicity of having his name mentioned in the papers as having been arrested for stealing, and generally he "comes through" very gracefully.

Where a consumer is suspected of stealing energy by some means which this company is not able definitely to determine, the meter is connected in series with a meter in an old transformer case, as shown herewith. This concealed meter is hung on a pole as close to his premises as possible without his becoming aware of what is being done. After the meters have run in series for ten days a box is put around the meter in his house and locked up; then the meters are allowed to run in series for another week or ten days. With this evidence at hand this company feels that it is sufficiently fortified to insist upon the consumer coming to its office, where he is accused of stealing energy and asked to settle.

Another company which follows practically the same procedure as to settlement had been disconnecting service as a means of bringing the offending customer to the office. The reason for abruptly discontinuing service under these circumstances is given as follows:

"As soon as theft of current is discovered we immediately disconnect service and take no immediate steps to approach the consumer. Owing to the fact that the lights of one who was a very free user of service have

been turned off the neighbors are inclined to gossip about it. The consumer usually calls on us within two or three days, and we then present him with what appears to him to be very incriminating evidence. He is told that the matter is a very serious offense and that our legal department is considering prosecuting him, but if he will call within a day or two we will give him definite information. We purposely postpone immediate settlement for several days, during which time the consumer becomes very anxious for reconnection of service and fearful of prosecution. He is then about in the right frame of mind to pay the estimated bill. By following this practice we have been uniformly successful in collecting for stolen energy."

STAGING A "SCARE" TO MAKE COLLECTION EASY

Companies operating in states the laws of which do not adequately protect against energy thefts have had to devise clever means of collecting for stolen energy



FOR CATCHING THE ELECTRICITY THIEF A METER IS MOUNTED ON A POLE WHERE IT CAN BE CONNECTED IN SERIES WITH THE METER

A section of the transformer case can be sawed out and the opening covered with a large name plate to facilitate the work of reading this concealed meter.

and preventing recurrence of the theft when the miscreant is discovered. One company, because it has not been able to obtain convictions, now contents itself with removing the house meter and replacing it by a meter on a near-by pole. Another company, operationg in a town of 5000 people, reports that it keeps on hand twelve boxes with meters installed in them. One of these can be installed on a pole at a cost of 50 cents. These twelve meter boxes have been found to be a paying investment. Others have tried discontinuing service, then tried pole meters, but are giving up this practice in favor of meter protective devices. In some cases the companies in collecting for the energy stolen add an amount sufficient to cover the cost of protective devices and in this way make the customer pay to prevent himself from repeating the robbery.

Another method of restraining a suspicious customer from repeatedly making unauthorized connections is outlined by a Southwestern company as follows:

"Following an agreement of willingness on the customer's part to pay for unregistered energy, we try to have him sign a statement in substance as follows:

> This is to advise that I have been using electricity from the wires of your company at ..... Street which has not registered on your meter. I have known that I was securing electricity in this way, and I herewith tender you $.... in settlement for the electricity so used.
>
> Name.....
> Address.....

"We feel that a statement of this character in our possession should at least have a restraining influence against the culprit attempting further theft of electricity. In the event that the signer should attempt a further theft, this statement would—should it be desirable to do so—be helpful in filing civil proceedings."

With the great majority of central stations, which desire not to prosecute electricity thieves, mainly because of the unfavorable public relations that might result, the problem is one of frightening the offender sufficiently to make collection for energy used easy. With this in mind, one lighting company gets the local prosecutor to send for the miscreant, to give him a "good talking to"—a scare. Then newspaper publicity, without mentioning any names, is obtained for the case. The item is also given out through the prosecutor. There is no arrest, no prosecution. The company believes the advantages of this plan are obvious.

In one community, after the contract department has explained the enormity of the offense with all the force the "star" salesman can muster, the accused person is handed a copy of "Senate File, No. 259—An Act to Prohibit the Theft of Electric Current, April 10, 1910." The extended legal phrases of this document, it is said, aid in collecting a bill based on "a rather liberal estimate of the energy appropriated." It has been found in a city of 15,000 in the West "that the most effective remedy for electricity stealing is to present a bill for $50, sending it to the offender by registered mail. The bill reads as follows:

> For electricity consumed for an indefinite period not registering through the meter.....$50.00

This practice when it was adopted soon became well advertised among the energy-stealing public and practically eliminated the trouble."

It is a favorite practice in many places when a theft is first discovered to secure informally the services of a police officer. While the company's representatives treat with the miscreant in his house, the officer strides conspicuously back and forth in front of the residence. Another company sends a local police sergeant to make the collection. His brass buttons and gruff manner automatically cause the proper scare. It is the practice of a utility serving several small cities in New Hampshire to secure a warrant for the arrest of the one who made the connections and to take him before a local lawyer on this warrant, which by arrangement made beforehand with the sheriff is not served. The company has the lawyer appear for the man. The company's representative states the case before the sheriff and the lawyer. The lawyer advises his client to make a cash settlement and collects a fee for himself and the sheriff. In another city served by a municipally owned plant all cases are settled by collecting the amount due in secret sessions of the local Board of Public Utilities. Some companies in Eastern cities have found it effective to complain to the fire marshall when wiring was tampered with. In such cases this official proceeds against

the thief on the basis that his action is a menace to lives and property and that a serious fire might have resulted from the "defective" wiring. In many cases photographing the unauthorized connections is resorted to in order to make a display of seemingly incriminating evidence when the customer is approached for collection.

In the very large cities it is generally necessary for companies to maintain a special department which among other things handles all cases of electricity stealing. This department in one city receives from the meter-testing, inspection and other departments 250 "leads" a month. No cash offer is made for these leads in this particular city, but offers as high as $15 are made to employees of some companies for such information. The company in question investigates all suspicious circumstances, and in 80 per cent of the suspected cases there proves to be nothing really wrong. The other 20 per cent, however, bear further investigation. Through the operation of this department, requiring the part-time services of five men, the company recovers $650 a month, or about $150 more than it costs to operate the department. The detail procedure of the department is as follows:

How to Keep a Constant Watch on Suspects

When the lead is received, the name, address and peculiarities are entered on a card. This card is kept in a file until the case is investigated. If evidence of theft is discovered, the department tries to collect an amount equal to the price of energy used plus the cost of investigation and collection. It resorts to prosecution only in extreme cases. On cases in which theft is discovered another card file is kept. It contains a continuous record of monthly meter readings. Should the readings fall off for any three consecutive months, a reinvestigation is made. This file is an accurate check on the action of any customer who has been found to know how to steal electricity.

It has been found by this company that certain classes of people are the worst offenders. Among these are saloonkeepers, who usually dispense drinks to linemen or wiremen for making an unauthorized connection; dentists, who because they possess mechanical ability, tools and leisure tamper with the meter itself, and janitors who make a practice of doing wiring for apartment dwellers. It is also said that the man who advises the company's employees to beware of his cross dog will bear watching. Another source from which trouble may be expected is the wired but unconnected house.

Broadly speaking, it seems to be the opinion of central stations that it is not good policy to prosecute electricity thieves if a proper collection can be made and if sufficient publicity can be given to this collection to deter others from trying the same scheme. While it is not the general practice, it seems that a constant but inoffensive watch should be kept on everyone who has ever been an offender. One concern marks meter cards of such people with a "W" in a 1-in. red circle. This warns the meter-man to be on the watch. Where an "epidemic" of stealing is encountered, however, it seems to be necessary to make examples of some of the offenders to stop the growth of unauthorized use of electricity. What is perhaps the most optimistic note in the whole situation comes from a Georgia company, which says: "Since Georgia has become a prohibition state the saloons—the worst offenders—are eliminated."

METHOD FOR TESTING INSULATION

New Method Based Upon Discovery of Effect at High Voltage Tests of Presence of Moisture

Results of insulation-testing investigations have been made the subject of a method patent (No. 1,212,467) issued to Sidney Evershed, who is with the firm of instrument makers, Evershed & Vignoles, Ltd., London, England. This step is rather remarkable in that no new type of instrument is involved in the claims.

The basis for one claim rests upon the discovery by research that one of the causes of the relatively low resistance of insulations when tested at high voltages is the presence of moisture in absorbent insulating materials in the form of drops and thin films which form leakage paths for electric current. When an insulator in that condition is subjected to electric pressure the propelling force known as electric endosmose drives water out of the drops in the films, thereby increasing their thickness and decreasing the resistance of the leakage paths.

If the electric pressure is gradually increased the insulation resistance of absorbent materials falls, rapidly at first, but more and more slowly as higher pressures are attained. The relation of voltage to insulation resistance may be expressed by a smooth curve which is convex to the base line from which resistance ordinates are measured, so long as the endosmose or film effect is the principal factor in determining its shape or law of curvature. Ultimately, if the increase in voltage is continued, the curve passes through a somewhat undefined point, or region, of inflection, and then begins to bend downward toward zero resistance, the curvature rapidly increasing until actual breakdown occurs. The complete characteristic curve, as it may be called, therefore consists of two parts of opposite curvature joined at a point or region of inflection, indicating the growth of a dangerous mode of leakage which ultimately ends in a breakdown of the insulation. These two significant parts of the curve may be referred to as the "film curve" and the "breakdown curve."

The law expressing the shape of the film curve is much the same for all absorbent materials, provided they do not contain more moisture than they can harbor in the form of drops and of thin films. Changes in the number of films acting in parallel do not affect the safety of the insulation, nor do they alter the law of the curve although an increase or decrease in the number of film paths necessarily lowers or raises the general level of the curve. Hence so long as the shape of the first part of the characteristic curve indicates conduction by films, the general curve level is unimportant. On the other hand, the presence of an excessive amount of moisture, particularly when it is in the form of local accumulations of water in bulk, is liable to produce a dangerous condition. This is due to the extensive electrolytic action which takes place under such conditions if the excess of water is not detected and removed before the conductors and insulating materials have been seriously damaged. Leakage conduction of this kind follows Ohm's law, since the resistance does not vary with the voltage, therefore the characteristic curve would follow a straight-line parallel with the base line. Hence the shape of the first part of the characteristic curve enables prompt discrimination between safe and dangerous modes of leakage through damp insulating materials.

Collection of Delinquent Accounts

Outline of Results Obtained by Means of Competition Between District Offices—Employment of Young Attorneys Found Effective —Inadvisability of "Bluff" in Threatening Cut-Offs

BY LEWIS A. MCARTHUR

General Manager Pacific Power & Light Company

A DELINQUENT account is not necessarily a bad debt, but it frequently winds up in that class, and it is very desirable from the point of view of an executive of any central station to see that the man in the field is doing his utmost to keep down the amount of delinquent accounts.

In most central stations in the average-sized and smaller communities service bills are due on the tenth of the month following the period of service, and frequently discounts are given to persuade customers to pay within the ten-day period. Most companies do not generally consider accounts actually delinquent until the books are closed again at the end of the month, thus calling all accounts active that are outstanding for a period of less than thirty days from the date of billing. Some companies consider their uncollected accounts delinquent on the eleventh of the month after service or on the day immediately following the end of the discount period.

KEEPING TRACK OF DELINQUENCIES

The most effective method of keeping track of the amount of delinquent accounts is to compare it with the total annual gross earnings. Of course the actual percentage will vary with the territory occupied by different companies and the type of people served. The Pacific Power & Light Company has made some interesting examinations into the question of delinquent accounts and the best method of clearing them up.

In January, 1916, a table was made of all the district offices, this table showing the percentage of delinquency at each place. These percentages varied all the way from 0.42 per cent to 19.2 per cent. The first-named community was one that was well off and the business was not scattered. The other community was in a very extensively irrigated district where farmers' accounts had to be carried for a considerable time before they were paid. Only two branches showed above 5 per cent of their gross earnings as delinquent, and most of them ranged round 1 per cent to 2 per cent.

PRIZES OFFERED TO KEEP DOWN DELINQUENCIES

A prize of $15 was offered to the district manager who should during the following year proportionally reduce his percentage of delinquency the most. In addition to that, two special prizes were offered to the men who should do the best general work, taking into consideration not only the proportional reduction in delinquencies but also the amount of money collected. The branches varied so much in size that the proportional method had to be adopted in awarding the first prize.

During the ensuing year the district managers were urged every month to keep after their delinquents. The traveling auditors went over the delinquent reports from month to month, and they were also checked up in the general offices in Portland. The most effective method of collecting was to get some rising young attorney in the country towns to go after the bad accounts on a commission basis. This method always brought returns. Letters from the company gave less satisfaction. Personal calls were found to be effective. Discontinuance of service in extreme cases was found to be highly satisfactory.

By the middle of the year the branch that had stood at 19.2 per cent had been reduced to 9.13 per cent and the other reductions had been in proportion. At the end of the first year there was no amount that stood over 13 per cent delinquent and there were six that were less than 1 per cent delinquent. All branches with the exception of two were less than 2 per cent delinquent. The actual reduction in dollars and cents amounted to about 33 1/3 per cent. This work is being kept up every day and is still producing good results.

TABLE OF DISTRICT OFFICES SHOWING PERCENTAGE OF DELINQUENCY AT EACH DURING COMPETITION

Office	Jan., 1916	Aug., 1916	Nov., 1916	Jan., 1917
Vancouver	2.03	0.743	0.69	0.39
Pendleton	0.88	0.93	0.73	0.54
Walla Walla	0.84	0.775	0.80	0.58
White Salmon	3.71	1.66	0.87	1.45
Dayton	0.78	1.38	1.06	0.46
Prosser	0.86	1.15	1.26	0.95
The Dalles	0.42	0.905	1.39	1.44
Lewiston	1.59	1.15	1.47	1.72
Pomeroy	1.26	1.74	N.R.	0.85
North Yakima	1.57	1.58	1.97	1.73
Goldendale	1.52	2.33	2.38	2.43
Astoria	1.50	1.25	3.35	1.49
Hood River	1.71	2.86	3.90	5.00*
Sunnyside	4.90	3.70	4.20	2.38
Toppenish	5.81	5.53	4.69	2.33
Pasco	19.20	9.13	13.35	12.80

*Estimated.

We feel that the use of young attorneys is desirable. We mail cut-off notices where that course seems necessary, and in every case a cut-off actually takes place on the date indicated in the notice. We do not send out cut-off notices as a bluff; that method has been proved to be ill advised and accomplishes nothing. One of the best ways to keep on the look-out for bad debts is to make careful examination of customers' credits before services are connected, bearing especially in mind that frequently a customer will come back to a community where he has lived before and where he may owe the light company a small balance. We have card indexes of our bad-debt customers for a number of years back, and every time a person applies for service we check him up on the bad-debt register to see if he owes the company anything.

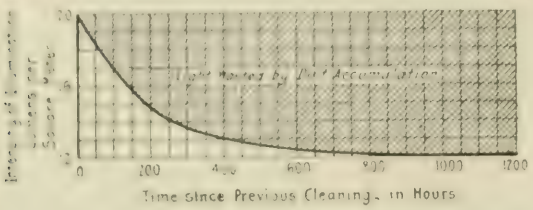
We find that less than one-half of 1 per cent of our gross earnings finally are charged off to bad-debt accounts. This we consider to be a fair record in a business badly scattered and dealing with many farmers who receive their income only once a year.

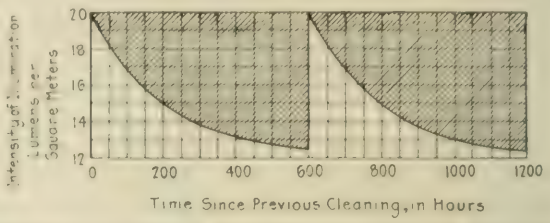
Costliness of Light Absorption

Importance of Preventing Dust Accumulation in Lighting Fixtures, Graphical Method of Determining the Most Economical Frequency for Cleaning, and Data Based on a Specific Case

BY ROY KEGERREIS

THE cost of good illumination is practically insignificant compared with many of the other running expenses of a factory or office, but there is perhaps no other item in the current expense account which so vitally affects the successful operation of an establishment. One of the chief benefits which are derived from good illumination is that the quality and quantity of the workmanship are increased. It has invariably been found that the wastage due to spoiled work is greatly decreased upon the institution of scientific illumination. Increased cleanliness is usually one of the direct results of improved lighting conditions. Many businesses are carried on with a small margin of profit, and it is therefore manifest that even a little saving on an item which may involve only a small percentage of the entire business will very materially make itself felt in the net profits.





FIGS. 1 AND 2—LIGHT WASTED BY ACCUMULATION OF DIRT WITH DIFFERENT INTERVALS BETWEEN CLEANING OF FIXTURES

The light from lamps deteriorates because of the collection of dirt on the light transmitting or reflecting surfaces, and also because of an inherent falling off in the luminous output of the lamp (due to blackening of the bulb in the case of incandescent lamps). Neither of these causes can be eliminated, but the effects of the first may be minimized by correct maintenance and cleaning, while the second may be lessened by proper renewal after the efficiency has fallen to such a value that it is most economical to discard the light-giving unit and replace it with a new one. Two distinct problems are thus involved, in that it is necessary to determine the useful life of a lamp and the proper frequency of cleaning. Considerable study and attention have been devoted to a complete analysis of the former problem, but the latter has been somewhat neglected. In what follows the writer will endeavor to present some definite data on it which should be of service in securing the most light for the least expense.

The light which is given off by a fixture is decreased by the accumulation of dirt. With most lamps it is dependent only on the time since the last cleaning and has very little to do with the actual number of hours which the lamp may be in use. The electric arc and gas lamp are exceptions to this statement to a certain degree. The one criterion for all comparisons and calculations of illumination is the useful light obtained. It is the product for which the money is ultimately spent and should accordingly be the basis for cost comparison. Fewer or smaller well-maintained lamps should be used, rather than permit an installation to be operated inefficiently.

Data for a typical case are given in Fig. 1, and from this it is apparent that there is a rather rapid falling off in the efficiency at first, after which practically no further decrease takes place. The shaded area between the curve and the horizontal line through its starting point represents the light which is lost because of the accumulation of dirt. The cost of this light gives the financial loss which is due to the dirt accumulation. If the fixtures were cleaned once during the time over which the graph extends, the area which represents the wasted light would be materially decreased, as is indicated by Fig. 2. It is thus apparent that much light may be saved by cleaning, but the cleaning involves an expense, and so the general problem of determining the most economical number of cleanings presents itself.

The most economical frequency of cleaning is dependent on the cost of the cleaning, the cost of the light and the form of the dirt-accumulation curve. The problem may be solved after these three factors have been determined, which may be done quite accurately for any given case if sufficient care and expense are directed toward their determination.

Two obvious methods may be used—the mathematical and the cut-and-try method. The latter is accurate enough, but becomes quite tedious since the process is somewhat involved because of its complicated nature, as may be inferred from the following solution.

The physics involved in the absorption of light by the constantly accumulating dirt and the form of the curve suggests that the graph is exponential. It becomes asymptotic to a horizontal line, and it accordingly follows that any law of variation which may govern the curve is very probably dependent only on the part of the ordinates above the horizontal asymptote. Fig. 3 results if the difference between the ordinates of the curve and the ordinate of the horizontal asymptote are plotted against time on semi-logarithmic paper, the logarithm of the ordinate differences being plotted on the ordinate scale. The resulting straight line conclusively shows that the curve of Fig. 1 is exponential.

A general form of the equation for the illumination efficiency curve is $y = a + be^{cx}$, the constants of which may be determined. By inspection $a = 12$, so when $x = 0$, $a + be^{cx} = a + be^{0} = a + b = 20$, therefore $b = 8$.

The quantity c may now be determined by selecting a suitable point and equating the ordinate at the point selected to $12 + 8e^{cx}$. Taking a point at $x = 150$, where $y = 15.75$, this equation reduces to $12 + 8e^{150c} = 15.75$, or $e^{150c} = 0.47$ and $150c = \log_e 0.47$. The second member $= \log_e 4.7 - \log_e 10$; therefore $c = -0.0050$. The equation for the curve of Fig. 1 is then $y = 12 + 8e^{-0.0050x}$, where x is the time in hours which has elapsed since the previous cleaning.

The horizontal line to which the curve of Fig. 1 tends to become tangent represents what the light production would be if the fixtures were never cleaned—which is a very common case in many places to-day. The area between this asymptote and the actual performance curve then gives a measure of the light which is saved by cleaning. The next step is to obtain an expression for the relation between the light saved and the time between cleanings, the obvious expression being:

Lumen hours saved per year per square meter =

$$k/24 \left[\int_{x=0}^{x=g} 8e^{-0.0050x} dx \right] \frac{8766}{g}.$$

k = average hours that the lamps are in use per day, g = hours between cleanings, and 8766 = hours in a year, which is taken as the time period for comparison.

By integration a more workable expression can be secured for the relation between the frequency of cleaning and the saving which results therefrom:

Lumen hours saved per year per square meter =

$$k\left(\frac{584{,}400}{g}\right)(1 - e^{-0.0050g}).$$

Fig. 4 gives the curve for this equation, with the value of k taken as twelve hours. The value of the light which is saved by the cleaning may be found by multiplying the expression for the light by the cost of a unit amount of light.

Saving per year per square meter =

$$k/g\,(584{,}400)\ (1 - e^{-0.0050g})\,0.0016 \text{ cent}$$
$$= k/g\,(935)\ (1 - e^{-0.0050g}) \text{ cents.}$$

curves of Fig. 5 gives the criterion for determining the most economical number of cleanings to give the lamp fixtures. The saving in cents per square meter per year which is effected by the cleaning is then equal to

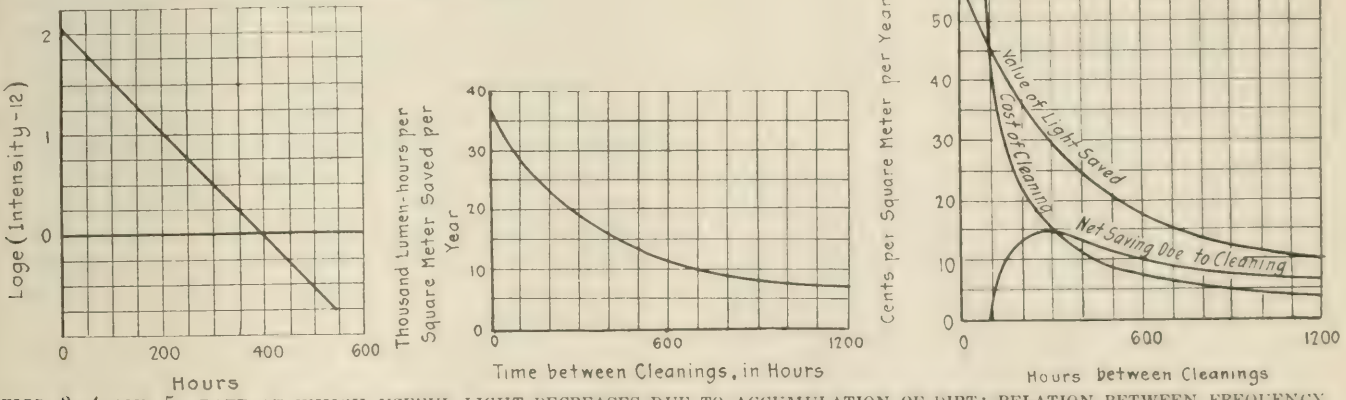
$$\left\{ \left[k/g\,(935)\ (1 - e^{-0.0050g}) \right] - \left[\frac{8766}{g}\ (0.5) \right] \right\} \text{cents.}$$

The third curve of Fig. 5 represents the preceding equation graphically. The most economical conditions exist when the time period between cleanings is such that the positive difference between the saving due to the cleaning and the cost of the cleaning is a maximum. This condition corresponds to the top of the hump in the curve. This is the desired answer to the solution, and not only gives the proper time which should separate successive cleanings but also shows the saving which will result with such a frequency of cleaning. The expense of the lighting will be higher than it should be if the cleaning is done less often because of the excessive cost of the light which is lost in the accumulation of dirt, and it will also be higher than it should be if the cleaning is done oftener than is indicated by the hump of the curve because the cleaning will then cost so much that the maximum saving cannot be effected.

The curves of Fig. 6 are exactly similar to the foregoing except that different hours of burning per day are assumed. The variation of the position of the desired maximum point with different hours of burning may be found by equating the first differential of the equation of the curve with respect to g equal to zero. The resulting equation is $-935k/g^2 + 935k/g^2(e^{-0.0050g}) + 935k/g\,(0.0050e^{-0.0050g}) + 4383/g^2 = 0$. Multiplying by $g^2/935$ and equating to k, the result is

$$k = \frac{4.7}{1 - [e^{-0.0050g}(1 + 0.0050g)]},$$

the curve of which is shown in Fig. 7. It will be noted that this curve becomes asymptotic to the vertical



FIGS. 3, 4 AND 5—RATE AT WHICH USEFUL LIGHT DECREASES DUE TO ACCUMULATION OF DIRT; RELATION BETWEEN FREQUENCY OF CLEANING AND LIGHT SAVED; AND VARIATION IN COST OF CLEANING WITH FREQUENCY OF CLEANING BASED ON LAMPS BURNING TWELVE HOURS A DAY

The curve for the saving which results from the cleaning shown in Fig. 5 is exactly like Fig. 4 with a different scale along the ordinate axis, since the equation of the curve of Fig. 4 has merely been multiplied by a constant, the cost of a unit amount of light.

It is evident that the cost of cleaning will vary inversely as the time between cleanings. The equation which represents the cost per year for cleaning a square meter of floor space is then $y = (8766/x)\,0.5$ cent. This equation represents a hyperbola, as is shown by the resulting curve in Fig. 5. The relation between these two whose abscissa is 4.7 hours. This shows that cleaning is unprofitable when the lamps are used less than 4.7 hours per day since the most economical time goes to infinity at this ordinate.

It is now possible to plot Fig. 8, which shows the maximum saving which may be realized for different hours of burning per day. This curve, as well as the previous one, very plainly indicates that a rather paradoxical condition exists when the lamps are used only a few hours per day—*i.e.*, it is more economical to operate the installation without cleanings, at least except at

extremely infrequent intervals, which would be of the same order as the general cleanings the interior as a whole would get.

Individual lamps vary in efficiency throughout their life. It is assumed, however, that any system to which these methods of analysis would be applied has been in service for a sufficiently long time for the diversity in

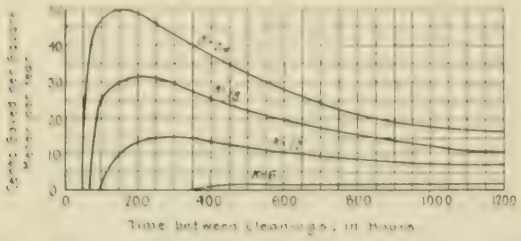
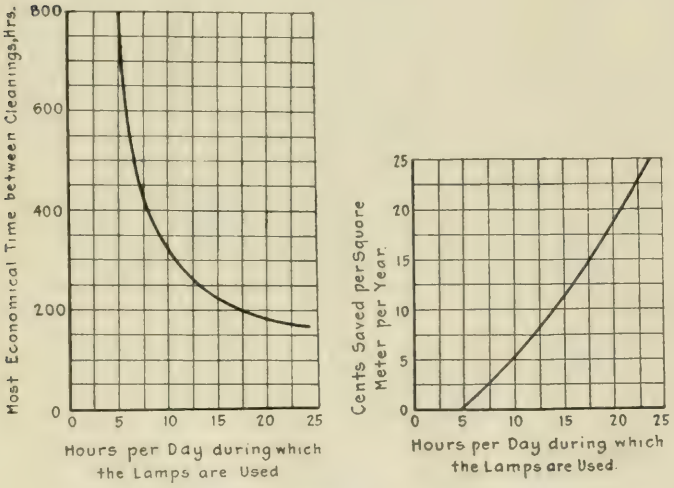


FIG. 6—SAVING POSSIBLE WITH DIFFERENT FREQUENCIES OF CLEANING BASED ON DIFFERENT HOURS' USAGE PER DAY

the renewal of the different units to have caused all parts of the life curves to be represented. If the system has not been in operation for a sufficiently long time, so that the average conditions may be realized, it is obviously necessary to make allowance for the inherent decrease in the efficiency.

A very practical question arises in many cases, namely, would it be more economical to merely dust the fixtures instead of taking them down to be restored to perfect cleanliness by a thorough cleaning? In general it will be most economical to do some dusting if the fixtures are easily reached, while if they are mounted in places where access to them is difficult occasional thorough cleanings will be the cheaper.

The greatest saving by cleaning will be realized when the lamps are used most. It is suggested that the lighting fixtures of the average installation be thoroughly cleaned once a month and dusted once between cleanings, which for a great many cases gives about the best practical economy.



FIGS. 7 AND 8—MOST ECONOMICAL INTERVAL BETWEEN CLEANINGS AND SAVING WITH DIFFERENT HOURS OF LAMP USAGE

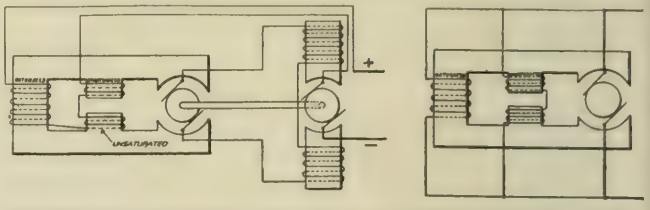
These considerations apply to all places where light is used for illumination. The application for determining the best frequency of cleaning which has been worked out in the preceding paragraphs is, of course, most applicable to the larger installations. The analysis applies to a certain set of particular conditions which exist in one installation, but the method would be identical for any other, and the results are very often strikingly the same.

The process may appear to be rather theoretical for such a practical problem. The factors which are involved in the solution permit of a much more definite determination than is usual in most cost keeping, but it will be found that the maximum point of the curve which gives the saving to be expected is not very definite. Considerable leeway is thus left for engineering judgment. The general form of the curve is the same for all lighting installations; the values which it represents, however, will vary with the design of the fixtures and the general cleanliness of the interior. Very large interiors, like those of factories, offices, halls and the like, can well have such methods applied to them without distrust in the conclusions reached.

VARIABLE-SPEED GENERATOR

Machine Equipped with Magnetically Shunted Yoke to Maintain Constant Current or Voltage

A type of variable-speed generator for constant-current or constant-emf. production is suggested in patent No. 1,202,752, issued to Frederick Newton of Luton, Bedfordshire, England. What appears to be the theory of action, which by the way does not coincide with the



GENERATOR CONNECTED FOR SELF AND SEPARATE EXCITATION

theory given in the patent, is as follows: A yoke having a magnetic shunt is arranged with two windings such that the yoke becomes saturated for normal shunt currents, whereas the magnetic shunt, which includes an air gap, has windings on the pole limbs which for normal currents and voltages are magnetically saturated. An increase in the shunt current due to increase of speed cannot increase the yoke flux since the yoke is saturated. On the other hand, with the unsaturated-shunt winding arranged to oppose the yoke excitation, the only path offered to the flux of the correcting winding must pass through the armature in opposition to the flux derived from the shunt winding on the yoke. The voltage of the armature thus remains substantially constant.

Instead of exciting the magnetic system by means of shunt coils connected across the generator terminals, series windings can be used to maintain constant current substantially irrespective of speed. With separate excitation the exciter armature furnishes the field current for the generator, whereas the generator furnishes the field current for the exciter yoke and its shunt.

Though especially adapted for use with variable-speed driving devices, as, for example, trains or wind or water turbines, the machine may be used as an ordinary generator for battery charging or line-booster service, in which cases it may be driven by a prime motor which runs at substantially constant speed. Its characteristics are of value then because it prevents fluctuation of generator output, line pressure or current, with fluctuation in the load which is carried.

Characteristics of Maximum-Demand Meters

Performance, Uses and Limitations of the Two Chief Types of These Instruments That Are Now Used Most Extensively by Central Station Companies—Their Separate Fields

BY W. F. KIMBALL

Engineer with Charles H. Tenney & Company

SEPARATE fields of application exist for the two types of maximum-demand meters which are being used most extensively by operating companies, and care should be taken to avoid using either type where the load is unfavorable to the inherent characteristics of the instrument. If this precaution is not taken, accurate results may not be obtained. In this paper the writer purposes to discuss the characteristics, uses and limitations of these two types of instruments—the time-interval, or integrated, demand meter, and the lagged-demand meter.

Since the recording mechanism of integrated, or time-interval, demand meters is reset to zero periodically, the instrument automatically divides the power-load curve into a series of blocks, each covering the same duration of time. Consequently this type of meter does not take cognizance of the load history. It should be obvious, therefore, that some load curves would make such an instrument indicate less than the true maximum demand, the error possible being as great as 50 per cent. For example, consider an instrument whose demand-recording mechanism is set back to zero every thirty minutes. Assume that the power load is zero until fifteen minutes after the demand-recording mechanism begins to operate. Then suppose a constant power load of 1000 hp. comes on and after remaining for thirty consecutive minutes drops instantly to zero and remains so. The true maximum demand for this case is obviously 1000 hp., yet the reading of the instrument would be only 500 hp.; thus the error would be 50 per cent.

Values higher than the true maximum demand can not be recorded by time-interval demand meters, since they register the integrated average load for a given maximum block of power, without giving cognizance to any load conditions either before or after that block of power. When the demand-recording mechanism is in operation it records in direct proportion to the speed of the watt-hour meter, but takes a definite, predetermined time interval to record the full value.

Results with Intermittent Loads

If used on a "rapid-fire" intermittent load like that composed of flash signs, merry-go-rounds, etc., an instrument of the time-interval type reset every thirty minutes will register the highest average load which occurs between the thirty-minute zero settings. If the load drops to zero several times during the thirty-minute period, the demand-recording mechanism will not drop back to zero to correspond with each drop of the load.

However, the time-interval type of maximum-demand meter will be absolutely correct if used on a constant load or if the period of uninterrupted operation of the demand-recording mechanism is coincident with the greatest average load for the same length of time. Where the load is fairly constant or where the maximum demand is approximately the same day after day, the time-interval type of instruments will give very satisfactory results.

Since the demand-recording mechanism of lagged-demand meters is not reset to zero except when the load drops to zero, these instruments take cognizance of the previous load history. It should be obvious, however, that load curves can exist which will make this type of instrument read less than the true maximum demand, the error in this case also being as great as 50 per cent with certain load conditions.

Again consider a "rapid-fire" intermittent load, like that composed of flash signs, merry-go-rounds, etc. Suppose the load drops to zero every two minutes and that the lagged-demand meter is lagged for thirty minutes. Every time the load drops to zero the demand-recording mechanism is reset to zero. The repeated rising and falling of the demand-recording mechanism under these circumstances is not quite analogous to the movements of the proverbial frog trying to get out of the well, but the net result is that the instrument will read only a very small fraction of the true maximum demand. The instrument error could obviously be considerably greater than 50 per cent under these circumstances.

Lagged-Demand Meters

The lagged type of demand meter can be made to record considerably higher values than the true maximum demand due to certain loads. This characteristic is due to the instrument taking cognizance of the previous load history. Fortunately the magnitude of errors due to this cause is limited in some cases by the action of the spring against which the torque of the demand-recording mechanism continually acts. It should be remembered that whenever the torque on the demand-recording mechanism just balances this spring there is no further increase in the registration of the lagged-demand meter. Subsequent lighter loads will not show any registration, but subsequent greater loads will cause higher registration than before.

The action mentioned in connection with lagged-demand meters as due to certain load conditions can be such as to produce readings over 20 per cent in excess of the true maximum demand. As an illustration, the action of an instrument is shown in the accompanying diagram, which covers a period of forty-five minutes. The loads for the first thirty minutes represent "load history" on which to base the discussion of the final fifteen minutes. It is assumed that the time lag for the instrument is fifteen minutes. Point *A* represents the actual reading of the instrument at the beginning of the final fifteen minutes. Curves I, II and III represent the actual registration of the instrument during the final fifteen minutes for each of several different load curves for that period. The load conditions and theo-

retical instrument errors are tabulated on the accompanying diagram.

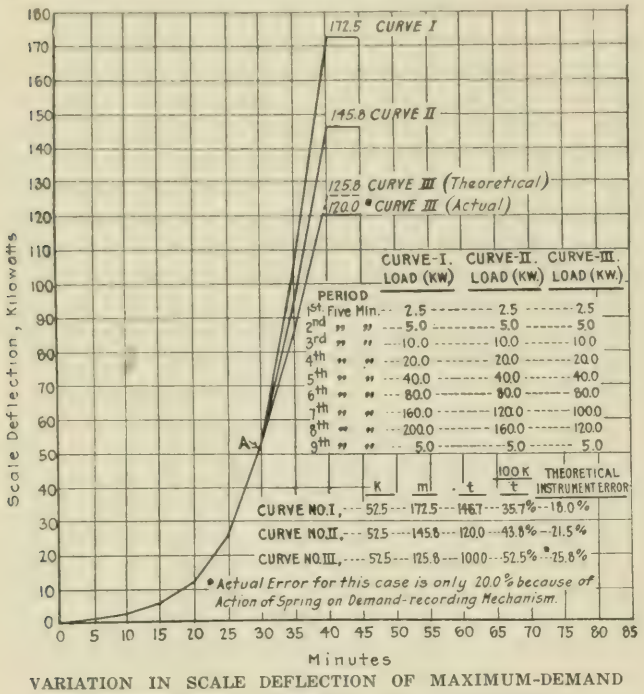
Before discussing the final fifteen-minute period it is interesting to note the error of the instrument at the end of the first thirty minutes. Obviously the true value of maximum demand for the first thirty minutes would be the average load for the second fifteen minutes, *i.e.*, $(20 \times 5 + 40 \times 5 + 80 \times 5) \div 15 = 46.7$ kw. The actual reading of the instrument at the end of the second fifteen minutes is

$$\frac{(2.5 \times 5 + 5.0 \times 5 + 10 \times 5)}{15} + \frac{(20 \times 5 + 40 \times 5 + 80 \times 5)}{15} = 52.5 \text{ kw.}$$

The instrument error (in per cent) at the end of the first thirty minutes is therefore

$$100 \times \frac{(52.5 - 46.7)}{46.7} = 12.4 \text{ per cent.}$$

The relation between the magnitudes of the instrument error, the true maximum demand and the reading



VARIATION IN SCALE DEFLECTION OF MAXIMUM-DEMAND METERS WITH DIFFERENT LOAD CONDITIONS

of the instrument at the beginning of the period considered can be shown by analytic geometry.

Let k = reading of instrument at beginning of period (due to previous load history).

m = reading of instrument at end of period.

t = reading which instrument ought to show at end of period, *i.e.*, the true value of maximum demand.

Consider the first five minutes out of the final fifteen-minute period. The equation for a straight line passing through two known points is

$$y - y' = \frac{y' - y''}{x' - x''}(x - x') \qquad (1)$$

For the line the instrument ought to follow $x' = 35$; $y' = t$; $x'' = 30$; $y'' = k$.

Substituting in equation (1),

$$y - t = \frac{t - k}{35 - 30}(x - 35) \qquad (2)$$

For the line the instrument actually does follow $x' = 35$; $y' = m$; $x'' = 30$; $y'' = k$.

Substituting in equation (1)

$$y - m = \frac{m - k}{35 - 30}(x - 35) \qquad (3)$$

Adding equations (2) and (3),

$$2y - m - t = \frac{x - 35}{5}(m + t - 2k) \qquad (4)$$

From equation (4)

$$m + t = 2y - \left[\frac{x - 35}{5}(m + t) - 2k\frac{(x - 35)}{5}\right]$$

$$(m + t)\left(1 + \frac{x - 35}{5}\right) = 2y + 2k\left(\frac{x - 35}{5}\right)$$

$$m - t = \frac{5}{x - 30}\left[2y + 2k\frac{(x - 35)}{5}\right] - 2t \qquad (5)$$

Since the instrument error in per cent $= 100\dfrac{(m - t)}{t}$ then from equation (5)

$$100\frac{(m - t)}{t} = \frac{100}{t}\left(\frac{x - 5}{30}\right)\left[2y + 2k\frac{(x - 35)}{5}\right] - 200 \qquad (6)$$

An inspection of equation (6) will show that when k is large and t is small the instrument error is greater than otherwise. In other words, the instrument error will be greatest when a small maximum demand is being measured and when the reading of the instrument at the beginning of the period (owing to previous load history) is a large percentage of the true maximum demand.

It is possible to select values of k and t, however, so that even on a rising load curve the instrument will come to a balance before the pointer reaches the theoretical value of m. This is due to the spring against which the torque of the demand-recording mechanism acts continually. The spring tension and torque are equal when the reading of the instrument is the same as the acting load. If it were not for this condition, it would be possible to pick out a load curve such that the instrument would read over 25 per cent higher than the true maximum demand. Obviously the true maximum demand for the entire forty-five minutes in this case represented by curve I will be $(80 + 160 + 200) \div 3 = 146.7$ kw. The instrument error for this case is therefore $100 \times \dfrac{(172.5 - 146.7)}{146.7} = 18$ per cent.

Curve II shows the registration of the instrument during the final fifteen minutes, with a smaller value of t and with k a larger percentage of t. In this case the true maximum demand for the entire forty-five minutes will be $(80 + 120 + 160) \div 3 = 120$ kw. The instrument error is therefore $100 \times \dfrac{(145.8 - 120)}{120} = 21.5$ per cent.

Curve III shows the registration of the instrument during the final fifteen minutes, with a still smaller value of t and k a still larger percentage of t. It should be noted that in this case the instrument comes to a balance in the eighth five-minute period before reaching the theoretical value of m. Obviously the true maximum demand for the entire forty-five minutes will in this case be $(80 + 100 + 120) \div 3 = 100$ kw. The theoretical error is therefore $100 \times \dfrac{(125.8 - 100)}{100} = 25.8$ per cent.

The actual error, which is less than the theoretical because of the action of the spring, is

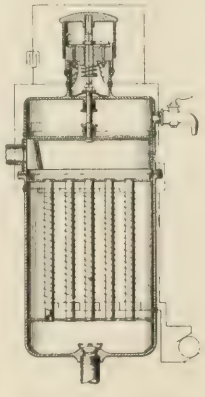
$$100 \times \frac{(120 - 100)}{100} \quad 20 \text{ per cent.}$$

Any further reduction in the value of t and still further increase in the ratio of k to t will result in a smaller excess reading of the instrument because of the balance of the spring against the torque of the demand-recording mechanism.

The conclusions to be drawn from the foregoing discussion and data presented herewith are as follows: (a) Both types of maximum-demand meter will record accurately on a load which is absolutely constant while the instrument is operating for a period of time equal to the time lag for which the meter is designed. (b) Correct registration of the time-interval type on a fluctuating load will occur only if the period of operation of the demand-recording mechanism is coincident with the period of greatest average load. For any other condition the time-interval type of instrument will read lower than the true maximum demand. (c) The lagged-demand meter is apt to read higher than the true maximum demand on a rising load curve. It is possible that this error may be as high as 20 per cent. (d) The lagged-demand meter will read low if there are frequent big reductions in the load. (e) It is possible with either type of instrument that the reading will be less than the true value of the maximum demand. (f) The lagged-demand meter, when used on certain rising load curves, will penalize the consumer. (g) There is no possibility of penalizing a consumer on account of rising load curves if the time-interval type of instrument is used. Summing up the whole discussion, each of these two types of maximum-demand meter has a field of usefulness, but care must be exercised in order to avoid using either type on a load to which it is not adapted.

Electric Water Heater

An electric water heater for the instantaneous heating of water has been developed by Emil Stranszky of New York City (patent No. 1,221,106). The heater may be mounted on an ordinary water faucet or attached to a water pipe. The heater is about 7 in. (17.8 cm.) high and 4 in. (10.2 cm.) in diameter. By turning the handle to the left cold water is served and by turning the handle to the right hot water at any temperature is given. In turning the handle two operations are performed, one closing the circuit and the other controlling the flow of the water.



SECTIONAL VIEW OF HEATER

In the heating chamber are several tubes, the ends of which are attached to head plates, each tube being covered with insulation. A coil of resistance wire is wound over the insulation of each tube. The coils are connected in parallel or series parallel, depending on the position of the water-controlling handle. A condenser is provided to prevent sparking at the switch. These heaters can also be made in large sizes.

LOWERING THE COST OF HANDLING ACCOUNTS

Simple and Economical System of Balancing Cash Receipts Daily in Use by Baltimore Central Station Company

The Consolidated Gas, Electric Light & Power Company of Baltimore has in operation a system of balancing cash receipts daily which is very simple and economical. Following is a résumé of the system employed: The service bill is rendered with payment stub attached, the stub being automatically detached by the tellers at the time of receipting the bill.

At hourly intervals payment stubs are taken from the tellers before any record has been made on them and assorted into section order. After being assorted these stubs are listed on adding machines, totals being made in section units, this listing being stamped with the date of the cash and the teller's number, together with the names of the clerks assorting, adding and verifying. The stubs are turned over to the comptometer operator, who verifies the machine listing, and are then listed on a summary which is maintained to record for each teller the daily receipts from sections. This summary is posted each day from listings prepared as outlined above and when added should represent the total amount of cash received each day from each teller. Totals of all tellers' summaries are listed on an adding machine by sections, the purpose being to determine the amount of money received.

The cash payment stubs are employed in crediting the customer's account and must therefore be further accounted for before they are in condition for posting.

After listing the teller unit is dispensed with and the stubs are assorted in racks which accommodate as many ledger units as are in use, namely, 200. At the end of the day after all the stubs from every teller have been assorted or racked in the ledger units, each unit is assorted into folio order and clamped together in lots of about twenty-five to prevent loss in handling and facilitate posting to the customers' accounts. After posting to the ledgers has been completed the stubs are added, totals being obtained for each ledger unit.

In performing this work eleven junior clerks are employed at a monthly labor cost of $434.50, making the average cost per stub 0.3 cent. About 13,636 stubs are handled per man during each month.

The unpaid balance at the end of the calendar month is obtained by securing a record of the cash payments posted to each ledger in the preceding calendar month between the first and the reading day of each ledger. Obviously this figure is practically the unpaid balance at the end of the previous calendar month, as the billing is entered upon the ledger once a month only and within the previous calendar month. By this method the major portion of the unpaid balance is secured automatically and it is only necessary to survey the ledger for bills remaining unpaid for one month or more. Thus the ledgers are balanced on a calendar-month basis as no attempt is made to balance each ledger until the reading date in the subsequent month has been reached. In this work seven clerks are hired at a monthly labor expense of $376.50, the average cost per account being 0.25 cent. About 21,428 accounts are balanced per month per clerk with this system, making it possible to operate with 50 per cent fewer clerks.

Can Central Stations Offer Lower Power Rates?

Electricity Marketed at Low Cost for Power Purposes in Western States Now Affords Communities Unprecedented Opportunity to Attract Industries

BY F. EMERSON HOAR
Gas and Electrical Engineer, Railroad Commission of the State of California

ECONOMIC conditions which have prevailed for the last two years have brought about important changes in the conditions of the power market. The Western states, where large manufacturing establishments are comparatively few and where the power possibilities are large, have come face to face with an opportunity which is without parallel.

The present unprecedented industrial situation is greatly hastening the time when the hydroelectric power possibilities of the Western states will be utilized either by the new industries seeking low-cost power or by the established power interests which will furnish low-cost power.

If the former condition obtains, the power companies will not only lose an important market which is both directly and indirectly profitable, but in all probability will be forced to compete with large blocks of surplus power produced by industrial establishments. As proof of this statement it is only necessary to call attention to the fact that the market invariably absorbs surplus hydroelectric energy.

Industries in which power is a large factor will sooner or later establish factories in regions where hydraulic power can be developed at low cost.

Raw materials are readily available in the Pacific Coast States for many of these new industries, transportation both by rail and water is at hand, and ample power and satisfactory rates can be obtained.

There are three general classes of industries which are being developed as a result of present economic conditions. Each class has certain characteristics which it is necessary to analyze in order to determine the desirability of the business from a power point of view.

The first class may be assumed to include those industries which are devoted to the production of the immediate instrumentalities of war. This class of business is largely of the mushroom variety and can well afford to pay the regularly established power rates. As a possible temporary market for surplus power this class may be of interest to the operators of hydroelectric properties, although caution must be exercised in making large capital expenditures to provide service facilities.

The second class embraces those industries established or enlarged to replace the wastage of war. The characteristic feature of industries of this class is a development beyond the needs of the normally available market. Unlike the class first mentioned, this class of business may continue to operate at full capacity for a considerable period after normal conditions are restored, with the possibility that an increased market will insure permanency. Usually the needs of industries of this class can be met with the ordinary industrial power rates, although special conditions will be presented requiring careful consideration.

The third class may be generally described as those industries newly established or enlarged to supply the normal demand for a product or commodity which has heretofore been obtained largely or wholly from foreign producers.

It is this latter class of business which offers the greatest opportunity for the successful marketing of large blocks of electric power. The reason why this opportunity exists is simply that foreign competition is temporarily eliminated, providing a ready market at prices largely in excess of normal.

Such a combination of favorable circumstances permits the establishment of new industries with the practical assurance that the usual starvation period can be avoided.

Kilowatt-Hour Basis Misleading

The chief obstacle to progress toward a rate which will attract large industries of the class referred to is not the cost of service but the attitude of the power companies. The evolution of the lighting company into the power company has been so rapid that the present-day opportunities for power development find the central station management still thinking and talking in kilowatt-hours. Power rates are almost invariably studied on the hour basis, and the relative desirability of two or more classes of business is usually judged by comparing the price per kilowatt-hour. The result of such a comparison is always misleading and conveys no idea as to the profitableness of any particular business. For example, a rate of 10 cents per kilowatt-hour under certain conditions may be and often is less profitable than a rate of 1 cent or less per kilowatt-hour under other conditions.

An illustration of this is a recent instance of intensive solicitation on the part of a large California company for a certain class of power business at a rate of approximately 3 cents per kilowatt-hour. This business, when secured, was in reality less profitable and less dependable than other business which the company had first objected to taking in large blocks at a rate of $25 per horsepower-year.

Annual revenue per unit of demand, not the kilowatt-hour rate, should be the basis of comparing the relative desirability of prospective power business, and even this comparison can become practically valueless if considered independent of the operating conditions of the supplying company and the characteristics of the prospective load.

There has been a tendency on the part of Pacific Coast power companies to regard 0.75 cent per kilowatt-hour as about the minimum profitable rate that should be considered, yet from 20 to 60 per cent of the business of several of the largest of the California companies is supplied at considerably lower rates. Four of these companies are regularly furnishing upward of 50,000 kw. at rates which average approximately 56 mills per kilowatt-hour. Similarly, the wholesale rate of $35 per

horsepower-year is occasionally suggested as the dividing line between profitable and unprofitable business.

Notwithstanding the difference in opinion which exists relative to minimum profitable rates, the base load of a large percentage of operating companies in California is made up of relatively large blocks of power yielding an annual revenue of from $12 to $30 per horsepower. Such base loads constitute the backbone of the income of these companies and have made possible the development of hydroelectric projects on a scale which without such business it would have been difficult to justify.

There is immediately available in California at this time from 15,000 kw. to 20,000 kw. in developed hydroelectric power which could be profitably sold for continuous service at rates varying from $15 to $25 per horsepower per year. In addition to this continuous supply large blocks of limited-period power are available, either for continuous delivery during eight to twenty hours per day throughout the year or for twenty-four-hour delivery during six to ten months of the year. The limited-period service could be supplied at low rates to the advantage of both the power companies and certain classes of industrial users.

Additional Power Sources

The early development of additional large power projects on the North Fork of the Feather River and on Big Creek, in California, is dependent largely upon the possibility of securing suitable base industrial loads. Of the 300,000 kw. or more which these new projects are capable of producing, the necessary base load ratio may be assumed to be from one-quarter to one-third of the total generating capacity to be installed.

It has been conservatively estimated that 70,000 kw. to be developed at a site on the Pitt River in California could be delivered 250 miles (402 km.) from the source over duplicate transmission lines to tidewater at a total cost of $130 per kilowatt. This estimate was based on copper at 16 cents. However, the minimum flow of Pitt River over a period of years would permit a development of 105,000 kw. in one plant capable of operating, so far as water is concerned, at 100 per cent annual load factor. This site is about 25 miles (40 km.) from railroad transportation and with a required total capital investment well within $35 per horsepower of generating capacity power could be delivered to railway points at a cost which would permit the dream of $7 to $10 power to be realized.

Disregarding the possibility of steam plant installation in the California oil fields, where both oil and natural gas are available at relatively low prices, only the hydroelectric possibilities are to be considered in reckoning with low-cost power for large industries. In fact, those companies which are now operating with large steam reserves are at a considerable disadvantage because of large production and overhead charges which must be saddled on new developments added to such a system.

For example, from 60 to 100 per cent of the hydroelectric power is about an average amount of steam reserve capacity to be installed by a California company doing an average light and power business. In the vicinity of San Francisco the steam reserve is about 60 per cent of the available hydroelectric capacity, and the ratio of steam to hydraulic capacity varies from no steam reserve in the northern portion of the State to no hydroelectric energy in the extreme southern portion.

Considerable advantage has already been obtained in California by tying together the transmission system of several of the larger companies. However, it is believed that the time is not far distant when all of the important power systems will be interconnected by means of a bus line traversing the central portion of the State in a northerly and southerly direction. Such a plan is believed to be entirely practicable so far as physical conditions are concerned, and by combining the diversities of demand and reducing losses it should permit the conservation of not less than 20,000 kw. in generating capacity. The pooling of production facilities, both steam and hydraulic, would in all probability make it unnecessary to increase further the steam reserve.

The present is a period of transition—a change from old to new industrial conditions such as will probably never occur again. The West urgently needs new industries, and it can attract them most easily by offering favorable terms for electric power. A careful analysis of every prospect for new industrial business would be well worth while, and in considering the desirability of undertaking to supply service to such industries it is essential that the power companies clearly recognize the necessities and limitations of the prospective business.

It would be well to have these investigations made by men not prejudiced in favor of the old kilowatt-hour method of comparison, and it should be borne in mind, in attempting to arrive at an equitable rate, that the present abnormal market conditions will cease to exist after the re-establishment of foreign commerce, and that the price which a new industry can afford to pay for power will be governed largely by conditions over which it has no control. Undoubtedly lower power rates for large industries are coming, and those power companies which first realize this new condition and endeavor to meet the situation will profit most thereby.

This article was written before the United States declared war against Germany and is not intended to refer to economic or military necessities brought about by conditions which have since developed.

TRUCK-DRAWN POLE TRAILERS

Cost of Using Trucks to Haul Poles Found to Be About One-Fourth That of Using Horses

In comparing the expenses of using horse and auto trucks to transport poles the Springfield district of the New England Telephone & Telegraph Company recently found that the truck-drawn trailer will do the same work as a horse-drawn trailer in about one-sixth of the time. During 115 hours of pole hauling in twelve days the truck traveled 441 miles (709.7 km.) at a cost of little more than 25 cents per mile (17.7 cents per km.). Using horses for the same work would have required seventy-one days at a rate of 97 cents per mile (69 cents per km.). An additional point in favor of such trucks is the fact that the hired teams are slow in delivering poles, causing a great deal of lost time and often necessitating an additional light team to transport the men and tools. When using a truck and trailer, the men, poles and tools will arrive on the job at the same time, so the work can proceed without delay.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

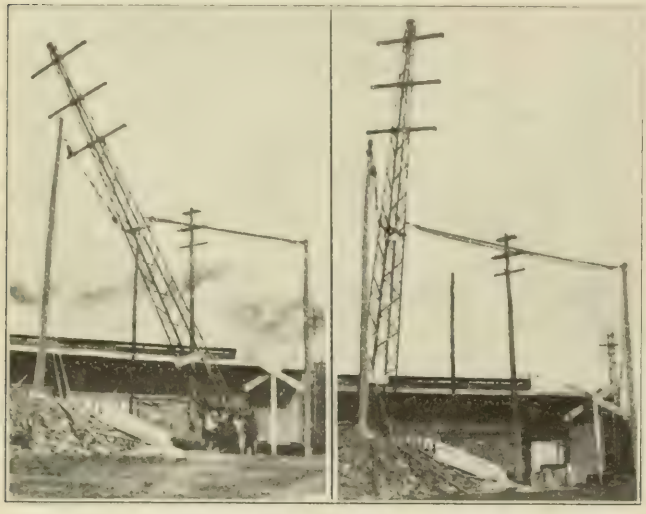
MOVING HEAVY TOWER

How Two Gin Poles Were Used to Transport a Transmission-Line Tower 30 Ft.

BY E. B. HOOK, JR.

Superintendent of Construction, Georgia Railway & Power Company

On account of changing the direction of a street in Rome, Ga., the 75-ft. (22.9-m.), 4-ton (3.6-metric ton) steel tower shown in the accompanying illustration had to be moved 30 ft. (9.1 m.) to bring it to one side of the roadway. This operation was performed by means



STEPS IN PROCESS OF MOVING TOWER

of two 40-ft. (12.2-m.) gin poles, thirty minutes being required to move the tower and bolt it to the new concrete foundation. Snow and sleet were falling during transportation. The insulators were removed from the tower and the 66,000-volt lines temporarily supported on wood poles. Blocks and tackle were fastened to the tower and the gin poles, which were erected and guyed at each end of the line along which the tower had to be moved. After the tower had been tilted in the direction it was to be moved the tackle on the pole toward which it leaned was hauled in, thus dragging the base of the tower into its new position. The other gin pole and tackle prevented the tower toppling over entirely.

OVERHEATING OF TRANSFORMERS

Causes of Overload and Need of Checking Meters to Make Certain They Show True Load

BY E. C. PARHAM

Owing to the fact that transformers have no moving parts, their field of trouble is generally limited to overload, lightning or mechanical abuse in handling. Overload may be due to high voltage, low frequency, or both. It may be due also to giving the transformer too much work to do or to trying to operate in polyphase or parallel connections transformers that are not adapted to such operation. Operators are apt gradually to overload a bank without being aware that they are doing so, the only certain check for such a condition being suitable instruments for showing what the transformers are doing. Proper connection of the instruments is as essential as their proper design.

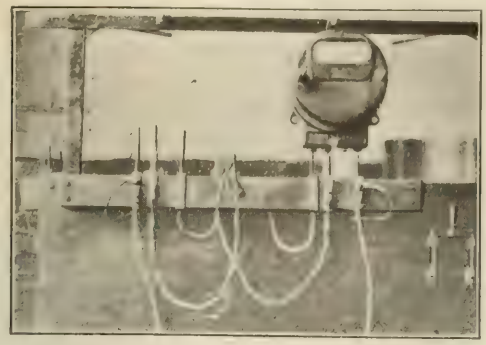
In one case an operator complained that two of three delta-connected oil-cooled units that had been in successful operation for years were overheating, and he stated that he was sure that the heating was not due to connected overload. The transformer elements were removed from the oil and carefully inspected. All coils were found to be correctly placed, correctly connected, of the correct rating and in good condition. They were replaced and the transformers again placed into service. Their output had always been measured through a polyphase watt-hour meter, but apparently it had not occurred to anyone that the indications of the meter were out of proportion to the load the transformers were carrying. A three-hour test disclosed the fact that as far as the indications of the meter were concerned transformers of one-fifth the size used could have safely carried the load, but on checking the connections of the meter the meter elements were found to be opposing each other. Readings taken after the connections had been corrected revealed overload conditions that at times were excessive.

TEST BAR FOR THE QUICK CONNECTION OF METERS

Bronze Pins Clamped to Test Bars Permit This Operation to Be Performed with Saving of Time and Labor

A labor-saving test bar for checking meters is in use in the meter shop of the Cumberland County Power & Light Company, Portland, Me. As shown, it consists of a pair of 2-in. (5.08 cm.) by $\frac{5}{8}$-in. (15.9 mm.) wooden strips which rest against the upper edge of an asbestos-sheet test panel. The bar at the front carries two sets of three clamps each separated by fiber blocks to prevent short-circuiting by the fingers when in use. From each clamp a bronze pin 3 in. (7.62 cm.) long projects upward, forming a plug which fits into the terminal bushing of the meter when the latter is hung in position above the test bar as shown. On the middle pin are wooden thimbles which protect the fingers from the live parts. Each pin is fitted with a spiral spring which forces it into the meter terminal and insures a good contact when in service. The meters under test are hung from a 1-in. (2.54-cm.) by $\frac{1}{8}$-in. (3.2-mm.) angle-iron bar carried on standards of the same size 11 in. (27.9 cm.) above the test bar. The upper bar can be lowered in an instant into one of several notches by manipulating the locking levers shown. From the clamps leads ex-

tend to a Mowbray test meter on a shelf at the bottom of the test panel and to the source of energy supply. The test bar is 23 in. (58.4 cm.) long and has been treated with black varnish. The test board contains load-vary-



METER RACK WITH AN INSTRUMENT IN PLACE

ing switches, a reversing switch for the checking meter, switches for cutting potential coils in or out, and for supplying energy at 100 per cent and 50 per cent power factor. The test bar was designed from materials readily available at the shop by H. J. Howarth, superintendent of the meter department. It saves at least two minutes per meter test, no adjustment of connections being required when the clamps are properly spaced to fit the particular size and type of meter under test. The clamp spacing and the height of the test bar can be determined by a moment's handling to suit any meter within the range of the test equipment.

VALUE OF TREATING POLES AND EQUIPMENT

Why It Pays to Buy Twenty Years of Life in Pole-Line Equipment, and Other Considerations That Reduce Cost of Service

In a paper read before the Minnesota Electrical Association, S. B. Hood of the Minneapolis General Electric Company made an appeal for permanency in line construction. It has been shown, he said, that the average life of a pole which has had a good open-tank treatment with a high-distillate creosote oil will be twenty years, as compared with eight to ten years for untreated poles. As an example of the economy of pole treatment, he continued, take a 35-ft. pole costing when it is set in position untreated $10 and having a life of eight years. Compare this with a treated pole costing in position about $11.50 and having at least twenty years of useful life. With interest at 6 per cent, the annual cost for the untreated pole is $1.85 and for the treated pole $1.26, a decrease of nearly one-third in the annual fixed charges.

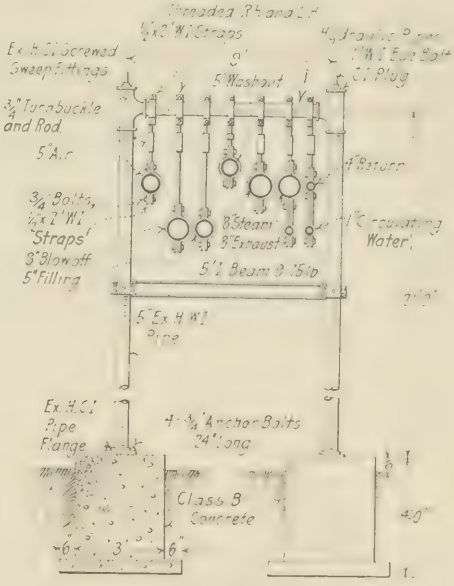
If the life of the poles is increased, it is necessary to get an equal life from the various pole fittings. In the case of hardware this has been accomplished by using a zinc coating, the hot galvanizing process having been proved the best. For cross-arms an equal life can be obtained by open-tank impregnation similar to that used for the pole butts. The life of the arm as well as its strength can also be increased considerably by using one of the several forms of metal pin which clamp around the arm. Where the cost of these is not warranted metal pins with a small shank may be used. The old-style wood pin, requiring the removal of a large part of the arm to provide a sufficiently large hole, should have no place in modern overhead construction, Mr. Hood pointed out.

For low-tension circuits, principally secondary work, where the maximum voltage does not exceed 750 volts between wires, cross-arm construction should be abandoned entirely for galvanized-steel racks or brackets. These cost less than good cross-arms with their fittings, and there is practically no limit to the useful life that can be had from them. In addition, they make it possible to support the wires in a vertical plane on short centers. In this position there is no tendency for the wires to swing together, and if the circuit carries alternating current the inductive drop is materially reduced by the close spacing. This method of construction permits taking off service drops without using an unsightly buck-arm. The general appearance of a line constructed with these brackets or racks is all that can be desired and should reduce the growing demand for underground construction in congested districts.

OVERHEAD PIPE SUPPORTS

Rack for Pipes in Places Where They Cannot Be Suspended from Some Overhead Structure

To support the steam mains which run overhead between its boiler and engine house one Eastern company employs the method illustrated herewith. Extra-strong wrought-iron pipe with extra-heavy screwed sweep fittings is used, supports being placed at 20-ft. (6.1-m.) intervals. The uprights, which are filled with concrete,



DETAILS OF RACK SUPPORTING PIPES

are braced by means of a 5-in. (12.7-cm.) I-beam and are anchored to concrete bases by means of bolts and anchor plates. Plug fittings screwed into the top of each upright hold in place a 1-in. (2.54-cm.) wrought-iron eye bolt to which are connected the wrought-iron rods for longitudinal bracing, the latter being tightened as required by adjusting the turnbuckles.

Pipes are supported from the horizontal pipe at the top by means of a turnbuckle on each hanger. Repairs are facilitated through the use of bolted wrought-iron

pipe straps connected to separate hangers. In order to drain the pipes some are inclined toward the boiler room while others are pitched to the engine house.

Openings for the entrance of pipes are left in each building wall. Plates protect these openings, each opening having three plates divided so as to be readily removable when required without disturbing any pipes other than the one to be taken down. Angles with bolt and anchor plates are used to secure the plates.

The pipes are carried overhead, since this arrangement permits the most direct run and one which does not necessitate the dripping of pockets that would otherwise be formed. Elaborate protection of underground pipes by means of a concrete tunnel or boxing which deteriorates along with the pipe covering is also avoided. Being exposed to the weather, the overhead pipes are well covered with canvas and a weatherproof protection of lead-coated sheet metal.

OIL ENGINES VERSUS TRANSMISSION-LINE SERVICE

Data That Indicate That a Line 20 Miles Long Can Compete Successfully with Service from an Isolated Plant

While fuel oil for operating an internal-combustion engine may cost more than coal for operating a steam plant, oil engines are usually popular in towns of about 900 population, Earl D. Jackson, a consulting engineer of St. Paul, Minn., declares. For effective day service, including connections to motors and ranges, however, Mr. Jackson does not consider that the combination oil engine and storage battery plant compares economically with transmission line service. As a basis for his views the following analysis is presented, it being assumed that an oil-engine plant containing one 50-kw. and one 15-kw. semi-Diesel unit is giving twenty hours of service and requiring the partial services of two men. The cost of a complete generating plant of this type, including the building, would amount to approximately $14,000. If the business is properly developed the plant should generate yearly about 75,000 kw.-hr. The generating cost per kilowatt-hour would then be as follows:

Fuel oil at 0.024 cent per kilowatt-hour	$1,800.00
Lubricating oil, incidentals, etc	500.00
Labor, two-thirds of superintendent's time, one-third being charged to distribution in town	600.00
Assistant operator	720.00
Interest at 6 per cent and depreciation at 7 per cent	1,820.00
Total	$5,440.00
Cost per kilowatt-hour ($5,440 ÷ 75,000)	0.073

To show how much transmission line could be built without having the cost of energy to the city exceed the cost from a separate generating plant, the following data were used. It was assumed that energy could be purchased for 3 cents per kilowatt-hour at the generating source, and that the core loss and line loss per year would be approximately 10,000 kw.-hr. This loss added to the original output (75,000 kw.-hr.) assumed for the oil-engine plant equals 85,000 kw.-hr. which would be purchased at 3 cents, making the total energy cost $2,550. The cost of transmission line repairs and inspection was placed at $600, making the total yearly cost $3,150. The difference between $5,440, the yearly expense of the generating plant, and $3,150, the transmission-line expense, gives $2,290, or the amount which would be applicable to interest and depreciation on the transmission line. If the fixed charges are taken at 13 per cent, it will be seen that $17,600 will be applicable for building the transmission line, which will build an inexpensively constructed transmission line 20 miles (32.2 km.) long with an outdoor-type substation.

DISTRIBUTION-LINE PROTECTION

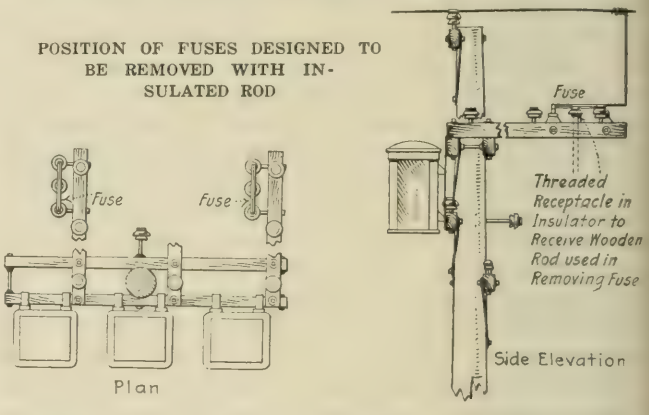
Practice That Is Followed by Southern California Company in Safeguarding Its Circuits

On the 2300-volt distribution system of the San Joaquin Light & Power Corporation, Fresno, Cal., all circuits are protected by automatic oil circuit breakers at the substations, pole-top oil switches being used for sectionalizing the line. All transformers are protected by General Electric plug cut-outs, the following table being used for fusing the 2300-volt transformers:

Kva.	Fuse Rating (amp.)	Kva.	Fuse Rating (amp.)	Kva.	Fuse Rating (amp.)
1	1	7.5	5	30	20
2	1	10	6	37.5	25
3	2	15	10	40	30
4	2	20	15	50	30
5	3	25	15		

Various makes of three-pole fuses, or a combination switch and fuse, have been considered, but the expense involved is so great compared with that of the 6600-volt disconnects now in use that it has been decided to continue the use of the switches named.

The 10,000-volt feeders from substations of this company are protected by three-pole General Electric K-12 automatic oil circuit breakers. All branch lines are connected with the main feeder through three-pole single-disk K.P.F. pole-top air-break switches. Similar-type switches are installed about every two or three miles apart to sectionalize the lines. Since almost all of the circuits are of the "loop" type, a short section of line can be cut out in case of trouble without serious interruption to the whole line. Taps leading to transformers are protected by "disconnects" made at the company shop. The construction of these switches is shown herewith. Attached to each cross-bar holding a fuse is a standard 10-kv. insulator. By screwing a threaded 5-ft. (1.5-m.) stick into this insulator the cross-bar may be removed from the clips for refusing or disconnecting. Approximately 15,000 of these "disconnects" are in service on this system, and very little trouble has been experienced from them. The cost of three of these "disconnects" f.o.b. storeroom is $5.78.



CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

DATA ON COST OF MINING COAL BY ELECTRICITY

Illinois Mine with a Daily Output of 5000 Tons Has Energy Consumption of 2.15 Kw.-Hr. per Ton Mined

From one typical totally electrified Illinois mine the output of which is 5000 tons of coal per day the energy used per ton mined was 2.15 kw.-hr., it was stated by Orlie Rue of Mattoon, Ill., before the recent meeting of the commercial men of the Illinois State Electrical Association. The coal is raised from a depth of 349 ft., the total hoisting distance being 400 ft. The thickness of the vein of coal is 8 ft. The equipment is:

Hoist—675-hp., 550-volt, 980-amp., 65-r.p.m. conical two-drum direct-current motor.
Auxiliary Motors—100-hp., 440-volt, 60-cycle, three-phase, 490-r.p.m. slip-ring; 3-hp., 440-volt alternating-current for air compressor.
Flywheel Set—Generator (direct-connected), 550 volt, 1000 amp.
Motor—450-hp., 2300-volt, 102-amp, three-phase, 60-cycle, alternating-current, 695-r.p.m.; 240-volt, 833-amp. exciter; flywheel, 9-ton, 9-ft. diameter.
Fan—75-hp., 440-volt, 60-cycle, three-phase, alternating-current; speeds, 300, 450, 600 r.p.m.
Shaker Screen—50-hp. direct-current motor.
Picking Tables—Three 5-hp. direct-current motors; shop, 10-hp alternating-current motor.
Motor Generator Sets—Two sets (duplicates); generator—250-volt, 1090-amp., 600-r.p.m., 300-kw. Motor—2300-volt, 87-amp., 600-r.p.m., 420-hp. alternating-current. Exciter—120-volt, 91.5-amp.
Underground—10-hp. direct-current motor-driven pump; eight 5-ton locomotives; two 12-ton locomotives; twenty breast-cutting machines.

The total alternating-current connected load at this mine amounts to 1479 hp. The energy for the operation is furnished by the Central Illinois Public Service Company. The following data were taken over a period of twelve months from March, 1915, to March, 1916:

Days worked	275.5
Tons produced	834,011.35
Average tons per eight-hour day	3,020.00
Total kilowatt-hours used per year	1,793,106.00
Kilowatt-hours per ton hoist, alternating current	0.62
Kilowatt-hours per ton, 2300-volt alternating current, including the hauling, cutting shaker screen and picking-table motors	1.10
Kilowatt-hours per ton, 440-volt alternating current, for such service as the ventilating fan, the air compressor and the workshop motors	0.43
Kilowatt-hours per ton mined	2.15

ADVERTISING ADVANTAGES OF ELECTRIC SERVICE

Public Told the Story of Increasing Costs and of Difference Between Selling Service and Selling Energy in Series of Nine Advertisements

There has recently been completed by the Duluth Edison Electric Company of Duluth, Minn., the publication of a series of nine service talks which were aimed to accomplish two purposes—one to impress upon the general public the trend of the cost of electric service with respect to that of other commodities entering into the cost of living and the other to show the central station customer what constitutes the difference between selling electricity and selling electric service. The first advertisement of the series was published on March 6 and the ninth and last of the series was published on April 1. This last advertisement so accurately sums up all that has been said in the foregoing series that the text is herewith repeated.

The first number of the series was a full-page advertisement containing a chart to show the trend of wages and city taxes and of the cost of such common commodities as meat, coal, cotton, wheat and electric lighting. It occupied a full page and announced the fact that a series of talks on the company's business would be published in succeeding issues of the paper. The topics treated in the succeeding issues were: Service interruptions, the commercial service department, connecting up the customer, lamp conveniences, courtesy, testing customers' lamps, and civic pride. Each of these subjects was published with a distinctive border in a 4.5-in. by 10-in. (11.43-cm. by 25.4-cm.) space. Each was a straightforward, clear-cut statement of the company's policy and its facilities for providing service, together with an appeal to the customer to use that service.

The results of this advertising which the executives of the company have noticed thus far are interesting. They have found that people are beginning to talk

SERVICE FIRST

ELECTRICAL SERVICE

(*Article No. 9 on Electric Service in Duluth.*)

Our business is *not* making and selling *electricity*. You may be a little startled at this statement, but it is true, very true. Instead, our business is to sell Electrical Service. There is a big difference between selling Electricity and Electrical Service.

Suppose you wanted to buy some electricity. We would run some wires to your house, any kind of wires, connect you on, and then go away and only look your direction when it came to sending you a bill. That would be selling electricity. But that is *not* our business.

Now suppose you wanted to buy some Electrical Service. We check up the amount you want and see that our lines to your house are made of copper wire of rigid specifications and ample size to give you proper pressure. A meter is carefully checked to see that it is correct before placing it in your house. We make every effort to get the current turned on in as short a time as possible so that you will not be inconvenienced for lack of service. We create convenient places to purchase your lamps, or deliver them to your door. We have the lamps carefully inspected by experts to protect you from defective lamps. We maintain a trouble department to help you should an interruption to service occur. We study your problems so as to give you the most economical use of the electricity. We try to answer all of your questions courteously. If something wrong has developed we send men to locate your troubles. We periodically test and inspect the lines to your house so as to take care of your added requirements so when they are attached the service will not be found lacking and inconvenience you. We have experts to give you honest advice on how to use electricity economically to accomplish a certain task.

This is selling Electrical Service, and is our business.

In the preceding articles we have described our services and told you how to use them. They were created for you. Take advantage of them.

DULUTH-EDISON ELECTRIC COMPANY

216 WEST FIRST STREET

Melrose 911—Telephones—Grand 295.

about electric service and that the idea of service is firmly fixed in their minds rather than simply the idea of electric lighting. This has been made clear in several instances where customers in talking to salesmen have of their own accord mentioned general electric service. Furthermore, it is definitely known that the feeling of the people toward the company is a sympathetic one. They are beginning to realize that its costs have increased enormously while the price of its commodity has remained the same.

ANALYSIS OF COSTS TO OPERATE ISOLATED PLANTS

Report of Sub-Committee of the Power Sales Bureau of the N. E. L. A. Gives Results of a Wide Investigation

In its first report the isolated plant division of the Power Sales Bureau of the N. E. L. A., I. Lundgaard, chairman, presents the results of a wide investigation of isolated-plant costs with comparative data on central station service. The report also includes a study of supply of auxiliary power to owners of water power. Under various headings will be found data on internal-combustion engine plants, recent information obtained on modern small-size steam engines and turbines, and information in regard to power plant construction costs. The committee also submits in this report a study of methods of computing steam required for the heating of buildings, with an analysis of the value of exhaust steam that is obtained from isolated plants for heating service.

In presenting its analysis of costs the committee points out that competitive sale of electrical energy is a matter of comparative cost of one source against another, not necessarily of comparative cost of power alone, but of cost as applied to the purposes of the buyer's business. An unreliable source of power, while inexpensive in itself, will obviously prove to be very expensive for ordinary manufacturing purposes wherever the production of a large number of employees depends entirely or in large measure upon the operation of machinery by power.

"While comparative power cost analysis is affected by such items as reliability and other matters of more or less intangible character, it is, however, the principal argument upon which the sale must be accomplished. The average power customer possesses an entirely inadequate knowledge of power cost analysis and is sometimes ill informed on matters of industrial economics, so that it is often necessary to undertake much education of the prospective power customer before the sale can be made.

"It is both unwise and impracticable to adopt the standard method of selling, namely, to tell the 'prospect' all about your wares and to say nothing about those of the competitor, because the competitor in this particular field invariably fails to tell all about his wares, and what he leaves out does not help to sell central station service.

"The power salesman must be able to undertake a complete engineering investigation of the 'prospect's' power requirements and submit to him a report showing the merits or demerits of all proposed methods of furnishing power. The preparation of such a report is undoubtedly the most important part of a power salesman's work."

COMPARATIVE COSTS OF OPERATING WITH ISOLATED PLANT AND BY MEANS OF PURCHASED POWER

COST OF ISOLATED-PLANT OPERATION

Character of Business	Kind of Isolated Plant (Considered "Steam")*	Electrical Equipment: No. of Units	Electrical Equipment: Total Capacity in Kw.	Mechanical Power Equipment: No. of Units	Mechanical Power Equipment: Total Capacity in Kw.	Other Uses for Steam‡	Boilers: No. of Units	Boilers: Total Hp.	No. of Men in Plant	Hours per Day Operation	Annual Labor Cost	Supplies and Repairs	For Power, Other Uses, Tons of Coal per Year	Cost of Coal	Ash and Coal Handling	Cost of Water	Cost of Floor Space	Purchased Electricity	Superintendence	Total Plant Investment	Per Cent of Fixed Charge	Annual Fixed Charge	Boiler and Compensation Insurance	Total Annual Cost
Fertilizer	E	2	225	1	225		2	700	7	24	$6,396	8800	4,800	$15,360										$22,556
Fertilizer	E	1	35	1	187		2	300	2		1,820	200	1,000	3,200										5,220
Office and manufacturing building	E	2	150			A	2	300	6	17	3,900	282	809	3,753	3104	841								8,080
Office building	E	2	150			B	2	300	6	24	4,130	400	1,200	3,840	60	130		$230						8,799
Hotel	P	3	325			C	3	525	9	24	8,684	2750	4,200	15,540	480	600				$57,900	13	$7,527		35,581
Chemical	E								7		7,080	2340	6,696	14,664		1164				30,000	15	4,500		29,808
Grain elevator	P								14		12,990	6500		22,400	1200					300,000	11	34,500		77,590
Hotel	E	3	925			D			16	24	3,360	900		25,326	720	1310								31,616
Apartment	E	3	217.5			E	3	600	6	24	5,520	1650	2,900	11,165	465	342			$1000				$170	19,142
Manufacturing building	E	3	300	2			5	1000	11		10,192	1200	7,500	29,250	480	2552				25,500	13	3,825	80	48,844
Manufacturing plant	P	1	500			A			9	24	8,190	3337	10,870	27,700		4128				46,385	13	6,030	163	50,548
Shoe factory	E	3	250				2	250		10	2,444	826	1,361	4,220		294	$300	353		15,000	15	2,250		10,687
Shoe factory	E			1	20		1	75	1	10	1,144	277	394	1,280		85		395				445		3,626
Automobile manufacturing	E			2	450	A	4	450	2	10	2,310	937	2,016	5,165	519	276	400	1900		25,500	15	3,825	80	15,352
Steel mill	E	4	1125	1	900	F	6	2100	17		16,798	4548	12,300	36,300		1020			3870	129,000	12.7	16,365		28,901
Chemical works	E	3	330	1	45	G	16	3200	27		28,943	2283		47,419		500								79,145

Character of Business	Maximum Demand, Kw.	Annual Consumption, 1000 Kw.-hr.	Cost of Electricity Purchased	No. of Men	Cost of Labor	Supplies and Repairs	Tons of Coal	Cost of Coal	Ash and Coal Handling	Water	Superintendence	Total Plant Investment	Per Cent of Fixed Charge	Annual Fixed Charge	Boiler and Compensation Insurance	Total Annual Cost
Fertilizer	450	1644	$17448	3	$2,548	$100	300	$840				$25,000	12	$3,000		$34,936
Fertilizer																
Office and manufacturing building		180		2	1,704	55	307	1,520	$40	$2						7,872
Office building		180	4,680	2	1,660	100	370	1,184	35	39						8,685
Hotel		788	12,312	5	4,472	950	2100	7,770	240	400		84,000	12	10,080		99,504
Chemical		2432	25,040									4,000	20	800		31,440
Grain elevator		3400	43,600	9	8,130	2500		8,000	1000			36,000	11	3,960		53,590
Hotel		1095	6 31,515	11												43,345
Apartment		250	10,000	3	1,560	550	1530	5,967	248	53					$87	38,675
Manufacturing building		688	21,325	5	3,148		2000	7,800	128	1300						95,778
Manufacturing plant	375	2573	21,601		7,176	1885	6796	17,320		970	$800				135	44,744
Shoe factory	125	206	5,083	1	565	250	506	1,570		15						7,425
Shoe factory			1,697		272	125	80	290		10					358	2,952
Automobile manufacturing	30	10	1,100												930	11,554
Steel mill	180	300	32,308	5	5,220	1915	2820	8,330							371	48,964
Chemical works	825	3896	50,644	16	15,636	600										67,080

*"P" indicates proposed isolated plant, "E" existing. †Figures based on difference between cost with I. P. service and cost with central station service ‡A, industrial; B, absorption, refrigeration, steam pumps; C, cooking and water heating; D, cooking and heating; E, water heating; F, miscellaneous, pumps and air compressors; G, pumps and air compressors.

In the accompanying table are presented data contained in a number of typical power sales reports. This table lists all the tangible cost items contained in the reports submitted, and while the tabulation will serve little or no purpose in the matter of estimating costs, it shows the number and relative importance of the different items that go to make up a power sales report.

Study of isolated-plant costs may be undertaken in two ways, the report states, namely, by investigating isolated-plant service as applied to particular classes of business or by investigating in detail every kind of apparatus that goes into isolated plants.

The conditions of service or the conditions of utilization of power and its by-products are so varied that investigation of power costs as applied to classes of business cannot be dispensed with. The committee submits data on service for office buildings, department stores and hotels as this year's contribution to the study of classes of service.

The matter of fixed charge against investment made in isolated plants may profitably be subjected to some discussion, the committee feels, in view of the difference in practice brought out by the analysis in the power sales reports in the table.

The items that go to make up the fixed charge are interest, depreciation, insurance and taxes, and a suitable percentage to cover the risk incurred in making the investment.

The majority of reports, it is stated, do not show any fixed charge against existing plants. In the opinion of the committee it would seem to be better practice in all cases to include in the power sales report the full amount of fixed charges so that the true cost of power would be recorded and not merely the operating cost. This procedure would contribute to the economic education of the customer, and he would not be so apt to lose sight of the factor of proper investment charges in his future undertakings. After the full amount of fixed charges has been included, qualifications pertaining to the conditions prevailing at the time of the negotiation may be made.

HEAVY STOCKING OF MOTORS IS FOUND VERY PROFITABLE

"Readiness to Serve" Industrial Companies Emphasized as a Policy Measure That Will Prove of Great Timely Value

Foresight in anticipating the demands of power customers for electric motors is a prime essential to prompt service installations and extensions by central stations. One company which maintains an average stock of several hundred motors, representing an investment of about $25,000, found that by selling these at list prices the total salaries of the power engineering department in 1916 were covered by the profits on motor sales, while immediate deliveries were made to customers to boot. Within a fortnight two orders for induction motors aggregating $37,000 have been placed, and it is likely that many of these units will be shipped from the factory direct to the power user instead of being passed into the central station stock.

The policy of selling at list price and adjusting this to market conditions stabilizes relations with local contractors and dealers. Greatly improved deliveries are the result of the company's policy, and the good effect of its "readiness to supply" upon the local community of power users is worth emphasizing as a point in company policy. Customers frequently order motors by mail, and the company maintains a standard range of sizes of from 1 hp. to 100 hp., the most common size used being 5 hp. The purchase of motors on a large scale for stock has been found to be one of the most profitable undertakings of the company.

SUFFICIENT MARGIN FOR HANDLING WIRING CONTRACTS

By Charging Contractors 10 Per Cent for Financing Central Station, Company Is Enabled to Carry Business Without Loss

About four years ago the Rockford (Ill.) Electric Company adopted a plan for financing the wiring of residences in its territory which was designed to assist the electrical contractors in the city. A flat price per outlet schedule was arranged with the contractor, and it was agreed that the central station should deduct a margin of 10 per cent from the contractor to cover its expense in handling the business. W. A. Griffin, in speaking of the success of the plan before the commercial men of the Illinois State Electrical Association, showed that this margin had been a little more than sufficient to cover all contingent expenses. The data given by the speaker on the business conducted under this plan are as follows:

Total amount of contracts		$34,584.00
Amount deducted by the central station company (10 per cent)		$3,458.40
Contingent expenses:		
Interest	$1,209.78	
(The average amount outstanding was $5,040.77, and the above interest was figured on that amount at 6 per cent for one-half of the period.)		
Accounting and collection expenses	1,380.00	
Losses from accounts uncollectible	171.03	
Total contingent expenses		2,760.81
Excess of amount received over amount expended		$697.59
Estimated revenue received during the four years from 1034 contracts secured under this plan		$41,360.00

It is interesting to observe from these figures that the company's loss from uncollectible accounts is less than 0.5 per cent of the total amount of the contracts handled. The fact that the average amount outstanding against the company was approximately $5,000, while about $8,500 worth of work was handled per year, is also of interest, in view of the fact that the company gave its patrons twenty-four months in which to complete payment of the wiring account. In Rockford line extensions in the residential districts were started only about ten years ago. During the last five years a vigorous all-year-round wiring campaign has been under way, and as a result about 51 per cent of the homes in the city are now enjoying electric service.

Chart for Reducing the Cost of Billing

The article on page 660 of the ELECTRICAL WORLD for April 7, 1917, regarding a billing chart used by the Marshall County Power & Light Company, Blue Rapids, Kan., whereby 50 per cent of the billing time is conserved, stated that "Similarly, the bill for a consumption of 118 kw.-hr. is found in column 8 [of the chart] opposite 110, reading $8.48." This, of course, should have read $9.08.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

ELECTRIC HEATING AND THE CENTRAL STATION

The Immense and Practically Untouched Field of Electrothermal Processes Requiring Comparatively Low Temperatures

THE meeting of the American Electrochemical Society held in Detroit, Mich., from May 2 to 5, brought out some very interesting electric furnace papers, especially on electric steel, and some very suggestive discussions of the relation between electric heating processes and the central station.

Without going into details of the electric steel papers we may quote from the paper of Dr. John A. Mathews, president of the Halcomb Steel Company, that the infant American electric steel industry already represents an output about eight times as great as the crucible-steel production and one-eighth that of Bessemer production. The discussion brought out data on two large new electric steel plants. At Toronto the Canadian government has in course of construction what will be the largest cold-charge electric steel plant, comprising ten Heroult furnaces of 6 tons (5.45 t.) each for cold melting for the production of shell steel. At South Chicago the United States Steel Corporation intends to make an installation in which molten metal from Bessemer converters will be transferred to two 250-ton (227 t.) open-hearth furnaces (acting as reservoirs) to be finally refined in ten electric Heroult furnaces of 30 tons (27.2 t.) capacity each. This will be the largest electric steel plant in the world, as the whole capacity of this triplex process will be 50,000 tons (45,300 t.) of steel per month.

During the meeting an excursion was made to two electric steel plants in Detroit. Both are supplied with electrical energy from the Detroit Edison Company and it is interesting to note that the rate charged for electrical energy is the same as that charged for electric motor service.

Processes of Electric Heating Requiring Comparatively Low Temperatures

From the central station engineer's viewpoint, however, the most interesting discussions, probably, during the meeting related not to electric furnaces (as commonly understood requiring exceptionally high temperatures) but to electric heating processes requiring comparatively low temperatures. Here is a wide and almost virgin field for central station activity, as pointed out in the paper by Dr. C. F. Hirshfeld, head of the research department of the Detroit Edison Company, on "low-temperature electrothermal processes." The term "low temperature" may be taken as referring to temperatures below about 290 deg. C. (554 deg. Fahr.). Such temperatures are below practically all commercial metal-melting temperatures but are common in numerous baking and drying operations which form a surprisingly large part of industrial processes. The exploitation of electric heating for such low temperatures in industrial practice is really comparatively old, since numerous small electrically heated appliances operating at such temperatures have been used as a matter of convenience in manufacturing establishments for a number of years. During the last few years, however, the use of electric heating for such temperatures has been adopted in cases calling for the installation of equipments with capacities ranging from several hundred to several thousand kilowatts. This is obviously a different sort of a proposition, and must be based on a far broader consideration than mere convenience.

Electric Japanning Furnaces

The first example discussed at length in Dr. Hirshfeld's paper relates to electric japanning furnaces. An installation of this kind may be seen in operation in the Dodge automobile factory, Detroit. The development of the electric japanning process is discussed at great length in the paper. At the time when electrification started it was customary to bake japan in direct-fired gas ovens in most plants. In these ovens gas is burned within the space in which the work is inclosed, and the products of combustion bake the work during the entire process. Temperatures of the order of 180 deg. C. (356 deg. Fahr.) were considered the maximum allowable, and from one and one-half to three hours were required per bake. For good work which was to show a fine finish and was to resist wear and weather three or more coats were deemed necessary. It was found to be particularly difficult to be sure of obtaining a high gloss, and the weathering qualities of work made under what were supposed to be exactly similar conditions were remarkably diverse.

When the electric japanning process had been developed it was found that while baking of the coats in the gas oven consumed a total of five and a half hours, the three corresponding coats were baked electrically in two hours and forty minutes.

Inspection of pieces baked in direct-fired gas ovens and similar pieces baked in electrically heated ovens always shows that the electrically baked material has a higher and more perfect gloss or finish.

The reasons for this are discussed at some length and notes are added on certain experiments conducted on a small scale for the purpose of determining the relative effects of baking by pure convection, baking by combined radiation and convection and baking by heating of the metal itself. For this purpose similar samples, dipped in the same japan, were baked in bottles. For convection baking filtered air was heated in an electric oven to the proper temperature and was then drawn through a bottle in such a way as to make it bathe the inclosed sample. For combined convection and radiation, the sample was surrounded by electric

heaters inclosed with it in a bottle, the volatiles being drawn off and circulation being maintained by means of a small laboratory pump. For baking by internal heating the bottle and its inclosed sample were suspended in an alternating magnetic field of sufficient intensity to give the desired temperature gradient. During baking volatiles were removed by a small laboratory pump.

It is of particular interest to note that baking by internal heating is essentially an electrical method, and that it is far removed in every way from methods previously in use. It is further important to note that with this method a maximum metal temperature of the order of 170 deg. C. (338 deg. Fahr.) and a bake of 15 minutes are perfectly capable of giving better results than can be obtained with external electric heating with 45-minute bake and a maximum temperature of 230 deg. C. (446 deg. Fahr.). It also seems probable that one coat baked in this way will prove the equal of two or three baked by the older methods. The effect of all this upon energy charges for a given weight of metal baked is perfectly obvious.

It seems hardly necessary to discuss at greater length the various phases of the japanning art. It should be evident that electric heating opens up opportunities for improving the product and the production methods used in obtaining that product. It should also be evident that electric heating is capable of reducing factory operations in this field to so exact a procedure that accurate laboratory control is made possible. With industrial conditions brought to this point it becomes possible for research chemists to work to advantage toward the improvement of the japans themselves and toward the improvement of the methods of their utilization.

The second example discussed by Dr. Hirshfeld related to the electric baking of foundry cores, which also seems a very promising field. There are numerous other low-temperature baking processes, and the majority are in the same undeveloped state as are the two cited above. One very important field in which little has been done is the baking of foodstuffs, such as bread and other cereal products. Electric heating has been applied to the baking of such materials in several cases with very gratifying results, improving both the appearance and quality of the product.

The introduction of electrical methods for such purposes as enumerated above should be of particular interest to the chemist, because it makes it possible to reproduce on an industrial scale a sequence of operations and conditions which have been worked out on a small scale in the laboratory. It makes it possible to control industrial production to the same extent that laboratory investigations are controllable, and it thus opens to the chemist in the industrial field a tremendous opportunity for improvement of product and increased production.

In the extended discussion of the paper Dr. Hirshfeld emphasized that the cost of energy is by no means necessarily the vital point. Ten years ago japanning was done by coal and coke firing. The change to gas heating involved an energy differential of 18 to 1, but the higher cost of the gas was considered of minor importance. Why not now change to electric heating where the differential is so many times smaller than in the former case?

Lamps and Lighting

Glasses for Protecting the Eyes.—W. W. COBLENTZ and W. B. EMERSON [illegible] newly developed [illegible] radiant energy, especially [illegible] infra-red or so-called heat rays. For protecting the eye from ultra violet [illegible] yellow, and red [illegible] made of white crown glass afford some protection from the extreme ultra-violet rays which come from mercury-in-quartz lamps and from [illegible] iron, copper or carbon. The vapors from these arcs emit only little infra-red radiation in comparison with the amount emitted in the visible and in the ultra violet. For shielding the eye from infra-red rays deep-black, yellowish-green, sage-green, gold-plated and bluish-green glasses are the most serviceable. For working near furnaces of molten iron or glass, if considerable light is needed, a light bluish-green or sage-green glass is efficient in obstructing the infra-red rays. For working molten quartz, operating oxy-acetylene or electric welding apparatus, searchlights, or other intense sources of light, it is important to wear the darkest glasses one can use, whether black, green (including gold-plated glasses), or yellowish-green, in order to obstruct not only the infra-red but also the visible and the ultra-violet rays. With respect to infra-red rays emitted by a furnace heated to 1000 to 1100 deg. C. about 99 per cent are obstructed by gold-plated glasses, about 95 per cent by sage-green or bluish-green glasses, about 60 to 80 per cent by very deep-black glasses, and about 60 per cent by greenish-yellow glasses.—*Technologic Paper, Bureau of Standards*, No. 93, May 5, 1917.

Generation, Transmission and Distribution

High-Tension Overhead Transmission Lines.—G. V. TWISS.—The first part of an illustrated article of which a summary is given as follows: The author discusses the subject comprehensively, dealing first with the general design of transmission lines. A comparison is drawn between the factors of safety required in Great Britain and those in Canada and the United States. Curves are given for facilitating calculations of cost. In dealing with line materials, a comparison is drawn between the pin-type of insulator and the suspension type. The Hewlett and metal hooded insulators are discussed at some length. Finally, the mechanical design and the testing of insulators are considered.—London *Electrician*, April 27, 1917.

Electrophysics and Magnetism

Effect of Cross-Magnetizing Fields Upon Hysteresis.—N. H. WILLIAMS.—An abstract of an American Physical Society paper. The effect of an alternating field applied at right angles to the direct field while the hysteresis curve was being traced was investigated by the author for steel specimens of varying degrees of hardness. The direct field reached a magnitude of 150 gausses, while an alternating field of maximum intensity, 80 gausses, was applied in some cases. With soft specimens all traces of hysteresis disappeared, while with very hard steel it was reduced till the width of the curve was less than a tenth of the width of the original curve. For soft specimens the magnetization curve with the alternating field applied lies almost

wholly outside and beneath the normal hysteresis curve. For hard steel it lies within the normal curve, except near the top, where it passes outside and above it. It has been possible to compute the induction that should correspond to any field intensity, and points thus determined are found to lie very near to the experimental curve. Their slight deviation from the experimental curve points to two conclusions: (1) The observed effects are not due to mechanical shock, as has been supposed by some. (2) With hard specimens there is a distinct rotational hysteresis or tendency for a flux to maintain its magnitude as it is forced to change its direction.—*Phys. Review*, April, 1917.

Electric Strength of Air and Measurement of High Voltages.—J. B. WHITEHEAD.—A Franklin Institute paper on the electric strength of air and methods of measuring high voltages. After discussing the needle gap and the sphere gap the author deals at considerable length with the corona voltmeter, its construction, application and calibration.—*Journal Franklin Institute*, April, 1917.

Telegraphy, Telephony and Signals

The Use of the Einthoven Galvanometer and a Detector of the Audion Type for Measuring the Strength of Radiotelegraphic Signals.—One of the important determinations to be made in radiotelegraphy is the measurement of signal strength at a receiving station. For making quantitative measurements it is very convenient to record the signals by means of an Einthoven galvanometer and a suitable photographic device. A permanent record is thereby obtained which can be measured accurately at the leisure of the observer. As a detector the author uses a vacuum-bulb detector which is sensitive and not easily thrown out of adjustment. A difficulty arises in its use from the fact that a battery with a large electromotive force is used in the plate circuit. A current of about one milliampere flows in this circuit whenever the detector is in use, thus making it impossible to use a sufficiently sensitive galvanometer directly in the receiver circuit. To avoid this difficulty the arrangement shown in Fig. 1 was used. The current which is continually flowing through the plate circuit causes a potential drop to exist across

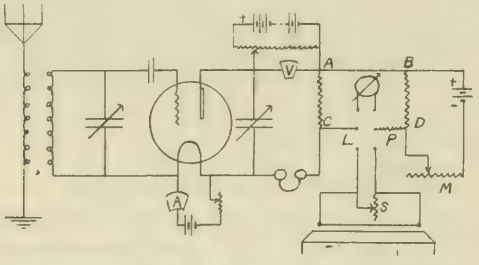


FIG. 1—CONNECTIONS FOR MEASURING THE STRENGTH OF RADIOTELEGRAPHIC SIGNALS

the resistance *A-C* in the circuit. This is balanced by an equal potential drop across a resistance *BD* in an auxiliary circuit. The two circuits are connected together at the point *AB* and the galvanometer is placed between the two circuits at *CD*. When no signals are being received the galvanometer should show no deflection. When signals are received the potential drop *AC* changes, thereby creating a difference of potential between *C* and *D* and causing a deflection of the galvanometer. If this galvanometer is of the Einthoven type it will follow the variations of the current with the reception of dots and dashes. It was found convenient to keep both of the resistances *AC* and *BD* constant at about 2000 ohms and to secure a balance by varying an additional resistance, *M*, in series with the auxiliary battery. Some further refinements are described together with results obtained by this method. *Phys. Rev.*, May, 1917.

Determining the Audibility Current of a Telephone Receiver.—EDWARD W. WASHBURN.—A long abstract of

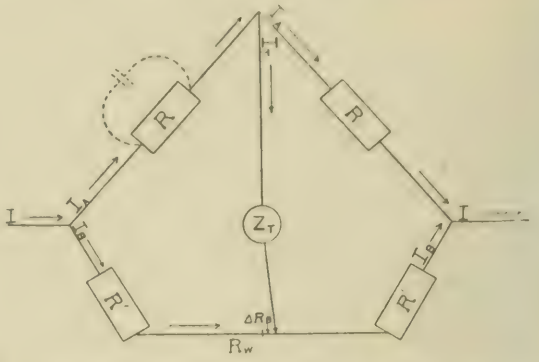


FIG. 2—ARRANGEMENTS FOR MEASURING AUDIBILITY CURRENT

a paper presented at the Chicago meeting of the American Physical Society. Audibility current is the current which must pass through the telephone in order to produce a sound which can just be recognized. The curve connecting the audibility current of a telephone with the frequency of the impressed emf. is a valuable indication of the field of usefulness of the instrument. The author describes a method using a Wheatstone bridge arrangement as shown in Fig. 2. The resistances R and R' should be substantially free from both inductance and capacity. For low-resistance telephones Curtis coils would fulfill this condition sufficiently well, but for high-resistance telephones, especially at the higher frequencies, film resistances would be preferable. The two resistances marked R' are connected by a stretched wire of suitable resistance (R_w), provided with a scale and a sliding contact. The telephone is connected to this sliding contact and to a point between the two resistances R as indicated. A small variable air condenser connected where it is required is employed to insure the exact balancing of reactances. The resistance of that portion of the slide wire lying between its central point and the position occupied by the sliding contact when the audibility current, I_r, is passing through the telephone will be designated by ΔR_B. The current I comes from a high-frequency generator whose frequency can be controlled and kept constant at any desired value. It enters the bridge network at the left and divides as indicated. In series with the bridge is placed a vacuum thermocouple (not shown in the figure) connected to a sensitive millivoltmeter. This instrument indicates the magnitude of the current I. For high-resistance telephones a hot-wire ammeter could be employed. The procedure consists in adjusting the current I until the range of silence on the slide wire is found to have a convenient measurable value. This range of silence is obviously equal to $2\Delta R_B$ ohms. The value of I_r is then obtained from the equation of the Wheatstone bridge. Further simplifications of the method and a numerical example are added.—*Phys. Review*, May, 1917.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

ELECTRICAL MANUFACTURERS' ACCOUNTING AND COST SYSTEM

Electrical Manufacturers' Council Makes Preliminary Issue of System Which Has Received Approval of Federal Trade Commission

The Electrical Manufacturers' Council has made a preliminary issue of a standardized accounting and cost system for the electrical manufacturing industry.

S. L. Nicholson, Westinghouse Electric & Manufacturing Company, chairman of the council, in an introduction gives a brief history of the movement for standardization of accounting and cost methods. The three organizations, embracing 197 member companies, represented by the council are the Electrical Manufacturers' Club, the Electric Power Club and the Associated

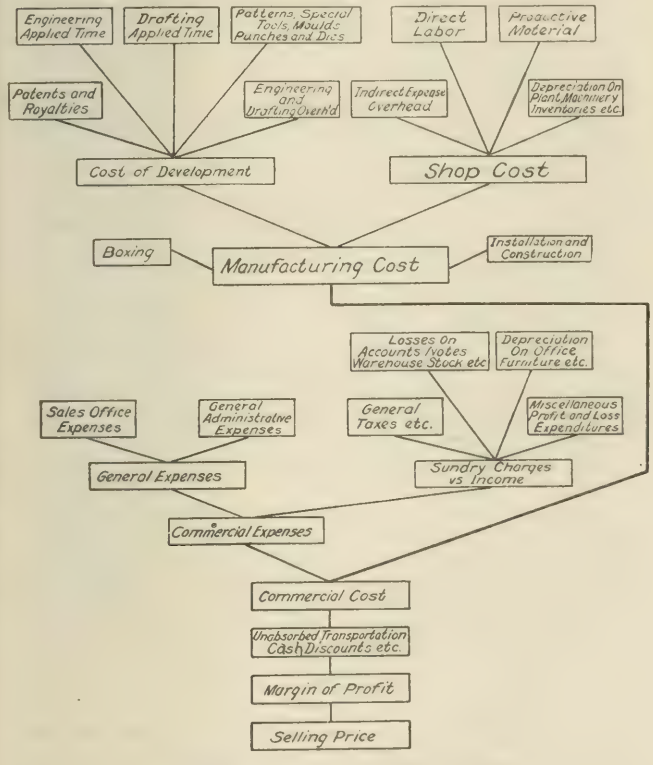


DIAGRAM OF THE ELEMENTS OF COST

Manufacturers of Electrical Supplies. The committee on the standardization of accounting and costs, appointed by the council, was chosen with reference to an adequate representation of all classes of manufacturers, large and small, simple and complex, Eastern and Western, etc., and was as follows:

American Conduit Manufacturing Company, Pittsburgh, Pa. (D. H. Murphy).

Belden Manufacturing Company, Chicago, Ill. (J. C. Belden).

Cutler-Hammer Manufacturing Company, Milwaukee, Wis. (H. F. Vogt).

D. & W. Fuse Company, Providence, R. I. (M. J. Offers).

General Electric Company, Schenectady, N. Y. (C. E. Patterson).

Harvey Hubbell, Incorporated, Bridgeport, Conn. (Harvey Hubbell).

Robbins-Myers Company, Springfield, Ohio (C. C. Miner).

Safety Insulated Wire & Cable Company, New York, N. Y. (LeRoy Clark).

Wagner Electric Manufacturing Company, St. Louis, Mo. (W. S. Thomas).

Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa. (J. C. Bennett).

The system developed by this committee has been approved by the Federal Trade Commission through Edward N. Hurley, chairman at the time the accounts were submitted. The council now submits the system for adoption by the three organizations of manufacturers. It has voted to continue the present committee as a standing unit on uniform accounting and cost methods. All questions and suggestions regarding the system may be addressed to C. E. Patterson, General Electric Company, Room 2059, 120 Broadway, New York.

Mr. Patterson, chairman of the committee, says the system "has been so planned that it not only conforms to the requirements of scientific accounting and an adequate cost system, but is sufficiently flexible so that it may be used to advantage by both large and small manufacturers."

A. I. E. E. MEETING PLANS ARE CHANGED BY WAR SITUATION

Proposed Four-Day Convention at Hot Springs Is Abandoned—Special Two-Day Meeting in New York, June 27 and 28

Discussion at a meeting of the board of directors of the American Institute of Electrical Engineers held in New York on May 18 showed that on account of the national situation a large number of the active members who usually attend the annual convention would not be able to spare the time this year to go to the proposed four-day meeting at Hot Springs, Va. Many of the members have already received commissions in the Engineer Officers' Reserve Corps of the army, and a large number are or soon will be in the service of the government in various other capacities. In view of these facts the directors decided that it would not be feasible to hold the proposed convention at Hot Springs.

It has been decided, however, to hold a special two-day meeting in New York, June 27 and 28, for presentation and discussion of papers that were to have been presented at the annual convention.

Iowa Convention Postponed

The Iowa Section of the National Electric Light Association decided to abandon its convention, scheduled to be held at Des Moines on May 24 and 25, 1917.

THE LIBERTY LOAN AND ELECTRICAL FINANCING

By F. A. VANDERLIP

To the Electrical World

I have your letter of May 18 and am very glad to answer your two questions.

How can electrical companies assist in placing the "Liberty Loan"?

In reply to this question, I would say that the electrical companies can assist in the distribution of the Liberty Loan

(1) By subscribing for their own account;

(2) By making it easy for every employee to subscribe and by seeing to it that every employee does subscribe;

(3) By sending out with all bills and notices an inclosure, which may be secured from the Liberty Loan committee in New York, giving reasons why customers should purchase Liberty Loan bonds and giving information as to how subscriptions may be entered;

(4) By granting facilities gratuitously to the publicity committees in towns where the electrical companies have headquarters or branches for the purpose of giving general advertisement to the Liberty Loan (signs, etc.).

What temporary and permanent effect will the government needs have upon the financing of public utilities?

In reply to the second question, I would say that it is obvious that, with industrial activity incident to the expenditure of large sums of money by the United States government, factories will be unusually busy and laborers will all be busy and working at high wages. This should mean a large sale of energy for electric light and power. At the same time, we must recognize that we are facing a period of unnecessary inflation, that there will be the usual phenomena accompanying inflation, that is, higher prices. The "cost of living" to corporations will go up as it does for individuals, but public service corporations cannot raise their rates as their costs advance. I do not believe that any expenditure that is unnecessary or that can just as well be postponed ought to be made by corporations, any more than an unnecessary expenditure should be made by an individual. We are giving the government $7,000,000,000 of purchasing power; our business is war; we cannot continue to have the same purchasing power ourselves while the government is exercising this purchasing power. We must compete with the government for labor; we must organize the nation for war. Those things that employ labor and can wait should wait.

F. A. VANDERLIP,
President the National City Bank of New York.

Seeking Men for New York National Guard

Every effort is being made to raise 10,000 recruits for the National Guard organization in New York State so as to increase it from the ordinary peace basis to war strength. The work is being carried on through various industries with the object not only of enlisting the required number of men, but also of getting those trained in some lines that are necessary to a complete and most effective organization. It is for this reason that the attention of readers of the ELECTRICAL WORLD is called to the desire of Governor Whitman and the authorities to enlist men in the electrical industries, where available, as well as others who can serve.

CHANGES IN WAR TAX BILL ASKED ON BEHALF OF N. E. L. A.

E. W. Burdett, C. L. Edgar and Arthur Williams Seek to Remove Ambiguities and Prevent Double Taxation

Everett W. Burdett, Charles L. Edgar and Arthur Williams have presented, as a committee of the National Electric Light Association, a statement to Congress asking that changes be made in the war tax bill. The statement is as follows:

The undersigned are a committee of the National Electric Light Association, duly appointed to bring the following considerations to the attention of the committee on ways and means of the House of Representatives and the committee on finance of the Senate. The chairman, Mr. Burdett, is also acting in the capacity of general counsel of the association.

The N. E. L. A. comprises in its membership about 1200 companies in this country and Canada engaged in the production, distribution and sale of electricity, comprising about 95 per cent of those engaged in that industry in this country.

We are not asking for any exemption or reduction in the taxes proposed to be levied upon the services rendered by the companies which we represent. Our purposes are twofold:

1. To remove ambiguities now apparent in the bill.
2. To prevent double taxation and discrimination.

Our specific suggestions are as follows:

I. Change the wording of Title V (page 19 of printed bill) to read as follows:

"Title V. War tax on certain transportation, electric, gas, steam, telephone and telegraph services and facilities, advertising and insurance."

II. In Section 500 (page 21, lines 1 and 2) strike out the words "electric power for domestic uses and of the amount paid for light or heat," and substitute therefor the words "electricity, gas and steam for domestic or household uses."

III. In Section 500 (page 21, line 5) insert after the word "provided" the words:

"That only one payment of such tax shall be required, notwithstanding the lines or facilities of one or more persons, corporations, partnerships or associations shall be used in furnishing such electricity, gas, steam or telephone services; and provided."

IV. In Section 4, page 5, at the end of line 18, add the words:

"Provided that the income derived from dividends upon stock of other corporations, joint stock companies or associations, or insurance companies, which are subject to the tax imposed by said Section 10 and this section, shall be exempt from the provisions of said Section 10 and of this section."

In support of these suggestions we beg leave to submit the following considerations:

I. The reason for this change is to indicate that the purpose of the bill is to bring within its scope certain services furnished by any persons, firms or corporations, whether or not they are technically "public utilities." The character of the seller is immaterial; the important thing is to reach all users of certain services, by whomsoever furnished. The title as it now stands indicates an intention of limiting the tax to services supplied by "public utilities" only, and thus discriminates between persons, firms and corporations engaged in the same business although not all technically within the definition of "public utilities."

II. Our reasons for the change suggested in Sub-section (e) of Section 500 are as follows:

(1) The phraseology as it now stands is meaningless, in that it undertakes to impose a tax on the use to which a thing is put instead of upon the thing itself. It is not the use which is sold, but the service or commodity. As a matter of fact, a company does not sell "electric power for domestic uses," or "light or heat," as such,

but sells electricity or electric energy, which the customer may put to any service which he desires. In the great majority of cases electric service for light, heat and power is given by the use of the same wires and is measured by the same meter. To separate these services so that each could be metered separately would require an entirely independent set of wires. Consumers would therefore have to spend large amounts of money for duplicate wiring, or else confine their service to either light, heat or power alone, whichever they considered of the most value to them.

(2) The word "domestic" is ambiguous, as it may properly be used in several different senses. We assume that the purpose is to secure a tax upon any use of electricity, gas or steam for domestic or household purposes, as distinguished from their use for commercial or manufacturing purposes. In the latter cases the government secures its taxes in other ways. We therefore suggest the phrase "domestic or household" uses.

III. The proviso at the end of Section 500, page 21, carefully eliminates the possibility of double taxation in the case of telegraph and telephone dispatches, messages or conversations. There is no reason whatever why the same security should not be given against double taxation for the services rendered by electric and gas companies. If there were no proviso in the section, it might fairly be claimed that no double taxation is involved; but the existence of a proviso confined to certain telegraphic and telephonic services might give strong ground for the claim that no such exemption was intended in the case of gas and electric services. We therefore urge the importance of such an amendment as the one above suggested.

IV. The income tax of 2 per cent, which it is now proposed by this bill to make 4 per cent, should be exacted from all corporations alike. Many companies are required to maintain separate company organizations to legally carry on their business, and under the bill as now drawn such companies would be obliged to pay a tax of 8 per cent (paying the 4 per cent twice) upon the net income received, while other companies not so situated would be obliged to pay only 4 per cent of their net income received from any stated business that it is intended should be taxed. Obviously, this tax should not be doubled in certain cases because of the necessary method of carrying on the business.

The foregoing is a brief statement of the changes which we propose and the reasons therefor. We would be very glad of an opportunity to appear personally before the committee or any member or members thereof for the purpose of stating with more particularity the necessity for and the propriety of the amendments which we suggest.

We are authorized to add that Edmund W. Wakelee, vice-president of the Public Service Corporation of New Jersey, who has heretofore appeared and submitted to the committee certain proposed changes in the bill, has been over those herein stated with care, and adopts them in place of his own, requesting that the latter be considered as withdrawn.

By a vote of 116 to 58 the House of Representatives has refused to eliminate from the war revenue tax bill the tax at 5 per cent on the amount paid for electric power for domestic uses and on the amount paid for light and heat. The Senate has not yet acted.

SUBSCRIPTION TO THE WORLD'S LIBERTY LOAN

General Electric Company Takes $5,000,000, and Announces Plan Whereby Employees May Take Additional Amounts in Installments

The General Electric Company has subscribed $5,000,000 to the Liberty Loan. It has also perfected a plan whereby employees may arrange to buy bonds on installments, independently of its own subscription.

NATIONAL COMMITTEE ON GAS AND ELECTRIC SERVICE

Organization Follows Authority Granted at N. E. L. A. War Convention—John W. Lieb Chairman—Washington Office Opened

Following the plan approved at the war convention of the National Electric Light Association to promote the fullest measure of co-operation by electric and gas utilities with the national government a "National Committee on Gas and Electric Service" was formed in Washington on May 18. The members are:

Chairman, J. W. Lieb, vice-president New York Edison Company and president N. E. L. A.; vice-chairman, William H. Gartley, chief engineer United Gas Improvement Company; secretary, G. W. Elliott; Walter R. Addicks, vice-president Consolidated Gas Company, New York; Philip P. Barton, vice-president Niagara Falls Power Company; John A. Britton, vice-president Pacific Gas & Electric Company; Alex Dow, president Detroit Edison Company; Charles L. Edgar, president Edison Electric Illuminating Company, Boston; A. E. Forstall, president American Gas Institute; Samuel Insull, president Commonwealth Edison Company, Chicago; Dr. D. C. Jackson, Massachusetts Institute of Technology; Joseph B. McCall, president Philadelphia Electric Company; Capt. William E. McKay, vice-president New England Gas & Coke Company, Boston; Herbert A. Wagner, president Consolidated Gas, Electric Light & Power Company, Baltimore; S. S. Wyer, consulting engineer Natural Gas Association, Columbus, Ohio.

Mr. Elliott, who offered to serve without compensation, will be in charge of the office which has been opened in the Munsey Building, Washington. J. B. Klumpp and Walter Neumuller will assist Mr. Elliott.

The committee will issue a circular urging electric and gas companies to inventory their man-power, dividing employees into classes according to the degree in which they are not essential, are desirable or are imperative in operation and to forward the total numbers of each of these three groups to the committee.

It was also decided that the companies should be advised that the committee is bringing to the attention of the proper authorities the question of giving these utilities preference in coal supply and also the imperative or immediate needs of each company so far as it may be affected by war conditions. To assist in this work gas and electric companies are requested to file data with the committee promptly in answer to a questionnaire which the committee is forwarding.

WHY IT IS THE "LIBERTY LOAN"

It is a loan from a free people to help to free the world.

It is a loan gladly made by a people who enjoy the priceless benefits and heritage of liberty to aid in establishing liberty in Europe and on the broad ocean highways.

Through it the largest and most prosperous nation of democracy gives strength to the worldwide cause of democracy.

DENOMINATIONS.—Coupon Bonds: $50, $100, $500, $1,000. Registered Bonds: $100, $500, $1,000, $5,000, $10,000, $50,000, $100,000.

ELECTRICAL SUPPLY JOBBERS TALK OF BUSINESS CONDITIONS

Large Gathering at Hot Springs, Va., to Discuss Problems Brought by War—$10,000 for Liberty Loan Bonds, $2,000 for Ambulance

The most successful meeting in point of attendance and of interest held by the Electrical Supply Jobbers' Association in some years convened at Hot Springs, Va., on Tuesday, Wednesday and Thursday of this week. All sections of the country, including the Pacific Coast and Southwest, were represented, and the peculiar business situation now confronting the electrical jobbers of the country as a result of war conditions was intimately discussed from every angle.

In addition to the regular meetings of the general association, two meetings of the Atlantic division, presided over by W. E. Robertson of Buffalo, were held on Tuesday as well as two meetings of the Central division under the leadership of Frank M. Bernardin of Kansas City.

Nor were the members so absorbed in business as to forget the spirit of patriotism now pervading the country, for the general secretary, Franklin Overbagh, was directed to purchase out of the funds of the association $10,000 worth of Liberty Loan bonds and a sum not exceeding $2,000 was also authorized for the purchase of an ambulance for service in France.

Three addresses were made at the Wednesday afternoon session on subjects in which the jobbers are at present vitally interested—one by Capt. Edwin W. Moore, president Habirshaw Electric Cable Company, on "The Wire Problem"; another by C. E. Corrigan, vice-president National Metal Molding Company of Pittsburgh, on "Rigid Conduit," and the third, on "Selling Electrical Service," by James M. Wakeman, Society for Electrical Development.

At the meetings of both the Atlantic and Central divisions the conduit, wire and socket situations were canvassed. The Atlantic division in particular had a very elaborate program mapped out and its session lasted till midnight on Tuesday without abatement of interest. A consensus of opinion was obtained from all present on the percentage increase of stocks on hand at the beginning of this year as compared with the years of 1915 and 1916, the percentage increase in the value of the stocks so carried, and the necessity of a reserve fund as a safeguard when prices begin to go back to normal.

In fact, the first session alone of the Atlantic division was admittedly one of the best ever held so far as impressing members with the fundamentals of legitimate business was concerned. The aim was to crystallize thought on the part of jobbers in certain definite directions so that each could reason out for himself what steps he ought to take to survive any abrupt change from above normal to below normal conditions in the market. The program as carried out was as follows:

Program of the Atlantic Division

(1) Is the jobbers' stock on a numerical and tonnage basis now above or below normal?

(2) Assuming that, figured on a numerical basis and on a tonnage basis, jobbers' stocks for May, 1915, and May, 1917, are practically identical, what is the percentage of increase in value on May 1, 1917, and to what level will values recede and over what period of time?

(3) What has been the average per capita increase in pay of employees since May 1, 1915, and how can this be reduced to normal?

(4) What will be the probable demand for materials due to building operations under way and projected?

(5) What is the condition of the iron conduit market, embracing (a) raw and finished manufacturers' stocks on hand and in process, (b) jobbers' stocks on hand and on order, (c) the outlook?

(6) What is the condition of the schedule material market as to manufacturers' stocks, unfilled orders, raw materials and labor conditions that enter into the cost of production, together with jobbers' stocks on hand?

(7) What is the condition in the flexible-conduit market, including metallic, non-metallic and armored conductors?

(8) Do present conditions in the copper market warrant jobbers to expect lower prices for copper during the next six months, taking into consideration conditions in the following: (a) mining, (b) smelting, (c) domestic demand, (d) foreign demand?

(9) Do present conditions in the steel market warrant jobbers to expect lower prices for steel during the next six months?

There was also some discussion on the probable duration of the war and what effect peace negotiations would have on the electrical supply market.

The Wire Problem

In his address Captain Moore outlined the merchandising functions of the jobbers and of the contractors and dealers and the relations that should exist between them and the manufacturers. He said in part:

"One of the essential factors in stabilizing business and preventing demoralization in price is establishing among manufacturers, contractors and jobbers an accurate system of cost accounting. The lack of such a system lies at the foundation of destructive competition.

"So far as we are concerned, we do not regard wire as sold until it is actually installed in service; in other words, we feel that after we have made our sale to the jobber it is up to us to help him with the sale of the wire to the contractor, and that after that we must help the contractor to sell it to the owner.

"Every one of our policies, therefore, is carefully scrutinized from the owner's point of view. We believe that there is nothing in the long run that will prove so economical to the consumer as distribution through the jobber and the contractor. You will note that we say 'economical'—not 'cheap.'

"We believe, as we have said, that we are not far from solving this proposition, and when we have solved it and have created a satisfactory market for our material with the contractor's customers we have no doubt in the world that he will see the wisdom of dealing with the jobber, and that he will establish fair and satisfactory relations with him. We believe that within a short time we will be able to see our business flow through regular channels.

"It is our intention to protect the jobber in every way possible. We realize that the jobber is severely handicapped in doing business by the necessity of carrying a stock, by the maintenance of a warehouse, and by the credit risk which he is absolutely obliged to take in the case of a large number of small customers; and for these reasons we think the jobber should be protected by granting him a lower price than any one else will receive who does not accept the same obligations.

"The same applies to the contractor. As he lightens his burdens by making the jobber carry a large stock

and a large force of salesmen, while he himself is carrying only a small stock and considerably less sales expense, so he, too, in turn, will be protected against the consumer, who carries none of these burdens, and who, consequently, must pay a profit to the contractor and to the jobber.

"It is our idea that 'quality' and 'service' are the two things which the owner of the building is entitled to have. We will furnish the 'quality' and stand responsible for it, but it is up to the jobber and the contractor to furnish the 'service.'

"We are not the least afraid that we are not going to succeed in our policy, because we have already attained success, even though our policy is not as yet fully worked out in all of its details. We do believe, however, that we should receive co-operation, and thorough co-operation, from the jobbers. We do not want the jobbers to go around and say that they handle two kinds of wire, one 'quality' and one 'cheap.'

"We do not think that any jobber should handle anything but good wire, and this does not mean either that we expect all of the electrical supply jobbers in the country to sell nothing but our material. We do feel, however, that no jobber should sell or buy any wire because it is cheap. He is neglecting his obligations to the public when he adopts this attitude.

"If he is now handling what is known as 'cheap' wire, he should immediately investigate the supplier's methods, both manufacturing and selling, and make absolutely certain that nothing is neglected in inspections, and satisfy himself that the material is up to the proper standard.

Standard Policy for Manufacturers

"We cannot emphasize too strongly to the jobber the importance of driving every manufacturer to adopting a standard policy of recognizing the jobbers. This is the only sane policy in the electrical business, and if a manufacturer is not intelligent enough to adopt such a policy, then his selling methods are open to criticism, and when any of his methods are open to question his manufacturing methods are also under fire.

"The jobber must accurately examine his cost of operation and sell no wire except at a profit. He must insist on buying and selling a 'quality' article only. He must deal on prices based on the market, wherever possible, and he must adopt a policy and stick to it. Don't let a salesman who has been unable to sell a standard article come along and show his ability by talking you into using a cheap article which is sub-standard. Convince yourselves that what you are doing is absolutely right, and convince your salesmen, and they will get you the orders, but make your policy and stick to it through thick and thin. A policy is not much good if it does not sometimes take a little courage to carry it out."

Rigid Conduit

The supply of rigid iron conduit is now quite limited, and the market conditions were ably analyzed by C. E. Corrigan. Twelve years ago, he said, there were only four manufacturers of rigid iron conduit in the country, and their total output ranged from 25,000 tons to 30,000 tons annually, while eleven manufacturers are now engaged in the business and the consumption has increased to 100,000 tons annually. Of course the production of conduit and its price vary in a measure with the iron and steel market. The merchant pipe production of the country, which includes conduit, boiler tubes and oil-country products, amounts to 2,750,000 tons annually, and conduit represents about 4 per cent of the pipe production of the United States.

Mr. Corrigan explained the condition of over-production which obtained in 1913 and its effect on the rigid conduit market. As a result of the conditions which then prevailed, the Pittsburgh basing discount plan was adopted, which recognized Pittsburgh as the center of application of terms so that all rigid conduit was thereafter sold f.o.b. Pittsburgh and must be quoted and billed at discounts delivered at destination. In this way the vexing problem of freight charges was eliminated as a disturbing factor.

Mr. Corrigan then outlined the growth of certain business practices and showed the evils of protection contracts covering specific jobs. In October last year all protection contracts were eliminated by the rigid conduit manufacturers. Under present conditions the manufacturers generally sell to authorized distributers and they in turn supply all other classes of trade. The speaker advised jobbers to qualify for the situation in every way possible by stocking the material in carloads and educating all other classes to purchase from them rather than from the manufacturers.

As an index of present and recent conditions Mr. Corrigan quoted comparative average prices on conduit for carload Pittsburgh basing discounts without preferentials, ½-in. size:

	Galvanized	Enameled
July to Dec. 31, 1915	76.70	64.70
Jan. 1 to June 30, 1916	92.00	83.38
July 1 to Dec. 31, 1916	105.20	92.20
Jan. 1 to April 30, 1917	127.98	115.98
Price current May 10	170.00	158.00

The discounts range from 61.65 to 15 per cent in the case of galvanized conduit and from 67.65 to 21 per cent in the case of enameled conduit. Conditions in the iron and steel market are such that at present many manufacturers of rigid conduit have withdrawn from the market and are caring for the wants of only their regular customers. Steel mills can make more money making other products at present, and the shortage of pig iron presages that conditions will become worse instead of better in the immediate future.

The demand for conduit no longer comes from investment building operations such as office buildings and the like, but from factory, state and government buildings, and especially from shipbuilding companies, whose demand for some time to come will be brisk. The steel business will continue to capacity, in Mr. Corrigan's opinion, long after the war has ceased, and that, in addition to the scarcity of raw material and labor, will lead to still higher prices.

The opinion of many in attendance is that there will shortly be no rigid conduit market at all, every sale being the subject of individual negotiation.

Work of Society for Electrical Development

Mr. Wakeman outlined briefly the work of the Society for Electrical Development in its various campaigns and the service the society was prepared to render the jobber. It was decided, he said, to change the date of the usual electrical week from December to spring and to conduct the wiring campaign in the fall instead of in the spring as heretofore.

NORTHWEST ELECTRIC LIGHT & POWER ASSOCIATION TO MEET

President Osborn and Prominent Members Feel It a Duty to Hold Convention—"Business Going On as Usual"

President M. C. Osborn of the Northwest Electric Light and Power Association announces that the annual meeting will be held in Spokane, Wash., on Sept. 12 to 15, as planned. Mr. Osborn speaks of the action of the National Electric Light Association and other organizations in abandoning their conventions and adds:

"Some apprehension has been felt by certain of the membership as to whether or not our convention would be held as usual. This matter has been taken up with the prominent members of the association, and it is felt that it is the duty of the president of the association to bring the convention to a successful conclusion, thereby expressing our confidence in the stability of our national government, and therefore it will be necessary for all of the members to bend their energies and assert their aggressiveness to a greater degree than ever in order to accomplish this.

"It is my belief that in no way can we better show patriotism than by displaying the same spirit that we, as citizens of the United States, displayed in our declaration for national liberty, in making this, our first war convention, greater than all those preceding it. Let us have our business going on as usual."

The program committee feels the importance of continuing, year after year, a paper or bulletin entitled "Experiences and Wrinkles." This will be compiled this year by Lewis A. Lewis, Washington Water Power Company, Spokane. A "wrinkle" is defined as "any device, short-cut method or experience which has been worked out and used to advantage in carrying on your business." President Osborn urges members to send Mr. Lewis any experiences or wrinkles which they may have gathered.

The present program is as follows:

Wednesday, Sept. 12, 10 *a. m.*—Address of welcome, Mayor of Spokane; response, D. L. Huntington, president Washington Water Power Company; committee reports; president's address; paper by J. C. Ralston, member American Society of Civil Engineers, "Aphorisms."

Wednesday, Sept. 12, 2 *p. m.*—Paper, "Practical Central Station Salesmanship." Editor-chairman, Lewis A. McArthur, Pacific Power & Light Company; George Bowen, Northwestern Electric Company; S. A. Hoag, Puget Sound Traction, Light & Power Company; H. W. Lines, Portland Railway, Light & Power Company; Lewis A. Lewis, Washington Water Power Company; C. R. Young, Pacific Power & Light Company.

Thursday, Sept. 13, 10 *a. m.*—Paper, "How the Engineer Can Assist the Commercial Department." Editor-chairman, D. F. Henderson, Washington Water Power Company; Gilbert L. Duffy, Puget Sound Traction, Light & Power Company; J. C. Henkle, Portland Railway, Light & Power Company; A. S. Hall, Pacific Power & Light Company; L. T. Merwin, Northwestern Electric Company.

Thursday, Sept. 13, 2 *p. m.*—Paper, "Co-operation in Modern Home and Apartment House Wiring Practice." Editor-chairman, A. C. McMicken, Portland Railway, Light & Power Company; H. H. Schoolfield, Pacific Power & Light Company; L. R. Grant, Puget Sound Traction, Light & Power Company; F. O. Broili, Northwestern Electric Company; Foster Russell, Washington Water Power Company.

Thursday, Sept. 13, 8 *p. m.*—Illustrated lecture, "Commercial and Residential Illumination," F. D. Fagan, manager General Electric lamp department on Pacific Coast.

Friday, Sept. 14, *Both Sessions*, 10 *a. m. to* 12 *m., and* 2 *p. m. to* 5 *p. m.*—Range committee report, W. R. Putnam, Utah Power & Light Company, chairman.

In connection with this report a paper will be read by H. B. Peirce, Washington Water Power Company, on "Busbar Diversity of Ranges," and one by B. I. Steele, professor of physics, Washington State College, Pullman, Wash., giving results of certain tests.

Friday, Sept. 14, 7:30 *p. m.*—The usual banquet will be held in the Elizabethan room, Davenport's. Informal.

For Saturday, Sept. 15, all-day arrangements have been made to visit the mine and smelter of the Bunker Hill & Sullivan Mining & Concentrating Company at Kellogg, Idaho.

The Washington Association of Electrical Contractors and Dealers will hold its first session on Thursday, Sept. 13, instead of Wednesday, Sept. 12, as previously announced.

ELECTRIC POWER CLUB ANNUAL MEETING PLANS

Sessions in Washington, June 11 and 12—Howard E. Coffin, C. E. Patterson, Costs and War Matters on Program

A change has been made in the plan for the annual meeting of the Electric Power Club. The meeting will be held at the New Willard Hotel, Washington, D. C., on June 11 and 12.

The first day will be devoted to reports of officers and committees, including standardization work, etc.

On the second day Howard E. Coffin will make an address on general manufacturing problems in connection with the national emergency. C. E. Patterson, comptroller General Electric Company, will present a paper on "Uniform Cost Accounting." This will be followed by general discussion and perhaps a short talk by a representative of the Federal Trade Commission.

A member of the club will present a paper analyzing manufacturing conditions during the last two years and showing the cause of increased costs. Government departments may also present some matters.

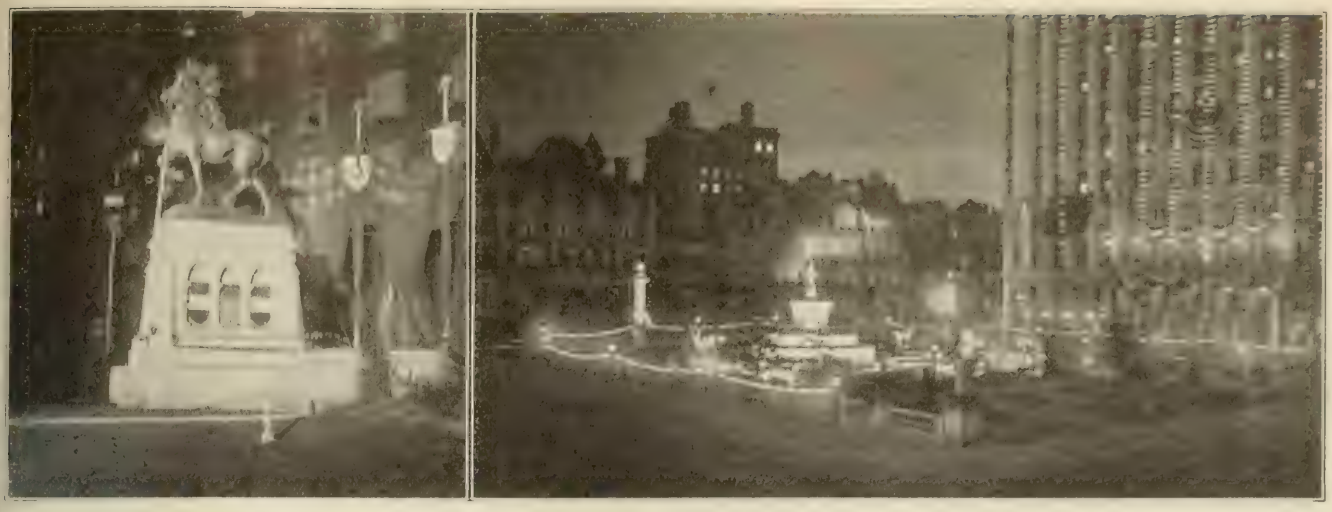
CO-ORDINATION OF UTILITIES IN GREATER NEW YORK

Plans for Effective Mobilization in the National Interest Being Worked Out with Public Service Commission

Carrying out the plan to mobilize through effective co-operation the public utilities of Greater New York, a committee was appointed at a meeting called by the Public Service Commission, First District, on May 17.

John W. Lieb, New York Edison Company, and representatives of gas and electric railway companies were appointed on an executive committee. Sub-committees:

Co-ordination of utility services—George Keegan, chairman; materials and supplies—W. R. Addicks; relation of the utility companies and their employees to the public service and to the national government—J. W. Lieb; relations with the authorities and the protection of plant and property—Travis H. Whitney, Public Service Commission.



ILLUMINATION OF THE JOAN OF ARC AND PULITZER STATUES IN NEW YORK

ELECTRIC LIGHTING TRIBUTE TO FOREIGN WAR COMMISSIONS

Effective Illumination in New York City During Visit of British and French Delegations Described by Clarence L. Law

Describing the effective lighting in New York City during the visit of the British and French war commissioners recently, Clarence L. Law, New York Edison Company, secretary of the Mayor's committee on illumination, states to the ELECTRICAL WORLD:

"The 'Golden Way' on Fifth Avenue extended from Twenty-fifth Street north to Eighty-fourth Street. In this district 528 lamps and globes were changed, increasing the candlepower from 400 to 750.

"The special lighting of the City Hall was produced by using two floodlighting lamps of 500 cp. each with the four flags on the roof. Light from a battery of twenty-five lamps of 500 cp. each was thrown on the façade of the center of the building.

"Both sides of the Washington Arch were lighted by batteries of flood lamps, there being twelve on each side.

"The shafts on the north side of Madison Square were each lighted by batteries of six 300-cp. units in projectors, making a very striking appearance.

"The Lafayette statue and the background especially built were illuminated by six floodlighting lamps in banks of three, diffusing the light.

"On the Waldorf-Astoria building a large electric sign in colors reproduced the badge of the Mayor's committee. This sign was erected in eight hours.

"The Public Library at Forty-second Street was lighted by a system specially designed to accentuate the particular features of the façade.

"At the Pulitzer monument the special illumination consisted of batteries of 500-cp. lamps in projectors installed in cypress trees in housings covered with greens to imitate vines.

"The Soldiers and Sailors' Monument was lighted in the same manner by projectors and 500-watt lamps.

"The Joan of Arc statue and its background were illuminated by a battery of twelve projectors equipped with lamps set across the drive, obscured partially by trees along the driveway.

"In all 112 projectors were used to light the different points, and it is estimated that the amount of light produced was equal to 5,000,000 candles."

SECTION MEETINGS OF THE ASSOCIATED MANUFACTURERS

Chairmen of the Sections to Meet with Board of Governors at Round-Table Dinner in New York on June 5

Chairmen of the various sections of the Associated Manufacturers of Electrical Supplies have been invited by the board of governors to attend a round-table dinner at Delmonico's, New York, on the evening of June 5. One of the subjects of discussion will be the relations of the sections to the national government in view of the needs arising from the war. C. E. Patterson, comptroller General Electric Company and chairman of the committee on the standardization of accounting and costs, will make a talk on the new accounting system.

Meetings of various sections have been called as follows:

June 5, 2 p. m.—Lighting fixture section.

June 6, 10 a. m.—Line material section and snap switch section.

June 6, 2 p. m.—Molded or formed insulation section, lamp receptacle and socket section and knife switch section.

June 7, 10 a. m.—Fan motor section and fuse section.

June 7, 2 p. m.—Panelboard and switchboard section and porcelain section.

June 7, 4 p. m.—Attachment plug section.

June 22, 10.30 a. m.—Outlet box section.

MANUFACTURERS' CLUB MEETING IN NEW YORK

Gathering Replaces the Usual Spring Meeting at Hot Springs, Va.—Resolutions Offer Co-operation with Council of National Defense

A meeting of the Electrical Manufacturers' Club was held at Delmonico's, New York, on May 17. It replaced the May meeting usually held at Hot Springs, Va.

Resolutions were passed offering the co-operation of the club with the Council of National Defense. Aside from this action only business of a routine character was transacted.

Dr. Talcott Williams made an address on international relations.

INJUSTICE OF FIXED RATES WHILE COSTS KEEP RISING

Missouri Association of Public Utilities, on Annual Convention Trip, Shows Immediate Need of Action—Committee on Rates and Fuel

The eleventh annual convention of the Missouri Association of Public Utilities was held on board the steamer Quincy on the Mississippi River between St. Louis and Cape Girardeau from May 17 to 19. Association members, their families and friends to the number of about 180 were on board. In his presidential address Hugo Wurdack, St. Louis, pointed out the absolute necessity of most efficient operation of all public utilities at this crucial time.

Injustice of Fixed Rates

John A. Porter, vice-president Light & Development Company of St. Louis, read a paper on "Variable Versus Fixed Rates," drawing attention to the injustice done to both the public and the utility by the continuance of fixed rates in the face of increasing prices of all commodities which go into the utilities' products. Mr. Porter presented data from ten plants to show how costs have advanced.

The spirited discussion which followed indicated an immediate need for action on the part of utilities and the Missouri commission to increase rates. It seems to be the prevailing impression that the increase can be had most expeditiously by increasing the price to large power customers without disturbing residential rates.

Dr. Shaw, a former member of the Public Service Commission, said: "I doubt very much if the proposition for variable rates upon the cost of commodities could be introduced without long discussion and more education upon the part of the commission than has already been given. I think it is more a question of emergency relief on account of existing conditions. I believe that if the matter is presented to the commissioners in the right light they will not see how they can avoid it, and if they do avoid it the courts will have something to say."

In the absence of C. S. Ruffner, vice-president Union Electric Light & Power Company, St. Louis, L. H. Egan read an editorial from the Electrical World of May 12, "Opportunities for Service Developed by the War," and abstracts from the report of the National Electric Light Association war convention.

The Friday afternoon session was opened by a paper on "The Relation of the Public to Public Utilities," by Dr. Shaw, formerly of the Public Service Commission.

"The Group Block Rate," a paper by J. E. McLeod, Laclede Gas Light Company, St. Louis, explained that company's rate system.

E. D. Bell, general superintendent St. Louis Electric Terminal Railway Company, presented a paper on "Interurbans as State Developers."

Committee on Rates and Fuel

At the final business session, Saturday morning, a committee was appointed to investigate the rate and fuel situation, and to prepare a report to be presented before the State Public Utilities Commission. It is expected that the efforts of this committee will operate to relieve immediately the difficult situation of the smaller companies.

The following were elected for the ensuing year: President, Bruce Cameron, United Railways, St. Louis; first vice-president, J. H. Van Brunt, St. Joseph (Mo.) Railway, Light, Heat & Power Company; second vice-president, J. N. Scott, Kansas City Gas Company; third vice-president, L. P. Andrews, City Water Company, Sedalia; secretary and treasurer, F. D. Beardslee, Union Electric Light & Power Company, St. Louis; executive committee, J. E. McLeod, Laclede Gas Light Company, St. Louis; L. H. Egan, Union Electric Light & Power Company, St. Louis; committee on public affairs, I. R. Kelso, St. Louis; E. D. Bell, St. Louis; J. R. Woodfill, Aurora, and C. L. Proctor, Joplin.

MEN WANTED FOR SIGNAL ENLISTED RESERVE CORPS

Several Thousand Trained Workers Are Needed for Field Signal Battalions of New National Army

The Signal Enlisted Reserve Corps of the United States Army needs several thousand trained electrical men, particularly those experienced in telegraph, telephone and radio work, including operators, construction men, wire men, maintenance men and electricians. This presents an exceptional chance for instructive employment in the service of the country. Ten field battalions are being organized in the Eastern Department of the army, and it is expected that they will be mobilized in the near future.

The Signal Enlisted Reserve Corps will be a part of the new national army, and comprises both field and telegraph battalions, the former serving with the various divisional headquarters in the field and the latter maintaining communication with interior bases.

This necessary branch of the service maintains the lines of communication between the commanding general of the division and his cavalry, artillery and infantry brigades, as well as with regimental and battalion headquarters. In their electrical work the signal corps field battalions maintain telegraph, telephone and radio communication, while in visual signaling they use wig-wag and semaphore flags and heliograph in the daytime, and at night flashlight and lantern.

In signaling, parties of three or four men are often employed, and there are, therefore, a large proportion of non-commissioned grades such as sergeants, corporals, etc., so that there is a good chance of promotion.

The Enlisted Reserve Corps is composed of men from eighteen to forty-five years of age and is subject to only fifteen days' annual service in peace, while in wartime it may be called at the discretion of the President. Pay corresponds to that of the regular army, and uniforms are furnished as well as transportation to place of mobilization.

Enlistment may be made by applying to signal officers of the various departments of the army, as follows:

Eastern Department, Army Building, 39 Whitehall Street, New York.

Central Department, Federal Building, Chicago.

Northeastern Department, Nottingham Chambers, Boston.

Southeastern Department, People's Bank Building, Charleston, S. C.

Southern Department, Fort Sam Houston, San Antonio, Tex.

Western Department, San Francisco.

COMMISSION VALUATION OF POTOMAC POWER COMPANY

Finding of Regulating Body Places Figure of $11,231,170 Upon Property of Company in District of Columbia

Announcement of the results of valuation of the Potomac Electric Power Company has been made by the Public Utilities Commission of the District of Columbia. In its conclusion the commission says:

"After full consideration of all the evidence in this case the commission finds the fair value of the property of the company used and useful for the convenience of the public within the District, as of July 1, 1914, to be $10,250,000. It finds the net addition to investment from July 1, 1914, to Dec. 31, 1916, inclusive, to be $981,170, and therefore further finds the fair value of the property used and useful for the convenience of the public within the District as of Dec. 31, 1916, to be $11,231,170. In reaching conclusions the commission has, as to every element of value, considered the company as a going concern in successful operation."

INCREASE IN POWER RATES BY THE PITTSFIELD COMPANY

Schedule Will Be Decreased or Increased 1¼ Mills per Dollar Decrease or Increase in Coal—Steam Heat Rates Also Up

Increases in power and steam heating rates are announced by the Pittsfield (Mass.) Electric Company as a direct result of higher coal cost. The advance in power rates takes effect on June 1 and that in heating rates on Sept. 1. The notice to power customers states:

"Coal cost $3.75 on the cars in Pittsfield when our present power schedule was adopted. To-day the cost of coal is $6.15, an increase of $2.40 a ton.

NEW POWER SCHEDULE OF PITTSFIELD COMPANY

Amount Used per Month Kw.-Hr.	Rate, Cents	Amount Used per Month Kw.-Hr.	Rate, Cents
0 to 100	6	5,000 to 10,000	2.5
100 to 200	5	10,000 to 15,000	2.25
200 to 300	4.5	15,000 to 45,000	2
300 to 400	4	45,000 to 75,000	1.8
400 to 800	3.5	75,000 to 100,000	1.7
800 to 1,500	3.25	100,000 to 150,000	1.6
1,500 to 3,000	3	150,000 and over	1.5
3,000 to 5,000	2.75		

Five per cent discount on above rates for payment of bills on or before the fifteenth of the month in which they are rendered.

This schedule is subject to change depending on the decrease or increase in the cost of coal.

Minimum charge for connection, 75 cents per month, plus 25 cents per connected horsepower or fraction.

RENTAL CHARGE FOR MOTORS BELONGING TO THE COMPANY, IN ADDITION TO ABOVE SCHEDULE

Size	Rent per Month	Size	Rent per Month
½	$2.00	7½	$7.50
¾	2.25	10	10.00
1	2.50	15	12.00
2	3.00	20	15.00
3	4.00	25	17.00
5	5.00	35	25.00

"For each $1 increase in the cost of coal the cost of producing electric power has risen 1¼ mills per kw.-hr.

"The directors of this company now find it necessary to increase the rates for electric power by the increase in cost of coal and announce a new schedule to take effect June 1, 1917.

"This schedule will be decreased or increased at the rate of 1¼ mills per dollar decrease or increase in the cost of coal. We hope the high price of coal is only temporary and that we will be able to restore the former schedule in the near future."

PORTLAND COMPANY VALUATION BY THE OREGON COMMISSION

Decision of Regulating Body That Value Is $55,307,474, of Which $19,492,153 Is Electric Utility Operating Property

A valuation of the property of the Portland Railway, Light & Power Company has been completed by the Oregon Public Service Commission. It says:

"Based upon a consideration of these elements, in the light of the entire record before it, and making due allowance for development cost and working capital, the commission finds as fact that the value of the utility property of the company for rate-making purposes, as that value is hereinbefore defined, plus the value of the non-utility property determined on the same basis, was on Dec. 31, 1916, $55,307,474. Of this amount $8,444,502 represents non-utility property, leaving a total valuation of the property used and useful in the service of the public of $46,862,972."

Of this value $19,492,153 represents electric utilities.

LIGHTING PREPAREDNESS PARADE IN COLUMBIA, S. C.

Outfit Mounted on an Automobile, with Wires Extended to Poles Carried by Scouts, Provides Illumination for Band and Flag

J. F. Knowlen, general superintendent Columbia (S. C.) Railway, Gas & Electric Company, calls attention to a unique method of lighting a preparedness parade and welcoming a "booster club" which was adopted recently in that city.

Mr. Perry of the Perry-Mann Electric Company of Columbia mounted a Delco lighting outfit on the rear of a Ford car and extended wires to poles bearing lamps which were carried in the parade by boy scouts. The energy provided light for the band and also illuminated a transparent flag.



PURCHASE OF UTILITIES BY THE MILWAUKEE SYSTEM

Company Acquires Property and Business of Commonwealth Power Company and Heating Business of Continental Realty Company

Early in July, 1916, the Milwaukee Electric Railway & Light Company was authorized by the Wisconsin Railroad Commission to purchase the Commonwealth Power Company property and plant. This followed the practical conclusion of negotiations between the parties looking to the sale to the Milwaukee company of the competing utility plant owned in large part by the principal stockholders of the Schlitz Brewing Company.

The Commonwealth company was organized in 1907 and built a plant and distributing system within a limited area in almost the exact center of Milwaukee, extending about one mile along the west bank of the Milwaukee River. For a number of years the principal load consisted of the power supplied to the Schlitz Brewing Company and to a few large buildings owned by the same interests in the business center. The company came under the provisions of the public utilities act and obtained an indeterminate permit upon surrender of its franchise. The Continental Realty Company owned and operated a heating distribution system, which was generally managed and operated as an auxiliary of the Commonwealth business.

The details, effecting actual transfer of the property pursuant to the authorization of the commission, were finally completed on April 9 of this year, and the Milwaukee company took possession of the property on that day.

The principal generating station of the Commonwealth company, on the west bank of the Milwaukee River immediately south of the Holton Street viaduct and near the north limit of the Commonwealth company's franchise district, has a rating of 6000 kw. It carried the principal load, but supplied no heating service. The company had a plant containing 1200 kw. in generating equipment in the Enterprise Building, Second and Sycamore Streets. The steam-heating mains radiating from this plant are already cut over to the extensive heating system of the Milwaukee company, and the Enterprise plant has been shut down. Electrical connections have been effected between the Milwaukee company's main Commerce Street station and the distributing system of the Commonwealth company, which permitted the closing down of the Holton Street plant. This station will be held in reserve by the Milwaukee company for peak-load service during winter months.

The equipment constituting the Enterprise plant is being removed and will be installed in the Milwaukee company's Oneida Street station for use in furnishing exhaust steam to the Milwaukee company heating system. Small substations operated by the Commonwealth company either have been discontinued or will be immediately, and the distributing system supplied from such substations is being cut over to the Milwaukee company's system. Owing to similarity in characteristics, the Milwaukee company took over the entire Commonwealth system with comparatively few changes.

The Commonwealth Power Company had a maximum load during the winter of 1916-1917 of 2500 kw. For the year ended June 30, 1916, the electric business of the Commonwealth Power Company amounted to $231,000 gross, of which about 40 per cent came from the Schlitz Brewing Company and allied interests. Consolidation will permit the business of both companies to be handled by one organization with considerable gain in economy.

SAN FRANCISCO TO EXTEND NEW LIGHTING SYSTEM

General Plan Harmonizes with Installation for the "Path of Gold"—Arrangements for Financing the Cost

Construction has been commenced on the installation of a lighting system in the triangular section of San Francisco bounded by Market, Powell, Sutter and Kearny Streets. The general plan harmonizes with the new lighting system installed recently on Market Street.

This plan provides for the illumination of approximately 8900 ft. of street and involves 15,000 front feet abutting property; 258 lamps are to be installed on 128 two-lamp standards. The lamps are to be 6.6-amp. luminous-arc type equipped with "San Francisco Gold Carrara" glassware as in the Market Street system.

It is the plan to operate 102 of the lamps all night, while the remainder will be turned out at midnight. The contract between the Pacific Gas & Electric Company and the Downtown Association provides that the merchants and property owners will contribute $16,177 per annum toward the system. On this basis the city is required to advance only $4,000 per year in addition to the present cost of lighting this district. In other words, the Pacific Gas & Electric Company has offered to install the system and operate it for five years at $27,652 per annum. At present the city pays $7,475 per annum for lighting this area.

The installation is to be carried out by the Pacific Gas & Electric Company, using equipment designed by W. D'A. Ryan and supplied by the General Electric Company. It will be in operation Oct. 1, 1917.

PLAN FOR THOMSON MEDAL FUND ISSUED BY N. E. L. A. COMMITTEE

Class B and E Members Asked to Contribute to Promote Studious Effort and Progress Among Younger Men

L. D. Gibbs, chairman, and Frank A. Birch, composing a committee of the National Electric Light Association to secure subscriptions to the Thomson scholarship fund, have written to Class B and E members suggesting that they take a voluntary part in the movement.

The fund is to be $5,000. It is proposed as a recognition of the eminently helpful work of Prof. Elihu Thomson. Suggested by Past-president E. R. Weeks, the plan adopted was worked out by a committee of which Charles L. Edgar was chairman and John F. Gilchrist, J. W. Lieb and Mr. Weeks members.

This medal is to be awarded "in any year to any citizen of the United States or Canada who at the time of the award shall not be over thirty-five years of age, and who, in the judgment of the trustees of the medal, shall have made a notable contribution to electrical science or its industrial applications through original investigation, research or discovery, or through whose direct efforts a substantial contribution to the advancement of the industry shall have been accomplished."

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Iowa Commissioners Rule on Danger Label.—The Iowa Board of Railroad Commissioners has given a formal ruling construing the provisions of Sec. 2120-r, code supplement, with reference to the length and width of the letters of the "label." The section referred to provides: "At any crossing of any highway by said transmission line the poles or towers next to the highway shall be labeled 'Danger. —— Volts Electricity.'"

Indiana Commission Orders Lower Rates in Terre Haute.—The Public Service Commission of Indiana has rendered a decision in the case in which the Commercial Club of Terre Haute sought revision of electric rates in that city. The Terre Haute, Indianapolis & Eastern Traction Company supplies electric service. The commission valued the property "used and useful for the convenience of the public" at $900,000 and ordered a lower rate to take effect June 1, 1917. It allowed a return on the $900,000 valuation of 7 per cent, or $63,000 annually. In referring to cost of coal, the commission says: "Defendant now claims that there will be an increase of $40,000 for fuel. This will no doubt be true for the next year, but we assume that the figure will not be so high over a period of five years. No doubt a revision of rates will be made near the expiration of that period if the result of the rates now established does not show that a modification should be made in a shorter period."

Testimony on Cleveland Valuation.—The Ohio Public Utilities Commission heard testimony on May 15 in the appeal of the Cleveland Electric Illuminating Company from the Cleveland city ordinance fixing the lighting rate at 3 cents per kilowatt-hour. Fred Schauffler, Cleveland real estate dealer, testified regarding the valuation of property by a committee of the Cleveland Real Estate Board. Director of Law W. S. FitzGerald cross-examined him as to the factors considered in fixing the value of the land at $935,096. The value given by the commission engineers was $921,728. Robert Lindsay, vice-president and general manager of the company, told how the company arrived at the value of its properties. He contended that the commission should not make a deduction for depreciation. Attorney FitzGerald criticised the commission's allowance of $1,115,724 for cost of attaching business, $303,551 for working capital, $5,00,000 for overhead expenses, and the items allowed for preliminary and administration expenses. The commission's total valuation of the property is $20,820,062, while the company's comes to $22,478.342. F. W. Ballard, former Cleveland commissioner of light, has been employed, and he was given until July 10 to prepare a statement on intangible values.

Consumers' Deposits in Illinois.—In the matter of W. L. Cook (Lacon, Ill.) vs. Public Service Company of Northern Illinois, the Illinois Public Utilities Commission discusses cash consumers' deposits and passes upon the equities thereof. The petitioner had been asked to make a cash deposit of $20 to assure the prompt payment of his bills for electric service at a hotel in Lacon; the company refused to accept a guarantee of a local property owner in good credit standing, and the customer appealed to the commission. The commission says: "The situation is little different from that which heretofore has confronted the commission on several occasions. This commission (as well as other regulatory commissions) has recognized the necessity of requiring reasonable cash deposits to assure prompt payments of consumer's bills, provided such deposits be collected without unfair discrimination. Uncollectible bills, if possibly not allowable as an operating expense in a utilities account, at least represent an item (or deduction from revenue) which must be given adequate consideration in a rate case before the commission can determine upon the fair rate of return that a utility is entitled to receive. The dishonesty of a few, manifested by uncollectible bills upon a utility's books, must ultimately be distributed over the rates which are paid by the more conscientious users of public utility service. In protection to the general public, it becomes necessary to establish fair and reasonable guarantees to assure that utility service bills be paid with reasonable promptness and dispatch. Naturally, the respondent herein, in common with utilities generally, would prefer that the question of a requirement of a cash deposit in individual instances be left to the utility's judgment. To a certain extent there is some argument in support of this view, inasmuch as the field of state regulation at this point appears to approach and mingle with the inherent management which properly is to be left to the utility itself. It has been the experience of this commission, however, that consumers generally are more or less averse to the making of cash deposits unless the reasonableness thereof has been passed upon by the commission, and it has been the further experience that considerable unjust discrimination and unreasonableness will be practiced by utilities if left to administer consumers' deposits without proper restrictions. Surely it is not improper that this commission take jurisdiction over the regulations governing such deposits, and such jurisdiction is well within the wording and the intent of the public utilities commission law." The commission required the utility to file regulations governing the terms and conditions under which consumers' deposits are required, held, and withdrawn; and, until such rules had been filed and accepted, the utility was required to desist in its practice of requiring consumer deposits in Lacon.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public-utility companies.

Claim for Minimum Rate During Receivership After Power Was Cut Off Not Allowed.—Where a contract for electric power service required the customer to pay a certain minimum rate for investment, whether energy was used or not, where the customer was placed in receivership, and the company immediately cut off the current without notice, its claim for the minimum rate during the receivership after the power was cut off cannot be allowed, it was held by the Supreme Court of North Carolina (925 E. 6).

Regularity in Support Furnished Dependents.—Under the workmen's compensation act authorizing an award for the death of an employee should he leave any widow, child, parent, grandparent or other lineal heir to whose support he had contributed within four years previous to the time of his injury, it is not necessary to show that there was any regularity in the support furnished or that those receiving contributions were dependent on the deceased employee, the Supreme Court of Illinois held in the case of Commonwealth Edison Company vs. Industrial Board of Illinois (115 N. E., 158).

Use of Streets Under Legislative Grant.—Under the law authorizing the construction of a telegraph or telephone line along public highways or across rivers or over any lands belonging to the State or to any private individual, and the erection of necessary fixtures, etc., and that such fixtures must not be so constructed as to incommode the public, and shall not be set up on private grounds without paying damages, no compensation need be paid to a city for the use of its streets for such fixtures, although the statute did not bargain away the police power of the state or a city or the power of the city under legislative authority to impose a license fee or tax, it was held by the Supreme Court of Iowa (162 N. W., 322). Under the legislative grant a telephone company had the unlimited right to use the public streets of a city for its poles, wires and apparatus, rent free, and this right continued until revoked by the State in the exercise of its reserved powers, since as the State has not only all the power delegated to a city, but complete and plenary powers over all matters which it may delegate, it was within the powers of the Legislature to make such grant. Where the fee title to streets and alleys is in a city, it is held by the city in trust for the general public, and not for itself and its inhabitants alone, and hence where permission or authority is granted by the Legislature itself, the city is not entitled to compensation.

Associations and Societies

A complete Directory of Electrical Associations is regularly printed in the first issue of each month on the next to last text page.

Associated Employees of the New Orleans Railway & Light Company.—At a recent meeting of the Associated Employees of the New Orleans Railway & Light Company E. N. Avegno was unanimously elected president for the coming year.

New York Electrical Society.—The 356th meeting of the New York Electrical Society was held in New York City on May 17. "Electric Travel in the Northwest and Mount Rainier National Park" was the topic of the evening, Gilbert McClurg being the speaker.

American Chemical Society. — The fifty-fourth meeting of the American Chemical Society was recently held in Kansas City, Mo. An interesting outline of hydroelectric developments in Canada was given by H. E. Howe, who acted as chairman of the industrial division.

Institute of Radio Engineers.—Professor Pupin was unable to present his presidential address before the Institute of Radio Engineers on May 16, as planned. He will present his paper on "Iron at Radio Frequencies" on June 6 at the Engineering Societies Building in New York City.

Something New in Industrial Lighting.—Ward Harrison, illuminating engineer of the National Lamp Works of the General Electric Company, Nela Park, Cleveland, addressed the Chicago Section of the Illuminating Engineering Society on May 18, his subject being "Something New in Industrial Lighting." This was the last meeting of the season.

Society of Terminal Engineers.—The first regular meeting of the recently organized Society of Terminal Engineers will be held in New York, in the United Engineering Societies Building, on May 29. Special papers on terminal engineering and mechanical freight and material handling will be read. Committees will be appointed and a program adopted for the future work of the society. The secretary is J. H. Leonard, 1133 Broadway, New York.

Indiana Electric Light Association.—The new-business committee of the Indiana Electric Light Association, of which O. M. Booher of Kokomo is chairman, is making arrangements for a live convention and get-together meeting at Fort Wayne, Ind., June 20. The following papers will be presented: "Increasing Load Factor on Existing Lines," by N. A. Perry of Indianapolis; "Organization of New-Business Departments," by Thomas Donohue, Lafayette, Ind.; "Sales Developments of Socket Appliances," by M. Milton Henoch, Pittsburgh, Pa.

Association of Iron and Steel Electrical Engineers.—The Philadelphia Section of the Association of Iron and Steel Electrical Engineers will hold a meeting in Philadelphia on June 2.

National Electrical Contractors' Association.—President Robley S. Stearns of the National Electrical Contractors' Association has announced that the next meeting of the executive committee will be held June 19 and 20, the place to be decided upon later.

Electrical League of Cleveland.—The Electrical League of Cleveland will hold its annual meeting on May 31. One of the chief purposes of this meeting will be to elect seven directors for two years. On May 17 J. E. Latta of the Underwriters' Laboratories of Chicago addressed the league on the subject of "New Tendencies in Safety Work."

Research as a Profession.—The Worcester Polytechnic Institute branch of the A. I. E. E. held a meeting on May 18 at which Dr. P. G. Nutting, director of the new research laboratory of the Westinghouse Electric & Manufacturing Company, spoke on the subject "Research as a Profession." Dr. Nutting was formerly with the Bureau of Standards at Washington and with the Eastman Kodak Company, as assistant director of its research department.

Association of Iron and Steel Electrical Engineers.—"Power Cost Accounting Systems as Practiced by Several Steel Mills in the Pittsburgh Section" is the title of a paper to be presented by W. O. Oschmann, chairman of the power committee, at the regular monthly meeting of the Association of Iron and Steel Electrical Engineers, held at Pittsburgh to-day. The safety committee will also meet. The papers to be presented at the eleventh annual convention in Philadelphia by the safety committee will be under discussion. At the June meeting of the Pittsburgh Section James Farrington will present a paper on "By-Product Coke Ovens in the Steel Industry." The Cleveland Section of this association will hold a meeting in October to form a permanent organization out of the Cleveland body.

Empire State Gas and Electric Association.—The Empire State Gas and Electric Association held its mid-year meeting on May 17 at Syracuse, N. Y. The first subject for consideration at this meeting was "Work on Consumers' Premises," which was introduced by J. P. MacSweeney of the Rochester Railway & Light Company. A paper was presented by W. M. Halsey of the Public Service Gas Company of New Jersey, on "Merchandising," and another by Thomas R. Elcock, Jr., of the United Gas Improvement Company, Philadelphia, on "Advertising." Robert W. Hoy of the Elmira Water, Light & Railroad Company read a paper on "Residence Lighting with Particular Reference to House-Wiring Campaigns." C. H. B. Chapin, secretary, and H. C. Deffenbaugh, assistant secretary of the association, introduced the subject of "Service Charge," by which was meant the service charge portion of a rate and not a charge for service connection.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Municipalities Empowered to Operate Utilities. — Governor Brumbaugh of Pennsylvania has signed a bill authorizing municipalities to lease and operate light, heat and power plants and systems and other public utility properties.

Co-operative Campaign of Pacific Gas & Electric Company.—The following supplements the statement of S. V. Walton, manager commercial department Pacific Gas & Electric Company, at the convention of the Pacific Coast Section, National Electric Light Association, as reported in the ELECTRICAL WORLD of April 28, 1917, page 815: Mr. Walton's statement at the Riverside convention with reference to the number and capacity of appliances put out in the co-operative campaign last year was to the effect that approximately 45,000 pieces, having a total rating of approximately 27,000 kw., were sold by the various jobbers participating in the campaign. The majority of these sales were made in the territory of the Pacific Gas & Electric Company, although, of course, a certain number were on lines other than those of that company, as the territory served by the jobbers is more extended than that served by the Pacific Gas & Electric Company.

Military Census of New York City Factories and Mercantile Establishments.—New York State proposes to take a census and inventory of the military resources of the State under laws passed this year and the State military law. A director of the census has been appointed for each county and one for New York City. E. P. Goodrich, member of the American Society of Civil Engineers, has been given the latter post. A preliminary enumeration has shown that in Greater New York there are about 3200 factories and mercantile establishments, in which are employed 400,000 persons. It was believed that this large group of persons could be readily segregated and returns secured from them in their places of employment. Director Goodrich has asked Alfred D. Flinn, member of the American Society of Civil Engineers, to organize a volunteer force among engineers of the various branches of the profession in New York City to take this part of the census. It is estimated that 400 or more engineer canvassers will be needed, each giving two full days or more of his time. Letters giving further information and forwarding pledge cards will be sent to the engineers of New York City in the near future. If any of the ELECTRICAL WORLD readers are able to help, and do not receive such an invitation, they may communicate with Director Goodrich or Mr. Flinn at room 904, 261 Broadway.

Men of the Industry

Changes in Personnel and Position—Biographical Notes



A. S. M'ALLISTER

A. S. McAllister, consulting electrical and illuminating engineer, and former editor of the ELECTRICAL WORLD, is one of the three vice-presidents elected at the annual meeting of the American Institute of Electrical Engineers last week. Dr. McAllister was born Feb. 24, 1875, at Covington, Va., where he received his early education. Upon graduation from Pennsylvania State College in 1898 he worked at mines near Windber, Pa., during that year and the next, where he gained experience in electric locomotive operation. In the following year he went to the Westinghouse works at East Pittsburgh, Pa., where he studied practical manufacturing details of direct-current and alternating-current machinery. In 1901 he completed a post-graduate course in electrical engineering at Cornell University, and in 1905 he received the degree of Ph.D. From 1901 to 1904 he was instructor in physics and applied electricity at Cornell, being appointed in 1904 to an assistant professorship in electrical engineering. The following year Dr. McAllister joined the staff of the ELECTRICAL WORLD as associate editor, becoming editor of the paper in 1913. In 1915 he resigned to take up engineering work as consulting engineer. Dr. McAllister is particularly well known for his pioneer work in illuminating engineering and in the design of alternating-current motors. He has contributed largely to contemporary engineering literature both in the form of original articles and in textbooks which are widely used. Dr. McAllister is a fellow of the Institute and a past-president of the Illuminating Engineering Society, besides being affiliated with many other technical associations of national scope.

H. B. Joyce, who was formerly power engineer of the United Electric Light & Power Company, has severed his recent connection with the Roth Wind Power & Ventilator Company to return to the United company, where he resumes the direction of the activities of its power bureau. Mr. Joyce received his engineering degree from Cornell University, and was foreman of the test department of the New York Edison Company for five years. During his previous connection with the United company, a number of very large power contracts were secured through him with companies engaged in refrigeration, metal refining and manufacturing industries.

S. J. Dill, vice-president of the United Gas & Electric Engineering Corporation, who was temporarily placed in charge of the operation of the company's Northern properties, succeeding George B. Tripp, will devote his time to the oil interests of the corporation, having recently been elected president of the Utilities Oil & Refining Corporation, which owns a large producing oil property in southern Kansas.

Bruce Cameron, superintendent of transportation of the United Railways, St. Louis, was elected president of the Missouri Association of Public Utilities at its 1917 annual convention last week. Mr. Cameron was born in Nevada, Mo., in 1877. He became connected with the United Railways in 1901, and in 1906 he was appointed superintendent of transportation, which position he still holds. In addition to his operating work, he has been active in the welfare work of the company.

Frederick Bedell, professor of applied electricity, Cornell University, was elected one of the vice-presidents of the American Institute of Electrical Engineers at the annual meeting last week. Professor Bedell, who is widely known as a writer of textbooks for electrical engineering students, has made very valuable contributions to the art in his research studies of alternating-current phenomena, especially as affected by wave form. Born in Brooklyn, April 12, 1868, his family moved to Montclair, N. J., four years later, where he received his early education. In 1890 he was graduated from Yale University, later pursuing graduate studies in science and engineering at Cornell University, where he was a fellow in electrical engineering from 1891 to 1892. During the following year he was an instructor in physics at Cornell, and from 1893 to 1904 was assistant professor of physics. In 1904 he was appointed professor of applied electricity, which chair he now holds. He was one of the three editors of the *Physical Review* from its foundation in 1893 through 1912, during which period the *Review* was controlled by Cornell University, and in 1913 was appointed its managing editor when the American Physical Society accepted its control. Professor Bedell had been very active in engineering and scientific association work and is a fellow of the American Association for the Advancement of Science. In 1914 he was elected a manager of the A. I. E. E. for a period of three years, and has served on a number of committees of the Institute, including the library committee, standards committee and international electrotechnical committee. He was a member of the International Electrical Congress held in Chicago in 1893, and the following year in St. Louis, and also was a member of the Jury of Awards of the Department of Electricity of the Louisiana Purchase Exposition in 1904. Professor Bedell is the inventor and patentee of various improvements in telegraphy, telephony and power transmission, including a system for the joint transmission of direct and alternating currents.



FREDERICK BEDELL

H. C. Cummins, formerly assistant general manager of the Northern States Power Company, has been transferred to the Chicago office of H. M. Byllesby & Company.

B. O. Lund, superintendent of the Northern States Power Company, Stillwater division, has been appointed successor to A. S. Cummins as manager of the district.

A. S. Cummins, formerly manager of the Northern States Power Company, Stillwater division, has been transferred to the New York office of H. M. Byllesby & Company.

T. D. Crocker, assistant general manager of the Minneapolis General Electric Company, has been appointed assistant general manager of the Northern States Power Company, to succeed H. C. Cummins, who has been transferred to Chicago. Mr. Crocker was graduated from the school of electrical engineering of the Ohio State University with the class of 1904, going with the Milwaukee (Wis.) Electric Railway & Light Company upon completion of his course. He rose during his eight years with that company through several positions in the operating departments to be general superintendent of the central heating department and later commercial engineer for the company. In 1912 he became commercial engineer for the Consumers' Power Company at St. Paul, Minn., and later was transferred to Minneapolis, becoming assistant general manager of the local company, which position he has held until his recent promotion. In 1915 he was elected president of the Minnesota Electrical Association.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

HIGHER PRICES FOR LIGHTING GLASSWARE ARE EXPECTED

Factories Faced with Possibility of Government's Taking Over 50 Per Cent of Output of Chemical Companies

Considerable uncertainty prevails at present in the lighting fixture glassware trade. A statement has gone out that the government will draw on chemical companies for 50 per cent of their output, and as this includes soda ash and sulphate of soda, besides other chemicals necessary to the production of glass, the factories are faced with a serious problem. Factories are having great trouble this year in securing a sufficient amount of these chemicals to keep going, therefore a curtailment of 50 per cent is naturally causing no small concern to producers.

Ordinarily glass furnaces close down at the end of June for the hot weather, when repairs and alterations are made. This year there is a possibility that the customary shutdown may as far as possible be dispensed with, or at least shortened in duration. No definite step has been taken on the matter, however.

That prices on lighting glassware will be higher in the near future seems practically certain. Just when the higher prices will go into effect and how great the advance will be it is not possible to foresee at this time, but it is known that manufacturers are working on new schedules and have advised branch offices to expect them.

Owing to the uncertainty regarding the possibility of maintaining production and because the increased value will warrant it the trade is being urged from different directions to secure its stock of glassware before it may be too late. A perceptible falling off in the demand for lighting glassware, particularly certain kinds, has been noticed. The entrance of this country into the war, it is felt, has been the cause.

TURBINE PRODUCTION SOLD OUT FAR AHEAD

Central Stations Anticipate Necessity for Increased Generating Facilities—Demand for Units of Larger Size Noticed

Each week sees the productive facilities for steam turbines booked further and further ahead. Capacity for the present year is sold out, and with the exception of some of the smaller sizes production for 1918 has been contracted for. In the very large sizes one manufacturer has but little left of 1919 production, and is now even booking orders for 1920 delivery. Only last week the largest single order on record, 200,000 kw., was placed. This order, which contains a number of 35,000-kw. units, will not be ready for delivery until probably well into 1918 or 1919.

Last year the demand for steam turbines eclipsed all previous records, but it seems evident that the business in 1917 will establish a much higher record. Already in certain districts the present year's business has gone ahead of the entire business done in 1916.

Realizing the sold-up condition of the market and anticipating the need that will be felt before long, a well-defined tendency has been noticed on the part of central stations to place orders for distant deliveries. As a result of the fuel situation central stations have this year taken on a very large power load, and this load is continually being added to. Consequently many stations are fast approaching their limit in generating facilities. In fact, there are some that have already reached this condition and are not in a position to take on further loads until additional equipment is received.

All through the market the tendency is particularly marked to purchase larger sizes than formerly. Quite a few orders have been received lately for 35,000-kw. units. But a few years ago a 200,000-kw. unit was hailed as very remarkable in size. Not only are turbines increasing in size, but they are working under higher steam pressures. These conditions have been stimulated by the present rapid rise in operating costs. The larger units, with higher steam pressures, give greater economies of operation.

Additions to factory space will permit of a much larger output of turbines this year than last, and it is owing to this increased factory space that the market is not sold farther ahead than it is. The manufacturers are doing everything in their power to increase and stimulate production, but the excessive demands have been greater than manufacturing facilities.

Not only has the central station business been large, but the demand for smaller units has kept up. These units, of course, can be supplied much quicker than the larger ones.

Prices have advanced somewhat, owing to the increased costs of manufacture. Castings and shapes are still advancing, and tend to swell the cost to produce turbines.

MANY CONCERNS MOVING INTO LARGER OFFICES

Increased Volume of Business Causing Trade Rapidly to Outgrow Present Quarters—Activity Not Confined to Large Concerns

Since the beginning of the year there has been a perceptible movement in the electrical trade toward larger office quarters. This is but one indication of the rapid growth of the electrical business, but it serves rather as evidence on the part of some manufacturers that the present volume of business is not expected to be greatly lessened. This activity is not confined to any single group, but, it has been noticed, applies to all lines and to the very large as well as to the very small concerns. More space has become necessary, and numbers of district offices are weekly seeking larger quarters. This is owing entirely to the tremendous volume of business now being carried.

PRICES OF HEATING APPLIANCES GO HIGHER

Demand Noticed to Be Falling Off in Certain Localities—Prospects Not so Hopeful as Could Be Desired

Effective the first of June, prices on electric heating appliances generally will be higher. This latest advance, it is understood, brings flatirons up to $5 list.

The increased prices have been necessitated by the unprecedented high cost of materials and labor. Iron and steel, which enter largely into all heating appliances, have been one of the principal items.

In certain sections of the country, particularly in the New England States and along the Atlantic seaboard, there is very little new business being done on heating appliances. The factories are running at full speed, but these orders were taken previously for this year's delivery. The central stations apparently have purchased to the full extent of their 1917 requirements. Department stores are not purchasing and they are finding conditions so dull just at

present that it is doubtful if much purchasing can be expected from this direction for some time.

The summer season, which ordinarily is a dull season for wholesale trade in appliances, is coming on, and according to present indications may be duller than usual. With higher prices, which are undoubtedly necessary, and with the falling off in demand owing to the war the prospects for the next few months as regards heating appliances are not as hopeful as they might have been otherwise.

EXISTING CONDITIONS IN WIRE AND CABLE MARKET

While Certain Kinds of Construction Have Fallen to a Minimum, They Have Been Offset by Gains in Industrial Development

According to all reports, conditions in the market for copper wire and cable continue to be very favorable. It is known that construction of certain kinds has been cut to a minimum, but this is made up for by the tremendous increases in industrial construction. An additional stimulus will undoubtedly be given to the market by the government's program for the expenditure of $1,000,000,000 in small ships for transporting supplies to Europe.

Recent reports to the Habirshaw Electric Cable Company, Inc., and the Electric Cable Company from correspondents in the South, Middle West and Far West point to favorable conditions. The reports, as printed in the companies' official publication, *The Wire Message*, are as follows:

Atlanta—Business conditions very favorable; good volume of construction; much building in prospect.

Chicago—Business normal; conditions good; central station and contracting work fair.

Los Angeles—Collections and money slightly tighter; residences and small building at a standstill; big business optimistic; our sales ahead of ability to supply.

Minneapolis—More conservatism apparent; unsettled price conditions; business good, but in small orders.

Salt Lake City—Prospect good; our business shows increase over last year.

REASONS FOR INCREASE IN THE PRICES OF RANGES

Higher Production Costs Cited with Details Concerning Difference in Price Between Gas and Electric Ranges

That the trade has not been sufficiently educated as to the reasons necessitating the increases in the price of electric ranges that have gone into effect in the last year and a half was explained in the ELECTRICAL WORLD of last week. In order to overcome this condition and lay its cards on the table, one of the prominent electric range manufacturers is mailing with a revised price list effective June 1 a folder telling briefly the extent to which production costs have increased and also some details about the difference in price of gas and electric ranges.

Within the past year labor costs have jumped 32 per cent, resistance wire 150 per cent, porcelain bricks 150 per cent, and steel 350 per cent. These are but a few of the raw materials entering the make-up of a range. The product of this particular manufacturer has taken an increase of only 30 per cent. Three increases took place this past year because the company did not want to raise its prices a penny more than was absolutely necessary at these different times. Its margin of profit to-day is a great deal smaller than it was a year ago.

Regarding comparative gas and electric range prices, a four-burner gas range and a four-burner electric range of the same style and capacity were chosen. With the exception of the gas range burners, the electric range of this concern has everything that is on a gas range, in addition to $23 worth of surface burners, $12 worth of oven burners, $10 worth of switches, $3 worth of fuse plugs and fuse blocks, and from $10 to $15 more for connecting wires, terminals, bushings, asbestos linings, oven installation, and the high-priced skilled labor it takes to assemble, weld and connect all the intricate electrical parts. This is an additional total of from $58 to $63.

On the two oven burners of this concern's product there are 198 parts. There are 172 electric spot welds. Each one takes considerable hand work on the part of nineteen skilled workmen. In other words, the electric range business is an electrical proposition, not a stove business, it is pointed out, and that is why the cost of an electrical range should not be compared with the cost of a gas range any more than should the cost of an automobile with the cost of a buggy.

FEW NEW PRODUCTS ARE NOW BEING DEVELOPED

Most New Pieces of Apparatus Appearing Are Only Improved Types of Equipment Already on the Market

Development of new products is becoming less and less. Most of the development work being done by manufacturers is in improvements to types already on the market. Slight changes here and there to improve operation or to cut down the expense of manufacture constitute the bulk of this activity.

Since the outbreak of war-order activity in the fall of 1915, new development work has received less attention. The manufacturers had neither the time nor the space necessary to devote to experimentation. Now there is an added reason for postponing this work. The price of labor and materials is so high that it practically prohibits the laboratory experiments necessary to produce a product that is of commercial value.

Under normal conditions, this character of work is very expensive, and with prices of material as high as they now are, and without the incentive of competition to make new products necessary, it is not difficult to understand why manufacturers should postpone developing new apparatus until present conditions change.

METALS MARKET SHOWS LITTLE CHANGE IN WEEK JUST PAST

Lead Prices Feel War Stimulation, Copper Slightly Easier in Sluggish Market

There has been but little change during the past week in the metals market. Lead apparently has felt the stimulation of war, and at this writing the outside price was quoted at 11 cents. Copper is somewhat easier than last week in a sluggish market. Tin is still strong, although slightly lower than last week, probably owing to technicalities. The old-metals market had strengthened slightly during the week.

Electrolytic copper was quoted nominally on Tuesday as follows: May, 32.25 cents; June, 31.25 cents; July, 30.25 cents; third quarter, 29 cents, and fourth quarter, 28 cents.

NEW YORK METAL MARKET PRICES

	May 15 Selling Prices Bid	May 15 Selling Prices Asked	May 22 Selling Prices Bid	May 22 Selling Prices Asked
Copper:	£ s d		£ s d	
London, standard spot	130 0 0		130 0 0	
Prime Lake	32.00	to 33.00†	31.50	to 32.50†
Electrolytic	32.25	to 32.75†	32.00	to 32.50†
Casting	30.87½	to 31.12½†	30.00	to 31.00†
Copper wire base	37.50†		37.00	to 38.00†
Lead	9.50		10.00	
Nickel	50.00		50.00	
Sheet zinc, f.o.b. smelter	19.00		19.00	
Spelter, spot	9.30	to 9.55	9.42½	to 9.67½
Tin, Straits	66.00		65.62½	
Aluminum, 98 to 99 per cent.	56.00	to 58.00†	56.00	to 58.00†

OLD METALS

Heavy copper and wire	27.00	to 28.00	28.50	to 29.50
Brass, heavy	17.00	to 18.00	17.00	to 18.00
Brass, light	13.00	to 14.00	14.00	to 14.50
Lead, heavy	8.50	to 8.75	9.00	to 9.25
Zinc, scrap	6.50	to 7.00	6.75	to 7.00

†Nominal.

Current Prices of Electrical Supplies

The prices quoted are those prevailing in standard package or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists to contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

ARMORED CONDUCTORS, FLEXIBLE STEEL

B. & S. Size	List, per 1000 Ft. Chicago	N. Y.
Single-Conductor		
No. 14 solid	$61.00	$61.00
No. 12 solid	71.00	71.00
No. 10 solid	90.00	90.00
No. 8 solid	106.00	106.00
No. 6 solid	145.00	145.00
No. 10 stranded	95.00	95.00
No. 8 stranded	115.00	115.00
No. 6 stranded	160.00	160.00
No. 4 stranded	205.00	205.00
No. 2 stranded	266.00	266.00
No. 1 stranded	315.00	315.00
Twin-Conductor		
No. 14 solid	104.00	104.00
No. 12 solid	135.00	135.00
No. 10 solid	185.00	185.00
No. 8 stranded	235.00	235.00
No. 6 stranded	370.00	370.00
No. 4 stranded	575.00	575.00

DISCOUNT PER 1000 FT.

	Chicago	N. Y.
Single-Conductor		
No. 14 solid:		
Less than coil	+10%	+10%
Coil to 1000 ft.	—10%	3%
No. 12 solid:		
Less than coil	+10%	+10%
Coil to 1000 ft.	—10%	3%
Twin-Conductor		
No. 14 solid:		
Less than coil	+10%	+10%
Coil to 1000 ft.	—10%	3%
No. 12 solid:		
Less than coil	+10%	10%
Coil to 1000 ft.	—10%	3%

ATTACHMENT PLUGS

	Std. Pkg.	List Chicago	N. Y.
Benjamin No. 903	100	$0.25	$0.25
Hubbell No. 5406	250	.30	.30
Bryant No. 706	100	.25	.25
G. E. 50996	250	.22	.22
Discount		Chicago	N. Y.
Less than 1/5 std. pkg.:			
Benjamin No. 903		12%	12%
Hubbell No. 5406		+10%	+20%
Bryant No. 706		+20%	+20%
G. E. 50996		+20%	+20%
1/5 to std. pkg.:			
Benjamin No. 903		20%	20%
Hubbell No. 5406		—10%	20%
Bryant No. 706		Net	20%
G. E. 50996		Net	20%
Std. pkg.:			
Benjamin No. 903		44%	44%
Hubbell No. 5406		—34%	34%
Bryant No. 706		30%	34%
G. E. 50996		—30%	34%

BATTERIES, DRY

Each Net	No. 6 Regular Chicago	N. Y.	No. 6 Ignitor Chicago	N. Y.
Less than 12	$0.35	$0.35	$0.35	$0.35
12 to 50	.30	.30	.30	.30
50 to barrel	.255	.28	.265	.29
Barrel lots	.24	.24	.25	.25

CONDUIT, METALLIC FLEXIBLE

Size, In.	Feet per Coil	List per 100 Ft. Chicago	N. Y.
5/16	250	$5.00	$5.00
3/8	250	7.50	7.50
1/2	100	10.00	10.00
3/4	50	13.00	13.00
1	50	21.00	21.00
1 1/4	50	26.00	26.00
1 1/2	25-50	35.00	35.00
2	25-50	45.00	45.00
2 1/2	25-50	52.00	52.00

CONDUIT, METALLIC FLEXIBLE—CONTINUED

	3/8" Single Strip Chicago	N. Y.	3/8" Double Strip Chicago	N. Y.
Less than coil per 1000 ft., net	$75.00	$75.00	$78.75	$82.50
Cost to 1000 ft. per 1000 ft., net	63.75	69.30	71.25	75.00
	1/2" Single Strip Chicago	N. Y.	1/2" Double Strip Chicago	N. Y.
Less than coil per 1000 ft., net	$100.00	$100.00	$105.00	$110.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List, per Foot Chicago	N. Y.	Size, In.	List, per Foot Chicago	N. Y.
7/32	$0.05 1/2	$0.05 1/2	1	$0.25	$0.25
1/4	.06	.06	1 1/4	.33	.33
3/8	.09	.09	1 1/2	.40	.40
1/2	.12	.12	1 3/4	.47	.47
5/8	.15	.15	2	.55	.55
3/4	.18	.18	2 1/4	.65	.65

Per 1000 Ft. Net.	7/32 In. Chicago	N. Y.	—1/4 In. Chicago	N. Y.
Less than $15.00 list	$55.00	$55.00	$60.00	$60.00
$15.00 to $60.00 list	27.50	24.50	30.00	27.00
$60.00 to $150.00 list	24.75	21.50	27.00	23.50

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

(*Card No. 38*)

Size, in.	Conduit, List per Foot Chicago	N. Y.
1/4	$0.08 1/2	$0.08 1/2
3/8	.08 1/2	.08 1/2
1/2	.08 1/2	.08 1/2
3/4	.11 1/2	.11 1/2
1	.17	.17
1 1/4	.23	.23
1 1/2	.27 1/2	.27 1/2
2	.37	.37
2 1/2	.58 1/2	.58 1/2
3	.76 1/2	.76 1/2

Size, in.	Couplings, List, Each Chicago	N. Y.	Elbows, List, Each Chicago	N. Y.
1/4	$0.05	$0.05	$0.19	$0.19
3/8	.06	.06	.19	.19
1/2	.07	.07	.19	.19
3/4	.10	.10	.25	.25
1	.13	.13	.37	.37
1 1/4	.17	.17	.45	.45
1 1/2	.21	.21	.60	.60
2	.28	.28	1.10	1.10
2 1/2	.40	.40	1.80	1.80
3	.60	.60	4.80	4.80
	Discount,		Discount,	
	1/4 In. to 1/2 In. Chicago	N. Y.	3/4 In. to 3 In. Chicago	N. Y.
Less than 2500 lb.	3.8%	7%	6.8%	10%
2500 to 5000 lb.	5.8%	9%	8.8%	12%

(For galvanized deduct six points from above discounts.)

FLATIRONS

	Chicago	N. Y.
List	$5.50	$5.00
Discount	30%	30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List Chicago	N. Y.
3-amp. to 30-amp.	100	$0.25	$0.25
35-amp. to 60-amp.	100	.35	.35
65-amp. to 100-amp.	50	.90	.90
110-amp. to 200-amp.	25	2.00	2.00
225-amp. to 400-amp.	25	3.60	3.60
450-amp. to 600-amp.	10	5.50	5.50
600-Volt			
3-amp. to 30-amp.	100	$0.40	$0.40
35-amp. to 60-amp.	100	.60	.60
65-amp. to 100-amp.	50	1.50	1.50
110-amp. to 200-amp.	25	2.50	2.50
225-amp. to 200-amp.	25	5.50	5.50
450-amp. to 600-amp.	10	8.00	8.00

FUSES, INCLOSED—CONTINUED

Discount	Chicago	N. Y.
List	28%	28%
Discount	38%	38%

FUSE PLUGS

3-Amp. to 30-Amp.

Per 100 Net.	Chicago	N. Y.
Less than 1/5 std. pkg.	$6.25	$5.25
1/5 to std. pkg.	5.25	4.50

Standard package, 500. List, $0.07.

LAMPS, MAZDA

105 to 125 Volts

Regular, clear:	Std. Pkg.	List, Each—Chicago	List, Each—N. Y.
10 to 40-watt—B	100	$0.27	$0.27
60-watt—B	100	.36	.36
100-watt—B	24	.65	.65
75-watt—C	50	.65	.65
100-watt—C	24	1.00	1.00
200-watt—C	24	2.00	2.00
300-watt—C	24	3.00	3.00
Round bulbs, 3½-in., frosted:			
15-watt—G 25	50	.50	.50
25-watt—G 25	50	.50	.50
40-watt—G 25	50	.50	.50
Round bulbs, 3¾-in., frosted:			
60-watt—G 30	24	.72	.72
Round bulbs, 4⅝-in., frosted:			
100-watt—G 35	24	1.05	1.05

	Discount—Chicago	Discount—N. Y.
Less than std. pkg.	Net	Net
Std. pkg.	10%	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

	Per 1000 Ft. Net—Chicago	Per 1000 Ft. Net—N. Y.
Less than coil (250 ft.)	$37.52	$35.17
Coil to 1000 ft.	28.14	26.73

LAMP GUARDS, WIRE

Per 100 Net	Chicago	N. Y.
Less than 50, Matthews 16-cp	$20.00	$20.00
Less than 1/5 std. pkg. Hubbell	28.35	29.00
Less than 36, 60-watt Loxon	30.00	25.00

OUTLET BOXES

Union Cat. No.	Black, List, per 100—Chicago	Black, List, per 100—N. Y.
101	$30.00	$30.00
102	30.00	30.00
103	25.00	25.00
106	20.00	20.00

Union Cat. No.	Galv., List, per 100—Chicago	Galv., List, per 100—N. Y.
101	$30.00	$30.00
102	30.00	30.00
103	25.00	25.00
106	20.00	20.00

	Black—Chicago	Black—N. Y.	Galvanized—Chicago	Galvanized—N. Y.
Discount				
Less than $10.00 list	40%	List	35%	List
$10.00 to $50.00 list	50%	42%	45%	37%

PIPE FITTINGS

Condulets, V.V., Unilets and Similar

Discount	Chicago	N. Y.
Less than 1/5 std. pkg.	10%	10%
1/5 to std. pkg.	20%	20%
Std. pkg.	30%	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

	Per 1000 Net—Chicago	Per 1000 Net—N. Y.
Less than 1/5 std. pkg.	$18.00	$20.00
1/5 to std. pkg.	13.00	15.80

Standard package, 2200. List per 1000, $20.

PORCELAIN KNOBS

Per 1000 Net	5½ N.C.—Solid Std. Pkg. 3500 Chicago	5½ N.C.—Solid Std. Pkg. 3500 N. Y.	Nail-it—N.C. Std. Pkg. 4000 Chicago	Nail-it—N.C. Std. Pkg. 4000 N. Y.
Less than 1/5 std. pkg.	$18.00	$24.30	$20.75	$28.00
1/5 to std. pkg	9.00	12.15	16.30	21.50

SOCKETS AND RECEPTACLES

	Std. Pk.	List—Chicago	List—N. Y.
⅛-in. cap key socket	500	$0.33	$0.33
⅛-in. cap keyless socket	500	.30	.30
⅛-in. cap pull socket	250	.60	.60

Discount	Chicago	N. Y.
Less than 1/5 std. pkg.	Net	Net
1/5 to std. pkg.	15%	15%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

Perkins or Trumbull Type A:	List—Chicago	List—N. Y.
30-amp. S. P. S. T.	$0.80	$0.80
60-amp. S. P. S. T.	1.20	1.20
100-amp. S. P. S. T.	2.25	2.25
200-amp. S. P. S. T.	3.48	3.48
300-amp. S. P. S. T.	5.34	5.34
30-amp. D. P. S. T.	1.20	1.20
60-amp. D. P. S. T.	1.78	1.78
100-amp. D. P. S. T.	3.38	3.38
200-amp. D. P. S. T.	5.20	5.20
300-amp. D. P. S. T.	8.00	8.00
30-amp. 3 P. S. T.	1.80	1.80
60-amp. 3 P. S. T.	2.68	2.68
100-amp. 3 P. S. T.	5.08	5.08
200-amp. 3 P. S. T.	7.80	7.80
300-amp. 3 P. S. T.	12.00	12.00
Perkins Type B or Trumbull Type C:		
30-amp. S. P. S. T.	0.42	0.42
60-amp. S. P. S. T.	0.74	0.74
100-amp. S. P. S. T.	1.50	1.50
200-amp. S. P. S. T.	2.70	2.70
30-amp. D. P. S. T.	0.68	0.68
60-amp. D. P. S. T.	1.22	1.22
100-amp. D. P. S. T.	2.50	2.50
200-amp. D. P. S. T.	4.50	4.50
30-amp. 3 P. S. T.	1.02	1.02
60-amp. 3 P. S. T.	1.84	1.84
100-amp. 3 P. S. T.	3.76	3.76
200-amp. 3 P. S. T.	6.76	6.76

DISCOUNT

Type A, Perkins or Trumbull:	Chicago	N. Y.
Less than $10 list	List	Net
$10 to $25 list	15%	15%
$25 to $50 list	18%	18%
Type B, Perkins, or Type C, Trumbull:		
Less than $10 list	10%	10%
$10 to $25 list	20%	20%
$25 to $50 list	28%	28%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List—Chicago	List—N. Y.
5-amp. single-pole	250	$0.28	$0.28
5-amp. single-pole, ind.	250	.32	.32
10-amp. single-pole	100	.48	.48
10-amp. single-pole, ind.	100	.54	.54
5-amp., three-point	100	.56	.56
10-amp., three-point	50	.76	.76
10-amp., 250-volt, D. P.	100	66	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List—Chicago	List—N. Y.
10-amp. single-pole	100	$0.45	$0.45
10-amp. three-way	50	.70	.70
10-amp. double-pole	50	.70	.70

Discount	Chicago	N. Y.
Less than 1/5 std. pkg.	+20%	Net
1/5 to std. pkg.	Net	15%
Std. pkg.	30%	28%

SWITCH BOXES, SECTIONAL CONDUIT

C. F. Mfg. Co.	List, Each—Chicago	List, Each—N. Y.
No. 155	$0.34	$0.34
No. 160	0.60	0.60

	Black—Chicago	Black—N. Y.	Galvanized—Chicago	Galvanized—N. Y.
Discount				
Less than $2.00 list	25%	Net	20%	Net
$2.00 to $10.00 list	25%	50%	20%	40%
$10.00 to $50.00 list	25%	60%	20%	52%

TOASTERS, UPRIGHT

	Chicago	N. Y.
List	$5.00	$5.00
Discount	30%	30%

WIRE, ANNUNCIATOR

Per Lb. Net	Chicago	N. Y.
No. 18, less than full spools	$0.65	$0.62
No. 18, full spools	0.55	0.53

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

	Price per 1000 Ft. Net—Less than 500 Ft. Chicago	Less than 500 Ft. N. Y.	500 to 1000 Ft. Chicago	500 to 1000 Ft. N. Y.	1000 to 5000 Ft Chicago	1000 to 5000 Ft N. Y.
No.						
14	$18.00	$18.00	$16.00	$14.50	$14.00	$12.50
12	29.89	27.05	25.62	22.85	21.35	20.95
10	41.51	39.27	35.58	33.66	29.65	24.68
8	60.13	51.44	51.54	48.42	42.95	33.51
—	82.20	89.57	75.35	76.80	68.50	50.63

WIRE, WEATHER-PROOF

Solid-Conductor, Triple-Braid, Sizes 4/0 to 8. Inc.

	Per 100 Lb. Net—Chicago	Per 100 Lb. Net—N. Y.
Less than 25 lb.	$45.00	$40.25
25 to 50 lb.	44.00	39.25
50 to 100 lb.	43.00	38.25

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Washing Machine Motors

Washing machine motors which have a high starting and pull-out torque at any position of the rotor have been developed by the Domestic Electric Company of Cleveland, Ohio. Among other characteristics pointed out for this



ROTOR OF WASHING MACHINE MOTOR

motor are its low starting current and cool operation under heavy overload. The motors are equipped with ball bearings. By using a bracket design the motors have been made splash-proof, it is claimed, when mounted in any position. A ribbed cast-iron frame is used for holding the stator steel punchings. The feet are cast integral with the frame and machined so that the shaft is always parallel to the base. The rotor core is substantially built of thin steel punchings, which are fastened together with copper rivets. The rivets serve as conductors and are short-circuited by copper end rings. In designing the starting switch, it is claimed, all unnecessary moving parts were eliminated. The only current-carrying parts are the stationary contact rings and the moving contact fingers. These motors are supplied with 10 ft. (3 m.) of waterproof cord and a connecting plug.

Spraying Outfits

Outfits for spraying the finish on wood and metal products with compressed air are made by the De Vilbiss Manufacturing Company of Toledo, Ohio. These outfits come in a wide range of capacities for handling very small parts of large pieces. The booths are constructed of heavy sheet steel on an angle-iron frame, with wire-glass windows in the sides and top and with a sheet-steel floor. Reflectors and sockets are built in the booths for lamps, and a portable spot-light is supplied and so arranged that it can be clamped on the frame in any desired position to direct the light upon the work. The back of the booth is funnel-shaped, an exhaust fan being mounted at the apex of the funnel. A 1/6-hp. Robbins & Myers motor of special design is used to drive the six-blade 16-in. (40.6 cm.) fan employed. The motor is completely inclosed to protect it from the fumes, but is provided with thorough ventilation by a stream of cool air which is drawn through the motor by the fan, the intake for the air being provided by a tube which opens outside the booth. This tube also serves to support the fan and is so arranged that the fan will swing back from the opening to give access to the blades. The exhaust fan is made in one size only, two or more fans, depending upon the requirements, being used in the larger booths. Where desired the sprayer is equipped with an electric heater which heats the air and finishing material before it leaves the spray nozzle.

As shown in the accompanying illustration, the outfits can also be furnished with a motor-driven turntable for supporting the work. The speed of rotation is adjustable through a wide range by a friction wheel and the disk oper-



SPRAYING OUTFIT FURNISHED WITH MOTOR-DRIVEN TURNTABLE

ated by a ⅛-hp. Robbins & Myers motor. It can be raised and lowered through a 10-in. (25.4 cm.) range by compressed air acting upon a piston which supports the revolving parts.

Motor-Driven Pump

To take the place of water lifts and for use either with open tanks or pressure tanks the Chandler Pump Company of Cedar Rapids, Iowa, has developed a motor-driven pump. It is designed for automatic switch control, either by the height of the water in an open tank or by pressure in an inclosed tank. Automatic switches for either class of tank can be supplied. The pump is made of heavy brass and has a two-lever brass plunger and a reliable check valve.

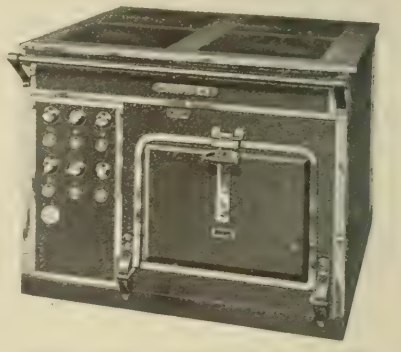
Unit Oven Range

The range shown in the accompanying illustration consists of one oven and four square hot plates, each provided with a three-heat switch, cut-out and inclosed fuses. The oven has a clear working space 27 in. (68.6 cm.) deep, 21.5 in. (54.6 cm.) wide and 16 in. (40.6 cm.) high. The heaters are enamel-incased and are situated in both the top and bottom of the oven. The walls are highly insulated. Square flush heaters of the inclosed Simplex-Hewitt type are used for the hot plates. Each heater is 14 in. (35.6 cm.) square and is heated over the entire surface. At high heat a very high temperature is obtained which is comparable with that which can be obtained by coal or gas.

The switches are placed in a flush panel in front and at one side of the oven. By removing the panel the switches, fuses and their connections are made accessible. On this switch panel is also a plug switch for connecting any extra heating appliance, such as a broiler, a rim griddle, a water heater or other auxiliary apparatus that might be found desirable by the purchaser.

The entire wiring of the range is very carefully laid to prevent its coming in contact with grease or moisture, and the heater connections may be easily reached. At high heat the oven takes 3.3 kw. and each of the square heaters approximately 4 kw. This makes a total connected load of 19.3 kw. As all of the heating elements are seldom used at one time it can be estimated that 12 kw. would be an unusually heavy demand.

The manufacturer points out that the top heaters are constructed by a new method allowing high wattage and intense heat to be obtained without damaging the elements. The range, it

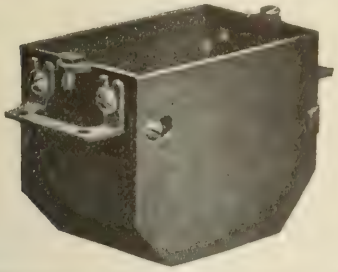


HOTEL TYPE OF UNIT OVEN RANGE

is said, is mechanically constructed so that it is rugged throughout. This range is made by the Simplex Electric Heating Company of Cambridge, Mass.

Switch Box

Sectional switch boxes that have one fixed guard and which may be easily assembled are made by the Acme Metal Stamping Company of Cleveland, Ohio. The knockouts on these boxes are uniformly secured. Those on the beveled



SECTIONAL SWITCH BOX WITH ONE REMOVABLE SIDE

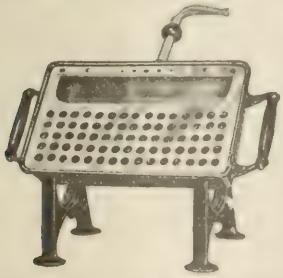
corners may be removed by tapping on the inside with a screwdriver or similar instrument, while the large knockout on the side may be removed by striking on the outside. Beveled corners, the manufacturer declares, have a decided advantage over square corners in many ways. The ears are reversible and adjustable.

Double-Tub Washer

A double-tub vacuum washer, equipped with a 0.25-hp. Emerson motor, is a product of the Dexter Company of Fairfield, Iowa. By keeping both washing tubs in operation and continuing the process of wringing and rinsing from one to another, it is claimed that there is a material saving in time necessary to complete a washing, particularly where a large quantity of clothes is to be handled. The tubs are equipped with cone-shaped plungers, which clean the clothes by the vacuum process, which is assisted by the rotary motion imparted to the mass of garments by the action of the plunger head. The action of the plunger head in each tub is governed by the opening and closing of the lids of these tubs.

Electric Radiator

An electric radiator designed for use in bathrooms and other places of small dimensions is shown in the accompanying illustration. It is designed to be used on either table or floor and has

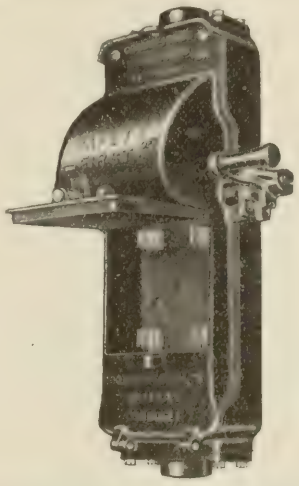


RADIATOR FOR BATHROOMS

handles provided for lifting. The size of the radiator is 7 in. by 11 in. (17.8 cm. by 27.9 cm.), and it is rated at 500 watts. The device is offered to the trade by the Pelouze Manufacturing Company, 232 East Ohio Street, Chicago.

Condulet Switch

The Crouse-Hinds Company of Syracuse, N. Y., has placed on the market a line of condulets that includes a fusible knife switch inclosed in a cast-iron box with a hinged cover. In this cover is a door which furnishes access to the fuse compartment. The design is such, however, as to prevent this door from being opened when the switch blades are closed. The switch is operated by a handle outside the case, and provision is made for locking this handle in either the "on" or "off" position. While these condulet switches are not regularly furnished with a quick-make and quick-break mechanism, they will be so furnished if a purchaser desires. These series condulets possess another desirable feature in that they

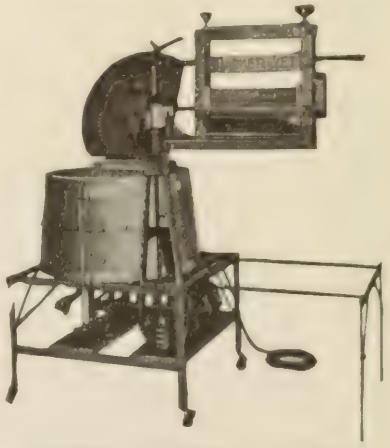


CONDULET WITH QUICK MAKE-AND-BREAK ATTACHMENT

are provided with separable hub plates —blank, single-hub and two-hub plates. The latter two are made to take standard sizes of conduit from 0.5 in. to 3.5 in. (1.27 cm. to 8.8 cm.). This makes it possible to equip the condulet for almost any arrangement of conduit installation and simplifies the work of installing. This device is made in numerous capacities, ranging from 30-amp., two or three-pole, 125-volt, to 200-amp., 500-volt, alternating-current three-pole switches, arranged for N. E. C. fuses.

Double-Tub Electric Washer

A double-tub electric washer in which all gears are accurately bored and carefully machined is being offered to the trade by the Globe Manufacturing Company of Perry, Iowa. The shafting for all gears that mesh runs in bearings or boxings cast in one frame. A wringer with 12-in. (30.48-cm.) wringer rollers is supplied with this washer. The wringer can be swung into any desired position. The frame is made of angle steel, is machine-riveted and well braced. Louisiana red cypress is used for the tubs. The cross-arm dollies grip the clothes firmly, do not damage them, and are thorough in their action of whirling the clothes back and forth through the hot soapy water. While the dollies are fastened to the dolly shaft they adjust themselves auto-



ELECTRIC WASHING MACHINE

matically to the clothes in the tub. They are hung within 2 in. (5.08 cm.) of the bottom of the tub, making it possible to wash small as well as large quantities of clothes. Locking the tub lids starts the washing mechanism in motion. All exposed moving parts are entirely inclosed. The machine is equipped with a ¼-hp. motor, wound to carry momentary overloads. The motor is equipped with a fiber gear.

Motor Chair

An electric-motor chair furnished with either 150 amp.-hr. or 200 amp.-hr. batteries is made by the Ford Motor Chair Company of Lafayette, Ind. The 150-amp.-hr. battery when fully charged will give five hours of continuous running service, it is said, and the 200-amp.-hr. battery will give seven hours. The batteries are of the 12-volt type and the motor is designed to develop 0.5 hp. to 2 hp., according to load. The motor is geared directly to the axle of the front wheel with a triple worm which permits the motor to propel the car up a 15 per cent grade when loaded with two adults. Extending in front



ELECTRIC WHEEL CHAIR

of the car is a guard which breaks the circuit between the batteries and motor and applies the brake when it comes in contact with any obstacle.

Trade Notes

PASS & SEYMOUR, INC., Solvay, N. Y., has commenced the erection of a three story addition to its plant about 60 ft. by 185 ft.

THE MOORE STEAM TURBINE COMPANY, Wellsville, N. Y., has increased its capital from $150,000 to $250,000 for expansion.

THE AMERICAN CONDUIT COMPANY, 116 Nassau Street, New York, is building a new plant at Fulton N. Y., for the manufacture of its specialties.

THE BABCOCK & WILCOX COMPANY, Bayonne, N. J., manufacturer of boilers, will build an extension to its plant on Third Street, providing for expansion in the boiler and marine shops.

THE DRIVER-HARRIS WIRE COMPANY, Harrison, N. J., has filed notice of change in company name to the Driver-Harris Company, Inc. The capital of the company has been increased to provide for business extensions.

THE MORGAN CRUCIBLE COMPANY, New York City, has moved from 114 Liberty Street to 519 West Thirty-eighth Street. The company's factory, which has been in Brooklyn, is now being moved to New York so that it will not only have larger quarters but also gain the advantage of having factory and office under one roof.

THE HYATT ROLLER BEARING COMPANY, Newark, N. J., announces that owing to advances in the costs of the raw materials that enter into the manufacture of Hyatt flexible roller bearings—advances that range from 10 to 50 per cent—and the higher wage rates prevailing in the labor markets, it has been found necessary to advance prices.

THE McCAUSLAND ENGINEERING COMPANY, Pennsylvania Building, Philadelphia, Pa., recently organized, is arranging for early operations at its new plant on Fifth Street, Chester, for the manufacture of electric motors. Contract has been awarded for improvements and extensions in three existing factory buildings to accommodate the new industry, totaling $50,000.

THE CASEY-MOORHEAD ENGINEERING COMPANY has opened offices in the Bessemer Building, Pittsburgh, Pa., as a firm of consulting electrical engineers, furnishing appraisals, estimates, reports, plans and specifications on electrical apparatus applied to industrial plants and coal mines. Both Mr. Moorhead and Mr. Casey were formerly with the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.

THE VULCAN FUEL ECONOMY COMPANY, Chicago, announces that hereafter all CO_2 recorders, gas analyzers, gas collectors and draft gages sold by the company will be known as Vulcan instruments, manufactured under the Hays patent rights. There is no change in the design of any of these instruments. Since Jan. 1 the company has sold soot cleaners for boilers amounting to more than 106,000 hp. Of these orders 51 per cent were repeat.

THE GENERAL ELECTRIC COMPANY will soon commence manufacturing operations in its new plant at Philadelphia. The structure will provide a floor area of about 125,000 sq. ft., covering a large section of the block bounded by Seventh, Willow, Marshall and Noble Streets. It will be six stories in height and give employment to more than 1000 people. The company is reported to be planning the erection of a large addition on the remaining portion of the block.

THE BARE WIRE COMPANY, INC., has been incorporated under the laws of the State of New York with a capitalization of $500,000. The offices of the company are at 10 East Forty-third Street, New York City. This company has acquired from the New York Central Railroad a tract of land in Yonkers. It will proceed to erect a building and install modern machinery for the manufacture of all forms of bare copper wires and cables. The company is closely affiliated with the Habirshaw Electric Cable Company and the Electric Cable Company. The most difficult problem that large manufacturers of insulated wires and cables have had to deal with during the past two years has been to secure a prompt and adequate supply of bare wire. One of the principal purposes of the new company is to assure the Habirshaw Electric Cable Company, Inc., and the Electric Cable Company an adequate supply at all times of every size of wire needed to enable them to give prompt and efficient service to their customers. The incorporators of the Bare Wire Company are Edwin W. Moore, J. Nelson Shreve, G. F. Waterbury, John S. Keith and Thomas C. Perkins.

NEW HYDROELECTRIC CONSTRUCTION IN FRANCE.—William H. Cole is in this country in charge of three undertakings in which the French government is indirectly interested. One of these projects is in connection with proposed hydroelectric work in the French Alps and Pyrenees, a development made desirable at this time by the scarcity of coal in France. This work will be undertaken by the Societe d'Hydraulique Fonciere et Industrielle, recently organized in Paris with a paid up capital stock of 25,000,000 francs. According to Mr. Cole, most of the hydroelectric machinery required in the developments now to be undertaken by this company will be purchased in America. Allied with this company is a second corporation, the Societe Centrale d'Industrie, whose purpose will be to distribute and use this power. The water power first developed will be in the Alps, and part of it will be used for the operation of sections of the Midi Railway. Both of these companies hold franchises for 100 years, granted by the French government. A third mission undertaken by Mr. Cole on this trip is in connection with the rehabilitation of the portions of northern France and Belgium retaken from the Germans. This undertaking will be carried out by an organization known as the American Bank Franco-Belgique. Mr. Cole is a member of the A. I. E. E., and his professional work in the past has included active connection with electric railways in Rio de Janeiro, Buenos Aires, Mexico City and Singapore.

Trade Publications

ANCHORS.—W. N. Matthews & Brother of St. Louis are mailing a folder descriptive of their "Scrulix" anchors.

LAMPS.—Catalog No. 17, descriptive of gas and electric portable lamps, has been prepared by Young & Russell, Philadelphia.

GROUND CONE.—Hickey & Schneider of 61 Broadway, New York City, have prepared bulletin No. 50, descriptive of the Burn-Boston carbon-ground cone.

SCREENS.—Traveling water screens for condenser intakes are illustrated and described in book No. 305, recently prepared by the Link-Belt Company of Chicago, Ill.

SWITCHES.—The V. V. Fittings Company of Philadelphia is mailing a folder descriptive of its safety switches, designed to protect the operator as well as the whole installation.

INSULATING MATERIALS.—An insulating guide has been prepared by the John C. Dolph Company of Newark, N. J. This is a descriptive catalog of this company's insulating varnishes and compounds.

PROJECTORS.—The Wheeler Reflector Company of Boston has prepared bulletin F, descriptive of its floodlight projectors. These projectors are for use with 400-watt floodlighting Mazda lamps with mogul base.

LINE MATERIAL.—A treatise on live-line material has been prepared by Hickey & Schneider of 61 Broadway, New York City. This treatise includes information and illustrations regarding the Johnson transmission tap clamps, insulator fault finder and insulator changer.

SUPPLIES.—The Northwestern Electric Company, Portland, Ore., has compiled a booklet giving an alphabetical list of all Portland dealers and contractors, members of the Oregon Association of Electrical Contractors and Dealers, which is given to each caller asking for prices on electrical work or supplies. The customer thus knows where to reach the men with whom he prefers to do business.

WAGON AND TRUCK LOADERS.—The Link-Belt Company of Chicago has prepared book No. 270, descriptive of its wagon and truck loaders for handling coal, coke, stone, sand, fertilizer and similar loose materials from storage. In this book are given illustrations, specifications and net prices of standard wagon loaders, and some of the special machines are shown which have been built to meet individual requirements.

WINDOW DISPLAY SERVICE.—A binder containing illustrations and instructions for the setting up of window displays has been prepared by the Western Electric Company. Realizing that the electrical merchant is often too busy to form original ideas and to "hand-letter" attractive display cards, this company offers to the dealers a window display service consisting of complete sets of cards and illustrations and complete instructions for the setting up of business-getting displays. From time to time new displays will be issued, to be placed in the binder.

New Incorporations

THE GRAY ELECTRIC COMPANY of Detroit, Mich., has been incorporated with a capital stock of $10,000 by John C. Gray, L. Gray and W. L. Gray.

THE GRAHAM (TEX.) ELECTRIC & AUTO COMPANY has been chartered with a capital stock of $27,000 by J. E. Dowdle, W. F. Babb and B. P. Walker.

THE J. C. LEWIS ELECTRIC COMPANY of Massillon, Ohio, has been chartered with a capital stock of $15,000 by J. C. Lewis and David H. Lewis.

THE LEET (PA.) TOWNSHIP ELECTRIC COMPANY has been incorporated with a capital stock of $5,000 by E. S. Raymond and others to operate in Leet Township.

THE LAUTON-ADAMS ELECTRIC COMPANY of New York, N. Y., has been incorporated with a capital stock of $10,000. Edward Schuster of Brooklyn, N. Y., is one of the directors.

THE ST. LOUIS (MO.) BATTERY COMPANY has been incorporated by August Mangold, Barton R. Ford and Roy J. Ward. The company proposes to manufacture storage batteries, etc.

THE CHESTER JOHNSON ELECTRIC COMPANY of Chicago, Ill., has been incorporated with a capital stock of $10,000 by Chester M. Johnson, Eugene Henry Johnson and Walter J. Johnson.

THE HARMONY (PA.) TOWNSHIP LIGHT COMPANY has been chartered with a capital stock of $5,000 to operate in Harmony Township. E. S. Raymond of Wilkinsburg, Pa., is interested in the company.

THE COMMERCIAL ELECTROLYTIC CORPORATION of Los Angeles, Cal., has been chartered with a capital stock of $100,000 by F. E. Stevens, J. McWilliams, Jr., R. T. Laughlin, J. R. Mason and F. F. Wehrle.

J. & P. DAVIGNON of Montreal, Que., has been incorporated by Joseph and Pierre Davignon, Joseph A. Lacasse and others. The company is capitalized at $45,000 and proposes to manufacture electrical machinery, etc.

THE FINLEY (PA.) TOWNSHIP ELECTRIC COMPANY has been incorporated with a capital stock of $5,000 to operate in Finley Township. E. S. Raymond of Wilkinsburg, Pa., is interested in the company.

THE EDGEWORTH (PA.) ELECTRIC LIGHT COMPANY has been granted a charter with a capital stock of $5,000 to supply electrical service in Edgeworth. E. S. Raymond of Wilkinsburg, Pa., is one of the incorporators.

THE RADIO-DENTAL X-RAY SOCIETY of New York, N. Y., has been incorporated with a capital stock of $15,000 to do a general X-ray and radiographing business. The incorporators are: Harry Rosenthal, Sophia and Bertha Rosenthal.

THE HOPEWELL (PA.) TOWNSHIP ELECTRIC LIGHT COMPANY has been granted a charter with a capital stock of $5,000 to furnish electricity in Hopewell Township. E. S. Raymond of Wilkinsburg, Pa., is one of the incorporators.

THE COTO-COIL COMPANY of Boston, Mass., has been incorporated with a capital stock of $100,000 to manufacture machines for electric coil winding. Robert A. Leeson is president and Frank N. French, 95 South Street, Boston, Mass., is treasurer.

THE ASSOCIATED LAMP & FIXTURE CORPORATION of New York, N. Y., has been incorporated with a capital stock of $4,000 to manufacture gas and electric fixtures. The incorporators are: Alexander A. Forman, Leon N. Cooper and James M. Gorman.

THE JOHN NEILSON COMPANY of New York, N. Y., has been incorporated with a capital stock of $500 to do a general electrical, hydraulic, mechanical and mining engineering business. The incorporators are: John Neilson, A. E. Walradt and Charles P. Blaney.

THE PIONEER MECHANICAL MINING COMPANY of Pittsburgh, Pa., has been incorporated with a capital stock of $6,000,000 to do a general mechanical and electrical engineering business. The local incorporators are: C. Fearon, K. M. Dougherty and J. Bacon of Wilmington, Del.

THE AMERICAN FORGING COMPANY of Paterson, N. J., has been incorporated with a capital stock of $100,000 to do a general mechanical and electrical engineering business. The plant will be located on South Fifth Street, Lakeview, east of Getty Avenue. Samuel S. Tompkins is agent.

New England States

ELLSWORTH, ME.—Arrangements have been made by the Bar Harbor & Union River Power Company for improvements to its local power station during the summer, which will include the installation of an additional 3000-kw. generator, replacing the wooden bulkhead at the head of the canal with concrete, etc. J. A. Leonard, engineer, will have charge of the work.

CLINTON, MASS.—Surveys are being made by the New England Power Company of Shelburne Falls for the erection of an electric transmission line from its nearest plant to the mobilization camp to be established at Ayr, to furnish electricity for lighting the camp and for power purposes.

LEOMINSTER, MASS.—The Leominster Electric Light & Power Company has closed its local plant. Energy for operating the system in Leominster is secured from the Connecticut River Power Company.

MALDEN, MASS.—The special committee appointed last fall to make investigations relative to the lighting situation has recommended the establishment of a municipal electric and gas plant.

SPRINGFIELD, MASS.—A bill is now pending in Congress which provides for an appropriation of $90,000 for equipping the Hill plant of the Springfield Armory for electrical operation. It is proposed to install large electric generating units to replace the 450-hp. steam engines now in use.

TURNERS FALLS, MASS.—The town officials are considering a proposal submitted by the Franklin Electric Light Company for the installation of a new street-lighting system to replace the lamps now in use.

WOODBURY, CONN.—The Public Utilities Commission has instructed the Woodbury Electric Light Company to reconstruct its electric distributing system immediately.

Middle Atlantic States

BROOKLYN, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, ninth floor, Hall of Board of Education, Fifty-ninth Street and Park Avenue, New York, until May 28 for electric shop equipment and wiring for shop motors in Public Schools Nos. 66, 109, 165, 173, 174 and 175. Further information may be obtained at the above office.

BUFFALO, N. Y.—The International Railway Company of Buffalo is contemplating extensions to its power plant at Niagara and Albany Streets.

BUFFALO, N. Y.—The Public Service Commission has authorized an issue of $1,500,000 of the International Railway Company's bonds, the proceeds to be used to finance extensions and improvements to its system, which will include extensions and additions to power huose and substation equipment, the purchase of 55 new cars, improvements to the equipment of present cars, track reconstruction, etc.

CANANDAIGUA, N. Y.—Negotiations are under way between the City Council and the Ontario Light & Traction Company relative to the installation of an ornamental street-lighting system in Canandaigua.

DUNKIRK, N. Y.—Arrangements are being made by the Niagara & Erie Power Company of Fredonia to exercise provisions of the franchise given by the city to erect station in the town and to furnish electricity to factories and private consumers.

EAST SALAMANCA, N. Y.—Contracts have been awarded by the Buffalo, Rochester & Pittsburgh Railway Company for the erection of new shops at East Salamanca, including machinery and erecting shops, blacksmith shops, storehouse and a transfer table, to cost about $500,000.

FREDONIA, N. Y.—The Village Trustees have authorized the fire and water committee to enter into a contract with the General Electric Company for new street lamps and other equipment, provided satisfactory arrangements are made with the Niagara & Erie Power Company. The lamps will be of 400 cp. and 600 cp.

HARTWICK, N. Y.—The Hartwick Power Company has been merged with the Colliers Light, Heat & Power Company of Cooperstown.

LEBANON, N. Y.—The Earlville (N. Y.) Electric Light Company has petitioned the Public Service Commission for permission to construct an electric-light plant and exercise a franchise in the town of Lebanon, and also for authority to issue $8,325 in bonds.

LYONS, N. Y.—A committee has been appointed by the Lyons Business Men's Association to look into the matter of installing an ornamental lighting system in the business district of the village.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

NEW YORK, N. Y.—Plans have been filed by the New York Edison Company for the erection of a one-story transformer station, 24 ft. by 46 ft., at 454 West Twenty-seventh Street, Manhattan, to cost about $35,000. W. Weissenberger, Jr., is architect.

NEW YORK, N. Y.—The Public Service Commission has approved agreement between the Interborough Rapid Transit Company and the Brooklyn Rapid Transit Company whereby the former company will supply power to operate the new subway lines of the Brooklyn Rapid Transit Company in Manhattan for a period of ten years. Agreement was also approved by which the Transit Development Company will supply energy for the Brooklyn Rapid Transit Company in Brooklyn.

THIELLS, N. Y.—Bids will be received by Frank A. Vanderlip, president of board of managers of Letchworth Village, 7 Wall Street, New York City, until May 29, for refrigeration equipment for storehouse, bakery, refrigerating plant and cold storage building, sanitary work and electric service connections for cottages E, F, G and H at Letchworth Village. Plans and specifications may be consulted at Letchworth Village, Thiells, at the office of the board of managers, 7 Wall Street, New York City, at the New York office of the Department of Architecture, Capitol, Albany. Drawings and specifications may be obtained at the Department of Architecture, Capitol, Albany.

WALTON, N. Y.—The Deposit (N. Y.) Electric Company has taken over the plant and holdings of the Southern New York Power Company of Walton.

WATERVILLE, N. Y.—The control of the Waterville Gas & Electric Company has been taken over by B. H. Shepard of Syracuse. The company, it is understood, will be reorganized.

CAMDEN, N. J.—Plans are being considered by the Delaware & Atlantic Telegraph & Telephone Company for the erection of a two-story addition to its telephone exchange building at Fifth and Market Streets, to cost about $38,000.

CLIFTON, N. J.—The City Council has authorized bids to be advertised for lighting the streets of the city.

GLASSBORO, N. J.—The Delaware & Atlantic Telegraph & Telephone Company is planning to install underground cable lines in High Street to replace the present overhead system.

LIVINGSTON, N. J.—The Township Committee has called an election to be held June 5 to make arrangements for a new street-lighting district.

NEWARK, N. J.—Improvements to the municipal fire-alarm telegraph system, including the installation of new underground cable, have been recommended by the Board of Fire Commissioners.

NEWARK, N. J.—Bids will be received by the Passaic Valley Sewerage Commission, 31 Clinton Street, Newark, until June 26 for three 50-kw. engine-driven generator sets, to be installed at the sewerage pumping station on the Kearny meadows. These units will be used to furnish electricity for lighting and screen lifting.

NEWTON, N. J.—Extensions and improvements will be made by the National Utilities Company of Boston, Mass., to its local plant and system and also to its power station at Dover. Harold R. Wilbur of Lambertville is district manager.

PERTH AMBOY, N. J.—The Board of Water Commissioners has adopted a resolution providing for an issue of $200,000 in bonds for extensions and improvements to the municipal water-works, including a new building and new pumping engine, to cost $53,000; new boilers and building, $35,000; dams, spillways, etc.

TRENTON, N. J.—Plans are being considered by the Imperial Porcelain Works, Mulberry Street, Trenton, for the construction of a new plant at Neptune City, to cost about $25,000. The company manufactures electrical porcelain goods.

WESTMONT, N. J.—The Township Committee has granted the Delaware & Atlantic Telegraph & Telephone Company permission to install underground conduit lines in Haddon and Wynnewood Avenues.

BETHLEHEM, PA.—The Bethlehem City Water Company is contemplating the installation of new electrically operated pumping equipment, with a capacity of about 10,000,000 gallons.

CONYNGHAM, PA.—The Harwood Electric Company of Hazleton is contemplating the installation of a distribution system in Conyngham to supply electricity for commercial lighting and power purpose.

GREENSBURG, PA.—The installation of an ornamental street-lighting system in the business district is under consideration.

JOHNSTOWN, PA.—H. D. Walbridge & Company, 14 Wall Street, New York, N. Y., have acquired control of the Citizens' Light, Heat & Power Company. Extension to the plant and system, it is understood, are under consideration.

LANSDOWNE, PA.—Bids are being asked for the erection of a new power plant, 73 ft. by 80 ft., two stories high, in connection with the new building for the new St. Vincent Home at Race and Eighteenth Streets, Philadelphia. Paul Monaghan, Drexel Building, is architect.

MILLERSVILLE, PA.—The Lancaster & York Furnace Railway Company, operating an electric railway from Millersville to Pequea-on-the-Susquehanna, has made arrangements with the Edison Electric Company of Lancaster for energy to operate its system.

PHILADELPHIA, PA.—The Green Box Company, Memphis Street, is contemplating the construction of a power house, 30 ft. by 60 ft., one story, in connection with its new factory addition. W. E. S. Dyer, Land Title Building, is architect.

PHILADELPHIA, PA.—A new boiler house, 49 ft. by 104 ft., one story, will be erected at the power station of the Philadelphia Electric Company, located at Robbins Street and the Delaware River, Tacony. The cost is estimated at about $60,000.

PHILADELPHIA, PA.—Bids are being asked by the Scofield Engineering Company, Commercial Trust Building, Philadelphia, for the erection of a brick and concrete power house and other structures for the Dunnellon Phosphate Company, Fernandina, Fla.

PHILADELPHIA, PA.—Plans have been prepared for the construction of a four-story building, 349 ft. by 78 ft., with a wing 205 ft. by 239 ft., and a power house, 73 ft. by 80 ft., at Lansdowne Avenue and Garret Road for the St. Vincent's Home, Paul Monaghan is architect.

PHILADELPHIA, PA.—Plans have been prepared by Harrison, Mertz & Emlen, engineers, Commercial Trust Building, Philadelphia, for two private water supply systems at Pleasantville, N. J., which provide for the installation of motor-driven deep-well pumping equipment.

PITTSBURGH, PA.—The Central District Telephone Company has acquired a site at Highland and Rural Avenues, on which it will erect a new telephone exchange.

PITTSBURGH, PA.—The Pittsburgh, Harmony & New Castle Railway Company has awarded contract for the construction of a new storage dam and addition to its power plant at Harmony Junction to the Faber Engineering & Construction Company of Pittsburgh.

SCRANTON, PA.—Preliminary plans are being prepared by the Maccar Truck Company for the erection of a one-story power house at its local plant. Duckworth Brothers, Coal Exchange Building, are architects.

SOUTH BETHLEHEM, PA.—Steps have been taken by the Lehigh Navigation Electric Company for the erection of a steel tower electric transmission line between Siegfried and the Bethlehem Steel Company's works.

YEADON, PA.—Plans have been filed for the erection of a power house, 50 ft. by 100 ft., for Theodore Presser, to cost about $30,000. Jesse T. Hoekstra is architect.

BALTIMORE, MD.—Contract has been awarded by the United Railways & Electric Company to the West Construction Company, for the erection of a substation, 60 ft. by 90 ft., at Sollers Point.

SALISBURY, MD.—One of the proposals submitted by the Eastern Shore Gas & Electric Company for lighting the streets of the city has been accepted by the city officials. The new contract, which is for a period of three years, will necessitate the rebuilding of quite a portion of the distributing system.

FARMVILLE, VA.—At an election to be held June 14 the proposal to issue $50,000 in bonds for a municipal electric-light plant, waterworks system and street improvements will be submitted to the voters. The present plans provide for developing 500 kw.

SHENANDOAH, VA.—Bonds to the amount of $30,000 have been voted for the construction of a hydroelectric power plant and filtration system. Plans were prepared by E. V. Dunston, engineer, Washington, D. C.

WASHINGTON, D. C.—Additions are being made to the Bliss Electrical School

Indiana Harbor, to cost about $100,000, including the installation of new equipment.

WASHINGTON, D. C.—Bids will be received at the office of the United States Marine Corps Quartermaster's Department, Washington, D. C., until May 28, for furnishing miscellaneous supplies to be delivered to the depot quartermaster, Marine Corps, 1100 South Broad Street, Philadelphia, Pa., as follows: 5000 flashlight batteries, 1,500 electric flashlights complete, with one battery, 100 field telephones, one end with batteries, 25,000 lb. barbed wire, and 20,000 lb. insulated copper wire. C. L. McCawley, brigadier general, is quartermaster.

WASHINGTON, D. C.—The Public Utilities Commission has authorized the Potomac Electric Power Company to issue $1,047,500 in bonds, the proceeds to be used for extensions and improvements as follows: Enlargement of the Benning power plant and installation of a 15,000-kw. turbine, at a cost of $290,000; addition to building at Fourteenth and C streets, $32,000; conduit, $60,750; extension of underground system, $10,125; extension of incandescent, underground street-lighting system, $30,250; extension of overhead system, $25,825; meters, $31,800, and poles and feeders, $15,000.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: San Francisco, Cal., Schedule 1119—75,160 lb. wire fabric. Brooklyn, N. Y., Schedule 1156—miscellaneous common, mercurial; mechanical thermometers, storage battery, etc.; Schedule 1146—55,000 chemical sounding tubes; Schedule 1145—miscellaneous material for switchboard panels; Schedule 1136—one heating and ventilating set (complete); three ventilating sets (complete). Norfolk, Va., Schedule 1139—25 electrolytic, oxygen and hydrogen generators. Philadelphia, Pa., Schedule 1130—indicating and annunciating systems with motor-driven pump; Schedule 1129—two sets motor-driven large plate-bending rolls. Various, Schedule, 1134—miscellaneous electrically driven deck winches. Washington, D. C., Schedule 1159—two motor-driven, back-geared, pillar crank shapers. Application for proposal blanks should designate the schedule desired by number.

North Central States

ALMA, MICH.—The Central Michigan Light & Power Company of Mount Pleasant has purchased the electric plant and distributing system of the Alma Grain & Lumber Company. The Central Michigan company has begun work on the construction of a new plant on the Pine River in Alma, to cost about $150,000, and has moved its headquarters from Mount Pleasant to Alma.

DETROIT, MICH.—The third unit of the Detroit United Railway Company's shops at Highland Park, consisting of carpenter shop, pattern shop and tinsmithing department, etc., has been completed. The fourth unit to be erected will be a brass foundry. A permanent power and heating plant will complete the layout. The cost of the entire work is estimated at about $1,000,000.

ANTWERP, OHIO.—The Northwestern Electric Light & Power Company of Delphos has applied for a franchise to furnish electrical service in Antwerp.

ELYRIA, OHIO.—Plans are being prepared by the Willys-Overland Company of Toledo for the construction of a boiler house, 30 ft. by 40 ft., at its local plant.

TOLEDO, OHIO.—Plans are being considered by the Central Union (Bell) Telephone Company for the erection of a new telephone exchange building, at Geneva and Arlington avenues, to cost about $110,000, with additional expenditures of $60,000 for outside connecting facilities.

WEST MANSFIELD, OHIO.—The sale of the municipal electric-light plant is reported to be under consideration.

ADAIRVILLE, KY.—The Adairville Lighting Company, recently incorporated, is planning to construct a hydroelectric power plant, to develop 135 hp., on the south fork of Red River, to cost about $15,000. The work will include a concrete dam, 10 ft. by 76 ft., to cost $2,500; power house, $3,200; 3-mile transmission line, $4,500; an urban system connecting Adairville with several small villages and large plantations, $2,350. Contract, it is reported, has been awarded for crude-oil set and urban distribution system.

CAMPBELLVILLE, KY.—The Campbellvlile Electric Light & Power Company, recently incorporated with a capital stock of $40,000, is planning to install an electric plant, to develop about 175 hp. at a cost of about $10,000.

COVINGTON, KY.—The Eagle Cordage Company is contemplating equipping its plant for electrical operation. Several small motors will be required.

PADUCAH, KY.—The City Commission is considering submitting to the voters a proposal to issue $185,000 in bonds for improvements to the municipal electric light plant at the next regular election.

FOUNTAIN CITY, IND.—The Town Board is considering a proposal submitted by Charles Wiley, representing the Richmond (Ind.) Electric Company, for the installation of an electric distributing system to supply electricity for lamps, heaters and motors to several towns near Fountain City. W. M. Bailey and others are interested in the project.

GREENSBURG, IND.—The City Council has granted the Greensburg Gas & Electric Company permission to improve the present street-lighting system at a cost of about $1,500.

LIGONIER, IND.—The local electric-light plant, owned by Lyon & Greenleaf, has been purchased by H. L. Crawford & Company of New York, N. Y. No change in management will be made for the present.

PLAINVILLE, IND.—The Indiana Power & Water Company of Bloomfield has applied to the County Commissioners for a franchise to erect electric transmission lines over the roads and highways of Daviess County and to erect an electric-light and power plant and distribution system in Plainville to furnish electrical service to residents in this village and to the inhabitants of the other incorporated districts in the county.

WINONA LAKE, IND.—The Public Service Commission has granted the Winona Electric Light & Water Company permission to issue $85,000 in bonds, the proceeds to be used for improvements and other purposes.

CHICAGO, ILL.—Bids will be received by the clerk of the Sanitary District of Chicago, 700-910 South Michigan Avenue, Chicago, until May 31 (extension of date), for furnishing a vertical hydraulic turbine and an alternating-current generator. For details see proposal columns.

ELGIN, ILL.—The old Waverly mill in Elgin is reported to have been purchased by B. S. Pearsall. The new owner, it is understood, proposes to install a hydroelectric plant.

EL PASO, ILL.—Beaudett & Croner of El Paso are contemplating enlarging their cold storage plant and installing additional machinery, at a cost of about $10,000.

EMINGTON, ILL.—Plans are being considered by the Town Board for the installation of an electric-lighting system.

RUSHVILLE, ILL.—Bids will be received by the Commissioners of Kelly Lake Drainage & Levee District, at the office of Glass & Bottenberg, attorneys, Rushville, until June 1, for furnishing and erecting any or all parts of an electrically driven pumping plant. For further information address the Jacksonville (Ill.) Engineering Company. Specifications will be furnished upon receipt of $3.

BARABOO, WIS.—Surveys have been completed for the erection of an electric transmission line from the power house at Prairie du Sac to Baraboo.

BROOKLYN, WIS.—Permission has been granted to the Brooklyn Electric Company by the Railroad Commission to use the poles of the Brooklyn Telephone Company for erecting wires for an electric distributing system in Brooklyn. H. J. Ellis is interested in the Brooklyn Electric Company.

NEENAH, WIS.—Plans are being considered for replacing the steam power plant at the water-works station with electrically operated machinery.

RACINE, WIS.—Plans are being prepared by the Milwaukee Light, Heat & Traction Company for the construction of an addition to its local plant to cost about $25,000.

RIPON, WIS.—The Ripon Light & Water Company has purchased the electric plants and holdings of the Wisconsin Light, Power & Milling Company in Eldorado and Rosendale, which include the power plant in Eldorado and 5 miles of transmission line. It is proposed to erect transmission lines from Ripon to Rosendale.

SHAWANO, WIS.—The Electric Light and Waterworks Commission has recommended improvements to the municipal water and light plant, including the installation of a 250-hp. Corliss engine, directly connected, and motor-driven pumps.

SPARTA, WIS.—The Wisconsin-Minnesota Light & Power Company, which recently purchased the electric light and power plants at Sparta and Angelo of the O. I. Newton Sons Company, is planning to erect an electric transmission line to connect the plant in this city with the power station in La Crosse. The plans provide for the erection of 90 miles of transmission lines, connecting Sparta, Tomah, and La Crosse with the plant at Nelson. A transmission line is now being erected from the local plant to Tomah. The power plant at Nelson, the Wisola dam, will be enlarged this year, increasing the output from 22,000 to 45,000 hp.

WAUSAU, WIS.—The Wisconsin Railroad Commission has granted the Wisconsin Valley Electric Company permission to issue $1,337,500 in bonds. Of the proceeds $561,000 will be used to refund bonds of the Wausau Street Railroad Company and notes of the Wisconsin Valley Electric Company, and the balance to provide funds for new construction.

AURORA, MINN.—Bids will be received by W. J. Rashleigh, clerk, the Independent School District No. 13, Hearding School Building, Aurora, until June 12, for construction of high school buildings, separate bids to be submitted on general contract, electrical work, heating and ventilating, temperature regulation, fans, motors, drives and heaters, air washers and humidity control equipment, and vacuum heating equipment. Plans and specifications are on file in the office of the architects, 320 Auditorium Building, Minneapolis, Minn., and at the office of the Board of Education, Aurora.

MARSHALL, MINN.—Bids will be received at the office of the city recorder, Marshall, until June 4 for furnishing one 150-hp. or 200-hp. engine or turbine directly connected to an engine-type generator. Generator to have a rating of 125 or 150 kw., 60 cycle, 2300 volts, three-phase, belted to a direct-current exciter. A. G. Bumford is city recorder.

BURLINGTON, IOWA.—The Board of Railroad Commissioners has granted the Peoples Gas & Electric Company of Burlington a franchise to erect electric transmission lines on the roads and highways between Morning Sun and Mediapolis, in Louisa and Des Moines Counties, to supply electricity for lamps and motors in this territory.

CENTERVILLE, IOWA.—The Iowa Southern Utilities Company of Centerville has been granted a franchise by the Board of Railroad Commissioners to erect electric transmission lines on certain roads and highways in Ringgold and Taylor Counties, to supply electricity for lamps and motors in this district.

CENTERVILLE, IOWA.—Bids will be received by the Board of Education of Centerville until June 5 for construction of high school building, including electric wiring, heating, plumbing, vacuum cleaner, etc. The cost of the building is estimated at about $150,000. M. E. Cleveland, 603 First National Bank Building, Waterloo, is architect.

CLINTON, IOWA.—Improvements, it is reported, are contemplated by the Illinois Railroad Company to its local yards, including a new power house, extensions to machine shops and improvements to the roundhouse, etc. The cost is estimated at $250,000.

FORT DODGE, IOWA.—Extensions and improvements involving an expenditure of $250,000, it is reported, are contemplated by the Fort Dodge, Des Moines & Southeast Railway Company.

MANSON, IOWA.—At an election held recently the proposal to issue bonds for the construction of an electric lighting and heating plant was carried.

WAPELLO, IOWA.—The electric plant of the Wapello Electric Light & Power Company, owned by the Burlington (Iowa) Railway & Light Company, was destroyed by fire on May 8, causing a loss of about $10,000. Two electric generators and two engines were completely destroyed. The three boilers may be repaired. An electric transmission line may be erected from Burlington to furnish temporary service. The plant, it is understood, will be rebuilt.

WATERLOO, IOWA.—The Board of Railroad Commission of the State of Iowa has granted the Cedar Valley Hydraulic Company of Waterloo a franchise to erect and operate electric transmission lines in Floyd County, from Charles City to Rockford, to supply electricity for lamps, heaters and motors.

KANSAS CITY, MO.—The city officials are seeking information on standards and equipment for illuminated street signs. It is proposed to mark all downtown streets and as many of the outside corners as possible. The cost of the work is estimated at about $50,000.

SPRINGFIELD, MO.—At an election to be held June 16 the proposal to issue $500,000 in bonds will be submitted to the voters.

VANDALIA, MO.—The Walsh Fire Clay Products Company contemplates equipping a power plant and installing clay-working machinery, at a cost of about $500,000. The Unit Construction Company of St. Louis will have charge of the engineering work.

BEACH, N. D.—The electric plant of the Beach Electric Company has been purchased by F. C. Hughes of the Glendive (Mont.) Heat, Light & Power Company.

FARGO, N. D.—Bids will be received by E. G. Guthrie, secretary board of education, Court House, Fargo, N. D., until June 4, for the construction of a school building. Separate bids to be submitted for general contract, heating and electrical work, plumbing, etc. Plans and specifications can be seen at the office of Haxby & Braseth, architects, Fargo.

FORBES, N. D.—Plans are being considered for the installation of a municipal electric-light plant. It is proposed to erect an electric transmission line from Ellendale to Forbes.

STEELE, N. D.—Local business men have organized a stock company and have purchased the property of the Goodwin Light & Power Company. The new company will be known as the Steele Electric Company and will be capitalized at $20,000. E. B. Miller, H. B. Allen and J. C. Loerch are among the incorporators.

VALLEY CITY, N. D.—The City Council has entered into a contract with the Dakota Engineering & Construction Company for furnishing energy to be taken at the city limits for a period of 20 years. The service will be furnished over a high-tension line, 35 miles long, connecting the villages of Sanborn, Rogers and Daxey. A 24-hour service will be given.

CHESTER, S. D.—The local electric-lighting system has been purchased by the Hartford (S. D.) Light & Power Company. An electric transmission line will be erected from Hartford to Chester, a distance of 4 miles. The Hartford company purchases energy from the Northern States Power Company.

HAVELOCK, NEB.—The contract for electric wiring for the new high school in Havelock has been awarded to the Capital City Electric Company of Des Moines, Iowa, at $4,175.

ABILENE, KAN.—The Riverside Light, Power & Gas Company is contemplating extensions to its system.

HAYS, KAN.—Plans are being prepared for improvements to the municipal electric-light plant and water-works system, to cost about $25,000. E. T. Archer & Company, New England Building, Kansas City, Mo., are engineers.

KENSINGTON, KAN.—Improvements are being considered for the municipal electric-lighting system.

NESS CITY, KAN.—Bids will be received by the County Commissioners of Ness County at the office of the county clerk, Ness City, until June 5, for the erection of a court house in Ness City, as follows: (1) For building complete exclusive of heating, plumbing and electric wiring; (2) electric wiring, heating and plumbing. Plans and specifications are on file in the office of J. C. Holland & Son, architects, Topeka, Kan.

SALINA, KAN.—Plans are being considered by the city officials and the Salina Light, Power & Gas Company for lighting the city park.

TORONTO, KAN.—Bids, it is reported, will soon be awarded for the construction of an electric-light plant. W. B. Rollins & Company, 209 Railway Exchange, Kansas City, Mo., are engineers.

Southern States

ANDERSON, S. C.—The Southern Public Utilities Company of Charlotte, N. C., has been awarded the contract for installing a new street-lighting system in the Orr cotton mill village. The 12 arc lamps now in use will be replaced with 83 Mazda lamps of 80 cp.

JEFFERSON, S. C.—The State Legislature has granted the city of Jefferson permission to issue $15,000 in bonds for a municipal electric-light plant and water-works system.

GAINESVILLE, GA.—The Southern Bell Telephone & Telegraph Company is contemplating the erection of an exchange in Gainesville, to cost about $13,000, and other improvements to cost about $40,000, including the removal of wires from the public square and the installation of common battery system.

THOMASVILLE, GA.—At an election held recently the proposal to issue $160,000 in bonds for improvements to the electric-light plant, fire-alarm system, water-works system, paving, etc., was carried.

CHATTANOOGA, TENN.—The Lucey Manufacturing Company is reported to be contemplating the erection of a power house, to cost about $6,500.

CARRVILLE, ALA.—The proposal to issue bonds for the installation of a transformer station and the erection of an electric transmission line from the plant of the Montgomery (Ala.) Light & Water Power Company to Carrville, a distance of 3 miles, will be submitted to the voters.

DOTHAN, ALA.—The City Council has entered into a provisional contract with the South Alabama Power Company whereby the latter will furnish the city with hydroelectric power from O'Mercer Creek. The company proposes to develop the water power of O'Mercer Creek and transmit the energy to Dothan to be distributed by the municipal plant.

MONTEVALLO, ALA.—The Montevallo Mining Company is planning to install a continuous coal conveyor and to make other improvements.

FERNWOOD, MISS.—Arrangements have been completed by the McComb-Magnolia Light & Railway Company of McComb with the Fernwood Lumber Company for the purchase of a site for the erection of an electric power plant in Fernwood.

GULFPORT, MISS.—The Gulfport & Mississippi Coast Traction Company, it is reported, contemplates purchasing equipment to convert boilers now using coal to wood burning. The company is also in the market for machinery to handle slabs and other saw mill refuse.

NATCHEZ, MISS.—Contract has been awarded to Brown & Henderson of Natchez for the construction of an electric plant for the Jefferson Military College.

PICKERING, LA.—The W. R. Pickering Lumber Company is planning to rebuild its sawmill and power plant, recently destroyed by fire, causing a loss of about $100,000. New equipment will be installed.

BILLINGS, OKLA.—Bonds to the amount of $10,000 have been voted for improvements to electric-lighting system.

BRISTOW, OKLA.—The plant and holdings of the Bristow Ice & Light Company have been purchased by J. J. and D. O. Darnell of Cripple Creek, Col. The new owners, it is understood, contemplate improvements to the system.

FREDERICK, OKLA.—The city of Frederick has taken over the electric plant of the Foster-Harris Gin & Electric Company, at a valuation of $35,000, which will be operated in connection with the water-works system. Service extensions are contemplated.

WAYNOKA, OKLA.—Bids are being asked by the city of Waynoka for alternating-current generators directly connected to oil-burning engines and other electrical equipment.

KINGSVILLE, TEXAS.—We are informed that the St. Louis, Brownsville & Mexico Railroad Company does not contemplate the installation of an electric-light and power plant as reported in the issue of April 21. The Texas Gas & Electric Company furnishes electrical service to local shops and terminals of the railroad company.

ODESSA, TEX.—The Odessa Light & Power Company, recently incorporated with a capital stock of $4,000, is planning to construct an electric-light plant in Odessa. R. M. Henderson, W. F. Bates and W. H. Rhodes are the incorporators.

Pacific and Mountain States

KEYPORT, WASH.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., has awarded the contract for alterations, etc., to the heating and power plant at the naval station at Keyport, to Charles C. Moore & Company of Seattle, Wash., at $27,803.

OKANOGAN, WASH.—A three-year contract between the Okanogan Valley Power Company and the United States Reclamation Service for power from the No. 2 power plant, near Okanogan, has been signed, and will take effect as soon as the water is turned on. Power to be used through the irrigating season. Connections will be made immediately between the Okanogan company and the Government lines. Electricity from this plant will be supplied to the towns of Okanogan, Omak and Riverside, while the Pateros plant of the company will furnish energy in Pateros, Brewster, Bridgeport and Mansfield.

OLYMPIA, WASH.—The Puget Sound Traction, Light & Power Company of Tacoma has petitioned the County Commissioners for a franchise to erect an electric transmission line between Nisqually and Log Cabin, near Tumwater. The proposed line would furnish additional energy to the Olympia Light & Power Company for use largely at the shipyards.

SPOKANE, WASH.—Plans have been approved by the Pacific Telephone & Telegraph Company for the erection of toll lines in the Inland Empire, involving an expenditure of $77,600. The work will include the erection of a phantom circuit from Colfax to Spokane, a distance of 59 miles; also stringing copper wire and establishing a phantom with an existing circuit from Colfax to Thornton, and dismantling an existing pole line and circuit from Oakesdale to Thornton Junction.

PORTLAND, ORE.—The City Council has refused to submit to the voters at the election to be held June 4 the proposal of Commissioner Daly to issue $1,777,000 in bonds for the installation of a hydroelectric power plant on Bull Run Lake.

FRESNO, CAL.—The State Railroad Commission has approved the application of the San Joaquin Light & Power Company for an indenture securing $4,500,000 in debentures. The commission has authorized the company to issue $1,000,000 in bonds at not less than 95, the proceeds to be used to reimburse treasury for capital expenditures which have been made for new improvements.

LOS ANGELES, CAL.—The City Council has given its approval of the plans for the installation of the new ornamental lighting system on Broadway, which will extend from the tunnel to Tenth Street, a distance of about 72,000 ft. The plans provide for the erection of 136 standards, 25 ft. high, each mounted with two lamps. The system will be installed under the supervision of William D'Arcy Ryan of New York, illuminating engineer.

STOCKTON, CAL.—The Western States Gas & Electric Company has filed an application with the State Water Commission for permission to appropriate waters of Medley and Echo Lakes in El Dorado County and Twin Lakes in Alpine County, for power purposes. The quantity of water applied for is 5000, 7000 and 8000-acre-ft., respectively. It is proposed to develop 2500 hp. at the existing plant of the American River Electric Company for a period of seven months in the year. The proposed main ditch, including penstocks, is to be 7.3 miles long. At Medley Lake it is proposed to erect a main dam 15 ft. high and two auxiliary dams 5 ft. each in height, and at Echo Lake a tunnel driven to draw the level of the lake about 40 ft. below the natural outlet, said tunnel to be 5 ft. by 6½ ft. in cross section and 2600 ft. long. The total fall to be utilized is given as 610 ft. from dam to waterwheel.

BOISE, IDAHO.—Application has been made to the Public Utilities Commission by the Beaver River Power Company of Boise for permission to extend its electric transmission lines to Marysvale. The company, it is understood, proposes to erect a new plant at Panguitch.

BOISE, IDAHO.—The State Land Board has decided to take up the question of having the Utah Power & Light Company supply energy in bulk to the Ashton & St. Anthony Power Company, so that the latter company can furnish electricity to operate the pumps of the Owsley irrigation project.

SALT LAKE CITY, UTAH.—The Utah Power & Light Company has petitioned the City Commission for permission to construct an underground vault in Main Street. The object of the station is to improve the service in the business district.

BUTTE, MONT.—Permits have been granted the Butte Electric Railway Company for the construction of two substations, one to be erected at Florence and Major Streets, to cost $1,700; the other at 218 East Center Street, to cost $2,400.

PUEBLO, COL.—Plans have been completed by the city engineer for a new lighting system on Broadway, Quincy and Jackson streets in the new Pacink District No. 1. The plans provide for the installation of ornamental standards in the center of the intersection of the streets in the district.

Canada

LETHBRIDGE, ALTA.—The Ellison Milling Company is contemplating erecting an elevator, to cost between $100,000 and $150,000.

ST. JOHN, N. B.—The contract for the construction of the new laundry and power house for the General Public Hospital has been awarded to Robert A. Corbett, etc.

tractor, for $12,700. The laundry will be equipped with electrically operated machinery.

ALYMER, ONT.—A by-law providing for an appropriation of $22,000 for remodelling the electrical distribution system in Alymer to distribute energy to be supplied by the Hydro Electric Power Commission of Ontario and $5,000 for the installation of an electrically operated pump to supply water for domestic purposes and a gasoline pump for fire purposes has been approved by the ratepayers.

BRANTFORD, ONT.—The Township Council has instructed the township solicitor to prepare a by-law providing for the township entering into a contract with the Hydro-Electric Power Commission of Ontario to furnish electricity to be distributed throughout the township.

HOWARD TOWNSHIP, ONT.—Plans are being considered for the installation of a hydroelectric system in Howard Township.

MARKHAM, ONT.—The Markham Board of Trade has passed a resolution urging the Hydro-Electric Power Commission of Ontario to extend its system to Markham.

SCARBORO, ONT.—The Township Council has passed a by-law authorizing the Hydro-Electric Company to erect street lamps on the Kingston Road from the city limits to the Kennedy Road, and on Danforth Avenue from the city limits to a point a mile out.

COATICOOK, QUE.—The Foundation Company of Montreal has been awarded the contract for the construction of a dam and penstock for Penmans, Ltd., in connection with a hydroelectric development of about 1800 hp.

EAST ANGUS, QUE.—Plans are being considered by the Brompton Pulp & Paper Company for the construction of a dam and power house at East Angus. The equipment will include electrical equipment, water wheels, turbines, generators and switchboard. The Montreal Engineering Company, 164 James Street, Montreal, has charge of the engineering work.

Miscellaneous

PANAMA.—Bids will be received by the general purchasing officer, the Panama Canal, Washington, D. C., until May 29 under proposal 2129 for furnishing 2300 ft. bronze wire, 8000 ft. brass chain, 1750 snap switches, 250 push buttons, six hand pumps, etc. For further information address Major Earl L. Brown, general purchasing officer.

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until June 9, for furnishing (under proposal 1146) 500 spark plugs, one band saw, milling outfit, 2000 ft. galvanized seizing wire, 3000 lb. galvanized steel wire, two sail makers machines, motor driven, and two motors: 3400 ft. electric cable, 48 kerosene fire pots, 144 burner plugs, 24 fuller caps, 2500 outlet boxes, 750 caps for plugs, 100,000 ft. conduit, oak, yellow pine, box car siding, redwood, poplar, hickory and fir. For further information address Major Earl L. Brown, general purchasing officer.

Record of Electrical Patents

Notes on United States Patents issued on May 15, 1917

1,225,785. INSULATOR FOR HIGH TENSION CONDUCTORS; Albert Aichele, Baden, Switzerland. App. filed Nov. 25, 1913. Surface in the vicinity of the socket is so shaped that the electric field is directed almost at right angles to the insulator surface so that glow discharge along the surface is prevented, and thus the tension at which the spark passes is increased.

1,225,829. ELECTRIC SWITCH; Charles F. Kettering and Robert S. De Maree, Dayton, Ohio. App. filed July 14, 1913. Controller switches.

1,225,826. ELECTRICAL HEATING UNIT; Frank Kuhn and Frank E. Shailor, Detroit, Mich. App. filed May 8, 1915. Improvements.

1,225,827. ELECTRIC HEATING UNIT; Frank Kuhn and Frank E. Shailor, Detroit, Mich. App. filed Oct. 15, 1915. For use in connection with electrically heated ovens.

1,225,887. VALVE-OPERATING MECHANISM; John H. Swan, Chicago, Ill. App. filed July 22, 1915. Motor having a double action, the primary action being utilized for actuating the valve and the secondary action being utilized for adjustment of the controlling means for the motor.

1,225,890. FUSE PLUG; Henry von P. Thomas, Kirkwood, Mo. App. filed May 15, 1916. Improvement.

1,225,901. HIGH-TENSION SWITCH; Ernst Weissberg, Cassel, Germany. App. filed June 10, 1914. Cut-out with means for extinguishing the arc set up on breaking the circuit.

1,225,963. MOTOR-CONTROL APPARATUS; Frederick Hymans, Glen Ridge, N. J. App. filed Oct. 20, 1914. Used in the operation of furnace hoists, etc.

1,225,975. MERCURY MOTOR METER; Robert C. Lanphier, Springfield, Ill. App. filed March 12, 1913. Auxiliary damping devices heretofore employed are dispensed with.

1,225,976. ELEVATOR-CONTROL SYSTEM; David Larson, Berlin, Germany. App. filed July 30, 1912. For automatic alternating-current electric elevators.

1,225,997. PANELBOARD AND LINING-STRIP SUPPORTING MEANS; Edwin A. Olley, Syracuse, N. Y. App. filed June 14, 1913. Improved.

1,226,009. BURGLAR ALARM; Charles Rieser, Chicago, Ill. App. filed Sept. 3, 1915. Portable.

1,226,017. INCLOSED FUSE; George A. Schaefer, Chicago, Ill. App. filed April 23, 1914. Link may be readily inserted between the terminals of the fuse without the use of special tools.

1,226,056. ELECTRICAL MEASURING INSTRUMENT; William M. Bradshaw and Walter G. Mylius, Wilkinsburg, Pa. App. filed Nov. 28, 1913. Friction compensating means therefor.

1,226,058. ELECTRICALLY CONTROLLED CALCULATING MACHINE; James W. Bryce, Bloomfield, N. J. App. filed April 12, 1916. Improvements.

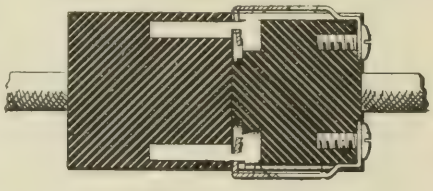
1,226,067. AUXILIARY APPARATUS FOR VAPOR CONVERTERS; Earl E. Eby, Winkinsburg, Pa. App. filed Oct. 21, 1916. Both the control of a keep-alive arc within the container and the flow of gas through an exhaust tube therefor may be effected.

1,226,069. ANODE STRUCTURE FOR VAPOR CONVERTERS; Sidney W. Farnsworth, Pittsburgh, Pa. App. filed July 12, 1915. Anode that shall be free from leaks, that shall produce and maintain a suitable rectifying arc without the liberation of occluded gases, and the temperature of which may be readily adjusted.

1,226,091. ALTERNATING-CURRENT INDUCTION MOTOR; Burton McCollum, Washington, D. C. App. filed Aug. 2, 1915. Yields a high starting torque with a relatively low starting current, and will also operate under load conditions with good efficiency and small speed regulation.

1,226,114. CIRCUIT INTERRUPTER; Karl C. Randall, Edgewood Park, Pa. App. filed April 6, 1914. Provides means for conducting the generated gas away from the contact members and for utilizing the gas in aiding the operation of the circuit interrupter.

1,226,122. ELECTRIC FURNACE AND METHOD OF PRODUCING MOLTEN MAGNETITE THEREIN; Arthur P. Scott, Chicago, Ill. App. filed Nov. 17, 1915. Improvements in single-phase alternating-current electric furnaces of the direct-arc type.



1,226,161—Connector

1,226,142. VOLTAGE-REGULATING SYSTEM; Norman W. Storer, Pittsburgh, Pa. App. filed Jan. 7, 1914. For maintaining substantially constant voltage upon translating devices, such, for instance, as the lamps which are commonly employed in electric railway cars.

1,226,151. REFILLABLE CARTRIDGE FUSE; Louis E. Weinberg, New York, N. Y. App. filed May 28, 1914. Permanent outer casing with a replaceable inner inclosed fuse.

1,226,161. CONNECTOR; Stanley Anthony, Boston, Mass. App. filed Sept. 24, 1913. Locks together in such a manner that accidental disconnection cannot occur.

1,226,255. MOTOR-CONTROLLING DEVICE; John Richmond, Rochester, N. Y. App. filed Jan. 8, 1914. Provision is made for automatically reversing the direction of operation of a motor intermittently by means of a continuously rotating controller.

1,226,264. ELECTRIC FURNACE; Frank C. Schmitz, New York, N. Y. App. filed Nov. 3, 1913. Water-cooled type.

1,226,279. PROCESS OF ELIMINATING AND RECOVERING ACIDS OR METALLIC SALTS; Harold E. Tiffany, Newark, Del. App. filed Jan. 5, 1916. Consists in the application of electrolysis or an electrolytic method to the washing or purifying of fiber or similar material in sheet, tube or other form for the elimination of any metallic salt.

1,226,290. STORAGE BATTERY; Theodore A. Willard, Cleveland, Ohio. App. filed July 6, 1915. Means for sealing the terminal posts to prevent creepage of battery solution upward along the posts to the exterior of the cover.

1,226,319. OIL VAPORIZER FOR EXPLOSIVE ENGINES; Charlie W. Dyer, Stratton, Me. App. filed July 27, 1916. Engine starters.

1,226,338. LAMP-SOCKET LOCK; Herbert R. Land, Little Rock, Ark. App. filed Jan. 11, 1917. Readily applied to the conventional forms of lamp sockets.

1,226,350. MECHANISM FOR WELDING PIPE BY ELECTRICITY; Clarence Mark and Carl O. Bergman, Evanston, Ill. App. filed Sept. 11, 1914. Electrically heating the edges of the blank so that when these edges have been raised to a sufficiently high temperature the blank is passed through forming and finishing rolls.

1,226,404. SWITCH; Alexander K. Sutherland, New Britain, Conn. App. filed Oct. 28, 1916. Rocking or oscillating switches of the push-button type.

1,226,406. ALTERNATING-CURRENT SYNCHRONOUS MOTOR; Robert W. Swift, Warren, Ohio. App. filed Dec. 4, 1914. Equipped with means for causing the rotor to operate in exact synchronism with the alternations of the current and to avoid lagging or slippage of the rotor relative to the pulsations of the current.

1,226,433. CURRENT TAP; William R. Young, Bridgeport, Conn. App. filed Jan. 30, 1917. Combined tap and receptacle affording connecting means for a plurality of attachment plugs.

1,226,451. ELECTRIC CONTROLLING AND FEEDING APPARATUS; Sidney B. Blakely, Chicago, Ill. App. filed Dec. 29, 1915. Improvements.

1,226,471. REFRACTOBY-METAL TUBE; William D. Coolidge, Schenectady, N. Y. App. filed Feb. 5, 1916. Improvements.

1,226,491. ELECTRIC METER; Alexander J. R. Fiego, Lynn, Mass. App. filed March 20, 1914. Simplifies the mounting for the ratio or reduction gearing of electric meters.

1,226,500. WATER EXPLOSION ENGINE; Gustav Fuehler, Verdon, S. D. App. filed Aug. 9, 1916. The engine is so arranged that upon the introduction of water into the cylinder the water bursts into steam and drives the usual piston.

1,226,534. ELECTRIC LOAD DISTRIBUTER; Jess E. King, Syracuse, N. Y. App. filed April 29, 1916. Responsive to small variations in the load required and capable of very close regulation so that the power taken from the primary source of supply may be kept practically constant.

1,226,546. AUTOMATIC MOTOR CONTROLLER; Lewis J. McDowell, Brooklyn, N. Y. App. filed Feb. 27, 1915. Improvements.

1,226,558. ELECTRIC-LAMP HOLDER; Victorino Martinez, Havana, Cuba. App. filed April 15, 1916. New arrangement of terminals and properly forms a unipoplar circuit breaker.

1,226,584. CUT-OUT; Henry T. Paiste, Philadelphia, Pa. App. filed Sept. 9, 1915. Improvements.

1,226,617. ELECTROMAGNET; Frederick R. Parker, Chicago, Ill. App. filed Sept. 23, 1916. Improvements.

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Engineers to the Front

WE ARE glad to see the vigorous efforts now being made to recruit and dispatch to France at the earliest possible moment a large force of engineers to deal with the great problems of transportation and reconstruction that lie before the Allies as they advance through the most ghastly desert that the eye of man has ever dwelt upon. Rehabilitation will very likely fall in chief upon American engineers. The recruiting and training of soldiers is a very slow task even when adequate preparations have been made, but engineer regiments are already trained to cope with hostile nature successfully, and employed as they will be behind the immediate firing line, the military side of their training need not be long drawn out. Let us have them then, these regiments of engineers, just as fast as they can be recruited and made ready, to make up as best we can for a signal failure in readiness with trained soldiers.

The Function of the Jobber

THE electrical supply jobbers of the country are gradually finding themselves. By that we do not mean to infer that they have not always been alive to the opportunities of their business, but that the members of the Electrical Supply Jobbers' Association are now taking a larger and more comprehensive view of jobbing affairs. Heretofore their actions have not been entirely void of friction begotten of bias and sectional feeling, whereas now there is a spirit of broad co-operation and co-ordination manifesting itself. This makes for stronger organization, greater efficiency, and, what is more important, it means that the jobbers are becoming better merchants. They are appreciating market conditions—the necessity of watching the market and providing against its idiosyncrasies by setting aside ample reserves. These conditions a few progressive jobbers have always had in mind, with the result that if their judgment was good they were successful. Now the lesson is being learned by nearly all. When the happy time comes (and indications are that it is not far distant) in which jobbers will fulfill to perfection their economic function in the chain of distribution between the manufacturer and the central station, dealer and contractor, there will be no question about their general recognition as distributers. They must, however, first attain a position to render an invaluable and indispensable service to manufacturer and consumer before they can reap the benefits which go with such a position. We are glad to observe the rapidity with which they are approaching that goal and the desire to get together with the rest of the industry.

The Stabilizer in Business

"KNOW thyself" is one of the fundamentals of right living. "Know your costs" is the first principle for the electrical manufacturer who does not want to blunder his way into bankruptcy. In the days before the Federal Trade Commission came into existence and friendly power it was the fashion to poke fun at Washington attempts to teach business anything. But that commission, conceived in a new spirit of helpfulness, has been a lever of tremendous importance to the business of the country, groping toward uniform accounting and cost systems. The Electrical Manufacturers' Council is especially to be congratulated that the system upon which its committee has worked for nearly a year has received the commendation of the Federal Trade Commission. True cost accounting is the best promoter of sound trade practices, the best stabilizer of business. With the information which it gives, the manufacturer makes no prices in ignorance of what he does. He may cut prices below cost, but if he does he knows that he will have to charge the difference to surplus or advance selling prices on other transactions enough to overcome the deficit. Behind the Electrical Manufacturers' Council in the sound accounting movement stand the three great organizations of manufacturers in the industry; behind all stands the Federal Trade Commission with creditor banks looming in the background demanding adherence to approved methods. Sooner or later the swift industrial pace of pre-war and wartime days will be followed by unsettled conditions in which rigid cost accounting will be the salvation of business, big or little.

Strafing the Submarine

THE newspaper inventor has been having the time of his life recently, owing to the very unwise chatter of certain worthy gentlemen who ought to know better. The submarine menace is one which is not lightly to be estimated. The campaign against England has been, although far from decisive, unpleasantly successful, and it is with great gladness that we learn of the active co-operation of a United States squadron in endeavoring to suppress it; but no good is done by premature announcements regarding the great things which Yankee ingenuity is about to do in the way of suppressing the submarines. We have abiding confidence, born of long experience, in the resourcefulness of the American inventor. In this case, however, he has set before him for quick solution by far the most serious task that has ever confronted the engineering profession. The public looks blindly for help in some

mysterious way from electrical devices of one kind or another. Electricity is still a name with which to conjure, so that the man in the street will swallow, hook, bait and sinker, almost anything that is thrown out to him in the way of an electrical promise.

Now, it is only fair to American engineers to state that a number of devices tending to the suppression of submarines have been suggested, investigated and tried. Some of them are regarded as very promising, well worth prompt experimentation on a considerable scale. Others give little hope of success, and while not fit for utter abandonment, cannot be considered as likely to relieve the situation. This much is certain, that whoever shall possess a thoroughly effective method of fighting submarines will be the last man in the United States to talk about it, for obvious patriotic reasons. People who bleat in the newspapers about what is going to happen when certain devices are adopted are simply playing into the hands of the enemy, the essence of success in all things being that absolute secrecy which leaves the foe without even a hint of impending fate or any knowledge of why submarines do not return save such as may be vouchsafed to him at the end of the war. Those who feel themselves near to the solution of the tremendous problem before us have it as their first duty to keep quiet and to keep their friends quiet lest knowledge of the danger suggest the cure. And, further, any one in an official position who babbles concerning such a matter should find his way to a federal prison by the shortest possible route. The less said the more will be accomplished, and nothing but evil can come of publicity regarding either methods or results. The public has a right to know in general whether things are being successfully done. It has no right to inquire into particulars information regarding which may save some submarine pirate from its doom.

Thompson Memorial Library

A PERMANENT memorial to the late Prof. S. P. Thompson is to be maintained, open to the public, in London by the purchase of his library and by adding it as an annex to the Institution's library on the Thames Embankment. Professor Thompson was a lover and collector of books. His electrical library is a rare and valuable collection. A committee of fifteen prominent scientists and engineers in England has been appointed to carry out the plan of raising a fund of $20,000 for the purchase of the Thompson library and of presenting it to the Institution.

Invitations for subscriptions have already been issued to the members of the Institution of Electrical Engineers in Great Britain. The committee felt, however, that since Dr. Thompson had many students, friends and admirers in America, it would only be courteous to open the subscription lists to electrical workers in America. The American Institute of Electrical Engineers has therefore issued a notice to its membership, inviting subscriptions to the Thompson memorial fund. We commend the movement as worthy of the support of American electrical engineers and bespeak for it a liberal financial response in this country.

The Modern Factory-Lighting Field

PROF. C. E. CLEWELL presents in this issue the first of a series of articles on the broad and important field of industrial lighting. At a time like the present, when the national crisis makes it necessary to rush the manufacture of supplies, many factories will find themselves in a condition of stress from the pressure which will most certainly be exerted to assure the completion of orders within specified dates.

Two channels are open for meeting this emergency. One of these, and probably that most commonly to be adopted, will be extending the hours of work to include the entire twenty-four-hour period of each day. The other will result in additional buildings for taking care of the abnormal demand for quick production. In both cases artificial lighting will play no inconsiderable part in the rate at which the work can be accomplished from day to day.

It is unusually timely, therefore, to present such a factory-lighting series, which can thus prove helpful not only in those cases where new lighting is to be installed or where improvements are under way in line with more or less normal conditions, but also to a great extent in rendering assistance at a time of acute national difficulties with the abnormal conditions they impose on many of the American industries.

One of the most surprising things to observe in this comprehensive treatment of the field of lighting is the very remarkable development which has taken place in the way such problems are looked upon both by factory owners and managers and by those more especially concerned with the engineering details of such work. It is little short of phenomenal to consider that prior to 1906 and 1907 the thought of using a metal-filament lamp for the general illumination of factory spaces was not only an unthought-of proposition but likewise one impossible of attainment. To-day the tungsten lamp is to be found on every hand for industrial lighting, and its peculiar flexibility of size in comparison with other types makes it an ideal unit for such work.

However, there are on the market to-day other important types of lamps which also have peculiar advantages for various factory purposes. For example, the mercury-vapor and quartz lamps have been adopted for wide and most successful applications in some of the largest installations on record. Improved types of arc lamps and special units such as the floodlighting lamps and the Moore tube color-matching lamp have their own particular uses. The aim of this series of articles is to explain the advantages of good lighting as a vital and tangible part of the propaganda of efficient management, and to outline the types of lamps now available, with an impartial and forceful discussion of where and how each may be used in representative classes of industrial service.

While new types of lamps have increased greatly the

possibilities of improved factory lighting, the owner or manager of an industry must first appreciate the economy, and we may add the necessity, of possessing lighting facilities of a high order before he is likely to realize their possibilities as an aid to his plant. Hence it is entirely logical to treat of these advantages in the preliminary article of such a series and later on to show how legislation must be depended upon to bring up the standards of lighting in those cases where managements lag behind the generally progressive tendencies of the times.

Taken as a whole, Professor Clewell will give in this series a most comprehensive and helpful treatment that will be of very material help to industries now preparing to improve lighting conditions for the fall and winter months. The series will also serve lamp manufacturers and central stations in furthering the use of more and better light.

Efficiency by Combination

WE HAVE preached many a sermon on the benefits to be derived from the skillful physical combination of generating plants, especially in the case of hydroelectric transmissions. One can hardly find a more useful text for a further homily than in the paper by J. A. Walls in our current issue. The time has come when extraordinary pains should be taken to make the most of hydroelectric resources and to save coal in every possible way. The transportation problems alone that are now before the country, to say nothing of the probable shortage of labor, are sufficient causes for investigating every possibility of fuel economy. At present the railroads are in a hopeless muddle for reasons too complicated to discuss here, even were such discussion within our province; but the obvious fact is that the more promptly steps can be taken to lessen the call for coal and the burden of coal transportation the better it will be for the country.

The application of this principle to electrical affairs needs little comment. The more power generated in big and economical stations and distributed as energy the less draft upon our coal supply and our means of carrying it. The special example considered by Mr. Walls is of a somewhat unusual character, inasmuch as the two cities concerned in the physical combination of utilities are at two ends of a fairly long transmission line with the power station between them, Lancaster, Pa., and Baltimore, Md., being the termini considered. The lighting and traction companies in both cities are parties to the arrangement for their mutual advantage. The chief load is carried by the water-power development on the Susquehanna River. By tying the plants together advantage could be taken of the diversity factor so as to lessen the total call for fuel and to enable the less efficient steam generating units of both plants to be shut down. By this conjoint scheme of working, the load factor of the hydraulic source of supply is kept above 90 per cent and a considerable improvement is made in the efficiency of the steam plants. The hydroelectric system gains in efficiency and the steam generation is accomplished with less waste of fuel and, what is equally important, less transportation of fuel.

The maximum gains were obtained only at the cost of considerable study of the exact load situation and adroit work in load dispatching so as to secure the highest efficiency. It is a fine example of the advantages of combined operation even of somewhat distant plants. It is easy to see how by extending the use of similar methods still greater gains could be made. Suppose, for example, that another plant taking power from the great Susquehanna station were well up in the coal fields, with possibility of relatively very cheap fuel, so cheap perhaps that under ordinary circumstances hydroelectric power would have but a small advantage; yet by a union of forces all would gain, the hydroelectric power would receive a still steadier load and hence would be operated at better average efficiency, and at times when steam had to be used power could be derived from cheap fuel in a highly efficient generating station, and wires instead of freight trains would accomplish the transference of the necessary energy. The long and short of the matter is that carrying energy in the form of fuel, which has at best a very low efficiency of utilization, is not an economical process and is particularly undesirable when, as now, the transportation facilities of the country are overstrained with the burdens of the hour. Now, if ever, is the time to make the most of the saving in fuel and men to be accomplished by electrical transmission.

The Coming Issues

SINCE there is every likelihood of the price of coal attaining higher levels, there is a possibility that oil engines will fill a greater niche than they ever have before in plants having poor load factors. To reduce operating expenses not only must more work be accomplished with less labor, but banking of boilers and other stand-by expenses must be eliminated or reduced. One article which will be presented in next week's issue will contain a discussion of the characteristics of and field for different types of oil engines. Another article in this issue will describe a method adopted by one large operating company for continuously indicating the condition of insulation on generators while they are operating. This subject should receive particular attention at this time, as the insulation must be watched carefully to prevent breakdown under the heavy overloads which will probably have to be carried because of increased industrial activity. The second installment of Professor Clewell's series on factory illumination will also be presented. It will deal with representative modern lamps, their fields of usefulness, and four types of industrial lighting. In the third issue of the month will be presented a discussion on the mutual inductance of parallel-axis reactors. This article will contain curves with which this factor can be readily determined without calculation. Another article will take up a method of determining the most economical distribution of transformers for a secondary system.

What Adequate Lighting Means to Industries

BY C. E. CLEWELL

Assistant Professor of Electrical Engineering, University of Pennsylvania

This article emphasizes the need for artificial light in summer as well as in winter months based on tests under actual service conditions, and points out some of the direct and indirect advantages of adequate light to the factory from the standpoint of increased production for the same labor and overhead cost, or of the same production with reduced labor and overhead. Other distinct advantages which are discussed include the effect of good light on accuracy in workmanship; the benefits which accompany reduced eyestrain as one of the elements in the physical fatigue problem; the beneficial reaction of cheerful surroundings, which is an important influence on operatives and which tends to increased order, neatness and sanitation and to greater care in the handling and operation of machinery and apparatus generally, also to more effective superintendence and management.

EFFICIENT factory management, it was pointed out recently in an editorial in a mechanical journal, requires that careful attention shall be given, first, to scientific time study, and second, to the gathering of data on the influence of such factors as shop lighting, heating, sanitation, ventilation, rest periods and surroundings upon production and upon the welfare of employees. This is an interesting proposition, because it divides successful factory management into two parts, one of which relates directly to production, while the other is concerned with more or less indirect influences on the employee, which in turn have a considerable effect on production.

Lighting as a Factor in Management

As one of these influences on successful factory management, lighting may be regarded first as a fundamental requirement for clear vision, and second, as a factor which contributes to the working efficiency as well as the comfort and contentment of every workman. As no chain is stronger than its weakest link, so with industrial workers—the eye, which is one of the most valuable of the senses, often fails with advancing age before the general physical strength gives out. Hence good light may properly be classed along with other helps in the conservation of the laboring classes, since it may be properly looked upon as an aid and a protection to eyesight, helping the workman to retain his standard of usefulness throughout the normal period of working years and to guard against failing vision.

Either consciously or unconsciously it is usually customary to associate activity with light, for without light, in one form or another, activity in a factory must cease. An adequate system of illumination is thus demanded from the standpoint of welfare as well as that of economy. The element of economy may be easily observed in any factory where no adequate provision is made for light, because of the noticeable lag in starting up the factory on dark mornings and in the slowing up of the work with approaching darkness toward the close of the day.

In marked contrast, the well-lighted factory, both directly and indirectly, promotes an increased output of better quality, tends to a better disposition among employees, reduces the liability to accidents and mistakes. All of these benefits are usually available with an expenditure equivalent to 1 or 2 per cent of the total production cost. The marked increase, recently, in attention to the subject of factory lighting has been due in no small measure to a realization, on the part of factory executives, of the influence of good light on workmanship.

The Engineering Point of View

Notwithstanding the importance of this higher appreciation of good lighting by factory managements, the engineering methods by which the proper results can be secured are, of course, equally important. The appearance of new electric lamps in sizes ranging from very small to very large units, and with remarkable increases in candlepower for given energy consumption, has done more than any other single item to advance the art of industrial lighting. For the proper application of these many new types, and because of the demand in the modern factory for lighting conditions which a few years ago would have been thought extravagant, engineering talent has become indispensable.



FIG. 1—SHOP ILLUMINATED TO PERMIT EFFECTIVE WORK THROUGHOUT ENTIRE DAY

In many of the older factories it has been necessary to educate the operators to the many advantages of good light. Trial installations or reference to other successful installations have been necessary in some cases to convince factory owners that good light brings returns and is not merely a source of expense. Since the interest of the average factory

owner can so often be secured through arguments which affect the output of his plant, there is, perhaps, no better way of obtaining his attention than to recount briefly some of the experiences in an actual plant. In line with this suggestion a particular case will be discussed where a portion of the factory buildings had been relighted according to modern ideas of good illumination, and where efforts were successfully made to convince the management that another expenditure was a step of economy.

BRIEF DESCRIPTION OF AN ACTUAL CASE*

During a period of one and a half years the company spent about $50,000 on lamps and wiring for installing a new and improved lighting system in its plant. In some places more arc lamps were installed, in others mercury-vapor lamps were employed, and in still another large portion of the plant tungsten lamps were adopted for the first time.

The work, however, was only partially completed, and the persons who were directly connected with the lighting work desired to see the improved illumination extended throughout the entire plant so that all dark spaces would be eliminated. To do so it was necessary to convince the management that the economies already effected warranted the additional expenditure.

NATURE OF THE ADVANTAGES TO THE PLANT

Since too many other conditions were changing throughout the plant at the time useful figures could not be obtained from the auditor's office. Consequently persons in the factory were asked to observe the conditions with the new lighting and compare them with those formerly existing. Among the results† of this canvass the following may be mentioned: One manager stated that under the older dark conditions in two sections good men would not stay and the departments had to be run with inferior or with new men. With the new lighting good men were glad to stay at the work. In an entirely different part of the factory, where the work was of another kind, a superintendent noted the same general condition. In still another section an individual workman testified that under the old conditions he was greatly hindered in getting about, because he could not see where he was stepping (the section had practically no daylight facilities) and the presence of rough pieces of scrap iron on the floor hindered his movements in finding material and in getting around in the operation of his machine. Personal observation in this section, after the new lighting was installed, showed that the floor was kept cleaner and bits of iron were not allowed to accumulate on the floor. In other words, a greater interest was being taken to keep the place in a neat and sanitary condition because of the better lighting conditions.

The foreman in another section, where unusually fine work was performed, stated that on one occasion the men on the night shift had not been able to do any work for the last two or three hours of the night because the old arc lamps had been out of order. This was a case of a direct loss at a time when production was sufficiently urgent to make night work necessary.

One of the foremen in another section of the factory stated that with the old inadequate light it was not unusual on dark mornings for the men to lose considerable time. For example, from 7 to 9 o'clock in the morning they would not do more than an hour's work, and the same condition prevailed during the last two hours of the day. According to this statement, there was a loss of two hours per day, or one-fifth of the time, due to bad lighting on dark days.

An individual workman in another section made the statement that under the old lighting it was necessary when he wanted to read a scale to place his thumb at the point on the scale and then to walk 20 ft. or 25 ft. (6.1 m. to 7.6 m.) to the nearest lamp, to read it. While this is an extreme case, it shows how several minutes can be consumed in an operation which should require only a few seconds.



FIGS. 2 AND 3—MEZZANINE FLOOR CONVERTED INTO AN EFFECTIVE WORKING SPACE; SHOP MADE BRIGHT BY USING MODERN MEDIUM-SIZED LAMPS IN PLACE OF FLAME-CARBON ARC LAMPS

COMPARISON OF LIGHTING COSTS AND WAGES

To reduce the findings for this particular plant to a more tangible basis, it is interesting to outline the total costs of lighting for a given floor area in terms of the wages for the same floor space. To do this, consider a factory bay like that shown in Fig. 4. Here ten 60-watt tungsten lamps are mounted at the ceiling of a comparatively low factory section. The total floor area of this unit bay is 640 sq. ft. (59.5 sq. m.), a space which will easily accommodate five or even more workmen. The fact that a single bay of this kind will accommodate

*Based on a memorandum made at the time by the chairman of the engineering committee in charge of relighting the plant.

†The cases refer to actual statements made by factory managers, superintendents, foremen and individual workmen.

say ten or even fifteen workmen does not warrant the assumption of these higher numbers, since throughout a large factory the distribution of materials and machines will probably reduce the average workmen per bay to the lower number. By taking five men for this unit area a more conservative rating of the wages per unit of floor space is thus assumed.

Under the further assumption that these five men

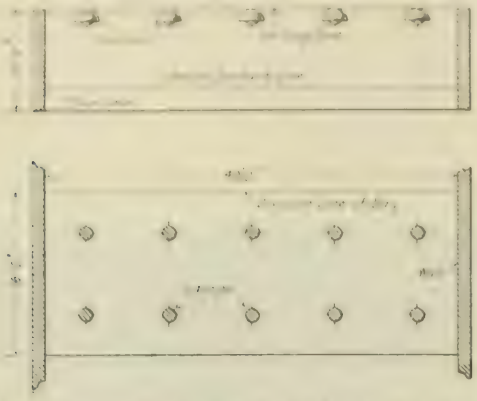


FIG. 4—ARRANGEMENT OF LAMPS FOR WHICH COSTS ARE SHOWN GRAPHICALLY IN FIG. 5

normally work eight hours per day, at the rate of $4 per day, the total wages per day per bay amount to $20. With overhead charges of 100 per cent for superintendence, etc., the total labor charge per day for the bay is $40, which is equivalent to $5 per hour, or to about 8 cents per minute.

From the lighting standpoint, it may be assumed that the ten lamps burn 2000 hours per annum, resulting in an energy consumption of 1200 kw.-hr. per annum. The maintenance charge, including renewals and lamp and reflector cleaning, may be taken at about 1 cent per kilowatt-hour, and the energy charge at say 2.5 cents per kilowatt-hour. Hence, the combined energy and maintenance charge per bay amounts to $42 per annum. Adding to this an interest charge of 6 per cent on the first cost of the installation (assumed as $50), the annual interest amounts to $3; and a de-

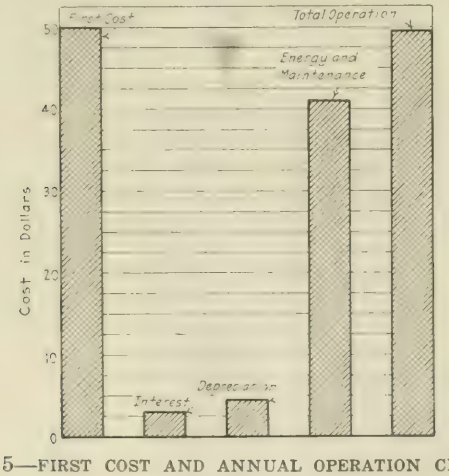


FIG. 5—FIRST COST AND ANNUAL OPERATION CHARGES FOR LAMPS

preciation charge of 12 per cent on the "non-renewable" value of the installation (taken as $37.50) amounts to $4.50, giving as a total for the operating cost of the lighting per bay per day a value of about 17 cents. These values are shown in a graphic form in Fig. 5.

From these relations the interesting deduction may be made that if the good lighting conditions make it possible for each workman to save as much as about two minutes per day of eight hours, the wages corresponding to this time will pay for the entire cost of lighting for the day. To appreciate what this means to the industries, it is only necessary to review the testimony of managers, superintendents, foremen and workmen as contained in the above account of the experiences in an actual plant, where losses of as much as several hours occurred under an old and inferior system. To find from a canvass of a plant, poorly furnished with light, that losses of an order of magnitude of thirty, sixty or even 120 minutes are occurring per day, when a total expenditure equivalent to the wages for two or three minutes per day will eliminate most if not all of these losses, can well form the basis for the most telling arguments in favor of necessary improvements.

Summer and Winter Requirements Contrasted

During the summer months, with the long days, there is a natural tendency to look upon illumination rather as a winter requirement and as a portion of the factory equipment attention to which, if improvements are needed, can be postponed until the shorter days of

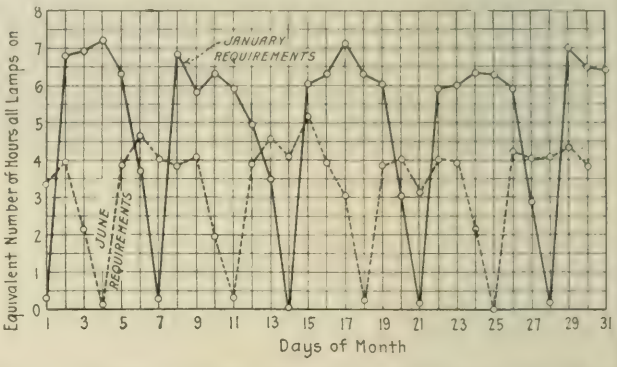


FIG. 6—NUMBER OF HOURS PER DAY DURING WHICH ALL LAMPS IN FACTORY SECTION WERE IN USE IN JANUARY AND JUNE

the fall and winter months. It is quite possible, therefore, that the persons responsible for making the investment may often put off the expenditure for illumination equipment to avoid the expense until the need is felt.

The writer has felt for a long time that there is considerable fallacy in the conclusion that artificial lighting is distinctly a winter requirement in the industries, and therefore suggested that tests be conducted over a sufficiently long time interval in a location where natural lighting facilities were good to secure some tangible information on this subject. Fig. 6 shows graphically the results of the test in a building one section of which is shown in Fig. 1. This factory has a number of floors, each of which is about 400 ft. (121.9 m.) long and 70 ft. (21.3 m.) wide, with a ceiling height of nearly 14 ft. (4.3 m.). Spacious windows extend along the two sides of the building and afford fairly abundant natural light to both side bays, and also normally, but in a lesser degree, to the central bays.

Occasionally some night work was conducted in certain parts of the various floors as special circumstances demanded, but the lighting requirements for this may be assumed to be fairly spread out because of the

length of time over which the observations were made. By noting the total watt-hours consumed in a given section and dividing this value each day by the total watts represented by all of the lamps installed in the section, a value results which may be taken as the equivalent number of hours during which all the lamps were in service. During January (taking only five full working days, that is, by eliminating Saturdays as half days, and also Sundays) the average is seen to be close to six and one-half hours per day, while in June it is close to four hours per day. These curves illustrate in a rather striking manner that the summer requirements may be as much as two-thirds of the winter requirements. Thus, in a case like this, good light is almost as important during the month of June as during January, even with the latter's shorter days.

The summer requirements were governed partly by fog and cloudy conditions during early mornings and late afternoons, also by generally cloudy conditions throughout the days, and by overtime work. Owing to the variables which enter, it is not presumed that these curves are generally applicable. They do show, however, the conditions in one factory where the need for artificial light was so poorly appreciated at the time the building was constructed that practically no artificial lighting was provided until long after the building had been occupied and used for manufacturing purposes.

Even with a considerable use of artificial lighting during the summer months, the summer requirements are less than those of the winter months. Hence persons in charge of the lighting division of a plant should consider the wisdom of conducting preparations during the longer days of the summer, when improvements are contemplated in an inadequately lighted factory. This is, of course, all the more desirable in factories where a wiring force is a part of the maintenance division of the plant. In view of the fact that the work of the wiremen and maintenance men will usually be heavier during the winter when the requirements for repairs and general upkeep of the lighting equipment is greatest, there is even more reason to undertake new work during the summer and early fall. It should also be noted that during the summer months, because of the reduced number of hours when the lamps are turned on, a change from an old to a new lighting system may be effected with the least disturbance to the regular employees through probable irregularities in the illumination service while wiremen are at work.

The foregoing notes have attempted to answer the general question of what adequate lighting means to the industries. From many standpoints it would be more desirable to be able to say definitely that good light will yield a return of so and so many per cent on the initial investment. Many efforts have been made to answer the question in this way; in some cases plans are contemplated for making the necessary investigations under actual factory conditions, so as to attempt to secure just such an answer. At the present time, because of the limitations of the available data and the absence of more complete information, the method adopted in this article for the treatment of this subject seems the only feasible plan, and it has the compensating feature that, when properly applied, arguments of the kind discussed may be used to considerable advantage, even with their tendency toward somewhat general rather than specific data.

PROTECTIVE EQUIPMENT

Arrangement of Spirally Wound Conductors Which Serve as Varying-Capacity Condensers to Absorb Transient Impulse Energy

It is now practically established that a lightning arrester should absorb the energy received rather than reflect line transients to be most effective. In an ingenious arrangement (patent No. 1,217,453), assigned by Ray P. Jackson of Edgewood, Pa., to the Westinghouse Electric & Manufacturing Company, a form of choke coil is proposed that has practical unity power factor for ordinary commercial frequencies, but which provides resistance, inductance and condensance for high-frequency transients. A relatively wide copper strap wound in the form of a spiral constitutes the current-carrying portion of the protective device. Between adjacent layers or convolutions of this winding are inserted layers of insulating material having high specific inductive capacity. The insulation may be made from paper or cloth impregnated with a suitable insulating compound or varnish, such as bakelite. Layers of a material such as asbestos cloth having a relatively low specific electrical conductivity with respect to that of the paper or cloth layers are similarly placed between the adjacent convolutions.

When high-frequency disturbances of short wave length are impressed upon the device, small segments of the conductor layers act as condenser plates, the effect being about the same as if condensers were connected in series around the coil. As the frequency of the disturbances decreases, larger segments of the coil act as condenser plates. As a consequence the capacity of the protecting device is automatically varied in accordance with the frequencies of the impressed impulses. The charging current supplied to these condensers must pass through the high-resistance layers, which absorb the energy of the charges and dissipate it as heat.

VIBRATING-TYPE RECTIFIER

Consists in the Employment of Contact Members Having Relatively Large Contact Surfaces

Thomas A. Edison of Llewellyn Park, West Orange, N. J., discloses in patent No. 1,221,981 a new principle for use in conjunction with mechanical alternating-current rectifiers. The usefulness of rectifiers of the mechanical type, as hitherto constructed, has been materially limited by the small current-carrying capacity of the apparatus and by their inability to operate successfully on any but low-voltage circuits, because of sparking and sticking of the contacts.

In brief, the rectifier consists of a number of vibrating armatures which carry contacts that are connected in series or series parallel. The series connection affords a plurality of breaks in series in a single unit, whereby sparking is reduced and the apparatus is rendered capable of rectifying currents of relatively high voltage. The series-parallel connection combines the advantages of the series and parallel connections.

The contact members have relatively large contact surfaces, one or both of each pair of co-operating contact members being preferably of carbon. By the use of contacts of this character the current-carrying capacity of each rectifying unit is increased, sticking of contacts is prevented, and sparking is reduced.

Power for Manufacturing in War Time

How Additional Power Has Been Made Available for Industrial Purposes by Several Utility Companies Interconnecting Their Systems, Thus Permitting Maximum and Most Economical Use of Combined Equipment

BY J. A. WALLS

Vice President and Chief Engineer Pennsylvania Water & Power Company

BECAUSE of the great demand for power for manufacturing purposes caused by the war, it has been hard to procure generating equipment and coal for power generation; consequently manufacturers, large and small, have been turning to the central stations to carry their loads. In other words, the manufacturer has thrown the burden of securing electrical generating equipment and coal for generation upon the central station, where it properly belongs, freeing his energies for application to his own manufacturing affairs.

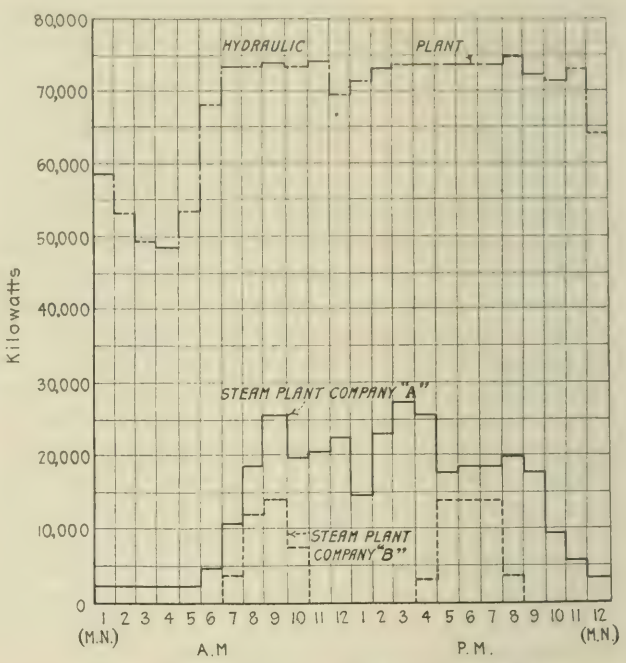
Central stations are thus confronted with the difficulty of getting deliveries of generating equipment, and also face higher prices for labor, material and coal. As central stations can use larger units than the individual plants they serve, there is a benefit to the country in the present war situation, because electrical apparatus manufacturers are relieved from building the host of small generating units otherwise needed for the individual manufacturing plants. Furthermore, the wholesale generation of power by central stations permits a saving—of present great importance to the nation—in the items of labor, material and coal, as against what is required for isolated-plant operation.

The more efficient use of the available supply of coal, labor and manufacturing capacity permitted by concentrating power generation in large efficient central stations makes it appear that still further benefits might be gained by combined operation of existing generating plants now under the control of separate corporations. Such operation would apply to plants situated in the same or adjacent cities, or where they would be able to exchange power over a connecting transmission system. The growing tendency in peace times for street railway systems to purchase power for their operation from central stations is one which might well be carried out more extensively under the present war conditions.

An example of the benefits derived from such operation is afforded by the public service companies of Baltimore, Md., and Lancaster, Pa., the street railways, lighting and power systems of the two cities having been tied together through the transmission system of a hydroelectric plant. With this arrangement it has been possible to work out a method of operating the available generating equipment of four public utilities so as to obtain a higher combined efficiency. Since the time of peak load of one utility does not coincide with the time of peak load of the others, the rating of generating equipment which will suffice to carry the combined load is less than if each of the utilities were to carry its own load with its own generating equipment.

Instead of one public utility using for its own load whatever efficient or inefficient equipment it happens to have available, it is possible, owing to the tying together of the generating plants, to shut down the most inefficient units of each plant and to run the large-capacity, high-efficiency units for the major portion of each day. The units with lower efficiency may be called into service principally during peak periods or during low-water conditions, and the most inefficient units of all may be kept idle or brought into service only during extreme conditions of seasonal peak, extreme low water or breakdown of other generating equipment.

Despite the unusually heavy load suddenly thrown upon these public service utilities, there is left available for off-peak generation a certain amount of relatively low-efficiency apparatus which can be called upon for generation in case of special demands by the government for power to manufacture war munitions. This equipment will be used regardless of the higher cost entailed by operating the less efficient power-generating equipment.



LOAD DISTRIBUTION ON COMBINED SYSTEM

The load carried by the hydraulic plant is well above 90 per cent load factor. The largest part of the steam generation is carried by the most efficient equipment operated by company A. Instead of using the remaining less efficient equipment to carry the two dotted peak loads, they are carried by the most efficient turbines of public utility B.

By carrying the bulk of the load with water power the public utilities of Baltimore and Lancaster were relieved to that extent of their coal difficulties, and by tying the plants into one system it was possible to take advantage of the diversity factor. Another advantage secured by the arrangement is that it is possible to put the bulk of the steam generation upon the most efficient steam-generating apparatus, and the old and inefficient equipment is called upon for less generation than would have been the case if the systems were not being operated for maximum combined efficiency. This makes for further saving in coal requirements for these localities.

In addition, breakdowns in any one utility are less apt to cause disastrous results in view of the possibility of obtaining assistance from unused equipment in the other utilities. In other words, relatively more reserve capacity is available than when the individual plants are operated separately.

The problem of obtaining the maximum combined operating efficiency is not a simple one. There were involved the difficulties of load dispatching, the necessity of considerable engineering investigation and the need of tests to ascertain costs for different operating conditions in the various steam plants.

The complete working out of this problem to obtain maximum efficiency is almost impossible in the face of rigid power contracts. However, the companies involved in this particular transmission system thoroughly appreciated the benefits to be derived from co-operation along the lines mentioned and allowed the power contracts to be so interpreted or modified as to make it possible to secure many advantages which otherwise would have been lost to all concerned in the general industrial situation in Baltimore and Lancaster. In view of the great demands made upon electrical manufacturers and transportation systems, it seems that this subject deserves attention in other cities favorably situated.

SELLING SECURITIES TO EMPLOYEES AND CUSTOMERS

The Opinions and Experiences of a Central Station Manager Who Succeeded in Raising Capital from His Community of 16,000 Inhabitants

Now that the United States is one of the belligerents it may be increasingly difficult, particularly for the smaller companies, to float bond issues. While there is apparently sufficient money in the country, there is still a feeling that money should not be tied up for too long a time, that it should be in as liquid a state as can reasonably be expected. In this connection, therefore, the experiences of a company in a small town in Ohio in distributing its securities among consumers and employees are not only interesting but may prove of value to other companies in the near future.

As explained by T. O. Kennedy, vice-president and general manager of the Massillon Electric & Gas Company, in a paper read before the commercial committee of the Ohio Electric Light Association recently, the necessity of raising money was forced upon the property in Massillon, a city of 16,000 inhabitants, in August, 1914, and some way had to be found for accomplishing it.

The company was confronted first with the problem of what form of security to offer, with regard both as to what forms were available and as to which would best appeal to its consumers, and became convinced that, in its own situation and under the particular conditions then obtaining, a purely local security could be sold more easily than an issue of the holding company and that it would be more advantageous for many reasons to offer a security of its own.

There was available at that time an issue of first mortgage 5 per cent gold bonds, but in August, 1914, investors were extremely averse to tying up their money for any great length of time. Consequently it was decided to issue collateral trust notes with these bonds as security. The local nature of the issue was emphasized by having a local bank act as trustee, and the notes were made for one year from date of issue. The interest rate was fixed at 7 per cent, owing to the tightness of money at that time and to the fact that competition for capital was strong in Massillon.

In connection with the marketing of the note issue Mr. Kennedy said:

"Before announcing our offering of notes we entered upon a publicity campaign by securing as many newspaper stories as possible describing our new power contracts, our proposed construction work, etc. In one interview stress was laid upon the fact that we intended to offer our securities first to our employees and consumers before accepting offers from underwriting brokers.

"When the notes were ready for sale we used a small amount of space in the daily newspapers and in a local trades labor weekly. These advertisements were patterned after the customary brokers' announcements and were not run long enough to give the idea that any difficulty was being experienced in selling the securities. We did not feel that this form of advertising did much good, and on a later issue we wrote our copy in a more popular form that we believe appealed more strongly to the people we were trying to reach.

"No letters were sent out except to 'prospects' who had been definitely located. In the later campaign, however, we sent a carefully written letter to each of our consumers inclosing a subscription blank. We secured very good results from these letters and feel that from the standpoint of public policy the letters were worth all they cost, even if no subscriptions had been received as a direct result.

"Our next step was the arrangement of a campaign of personal solicitation. Four members of the local organization were drilled in good selling talks and were offered a small commission for all sales made. One member of our board of directors, a local attorney, was also offered the same commission.

"The first selling efforts were made among our own employees, partly for practice, but mainly in order that every employee should fully understand the proposition so as to be able to answer the questions of other 'prospects.'

"All of the professional men in the city were solicited, and we not only made sales to several but secured good tips from ministers, doctors, dentists and lawyers. Insurance men were also a source of good information concerning people who had money to invest.

"A special effort was made to secure the funds of lodges and fraternal organizations. This short-time security appealed to these 'prospects,' and we had very good success. In some instances we dealt only with the finance committees, but in others it was necessary to submit the proposition to the entire organization at a regular meeting. We feel that this was also worth a great deal to us from a public policy standpoint.

"As the notes were also being offered by brokers in nearby cities, we co-operated with them fully, especially when a broker had regular clients residing in our community.

"For the purpose of locating laboring men with incomes sufficient to enable them to invest, we secured the payrolls of large manufacturers in our town."

Helping the Financial Mobilization

Electrical Companies, Pressed by Unprecedented Demands for Energy Under Conditions Which Make High Standards in Service Costly, Must Maintain Facilities

IN HIS statement to the ELECTRICAL WORLD, published in last week's issue, F. A. Vanderlip, president of the National City Bank of New York, said:

"With industrial activity incident to the expenditure of large sums by the government, factories will be unusually busy and laborers will all be busy and working at high wages. This should mean a large sale of energy for electric light and power."

Then, in adding a caution against any expenditure that is unnecessary or that can just as well be postponed, Mr. Vanderlip said:

"We are giving the government $7,000,000 of purchasing power; our business is war; we cannot continue to have the same purchasing power ourselves while the government is exercising this purchasing power."

For the industry at large this means that in the opinion of the foremost financial authority in the country the companies may expect:

(1) A continuation of growth in business to the extent that their facilities of plant and fuel supply will permit.

(2) Subordination of their financial needs to the financial program of the government.

GROSS EARNINGS CONTINUE LARGE

The ELECTRICAL WORLD'S regular monthly compilation of central station earnings and output, published elsewhere in this issue, shows that business is continuing to maintain large gains over the corresponding period of the previous year. As compared with the previous year the March returns indicate gains of 15 per cent in gross revenue and 25 per cent in the output of energy. Neither the statistics, therefore, nor the prospects clearly in sight indicate anything but that business will be maintained at top notch.

The problem before the central stations is to keep organization and equipment at the highest point of efficiency, to insure the utmost conservation in the production, distribution and use of energy. Certainly all of the efforts of companies will be directed toward economical production and distribution. In the effort to secure economy in the use of energy, however, public co-operation, perhaps even legislative or military action by the authorities, will be necessary. If for military reasons it is advisable that power be withheld from one or more classes of users to be applied to other industries it will be the plain duty of the constituted authorities and the companies to follow whatever course meets the national need. Technically such action might involve discrimination under regulatory laws; actually the companies would be lacking in the first characteristic of patriotism if their resources were not subject to the national call before any other. If the co-operation of the authorities is desirable to keep every step of this character within the strict bounds of legality the commissions generally will, it is believed, act without delay.

In plans for careful conservation in the use of energy there is no expectation that volume of gross output will be on anything but an ascending scale.

The other point raised by Mr. Vanderlip in his statement is that in effect the companies cannot finance while the government is making so heavy a call upon the investment resources of the country. This is fully realized by company executives. It is fair to say that the companies have not been caught unfinanced, widely extended in commitments to capital expenditures or with large outstanding short-time bank loans. Pretty generally they have financed their requirements to or including the year 1917. The great demand for securities in 1916 enabled them to provide for their capital needs.

What they face now, however, is a demand for more and more energy for absolutely imperative industries at a critical juncture when it is conceded that corporate financing must and should wait until the national treasury says that it has enough. They willingly wait not only until the avenues of finance are open again, but they also withhold their needs in materials and supplies until the government's prior needs are met.

Such a policy, although accepted patriotically, requires the most careful planning for the future. By the economics of the industry companies are prevented from continuing to expand at the rate of the last two years without an expansion in physical plant corresponding roughly to the increased volume of business. It takes $50,000 to $100,000 of investment to make $10,000 of gross earnings. Add 15 per cent to gross earnings of the figure stated and it takes, say, roughly, $7,500 to $15,000 of investment to provide for it. Even if the company, by superior operating efficiency or by overloading plant, is able for a time to take care of larger volume of business without larger investment, the moment of capital expenditure is only deferred; it must be made sooner or later.

Until the time when financing is again possible on the largest scale, it is to be expected that operating resources and ingenuity will be strained to the utmost. "Daylight saving" may be adopted to promote conservation. Another step which is suggested is that factories be encouraged to dismiss operatives at irregular hours so as to lessen the peak-load power requirement of electric railways.

Two of the matters which are receiving urgent consideration at present as part of the entire large question involved are coal cost and supply and other costs. Both of these operate heavily against economical operation at this time and no certain relief is in sight.

In the final analysis it is evident that the companies cannot permanently both increase business and refrain from capital expansion. Since larger volume of business is clearly inevitable the alternative which will be adopted is that of scrutinizing every capital expenditure so that each dollar shall be put where it will do the most good.

Mr. Vanderlip also made the general statement that "the 'cost of living' to corporations will go up as it

does for individuals, but public service corporations cannot raise their rates as their costs advance." Without any effort to interpret the views of Mr. Vanderlip, it will be recognized that while increases in rates by electrical utilities have not been commensurate with the abnormal increase in cost, some advances in power rates have been made which tend to offset in certain properties the heavier cost of coal, etc. Such advances have been made after the extent of the burden caused by higher operating costs has been demonstrated clearly.

PRICES OF SECURITIES

Prices of securities of electrical companies do not give a definite clew to the future to the seeker for information of prophecy value. Comparatively few of the securities of electric central station companies are listed on the stock exchanges. Those which are so listed, of course, suffered with other securities in the widespread decline which followed the announcement of war but has now apparently been arrested by the growth of a better sentiment and a better understanding of the tremendous effect of the government's great buying program.

Many conflicting influences in the markets, such as the overwhelming preponderance of speculation in war and metal specialties, the shadow which hangs over the steam railroad situation and the heavy financial requirements of the government, make it especially difficult to appraise the position of good public utility securities.

Such securities should be and in ordinary times are less subject to violent fluctuation than the majority of active stocks. The business on which they are based is more stable, and its growth at a fair rate from year to year without interruption is to be expected under all but extremely abnormal conditions. So many of the operating electric central station properties, however, are connected with gas or other utilities or are controlled by holding companies that it is difficult to compile accurate comparative statistics.

COMPARISON OF CENTRAL STATION AND OTHER STOCKS

	1917 High	1917 Low	1916 High	1916 Low
Wholly or Partly Electrical Properties				
Columbia Gas & Electric Co., Cincinnati	*47⅞	34⅛	53⅞	30¼
Commonwealth Edison Co., Chicago.	142⅞	‡120¼	147	139½
Consolidated Gas Co., New York...	134⅝	104⅝	144¾	129¾
Consol. Gas, E. L. & P. Co., Baltimore	127	109½	130½	107
Edison Electric Ill. Co., Boston.....	226	183	250	225
Montana Power Co. com.....	109¼	93½	114⅞	68¼
Montana Power Co. pfd.....	117½	114	117¼	109
North American Co.....	72⅜	61	75⅞	65½
Pacific G. & E. Co., San Francisco...	†68¾	55¾	67	56
Philadelphia Electric Co. ($25 par).	34⅜	29½	34½	27
United Gas Imp. Co. ($50 par).....	91½	‡76¾	93½	86
Other Utilities				
American Tel. & Tel. Co.....	128½	116¼	134½	123⅛
Boston Elevated Railway.....	79	65½	88½	65½
Brooklyn Rapid Transit Co.....	82	54	88⅞	81
Brooklyn Union Gas Co.....	129	116½	133½	126
Chicago Railways, Series I.....	72	69	80	70
Chicago Railways, Series II.....	25	12	27½	13
Interborough Consolidated Corporation, New York, com.....	17⅛	8¼	21⅛	15½
Interborough Consolidated Corporation, New York, pfd.....	72¼	50¾	77½	69
Mackay Companies com.....	89¾	82¼	91	78
Mackay Companies pfd.....	67½	64	68¾	64⅞
Massachusetts Electric Cos. com....	5½	3	8¾	4½
Massachusetts Electric Cos. pfd.....	27½	20	44	26
Massachusetts Gas Companies com..	100½	87	100¾	79
People's Gas Lt. & Coke Co., Chicago	106¼	70⅞	118	100⅛
Third Avenue Railway, New York...	48¾	17½	68½	48
Western Union Telegraph Co.....	99¾	90¾	105½	87
Steam Railroads				
Atchison, Topeka & Santa Fe com...	107½	98½	108⅞	100¼
Baltimore & Ohio com.....	85	67⅞	96	81½
Chicago, Milwaukee & St. Paul com..	92	69⅞	102½	89
Chicago & Northwestern com.....	124¼	108¼	134⅞	123
Great Northern	118¼	103⅛	127½	115
Illinois Central	106⅜	100	109⅞	99¾
Louisville & Nashville.....	133¾	119	140	121⅛
New York Central.....	103⅝	86	114¼	100¼
Norfolk & Western.....	138⅝	116½	147⅛	114
Pennsylvania	57⅜	51⅜	60	55
Southern Pacific	98⅛	88¾	104⅛	94¼
Union Pacific	149⅞	128⅞	153⅜	129¾

*New York Stock Exchange quotation. †Chicago Stock Exchange quotation. ‡After new allotments of stock at par pro rata.

COMPARATIVE STATISTICS

It is thought best by the ELECTRICAL WORLD, however, to present such statistics as are available to compare the recent fluctuations in central station securities with those of other properties. The intent is to confine the list so far as possible to stocks having a free and active market on exchanges, and especially to omit any properties affected in large degree by war orders.

Even with this explanation it is necessary to modify the presentation by the statement that in many cases some development of a local or special nature has had an effect upon quotations. Steam railroad stocks are at a very low level compared with the levels of recent years. The Montana Power Company has been increasing its dividend return. The Commonwealth Edison Company of Chicago gave stockholders the right to subscribe to a new issue; and in addition the long-continued franchise and rate controversy between the city of Chicago and the People's Gas Light & Coke Company, leading to a reduction in the dividend rate of that company, has had a sympathetic effect upon securities of all Chicago utilities. The stock of the Edison Electric Illuminating Company of Boston has been affected by the financial exigency of the Boston Elevated Railway.

Subject to these qualifying considerations, the accompanying statement may be accepted as indicating that the listed stocks of electric central station companies have been substantially as stable, and generally on a higher level, when compared with recent years, than the securities of the other companies shown.

PRICES LOWERED TOO MUCH, SAYS INSULL

After the recent flurry in public utility stocks Samuel Insull, president Commonwealth Edison Company of Chicago, expressed the belief that the drop was unwarranted.

"Gross receipts," said he, "are unprecedented, and while expenses are extremely high, they are by no means of an extremity to have warranted the depreciation in the certificates of the general run of utilities companies.

"Such a decline would suggest a reduction of dividends, a suggestion which is without warrant so far as the companies with which I am associated are concerned. To instance the Commonwealth Edison Company, I am certain that the 8 per cent dividend is not imperiled.

"Relatively, the same assurance may be extended to the other properties under my charge. It is well to remember at present (when the public is more or less disquieted by the lowering quotations on the stock exchange) that, in addition to the seasonal lower cost of operation which necessarily exists because of the difference in the demand for fuel between summer and winter, other savings are possible."

"The bourse pendulum, as it relates to electric and gas utilities stocks, has swung too far in the adverse direction. I speak, of course, from the viewpoint of intrinsic property value and of earning power."

"Give Us a Chance to Make Good"

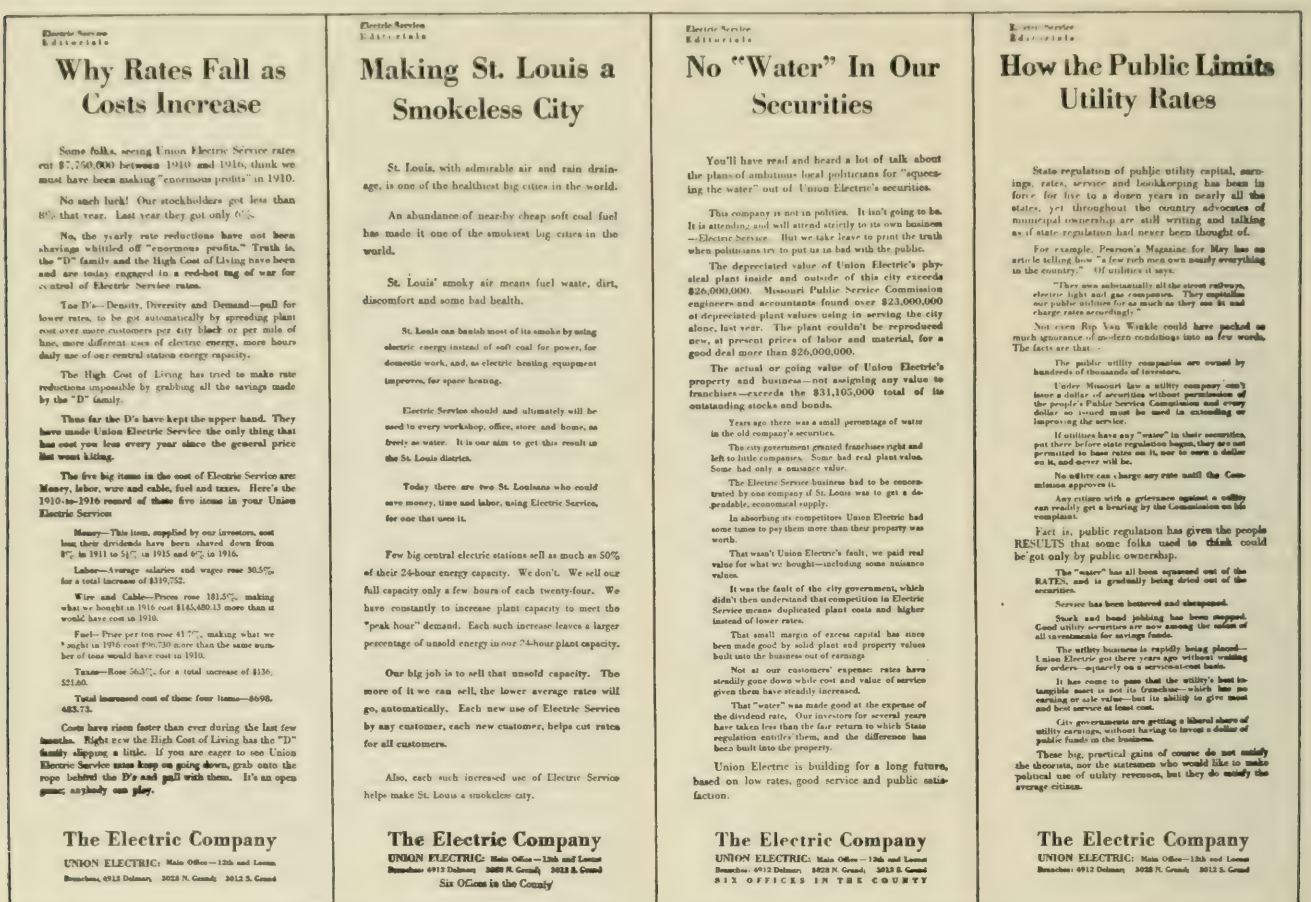
Union Electric Light & Power Company of St. Louis Conducts a Successful Newspaper Advertising Campaign Dealing with Service, Finances, Rates and Merchandising

THE Union Electric Light & Power Company of St. Louis has published in local newspapers a series of advertisements dealing with its service, financial position, rates and merchandising features.

As a culminating feature the most recent advertisements offered to its customers the new issue of preferred stock of the company. Without intervention of bankers or direct solicitation, but solely as a result of the advertising, the stock was disposed of in a week.

Several of the advertisements went into the detail of the history of the contract with the Mississippi River Power Company for power. "Perfectly Good Humor, No Hitting Back, Just the Facts," said the company. Succeeding advertisements presented facts showing that the contract was an industrial asset for St. Louis.

Repair facilities, lamp renewals, why rates went down as volume of business increased, equalization of residence rates and the large taxes were notable features.



Electric Service Editorials

Why Rates Fall as Costs Increase

Some folks, seeing Union Electric Service rates cut $7,750,000 between 1910 and 1916, think we must have been making "enormous profits" in 1910.

No such luck! Our stockholders got less than 8% that year. Last year they got only 6%.

No, the yearly rate reductions have not been shavings whittled off "enormous profits." Truth is, the "D" family and the High Cost of Living have been and are today engaged in a red-hot tug of war for control of Electric Service rates.

The D's—Density, Diversity and Demand—pull for lower rates, to be got automatically by spreading plant cost over more customers per city block or per mile of line, more different uses of electric energy, more hours daily use of our central station energy capacity.

The High Cost of Living has tried to make rate reductions impossible by grabbing all the savings made by the "D" family.

Thus far the D's have kept the upper hand. They have made Union Electric Service the only thing that has cost you less every year since the general price list went kiting.

The five big items in the cost of Electric Service are: Money, labor, wire and cable, fuel and taxes. Here's the 1910-to-1916 record of these five items in your Union Electric Service:

Money—This item, supplied by our investors, cost less; their dividends have been shaved down from 8% in 1911 to 5½% in 1915 and 6% in 1916.

Labor—Average salaries and wages rose 30.5%, for a total increase of $319,752.

Wire and Cable—Prices rose 181.5%, making what we bought in 1916 cost $145,480.13 more than it would have cost us in 1910.

Fuel—Price per ton rose 41.7%, making what we bought in 1916 cost $96,730 more than the same number of tons would have cost in 1910.

Taxes—Rose 56.3%, for a total increase of $136,521.60.

Total increased cost of these four items—$698,483.73.

Costs have risen faster than ever during the last few months. Right now the High Cost of Living has the "D" family slipping a little. If you are eager to see Union Electric Service rates keep on going down, grab onto the rope behind the D's and pull with them. It's an open game; anybody can play.

The Electric Company

UNION ELECTRIC: Main Office—12th and Locust
Branches: 4913 Delmar; 3023 N. Grand; 3012 S. Grand

Electric Service Editorials

Making St. Louis a Smokeless City

St. Louis, with admirable air and rain drainage, is one of the healthiest big cities in the world.

An abundance of near-by cheap soft coal fuel has made it one of the smokiest big cities in the world.

St. Louis' smoky air means fuel waste, dirt, discomfort and some bad health.

St. Louis can banish most of its smoke by using electric energy instead of soft coal for power, for domestic work, and, as electric heating equipment improves, for space heating.

Electric Service should and ultimately will be used in every workshop, office, store and home, as freely as water. It is our aim to get this result in the St. Louis districts.

Today there are two St. Louisans who could save money, time and labor, using Electric Service, for one that uses it.

Few big central electric stations sell as much as 50% of their 24-hour energy capacity. We don't. We sell our full capacity only a few hours of each twenty-four. We have constantly to increase plant capacity to meet the "peak hour" demand. Each such increase leaves a larger percentage of unsold energy in our 24-hour plant capacity.

Our big job is to sell that unsold capacity. The more of it we can sell, the lower average rates will go, automatically. Each new use of Electric Service by any customer, each new customer, helps cut rates for all customers.

Also, each such increased use of Electric Service helps make St. Louis a smokeless city.

The Electric Company

UNION ELECTRIC: Main Office—12th and Locust
Branches: 4913 Delmar; 3023 N. Grand; 3012 S. Grand
Six Offices in the County

Electric Service Editorials

No "Water" In Our Securities

You'll have read and heard a lot of talk about the plans of ambitious local politicians for "squeezing the water" out of Union Electric's securities.

This company is not in politics. It isn't going to be. It is attending, and will attend strictly to its own business—Electric Service. But we take leave to print the truth when politicians try to put us in bad with the public.

The depreciated value of Union Electric's physical plant inside and outside of this city exceeds $26,000,000. Missouri Public Service Commission engineers and accountants found over $23,000,000 of depreciated plant values using in serving the city alone, last year. The plant couldn't be reproduced new, at present prices of labor and material, for a good deal more than $26,000,000.

The actual or going value of Union Electric's property and business—not assigning any value to franchises—exceeds the $31,105,000 total of its outstanding stocks and bonds.

Years ago there was a small percentage of water in the old company's securities.

The city government granted franchises right and left to little companies. Some had real plant values. Some had only a nuisance value.

The Electric Service business had to be concentrated by one company of St. Louis was to get a dependable, economical supply.

In absorbing its competitors Union Electric had some times to pay them more than their property was worth.

That wasn't Union Electric's fault, we paid real value for what we bought—including some nuisance values.

It was the fault of the city government, which didn't then understand that competition in Electric Service means duplicated plant costs and higher instead of lower rates.

That small margin of excess capital has since been made good by solid plant and property values built into the business out of earnings.

Not at our customers' expense: rates have steadily gone down while cost and value of service given them have steadily increased.

That "water" was made good at the expense of the dividend rate. Our investors for several years have taken less than the fair return to which State regulation entitles them, and the difference has been built into the property.

Union Electric is building for a long future, based on low rates, good service and public satisfaction.

The Electric Company

UNION ELECTRIC: Main Office—12th and Locust
Branches: 4913 Delmar; 3023 N. Grand; 3012 S. Grand
SIX OFFICES IN THE COUNTY

Electric Service Editorials

How the Public Limits Utility Rates

State regulation of public utility capital, earnings, rates, service and bookkeeping has been in force for five to a dozen years in nearly all the states, yet throughout the country advocates of municipal ownership are still writing and talking as if state regulation had never been thought of.

For example, Pearson's Magazine for May has an article telling how "a few rich men own nearly everything in the country." Of utilities it says:

"They own substantially all the street railways, electric light and gas companies. They capitalize our public utilities for as much as they see fit and charge rates accordingly."

Not even Rip Van Winkle could have packed as much ignorance of modern conditions into as few words. The facts are that—

The public utility companies are owned by hundreds of thousands of investors.

Under Missouri law a utility company can't issue a dollar of securities without permission of the people's Public Service Commission and every dollar so issued must be used in extending or improving the service.

If utilities have any "water" in their securities, put there before state regulation began, they are not permitted to base rates on it, nor to earn a dollar on it, and never will be.

No utility can charge any rate until the Commission approves it.

Any citizen with a grievance against a utility can readily get a hearing by the Commission on his complaint.

Fact is, public regulation has given the people RESULTS that some folks used to think could be got only by public ownership.

The "water" has all been squeezed out of the RATES, and is gradually being dried out of the securities.

Service has been bettered and cheapened.

Stock and bond jobbing has been stopped. Good utility securities are now among the safest of all investments for savings funds.

The utility business is rapidly being placed—Union Electric got there years ago without waiting for orders—squarely on a service-at-cost basis.

It has come to pass that the utility's best intangible asset is not its franchise—which has no earning or sale value—but its ability to give most and best service at least cost.

City governments are getting a liberal share of utility earnings, without having to invest a dollar of public funds in the business.

These big, practical gains of course do not satisfy the theorists, nor the statesmen who would like to make political use of utility revenues, but they do satisfy the average citizen.

The Electric Company

UNION ELECTRIC: Main Office—12th and Locust
Branches: 4913 Delmar; 3023 N. Grand; 3013 S. Grand

FOUR EDUCATIVE ADVERTISEMENTS OF ST. LOUIS CENTRAL STAT ON COMPANY

The fundamental purpose of the advertisements was to show the citizens of St. Louis and the surrounding territory that they were being taken into the confidence of the company. "A New Series of Get-Acquainted, Get-Together Talks" they were called in the initial advertisement. It was also stated that the truth about alleged "water" in the securities would be told, and that the reason why rates must cover a wide range to treat all customers justly would be explained.

One of the most interesting of the electric service editorials, following out the promise that "the New Union Electric Company's business policy" would be set forth, was entitled "Looking Forward to 1925." The company explained how it was planning increased capacity to take care of the great growth which it expected in "good old St. Louis."

A closing advertisement contained the warning:

"Our future rate reductions, heretofore announced as calculated for normal conditions, depend upon increased volume and density of service sales, and upon the cost of labor, capital, fuel and materials needed hereafter to provide the service. It is possible that war prices for some or all of these essentials may require us hereafter to ask the Public Service Commission to permit us to raise some rates temporarily so that we may not have to conduct the service for less than its fair cost. We hope, as you do, that this possibility may be avoided."

A better understanding between the company and its customers, a better knowledge of the business by employees and favorable comment of St. Louis daily newspapers were some of the definite results.

First Quarter Light and Power Income $121,300,000

Results of March Operation Show Earnings of $37,400,000, a Gain Over the Previous March of 15.1 Per Cent—Output 2,160,000,000 Kw.-Hr., an Increase of 25 Per Cent

DURING the first quarter of the current year the central station income from electric light and power, according to the returns received and compiled by the ELECTRICAL WORLD, amounted to $121,300,000, an increase over the first quarter of 1916 of more than $15,000,000 or 14.4 per cent. The output for the first three months of 1917 amounted to 6,500,000,000 kw.-hr., an increase over the corresponding period of last year of roughly 1,250,000,000 kw.-hr. or 23.7 per cent.

Based therefore on the returns for the first quarter of the present year, the earnings from energy sales for 1917 should total around $500,000,000, while the output should reach 26,000,000,000 kw.-hr.

As a result of March operations, earnings from light

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE-MONTH PERIOD

	Percentage of Industry Represented	Income from the Sale of Energy			Kw.-Hr. Output		
		1916	1915	Per Cent Increase	1916	1915	Per Cent Increase
April.....	64	21,206,000	18,375,000	15.5	1,137,602,000	920,464,000	23.1
May.....	64	20,345,000	17,559,000	16.0	1,170,143,000	944,681,000	24.0
June.....	64	20,254,000	17,551,000	15.4	1,170,679,000	968,724,000	21.0
July.....	64	19,760,000	17,301,000	14.2	1,174,374,000	976,704,000	24.4
Aug.....	64	20,502,000	17,861,000	15.0	1,262,575,000	1,015,805,000	22.4
Sept.....	64	21,432,000	18,600,000	15.2	1,268,339,000	1,037,976,000	21.2
Oct.....	64	22,882,000	20,164,000	13.5	1,347,502,000	1,125,132,000	19.9
Nov.....	64	24,819,000	21,744,000	14.4	1,396,537,000	1,148,221,000	21.7
1917		1917	1916		1917	1916	
Dec.....	62	25,306,000	22,029,000	15.0	1,345,883,000	1,112,280,000	21.0
Jan.....	63	27,408,000	23,969,000	14.4	1,495,829,000	1,180,884,000	26.7
Feb.....	62	25,033,000	22,164,000	13.0	1,222,473,000	1,022,667,000	19.8
March....	58	21,716,000	18,879,000	15.1	1,253,087,000	1,002,938,000	25.0

TABLE III—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR UNITED STATES—CITIES GROUPED BY SIZE

	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
INCOME:										
Group 1.....	14.9	13.8	13.9	15.0	11.6	13.0	15.0	12.0	12.0	13 6
Group 2.....	17.7	16.8	15.7	20 4	19 2	17.7	16.6	19.0	19.7	22.0
Group 3.....	21.8	19.5	20.9	18.4	18.5	18 2	15.2	15 2	12.5	15.1
Group 4.....	11.0	9.0	9.5	11.3	13 5	12 8	12.3	15.5	10.3	18.3
Group 5.....	15.3	12.2	14.9	13.3	16 0	12 8	9.5	20.2	66.7	15.9
OUTPUT:										
Group 1.....	18.7	18.1	21.4	18.5	16.6	18.2	18.7	22.5	18.5	20.3
Group 2.....	17.5	22.9	33.0	32.9	31.1	27.2	20.2	30 5	24.0	37.8
Group 3.....	21.8	27.8	31.1	19.3	24.0	32.0	28.8	34 4	14.8	25.1
Group 4.....	19.3	16.1	23.0	26.0	20.4	19.7	21 0	30.5	20.2	26.0
Group 5.....	19.0	11.6	16.8	15.3	18.3	33.0	25.4	21.3	21.3	50.7

TABLE IV—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR NEW ENGLAND STATES—CITIES GROUPED ACCORDING TO SIZE

	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
INCOME:										
Group 1.....	16.4	12.6	9.6	16.5	12.1	13.5	12.5	12.5	12.3	7.0
Group 2.....	19.8	20.6	15.1	25.5	21.3	20.0	30.2	16.1	18.4	19.4
Group 3.....	18.2	21.2	15.0	20.5	18.0	19.4	16.5	17.8	15.7	16.5
Group 4.....	7.2	6.2	11.1	10.5	15.4	16.0	16.0	22.0	12.8	25.8
Group 5.....	21.7	14.9	17.5	18.3	18.2	18.6	12.2	24.0	15.1	21.0
OUTPUT:										
Group 1.....	30.0	19.2	31.3	34.0	17.5	18.0	10.8	20.7	19.6	24.0
Group 2.....	26.3	14.1	32.0	37.7	35.0	24.7	18.2	24.8	18.5	22.9
Group 3.....	15.0	31.4	45.5	32.4	42.6	35.9	22.0	20.9	35.7	34.5
Group 4.....	21.0	26.6	39.4	32.9	48.9	40.0	55.2	73.8	38.1	32.7
Group 5.....	31.7	13.5	21.3	27.4	22.0	17.0	35.7	29.2	26.8	76.0

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	Percentage of Industry Represented	New England States			Percentage of Industry Represented	Atlantic States			Percentage of Industry Represented	Central States (Illinois Excluded)			Percentage of Industry Represented	Pacific and Mountain States		
			1916	1915	Per Cent Increase		1916	1915	Per Cent Increase		1916	1915	Per Cent Increase		1916	1915	Per Cent Increase
INCOME	April.....	64	2,221,000	1,898,000	17.0	67	8,794,000	7,596,000	15.8	56	6,289,000	5,292,000	19.0	88	3,825,000	3,520,000	8.8
	May.....	65	2,103,000	1,788,000	17.0	67	8,226,000	7,131,000	15.4	56	6,085,000	5,123,000	18.7	88	3,874,000	3,469,000	11.6
	June.....	65	2,208,000	1,906,000	16.0	67	8,045,000	6,905,000	16.5	56	6,007,000	5,143,000	16.9	88	4,017,000	3,539,000	13.5
	July.....	65	2,130,000	1,875,000	13.7	67	7,832,000	6,621,000	16.4	56	5,926,000	5,095,000	16.3	88	3,755,000	3,493,000	7.6
	August....	65	2,203,000	1,935,000	13.7	66	8,000,000	6,875,000	16.4	56	6,195,000	5,266,000	17.7	88	3,883,000	3,582,000	8.4
	September	65	2,315,000	1,982,000	16.8	66	8,631,000	7,445,000	16.0	56	6,505,000	5,537,000	17.8	88	3,979,000	3,644,000	9.2
	October...	65	2,684,000	2,331,000	15.2	65	8,887,000	7,930,000	12.1	56	6,968,000	5,895,000	18.2	87	4,213,000	3,889,000	8.3
	November.	65	2,912,000	2,516,000	15.7	65	10,061,000	8,859,000	13.5	56	7,410,000	6,313,000	17.4	87	4,246,000	3,947,000	7.5
	December	65	3,203,000	2,814,000	14.0	66	11,059,000	9,348,000	19.6	56	7,898,000	6,997,000	13.0	75	2,987,000	2,735,000	9.3
	1917		1917	1916			1917	1916			1917	1916			1917	1916	
	January...	64	3,181,000	2,762,000	15.1	66	11,400,000	9,874,000	15.6	56	8,081,000	7,013,000	15 2	86	4,602,000	4,020,000	9.5
	February..	64	3,039,000	2,686,000	13.1	65	10,249,000	9,021,000	13.6	53	7,345,000	6,439,000	14.1	86	4,239,000	3,886,000	9.0
	March....	60	2,748,000	2,442,000	12.5	65	10,175,000	8,881,000	14.6	52	6,032,000	5,188,000	16 3	72	2,761,000	2,438,000	13.3
			1916	1915			1916	1915			1916	1915			1916	1915	
KW.-HR. OUTPUT	April.....	64	84,769,000	64,816,000	30.8	67	403,223,000	326,574,000	23.4	56	344,866,000	273,367,000	26.4	88	302,386,000	253,778,000	19.2
	May.....	65	84,719,000	64,318,000	31.8	67	409,529,000	333,585,000	22.0	56	345,860,000	275,328,000	25.6	88	328,793,000	266,599,000	23.2
	June.....	65	87,829,000	69,506,000	27.6	67	396,630,000	327,541,000	21.2	56	350,015,000	288,982,000	21.2	88	328,996,000	277,915,000	18.6
	July.....	65	85,317,000	71,160,000	19.8	67	401,179,000	333,771,000	20.3	56	350,708,000	287,407,000	22.2	88	325,647,000	279,285,000	17.4
	August....	65	97,197,000	72,900,000	33.4	66	433,129,000	344,730,000	25.7	56	374,327,000	295,866,000	26.5	88	333,468,000	279,976,000	19.1
	September	65	98,350,000	73,343,000	34.2	66	446,534,000	369,815,000	20.8	56	387,626,000	307,485,000	26.2	88	335,817,000	288,332,000	16.4
	October...	65	107,756,000	83,705,000	28.8	65	426,151,000	373,705,000	14.2	56	408,364,000	324,509,000	25.9	87	355,014,000	306,828,000	15.8
	November.	65	111,873,000	89,015,000	25.7	65	533,252,000	424,746,000	25.6	56	415,491,000	334,044,000	24.4	87	346,847,000	293,518,000	18.2
	December	65	117,763,000	97,387,000	21.0	66	535,410,000	444,923,000	20.4	56	425,510,000	354,258,000	20.0	75	256,006,000	206,838,000	23.8
	1917		1917	1916			1917	1916			1917	1916			1917	1916	
	January...	64	120,211,000	93,163,000	29.1	66	564,699,000	429,432,000	31.5	56	437,923,000	351,335,000	24.5	86	363,094,000	298,990,000	21.4
	February..	64	110,114,000	88,324,000	24.7	65	418,407,000	341,877,000	22.5	53	357,175,000	311,199,000	14.7	86	325,182,000	272,691,000	19.2
	March....	60	115,812,000	90,303,000	28.3	65	537,418,000	424,234,000	26.7	52	343,195,000	282,435,000	21.5	72	256,592,000	205,966,000	24 6

and power amounted to $37,400,000, an increase over the previous March of a little less than $5,000,000 or 15.1 per cent. The March output was 2,160,000,000 kw.-hr., which is considerably more than 400,000,000 kw.-hr. greater than the output in March of last year. The increase amounts to 25 per cent.

Both earnings and output showed increases in per cent as compared with previous months. In the New England States the increase in earnings shows a smaller per cent than in previous months as a result of the figures from the larger cities. This is probably affected considerably by the natural falling off in consumption for lighting.

Rate of growth in output apparently continues undiminished, which of course means that the actual growth in kilowatt-hours is becoming larger and larger. As has been pointed out before, this growth is largely

TABLE V—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT HOUR OUTPUT FOR ATLANTIC STATES—CITIES GROUPED BY SIZE

	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
INCOME:										
Group 1	16.4	16.8	16.1	16.2	10.7	13.7	18.8	15.0	13.0	14.3
Group 2	21.9	18 5	21.6	19.0	21.0	22.5	21.7	28 3	27.3	27.0
Group 3	12 0	14 2	15.0	14.0	14.6	13.0	13.4	12 5	10.4	15.1
Group 4	15 4	10.0	14 4	9.8	13.5	13.1	14.4	14.0	11.3	20.0
Group 5	15 2	13.0	19.4	8.9	14.3	16.0	14.3	11.1	11.8	12.5
OUTPUT:										
Group 1	13.1	23 4	28.5	23.6	19.2	20.8	21.5	32.5	22.0	21.3
Group 2	31.8	27.4	32 5	26.7	33.0	31.9	28.2	42.6	31.2	63.2
Group 3	13 2	11.5	16.0	24.7	4.5	19.0	15.9	27.2	21.2	21.6
Group 4	19.7	16.3	29.5	18.6	17.5	14.6	16.0	25.4	18.8	19.1
Group 5	11.1	13.5	20.4	1.3	1.5	5.8	6.9	9.4	17.0	3.2

TABLE VI—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR CENTRAL STATES—CITIES GROUPED BY SIZE

	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
INCOME:										
Group 1	16.4	15.8	16.5	16.6	18.0	16.5	13.0	15.5	14.0	15.8
Group 2	17.5	17.3	21.8	21.5	21.0	17.0	16.0	17.8	18.7	23.8
Group 3	20.5	18.6	18.4	13.4	10.9	13.0	1.8	6.0	0.5	4.4
Group 4	17.5	17.5	10.7	20.0	19.7	16.8	15.5	19.8	16.3	18.0
Group 5	12.6	6.1	11.8	11.0	18.4	14.3	†	19.3	16.7	3.4
OUTPUT:										
Group 1	23.8	21.0	24.3	22.3	24.9	24.8	22.3	25.4	17.8	19.7
Group 2	12.3	25.7	36.4	40.0	31.7	29.7	24.4	29.0	23.6	34.5
Group 3	31.8	26.0	25.7	20.7	17.3	19.7	1.2	5.8	30.0*	4.5
Group 4	34.3	21.1	23.0	33.8	26.1	21.2	21.4	24.5	13.0	29.0
Group 5	4.0	8.6	6.1	13.7	28.2	16.8	9.9	15.5	17.1	24.5

*Decrease.
†Results omitted owing to insufficient returns.

TABLE VII—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR PACIFIC AND MOUNTAIN STATES—CITIES GROUPED ACCORDING TO SIZE

	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
INCOME:										
Group 1	7.5	4.7	5.5	6.2	4.2	4.5	4.0	5.4	7.2	11.3
Group 2	1.2	0.6*	0.7	4.9	1.3	3.0	3.6	7.5	5.5	0.6
Group 3	39.5	28.3	32.5	28.5	32.4	31.0	30.0	27.6	23.5	22.8
Group 4	3.6	1.0	0.5	11.5	7.2	0.4	0.6*	8.6	2.0	11.0
Group 5	12.8	13.2	13.0	11.7	13.5	17.1	11.1	20.3	17.1	16.0
OUTPUT:										
Group 1	8.0	10.0	6.3	7.1	5.2	8.0	8.6	11.0	14.0	18.0
Group 2	1.0	2.0	6.5	7.8	9.7	11.4	8.7	11.8	16.2	8.9
Group 3	74.5	56.1	57.5	60.0	63.7	61.3	48.0	59.5	36.8	36.3
Group 4	10.0	4.0	7.5	12.0	*0.5	4.2	2.6	15.2	14.0	26.5
Group 5	16.0	10.8	16.5	7.0	14.7	42.3	5.4	19.1	9.4	13.1

*Decrease.

new business, particularly industrial power load. The advancing cost of fuel in addition to the sudden demand for increased output has helped to make the operation of isolated plants unprofitable.

Compared with previous years, there is little increase on the whole from other than industrial load. Domestic consumers are not buying energy-consuming devices as freely as in the past, nor is it as easy to interest owners of houses to wire them under existing prices for electrical construction. Besides, there has been but little building activity other than for industrial purposes owing to market conditions for labor and material.

The demand for power, however, is actually becoming

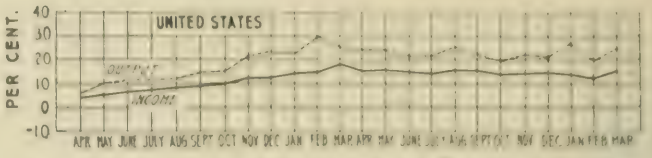


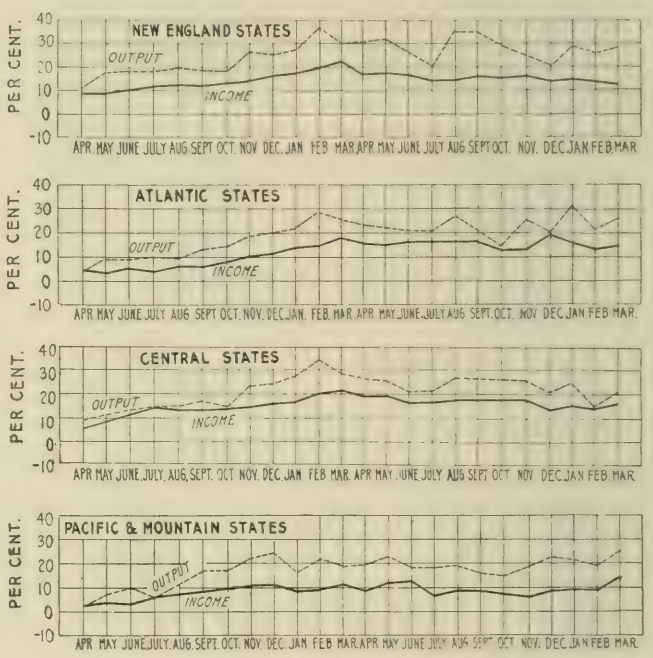
FIG. 1—CENTRAL STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT FOR UNITED STATES

greater. Shipbuilding yards and mines are particularly noticeable just now in the power market.

Government's Activity a Factor

The government program for a billion tons of shipping, backed up by the activity of private yards, means the consumption of large quantities of energy for some time. One plant in the East has recently signed a contract of such proportions with a shipyard that for the present it is unable to take on further power business. Coal mines in order to stimulate production, it is understood, are more and more increasing their consumption of electrical energy.

The accompanying curves show graphically the percentages of increase of both income and output given in Tables I and II. The remaining tables contain percentages of increase of income and output grouped



FIGS. 2 TO 5—CENTRAL STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT SECTIONALLY

according to the size of community served. Group I contains those companies operating in cities having a population of over 100,000 inhabitants; group 2 those operating in cities between 50,000 and 100,000 inhabitants; group 3, between 25,000 and 50,000; group 4, between 10,000 and 25,000, and group 5, between 5000 and 10,000.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

EMERGENCY REPAIR OUTFITS

How Men and Materials Are Handled to Reduce Time Required to Effect Emergency Repairs

Several years ago when any burn-out occurred which required immediate repairs the street department of the Commonwealth Edison Company was hampered considerably in getting tools and material to the scene of trouble on account of the distance from the main toolroom and storeroom. To make tools available for just such cases the department has since arranged to place in several outlying substations tool kits containing all tools and materials necessary for making up high-tension joints of various sizes. Whenever material is used from one of these kits the foreman doing the work sends into the supervisor of tools a list of the material taken from the kit. The latter immediately replaces the material used and at the same time checks all material as well as tools contained in the outfit. Thus the equipment is kept complete in accordance with the printed list tacked on the inside of the tool-box cover.

On account of the amount of installation work which the Commonwealth Edison Company does, it is necessary to have an emergency delivery truck which during the day is kept busy delivering material to construction gangs. The driver, who keeps in touch by telephone with the supervisor of tools, is then available at any time to deliver tools and material in case of emergency. In order that no time shall be lost in making up an outfit, a kit of tools and material similar to that placed in outlying substations is held in readiness at the central toolroom, so that the emergency truck may at once deliver the necessary equipment to the scene of trouble.

BURNING-OUT OF STARTER

Relieving Situation Caused by Operating Motor with Starter on Intermediate Point

BY E. C. PARHAM

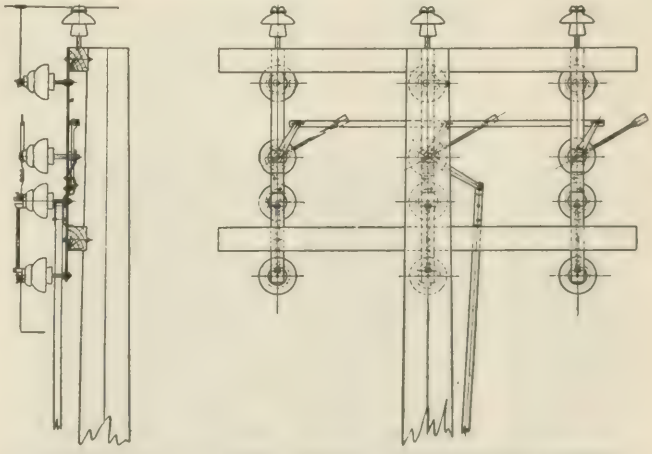
Motor-speed control by means of resistance in the armature circuit should be avoided ordinarily because of the great waste of energy in the resistance. The method is used in controlling direct-current traction motors, not because it is all that could be desired, but because it is the only practicable method available. The method is not so inefficient in this special application, because the two or more motors that are being controlled permit of series parallel and field control—combinations that make available several speed values without requiring any resistance in the armature circuit. Where a starting resistance is to be used for continuous running, this condition should be specified at the time of ordering; otherwise an ordinary starter will be furnished, and starters are not designed to withstand continuous running on intermediate positions unless so specified.

An operator in charge of producing steel bars and rods complained of the frequent burning out of the starting resistance of a 175-hp. motor that was applied to the driving of the rolls. Investigation disclosed that the manufacturer's recommendations as to the capacity of the fuses to be used were being observed. As the size of the stock handled by the motor had gradually been increased, a condition was reached where the motor at times was working at the rate of 400 hp. or more. Having tired of replacing fuses and noticed the relationship that existed between the blowing of the fuses and the ammeter readings, the attendant had adopted the practice of moving the starter handle back onto a resistance position whenever the current approached the critical value. As the motor was to be replaced soon and as the cost of a resistance grid or two was small compared to the losses incident to delay, the situation was relieved by arranging so that a whole resistance frame could be quickly replaced when a grid burned out.

FUSED DISCONNECTING SWITCH

Combination Apparatus Developed by Pacific Coast Company for Use on 11,000-Volt Lines

A combined disconnecting switch and fuse which may be operated manually from the ground before a lineman climbs a pole, thus enabling him to replace a fuse without hazard, has been developed by the Pacific Gas & Electric Company. All three legs of this switch are opened at once. The device is simple in operation, inexpensive



CONSTRUCTION OF FUSED OUTDOOR DISCONNECTING SWITCH

and has given satisfaction in the numerous cases where it has been used. The fuse consists of a wire incased in a glass or a porcelain tube held between two clips by means of screw clamps. These latter in turn fit into insulators which form the support. The switch and fuse are mounted directly on the cross-arm and poles supporting the line and transformers. It is the opinion of this company that this type of disconnecting switch and fuse is the only safe type to use on 11,000-volt work, irrespective of the details of design.

METHOD OF CONSTRUCTING BOILER FURNACE SETTINGS

Practice of a Large Company in Constructing Settings for Boilers to Minimize Air Leakage and Heat Radiation

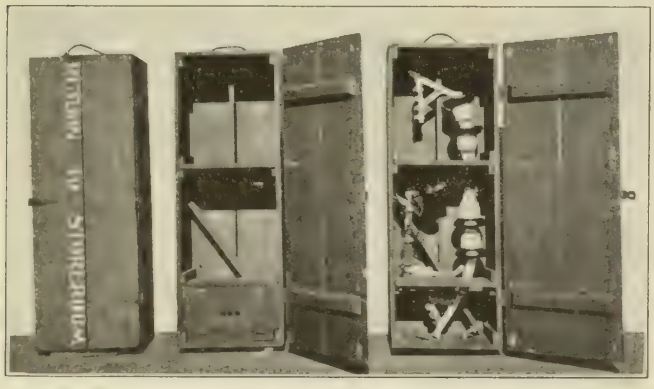
Radiation of heat and infiltration of air are two factors which should be given careful consideration in constructing settings for boilers. One large company has adopted the following practice in constructing the side walls for its boiler settings: The setting is built up with a 9-in. (22.8-cm.) wall of firebrick, a 4.5-in. to 9-in. (11.4-cm. to 22.8-cm.) wall of Armstrong nonpareil cork brick, or "Sil-o-cel" brick, and a 4.5-in. (11.4-cm.) wall of common red brick, upon which is put an air-tight coating of "Armorcote" roofing cement. The mechanical bonds between the walls are obtained by the usual header construction. High-temperature brick is used for the arches and walls where overfeed stokers or chain grates are used with temperatures running up to 2800 deg. Fahr. (1555 deg. C.). With underfeed stokers, such as the Taylor or Westinghouse, the temperatures will not run much above 2400 deg. Fahr. (1333 deg. C.), operating at a 200 per cent rating, if proper firing is used. Hence a high-heat resisting brick is not so essential as one with high mechanical strength and resistance to abrasion by slag.

ASSEMBLING AIR-BREAK SWITCHES AT STOREROOM

Units Compactly Stored in Special Cases by San Diego Operating Company to Obviate Necessity of Assembling in Field

Where a number of air-break line switches are used on high-voltage distribution systems (11,000 volts and up) it will be found advantageous to fit them up ready for service at the store yard, in order to reduce the time required for mounting them in the field. As shipped by the factory, knocked down, air-break line switches require considerable labor to set up.

To facilitate handling such units, the San Diego



COMPARTMENTS FOR HOLDING ASSEMBLED AIR-BREAK SWITCHES

(Cal.) Consolidated Gas & Electric Company utilizes wooden boxes specially constructed to contain them. Each box holds one single-pole unit made up complete, including strain clamps. By means of guides and blocks the element is held rigidly in place, thus obviating breakage in transportation. The small compartment with a cover, shown in the center box of the illustration, contains the miscellaneous hardware necessary for mounting the switch. Each set of three boxes required for a complete three-phase switch is painted a distinctive color to facilitate checking and handling. The switch shown in the figure is manufactured by the Pacific Electric Manufacturing Company.

THE VENTILATION OF UNDERGROUND SUBSTATIONS

Taking Air from Above Street Level or Separate Air Supplies for Sustenance of Life and Cooling of Machines Recommended

BY ALBERT MARTINEAU

Ventilation of underground substations is vitally important for the safe operation of the apparatus and the welfare of the operators who spend eight hours or more in these underground structures. At best it is not a simple matter to pass 50,000 cu. ft. (1400 cu. m.) or more of air per minute into a space 15 ft. to 40 ft. (4.6 m. to 12.2 m.) below the sidewalk, nor is it easy to draw so much air through a relatively small opening such as can be obtained in congested cities. The problem is somewhat simpler to-day than it was a few years ago, because the oil-filled transformer and induction regulator has taken the place of air-cooled apparatus extensively, thus reducing the amount of air required for cooling these pieces of equipment. On the other hand, the rating has increased enormously—the rating per unit of floor space being twice what it was a few years ago. Therefore greater quantities of air are required for cooling. Another factor is involved that has worked to the disadvantage of the men employed in these underground stations; that is, that the huge rotaries now in use give off large quantities of heat, make the station atmosphere dry and hot, and by their large armatures churn this air up, still further drying and mixing it with dust. One method of overcoming these objections is to inclose rotating machines in the same way that the air-cooled transformers are inclosed—a more difficult matter in view of their size and the need for frequent inspection and adjustment.

Air may be taken into underground substations in either of two ways—from the level of the sidewalk or from above the sidewalk. When the air intake is on the level of the sidewalk, dirt, dust and moisture are drawn in to the detriment of the air-cooled apparatus as well as the operators. Fumes from automobiles standing outside, newspapers and other litter are also drawn into the duct. In the winter ice is liable to clog the entrances. While periodic cleaning of the machines removes much of the dirt and dust, all is not removed, hence the amount of foreign matter lodged in the interstices and ducts accumulates surely but slowly, not only interfering with the passage of air but also acting somewhat as a heat-insulating coating. Air filters and washers would reduce trouble from this source considerably, but they require space, involve an initial and upkeep expense and cause another complication.

Taking in air on the sidewalk level is still more injurious to the men working in underground substations. Dust and dirt, especially when dry, are recognized as carriers of bacteria. In addition, the hot, dry air usually encountered in underground substations tends to irritate the nasal, bronchial and throat pas-

sages, even when bacteria are absent, by affecting the mucous membrane.

For these reasons it is better to take air from above the street level, say, six or more feet (1.8 m.) above. Where buildings prevent, as they usually do, the intake may be placed in the sidewalk. The duct must not only be high enough to prevent sucking in the dust from the street but must not inconvenience passers-by. The intake should be installed as close to the station as feasible because the greater the length the greater the pressure drop due to resistance to air flow; hence the more must be the expenditure for power to pass a given quantity of air into the station. Where the location of the substation and the walls of superstructures permit, a sheet-steel air duct may be installed against the side of the building. Two separate air supplies—one for the men and one for the apparatus, each maintained independent and isolated from the other—would be the solution to the problem that now exists.

HEAT-RESISTING COVERING

How to Make a Flexible Protective Tubing for Wire Not Exposed to Moisture

BY RENICE RADCLIFFE

Inexpensive tubing for electrical wires can be made in the following way: Coat a straight brass or iron rod heavily with melted paraffine and allow it to cool. Then mix one part of plaster of paris and two and one-half parts of water, adding a small quantity of lime. Tear muslin strips 1 in. wide (2.54 cm.) and dip into mixture. After allowing them to absorb all they will hold, wind them smoothly around the rod, working slantwise from end to end. Enough layers may be applied to give the desired thickness. When the plaster is thoroughly hardened heat the metal core until the paraffine is soft enough to permit removal of the rod. Tubing made in this way is a non-conductor, heat-resisting, slightly flexible and can be cut into desired lengths with a hack saw.

ENGINEERS AND THE WAR

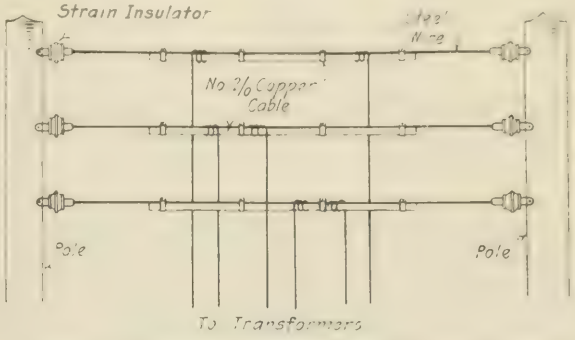
Granting of Special First-Class Engineers' Licenses During War Opposed in Massachusetts

E. W. Burdett, counsel for the Massachusetts Gas and Electric Lighting Association, appeared before the legislative committee on mercantile affairs at Boston recently, on behalf of a bill to permit the granting of special first-class engineers' licenses during the war. Representatives of large New England textile mills supported the measure on the ground that there may be a shortage of engineers as a result of selective conscription for war service. The bill was vigorously opposed by representatives of the International Union of Steam and Operating Engineers, the National Association of Stationary Engineers and other organizations of engineers and firemen, who contended that a surplus of men holding first-class licenses now exists, that there is no danger of a shortage, since most holders of such licenses in Massachusetts are above the probable maximum draft age, and that the granting of temporary first-class licenses, even with examinations as proposed, would lower the standard of engineers and prove dangerous to the public.

SUPPORTING OUTDOOR BUSES

Bus Conductors Attached to Steel Span Wire Terminating at Pole Supports in Strain Insulators

Steel anchor wire is used in the Greensboro (N. C.) substation of the Southern Power Company to hold in position the No. 2/0 copper cable buses that are used for a large transformer bank. When large cables are



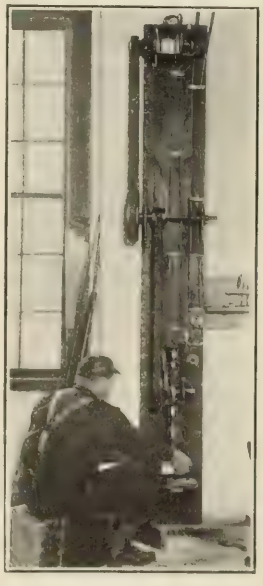
METHOD OF STRINGING STEEL WIRES TO HOLD BUSES

fastened directly on insulators and strung for any distance, they sag and necessitate clumsy joints at the insulators, giving an unsightly appearance. By stringing steel wires as shown in the accompanying diagram and tying the cables to them at frequent intervals the cables are held rigidly in line. Besides improving the appearance of the buses this allows a saving in the copper which would be necessary to reach entirely to the insulators and to make a tie on them.

PORTABLE POWER-DRILL PANEL

Outfit for Connection Directly to Service Wires Without Auxiliary Apparatus in Series

A convenient portable power-drill panel used by the United Electric Light Company of Springfield, Mass., is illustrated herewith, the outfit being of the home-made variety. It consists of 1.5-hp. General Electric induction motor running at 1780 r.p.m. and belted to a 10-in. (25.4-cm.) upright drill at the bottom of a 1.75-in. by 15-in. (4.4-cm. by 38.1-cm.) plank about 10 ft. (3 m.) long. Speed reductions from the motor to the drill are obtained by the following sequence of pulley diameters: 3.25-in., 12-in., 4-in. and 10-in. (8.3, 30.4, 10.2 and 25.4-cm.). The motor is of the single-phase type, and can be connected to the line by snap-switch control, with no other equipment in circuit except the usual fuses. When considerable work is to be done in one place the panel is lag-screwed to a station wall. It has been found useful in switchboard erection and in other construction and maintenance work where local drilling of steel or wood is desirable to secure accurate fits.



PORTABLE DRILL PANEL

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

SALES DEPARTMENT CANNOT SELL ELECTRIC RANGES

An Important Part of the Electric Cooking Campaign at Milwaukee Is the Interdepartment Co-operation That Prevails

It's not often that a sales manager will admit that his department cannot sell anything that it is supposed to sell, but such was the admission of R. B. Snyder of the Milwaukee Railway & Light Company at the first meeting of the company's range committee, composed largely of members of departments other than sales. This committee consisted of the sales manager, the sales manager's chief clerk, the heads of the range department, trouble department, distribution department, installation department and electric shop sales force, the chief clerk of distribution department, and several installers.

At the first meeting of this committee Mr. Snyder, who acted as the chairman, explained the purpose of the meeting as follows:

"Our experience with electric ranges during the three or four months we have been dealing in them has shown that the sales department cannot sell an electric range. Experience indicates that the customer, largely to get rid of the salesman, will sign an order and say, 'Yes, we will try one of those ranges.' That, however, is as far as the sales department has been able to get.

"Now if ranges are to be sold the trouble department and the distribution department must do it, and it is essential that the ranges should be sold because they are now and will continue to be a large part of the revenue-producing apparatus on the company's lines.

"Right in this connection there is a suggestion which comes to my mind. I have found by examining the trouble department's records that it actually has been giving twenty-five-minute service on every trouble call. That means that on the average every trouble call reported is attended to by a member of that department within twenty-five minutes after it is received. With that kind of trouble service already established, it should be an easy matter for the trouble department to make electric ranges stay sold.

"It should be possible to install in the carhouses in the different sections of the city some kind of a box in which the elements for electric ranges could be stored. Then when the troubleman after completing each job calls up the office he can be told if there is any electric range trouble in that neighborhood, can go to the carhouse and get the necessary repairs and reach the range in a very short time."

This suggestion was enthusiastically received, and a committee consisting of the operating men, with the sales manager as an ex officio member, was appointed to design the box for storing elements in the carhouses.

In like manner it was pointed out that the installation department is a large factor in the sale of electric ranges. Without its co-operation in properly burning the paint off the ranges and testing them out before they are sent to the customer the sales department is powerless. In order to perfect the service in this respect it was agreed that every electric range order should be stamped across its face in red ink with the glaring word "RANGE." All orders marked in this fashion receive the same sort of attention that is accorded the largest power jobs.

After this work had been started and systematized, one of the troublemen came forward with another important suggestion, which was adopted. He pointed out that if he had a card file giving the name of each electric range owner, together with the type and make of the range, it would be of material assistance to him. When a trouble call from a range customer comes in, for instance, the woman of the house usually says, "My oven won't work," or "One of the plates on top of my range won't work." Before the card index was installed the trouble department had to ask her what type of range she had and what make it was. Usually she had to go to the stove and investigate. With the present system the card index is near the telephone so that when a range customer says her oven won't heat the trouble department gets her name, looks through the card index, locates the type of range on the card, and is then in a position to give the call to the first "trouble shooter" available.

It is in this way that the co-operative assistance of the operating departments of the company has been secured. Furthermore, when intercompany conferences on electric range practice were arranged, the men were largely from the operating department—only a few belonging to the sales department. This practice, which was contrary to that which is usual, was adopted because it was realized what a large and important part departments other than the sales department have to play in the actual selling of electric ranges.

APPLIANCES FOR EMPLOYEES PROVIDED WITHOUT CHARGE

A More Liberal Policy of Education of Salespeople in Use of Appliances Conducive to Larger Volume of Business

The general manager of electric shops for one of the largest central stations in the country recently said: "If I had my way about it, every clerk in our store would be given free of charge every electrical appliance that he could use in his home. I believe it would increase his ability as a salesman of these goods and would be a fine stroke of policy as well."

A few days later a salesman engaged in the actual selling of electrical appliances for a Middle Western company expressed his viewpoint on this question by saying: "How can we salesmen talk electrical appliances

without using them ourselves in our homes? How can we tell a woman how to iron if we know nothing about ironing? How can we talk suction cleaner if we never swept, beat or suction-cleaned a rug? Can we tell a 'prospect' that the electric toaster makes good toast, the electric percolator is pretty, the chafing dish is nice, that they make handsome electric appliances, and sell goods through such chatter? This class of talk does not sell merchandise.

"We must talk from our hearts, not from our mouths. We must know what these things will do—how easy it is to wash, iron, clean and cook with electrical appliances. In order to appreciate electrical appliances, it is absolutely necessary that we occasionally do the washing, the ironing and the cleaning of our rugs ourselves. It is necessary that we eat the crisp, hot, golden-brown toast made by the electric toaster and drink the delightful coffee made by an electric percolator."

In the foregoing paragraphs are viewpoints of men of two different classes most vitally interested in the sale of electrical goods. Their opinions are identical in trend, yet the universal policy of central stations on this topic is not as liberal as both would like to see it. Perhaps this is because the need for forcing appliance sales to their utmost has not been apparent up to the present time, but with the present high prices of construction material and growing overhead expense the need for building loads on existing lines that will not be of a peak character daily becomes more evident.

It is with these thoughts in mind that those who are responsible for the policies of commercial departments are considering a more liberal policy in the matter of educating the salespeople in the actual use of electrical goods.

MOVEMENT TO COMPENSATE EMPLOYEES FOR LEADS GROWS

So Far Confined Largely to Larger Central Station Companies, Although No Reason Why Smaller Utilities Should Not Do Likewise

Within the past year there has been a very noticeable tendency on the part of larger central station companies —and there is absolutely no reason why the movement should not spread rapidly to the smaller companies— to stimulate the interest of employees toward helping the company increase the load on its lines by recompensing the employees in some manner for all leads furnished.

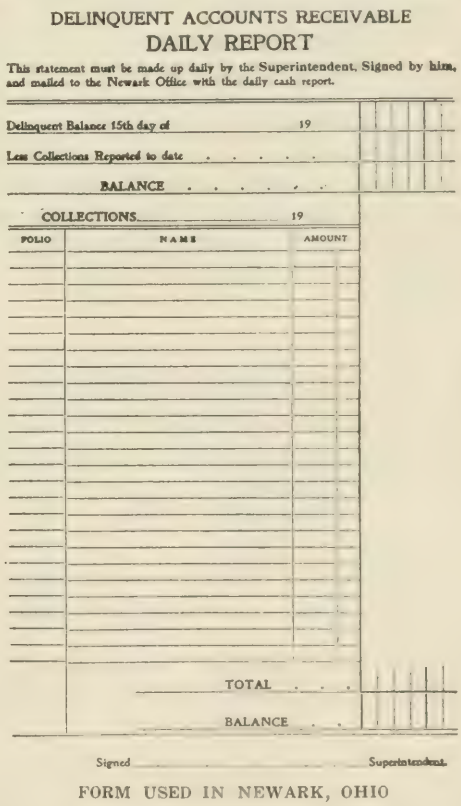
One of the latest companies to inaugurate such a system is the Edison Electric Illuminating Company of Brooklyn, which offers prizes monthly for leads resulting in business, the value of the prizes depending on the character of the lead. The details of the Brooklyn system have been announced as follows:

> In order to stimulate the co-operation of all employees in notifying the sales department of prospective business, of customers interested in the use of appliances, and customers' complaints which would not otherwise come to the attention of the company, the leads have been classified in the order of their importance and suitable awards will be made each month accordingly.
>
> The nature of each employee's work, the facilities offered him to secure leads and the importance of the result of the leads will form the basis for awarding prizes.
>
> The order of importance of leads is as follows:
>
> 1. For the electrical equipment of unwired premises along the line of the company's mains.
> 2. For the name and address of any institution or enterprise where a private plant is in use, provided that this plant is not already on record in the census of the power engineering bureau.
> 3. For the sale of appliance or appliances by the Edison Shop or branch offices. The information to be conveyed by this type of lead is to be the result of the employee having interviewed and interested a "prospect" in the purchase of some specific article or articles indicated in the lead.
> 4. For information concerning any legitimate complaint or grievance of a customer.
>
> Leads should be forwarded to the chief clerk of the sales department.

KEEPING DOWN DELINQUENCIES BY MEANS OF DAILY REPORTS

Methods Adopted by Medium-Sized Ohio Property Found to Have Worked Out to the Satisfaction of the Company

A few years ago the American Gas & Electric Company, through its monthly publication, the *A-G-E Bulletin*, started throughout the subsidiary properties a campaign to reduce delinquencies. No general plan


DELINQUENT ACCOUNTS RECEIVABLE
DAILY REPORT

This statement must be made up daily by the Superintendent, Signed by him, and mailed to the Newark Office with the daily cash report.

Delinquent Balance 15th day of 19

Less Collections Reported to date . . . . .

BALANCE . . . . .

COLLECTIONS 19

POLIO	NAME	AMOUNT

TOTAL . . .

BALANCE . . .

Signed . . . Superintendent.

FORM USED IN NEWARK, OHIO

for use by all companies was adopted—each had to work out its own salvation. All are situated in medium-sized communities. A description of the early progress of the campaign will be found in the April 17, 1915, issue of the ELECTRICAL WORLD.

At the Newark office of the Ohio Light & Power Company, one of the subsidiary properties, a daily report on collections of delinquent accounts must be made by all of the superintendents reporting to that office. The report, similar to the one shown here, is 5 in. by 9¼ in. (12.90 cm. by 23.50 cm.) in size, printed on light-weight paper.

E. S. Browne of the Newark office, writing in the

May issue of the *Bulletin*, says in regard to the daily report:

"We found that in some of our towns the matter of collections was being neglected, and in order to keep the matter before the superintendents daily, we adopted the daily report of collections of delinquent accounts. It has worked out very satisfactorily and has decreased to a marked degree our delinquents as compared with our twelve months gross."

COMMUNITY APPRECIATION OF RATE FUNDAMENTALS

Will Brush Away Large Amount of Utility's Rate Troubles if Done Before Danger Comes to a Head

In a paper read before the recent Southwestern Electrical and Gas Association, Secretary H. S. Cooper concluded with the following apt remarks:

"Long before the 'danger' actually comes to a head the utility should educate its community to the knowledge that any local conditions in one community which are more unfavorable to low costs of utility operation than they are in another city will tend to give the first city higher utility rates independent of any action or intention of the utility itself.

"Once a community is made fully to understand and appreciate this point, a large amount of the utility's rate troubles have been brushed away. Also if a community is made fully to understand and appreciate what these local conditions are and how they affect the cost of operation a still further amount of the rate troubles will be eliminated. This presupposes, however, that the rates of the utility have been made on some equitable basis and give only a reasonable return to the utility."

WOMEN PROVE SUCCESSFUL AS CENTRAL-STATION SOLICITORS

Those Who Really Need Work Make a Success of Selling the Low-Priced but Large Energy-Consuming Devices

In the opinion of the sales executives of the Duluth Edison Company, men solicitors are all right for selling washing machines, vacuum cleaners, electric ranges and the larger equipment on which there is sufficient profit to pay high salaries. They cannot be used economically, it is thought, to sell the smaller appliances which are the real revenue producers but which do not permit the salesman to make a large profit on each individual sale. For this reason the Duluth Edison Company employs women as its house-to-house canvassers on the smaller devices which must be sold to load the lines. In every case the women who are hired must be in need of the jobs they seek to make a living. Only women of this type have been employed, because experience has taught that they are dependable, that they work hard to sell goods and that they stay with the company indefinitely. Women with these qualifications, it is believed, if they have the least originality and sales ability, will make good in this type of work. At Duluth these saleswomen are paid $50 a month and $1 per kilowatt for all load placed on the line over and above 25 kw. At this work they make salaries that are above what they could make in other positions which they would be able to fill.

Their work is carried on systematically. When they start out in the morning they have a pack of cards, each one of which is a record of some customer. The card gives the customer's name, tells what appliances have been sold to the customer and when the last call was made. These customers are called on and the appliances looked over. If any are out of order, the saleswoman reports it to the company, which sends a man to get the defective device, repair it and return it free of charge. Before the inspection is over the canvasser usually finds that the customer is interested in some other device, and either makes a sale or marks the card so that it will be returned to her for a future call.

By following out this plan of selling the smaller appliances, the Duluth company is able to avoid the trouble that comes from being constantly obliged to train solicitors. Furthermore, it is believed that the use of women in this capacity accomplishes more for the company than would the use of men of the caliber it could afford to pay.

ECONOMY OF ELECTRIC TRUCK OVER USE OF HORSES

Statistics Compiled by New York Electric Vehicle Association Show Saving of $800 a Year—Items Overlooked by Horse Owners

The New York Electric Vehicle Association has compiled some interesting facts and figures relating to the cost of operating and maintaining a small horse-drawn delivery outfit consisting of three horses and two small trucks or wagons. The purpose of presenting these data is to show the comparative cost of this type of delivery system and the cost of maintaining and operating an electric vehicle capable of doing the same work.

The following is an illustration of correct accounting for one year for three horses and two wagons, based on actual conditions in New York City:

Board, at $1 per day	$1,095.00
Shoeing, at $2.25 per month	81.00
Services of veterinary	30.00
Clipping	5.55
Repairs and painting of wagons	200.00
Repairs to harness	45.00
Amortization for horses, at 20 per cent (assuming the value of a horse at $200)	120.00
Amortization for wagons and harness (assuming value at $375)	75.00
Insurance	25.86
Interest on investment	103.50
Total	$1,780.91

An electric vehicle of the type capable of doing the same amount of work as this horse and wagon equipment, the association states, can be operated and maintained at a cost from $900 to $1,000 a year. This figure is based on a compilation of costs exactly the same as for the horse-drawn equipment.

In addition to the economy of approximately $800 per year, there are many other advantages in favor of the electric vehicle. Its life is from twice to three times that of a horse, its average working speed is more than double the speed of a horse, it is cleaner, and it requires less space.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

RADIATION FROM STRAIGHT AND HELICAL FILAMENTS

The Difference in Brightness of the Interior and Exterior Surface of the Helical Filament of the Gas-Filled Tungsten Lamp Explained

ATTENTION has often been called to the fact that the interior surface of the tungsten filament of an incandescent lamp has a higher intrinsic brilliancy than the exterior surface. In an investigation conducted by W. W. Coblentz at the Bureau of Standards and shortly to be published in Scientific Paper No. 300 an attempt was made to determine the reason for this difference.

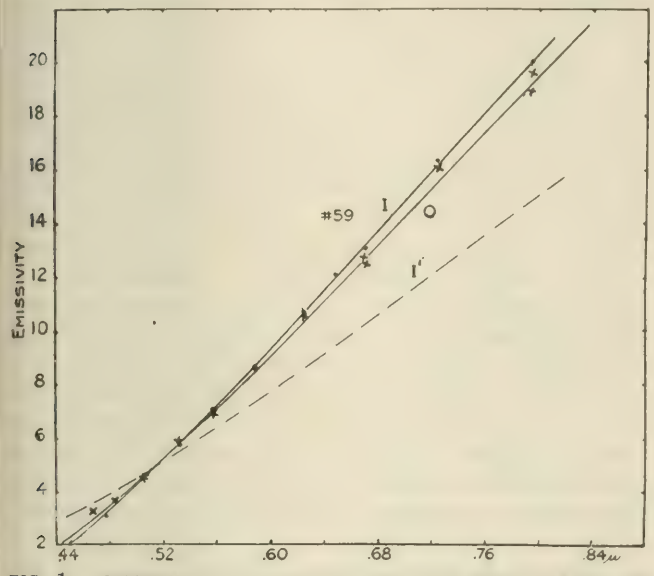


FIG. 1—DISTRIBUTION OF ENERGY RADIATED FROM INSIDE AND OUTSIDE OF HELICAL FILAMENT OF TUNGSTEN

Measurements made with a physical photometer showed that for the gas-filled lamp used the brightness of the interior was 1.87 times that of the exterior surface. This difference might be due to a difference in temperature or to a difference in quality of the radiation. The researches of Worthing and of Langmuir indicate that the difference in temperature could not be greater than 5 deg. C., whereas a difference of 200 deg. C. would be necessary to account for the observed difference in brightness.

If the increased brightness observed within the helix is due to blackening of the radiation, caused by reflections, then the spectral-energy curve should be much higher and unsymmetrical on the long wave-length side of the maximum emission, as compared with the spectral radiation from the outside of the turn of the helical filament, for it is well established (both experimentally and theoretically) that in metals the spectral-energy curve in the infra-red falls very much below the spectral-energy curve of a black body at the same temperature.

An examination of the spectral-energy curves from the two types of filament was undertaken to discover what difference in quality of radiation there might be. The first results of this investigation were published in the ELECTRICAL WORLD for 1914 (Vol. 64, page 1040). More accurate measurements have since been made.

One series of spectral-radiation measurements was made (with a vacuum spectrobolometer and fluorite prism) upon the helically wound filament and upon the hairpin filament set to the same emissivity, in the visible spectrum, as the outside of the turn of the helical filament. For this purpose the lamps were calibrated by operating the hairpin filament at its normal temperature (wave-length of maximum emission = 1.06 microns) and adjusting the current through the spiraled filament so that the outside of the surface of the turn had the same emissivity (in the visible spectrum), and hence the same intrinsic brilliancy, as the straight wire.

After reducing the energy curves to a common ordinate in the visible spectrum it was found that the area of the energy curve of the spiraled filament was only 7 per cent larger than that of the energy curve of the hairpin filament owing to "blackening" of the radiation in the region from 1 to 3 microns. While this proved, of course, the presence of some reflected light from within the helix, it did not account for the 90 per cent increase in the visible spectrum.

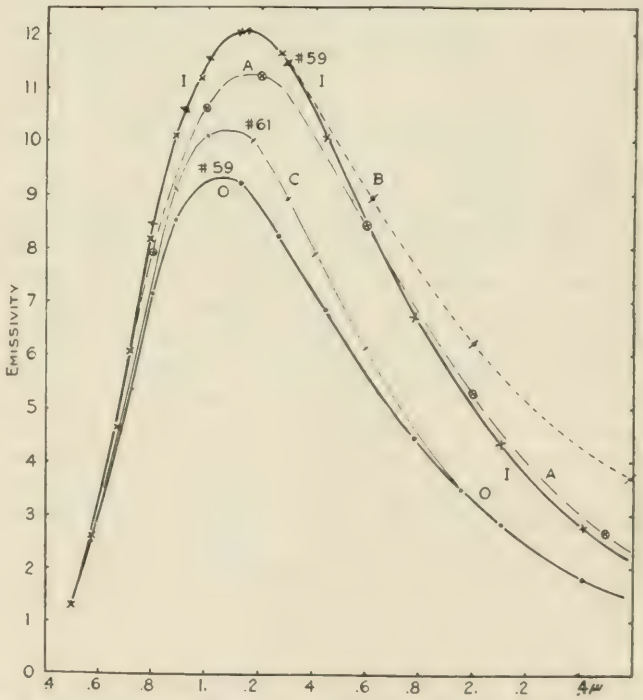


FIG. 2—RADIATION FROM INSIDE AND OUTSIDE OF HELICAL FILAMENT, FROM HAIRPIN FILAMENT AND FROM BLACK BODY

It was evident that in order to reach definite conclusions in this matter it would be necessary to determine the spectral-energy curves of a small area on the

inside and outside of the turn of the helix. This is a much more difficult problem than the one in which observations are made on the radiation from a long filament because of the reduction in energy and difficulty of projecting a satisfactory image of the spiral upon the spectrometer slit. However, during the past year the work was undertaken anew, using a mirror spectrometer, fluorite prism and bismuth-silver thermopile.

The data for the visible spectrum are given in Fig. 1. Curve I gives the distribution of energy radiated from the inside of the turn. Similarly, curve O gives the energy distribution of the radiation from the outside of the turn of the helical filament of the tungsten. In the latter the ordinates were magnified 2.2 times in order to superpose the curves, and hence the errors are magnified as compared with curve I. In each curve the data represent two distinct series of measurements. It is to be noticed that the two curves intersect at a very acute angle, which is so small that in the earlier tests the difference in the slope of the two curves was attributed to experimental errors.

The curve O indicates that the light emitted from the outside of the turn is relatively stronger in the blue than the light emanating from within the turn of the helix. That is to say, the light from within the helix is redder than that from the outside of the turn. This indicates that the increased brightness of the light from within the helix is caused by reflections which deplete the blue as compared with the red.

The distribution of the energy radiated from the inside of the turn of the spiral is shown in curve I of Fig. 2. Similarly, curve O gives the distribution of spectral energy radiated from the outside of the turn of the wire. Curve C gives the energy distribution of the hairpin filament when set to the same brilliancy as the outside of the turn of the helical filament. The lack of coincidence of curves O and C may be due to a slightly higher temperature (perhaps 10 deg.) of the hairpin filament.

Fig. 2 furnishes evidence which will account for the increased brightness of the inside surface on the basis of multiple reflection of light. On account of multiple reflections, the light from the interior should be redder and the light from the exterior relatively more intense in the blue. Making use of the known reflecting power of tungsten and applying the data to curve O on the assumption of three internal reflections, curve A is obtained, and this comes near to coincidence with the observed curve I for the radiation from within the helix. The reflection coefficients used were determined at room temperature, but it is well known that in the infra-red region the reflecting power of metals decreases with rise in temperature. Hence an application of a temperature correction would bring the computed curve closer to the observed curve.

The ratio of the areas of the curves I and O is 1.36, which indicates that the radiation from within the helix is more nearly like that from a black body, and as a result the luminous efficiency has been reduced by 36 per cent. In spite of this reduction in luminous efficiency there is a net gain in over-all efficiency due to the saving of energy usually lost by conduction and by convection. It is in order to effect the latter saving that the lamp filament is wound helically.

An examination was made of the light from the inside of the helix by using a Nicol prism. The regions of greatest brightness showed marked polarization of the light while that from the outside of the turn showed but little polarization. This would indicate that the polarization is due to the reflection of light from adjacent filaments.

Generation, Transmission and Distribution

Card Representation of Variation in Electrical Supply. In a recent issue of the *Revue Générale de l'Electricité* M. A. Ticier describes an ingenious method of representing the variations in central station supply. Each day the draftsman responsible for the tabulation of data relating to supply cuts out a sheet of cardboard the contour of which represents the scale of the load at each moment during the previous twenty-four hours. The contour cards thus prepared are mounted side by side, the complete set for a year being easily contained in a box 19.6 in. long and 7.9 in. wide (50 cm. by 20 cm.). In this way the station secures an exact representation of all load fluctuations. Such models are very useful not only in recording the variations in different seasons of the year and between different localities, but as presenting the results of any temporary breakdown. They have also furnished a useful lesson to those of the general public who would not otherwise have appreciated the fluctuations in load to which a station must accommodate itself and the resulting necessity for the several special methods of charging.—London *Electrician*, May 4, 1917.

Pressure Harmonics in Polyphase Systems and Windings.—B. HAGUE.—The conclusion of a long mathematical paper which is summed up by the author as follows: In the first part of the paper the general properties of harmonics in a polyphase system of pressures is discussed, while the second part deals with the effect thereon of the armature winding from which the polyphase system is derived. The purity or otherwise of the shape of the pressure wave of an alternator depends first on the harmonics present in the flux-density distribution of the machine and secondly on the "winding factor," a function of the arrangement of the winding on the armature periphery. The shape of the flux-density curve and the character of the polyphase system required from the winding being known, the tables in the concluding part of the article give at once the relative magnitudes of the pressure harmonics present in the emf. wave of the phases, the actual behavior of these harmonics in the system then following from the theory discussed in the first part, whether the phases of the winding be independent or interlinked.—London *Electrician*, March 30, 1917.

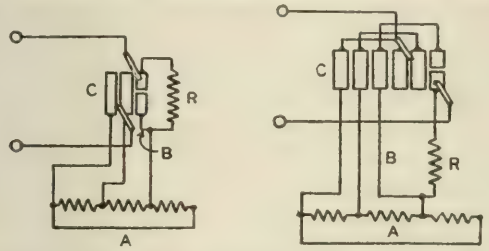
Installations, Systems and Appliances

Rating of Intermittent Motors of Large Output.—H. H. BROUGHTON.—When an intermittent motor follows a definite cycle of operations the root-mean-square (r.m.s.) method, or a modification of it, is perhaps the most convenient and reliable method of determining the rating to be given to the motor. The principle underlying the r.m.s. method is well known, but the application of the method varies with different firms. In consequence of this variation motors intended for the same duty may have very different name-plate sizes. The author gives as an example the motor required for driving a single-stage winder for a compound shaft, and shows that the three methods in use give widely

different results. Thus by the true r.m.s. method it is found that a motor of 667 hp. is required. Making allowances for the lower efficiency of the cooling surfaces during the reduced speed and standstill periods of the cycle, according to one method the result is a rating of 761 hp., and according to another method the rating is 741 hp. Since the duty is known and as the temperature rise is limited by the specification, this means that what one firm calls a 761-hp. motor another firm will call a 667-hp. motor. This tends to give the user the impression that he is getting better value for his money from one firm than from another, whereas the motors are alike. In view of the large number of motors in use rated in these varying ways it is recommended that the engineering standards committee frame rules so as to get rid of the feeling of uncertainty which prevails among those who use the r.m.s. method.—London *Electrician*, May 4, 1917.

Units, Measurements and Instruments

Direct-Current Watt-Hour Meters.—An English translation in abstract of a recent German article by R. Ziegenberg on improvements in direct-current meters of the Thomson type. The principal new features are the use of a flat-coil armature and an electromagnetic connection between meter and counting train. The chief reason why disk-type armatures have not hitherto gained much acceptance in this connection is that sector coils of too small an angle have been employed. Increasing the number of armature coils ren-



FIGS. 3 AND 4—SHUNT SECTIONS OF WATT-HOUR METER

ders the meter torque more uniform, but it also reduces the actual value of the torque. Current flow in adjacent radial conductors is in opposite directions (save in the radial conductors connected to the commutator bars undergoing commutation at the moment), and when such contraflow occurs in a single field, the net torque due to the conductors concerned is zero. The way to obtain a high driving torque from a light-disk armature of low resistance is to employ wide-angle sectors, and not more than two armature coils per field pole, but preferably fewer. Adjacent radial conductors are then in fields of opposite polarities when they are carrying current in opposite directions or, at the worst, one set of radial wires is in only a weak field of the same polarity (near the neutral zone). There is no particular mechanical difficulty in the construction of a disk armature, and, though the diameter of the latter be about 50 per cent greater than that of the alternative drum-wound armature, the construction as a whole is simpler and more compact. Furthermore, when using an electromechanical recording train, instead of directly geared mechanism, the total saving in spindle length is about 50 per cent. A four-pole field system and six-coil armature represents a satisfactory compromise between simplicity of construction, high driving torque and minimum dead weight, and resistance in peripheral copper (which is ineffective as regards driving torque). For driving the recording train a suitable source of variable current is needed. Figs. 3 and 4 show the shunt circuits only of a watt-hour meter with three-section armature *A* and three or six commutator bars *C* respectively. Fig. 3 corresponds to a two-pole field system, and Fig. 4 to a four-pole field system, each armature section in the latter case consisting of two coils opposite to each other on the armature and connected in series. [An ingenious method of effecting the connection between diametrically opposite commutator bars in this case (Fig. 3) is to form each pair of such bars from a single silver strip bent to U-shape. The limbs of the U form the two contact bars, while the end piece forms a perfect and reliable cross connection and, being drilled, serves also for attachment of the commutator elements to the spindle. Insulating disks are placed between the three U-pieces, which are spaced circumferentially equidistant on the spindle in building up a six-bar, three-section commutator.] It will be seen that in both cases one commutator bar is divided at the center of its length, and the brushes are set so that during each revolution of the armature connection is completed once through the direct lead *B* and once through the resistance *R*. When the latter is in circuit the potential difference across the brushes is increased by the amount *IR* (*I* being the armature current). This pressure increase suffices to actuate the recording magnet, which is connected across the brushes. For convenience and security, the commutator is made rather longer than usual when this arrangement is employed. A central insulating ring is added (primarily to support the inner ends of the divided bar), and one brush bears on the upper and one on the lower half of the commutator.—London *Elec. Rev.*, April 27, 1917.

Telegraphy, Telephony and Signals

Range of Wireless Stations.—R. CHENEVIX TRENCH.—The author introduces modifications into the Austin-Cohen empirical formula for the range of wireless stations so as to take into further account the effect of actual working conditions. The results obtained are illustrated by means of a number of curves, and the use of these curves is finally illustrated by the working out of certain empirical examples.—London *Electrician*, April 20 and 27 and May 4, 1917.

Miscellaneous

Blind Operators in the German Electrical Works.—According to the *Elektrotechnische Zeitschrift*, the authorities in Brandenburg have been endeavoring to find occupation for men who have lost their eyesight, and a number are now being employed in the Siemens-Schuckert Works. They are found quite serviceable for such work as gaging small parts, stamping numbers, packing small articles and testing fuse plugs acoustically. A room is given up to their working, and special precautions are taken in the location and fencing of machines and the elimination of sharp projections that might cause injury. The workers are paid a minimum wage of 28 pf. (about 7 cents) per hour, but some earn as much as 55 pf. (about 14 cents). It is stated that they prefer machine work to hand work, the noise of the machine being apparently a useful guide to the progress of each operation.—London *Electrician*, May 4, 1917.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

ELECTRICAL COUNCIL OF UNDERWRITERS' LABORATORIES

Second Meeting of New Organization in Chicago Well Attended and Much Business Affecting the Industry Is Transacted

The second meeting of the newly organized Electrical Council of the Underwriters' Laboratories was held at the principal office and testing station at Chicago on May 23 and 24. The following members attended:

Dana Pierce, chairman, New York; W. J. Canada, Bureau of Standards, Washington; H. H. Clark, Bureau of Mines, Pittsburgh; H. S. Wynkoop, Department of Electricity, city of New York; V. H. Tousley, Department of Electricity, Chicago; H. F. Strickland, Hydro-Electric Power Commission of Ontario, Toronto; L. A. Barley, Rocky Mountain Fire Underwriters' Association, Denver; R. C. Bird, Fire Underwriters' Electrical Bureau, New York; W. S. Boyd, secretary Western Association of Electrical Inspectors, Chicago; G. E. Bruen, Suburban Fire Insurance Exchange, New York; B. W. Clark, Public Lighting Commission, Detroit; W. Devereux, Philadelphia Fire Underwriters' Association, Philadelphia; J. C. Forsyth, New York Board of Fire Underwriters; B. H. Glover, Underwriters' Laboratories, Chicago; W. D. Matthews, Chicago Board of Underwriters, represented by F. G. Waldenfels; A. H. Miner, Underwriters' Bureau of New England, Boston; C. W. Mitchell, Board of Fire Underwriters of the Pacific, San Francisco; I. Osgood, Boston Board of Fire Underwriters; A. M. Paddon, Underwriters' Association of New York State, Syracuse; E. H. Sigison, Buffalo Association of Fire Underwriters; R. P. Strong, Louisiana Fire Prevention Bureau, New Orleans; A. G. Wilbor, Factory Insurance Association, Hartford, Conn.; F. A. Cambridge, city of Winnipeg, Manitoba, Canada; and F. O. Evertz, Department of Electricity, Columbus, Ohio.

The meeting was the first business session of the council. A lively interest was manifested by members in discussions of the scope of work and methods of procedure to be followed and the results to be sought in the elaboration of standards for construction of tests of electrical appliances and the regular work of examining and testing appliances under such standards.

An extension was made to the existing standards on metal molding to include surface metal raceways of one-piece design for use on two-wire circuits not exceeding 1320 watts capacity, and under this extension the new surface wiring raceway known by the trade name of "Wiremold" was listed as standard.

On the subject of fuses action was taken directing that the staff engineers undertake an investigation with the view to reporting to the Electrical Council for consideration at a future date suggestions for a possible set of specifications, method of testing, supervision and field follow-up of the details of design, construction and performance under test of so-called refillable fuses.

W. J. Canada of the Bureau of Standards and H. H. Clark of the Bureau of Mines made interesting statements concerning present tendencies in the construction of electrical devices from the viewpoint of accident hazards. A resolution was adopted calling attention of manufacturers to the desirability of paying more attention to these features in the design and construction of appliances.

The newly developed standard on armored cables was formally adopted.

Other subjects of discussion included construction and use of miniature motion-picture machines and their special films, electrical heaters and pressing irons, ground clamps, bell-ringing transformers, and disconnecting plugs or receptacles of large capacity for battery-charging circuits and similar uses.

PROMPT REPAIRS FOLLOW WESTERN CYCLONE DAMAGE

Transmission Lines Enable Central Illinois Public Service Company to Restore Electric Service in Cyclone District

Without calling in outside help, the Central Illinois Public Service Company, with headquarters at Mattoon, is rapidly repairing the damage to its property done by the cyclone which struck several Middle Western states May 26. While full details are not yet available, the Mattoon power house, the Kincaid power house and transmission lines both east and west of Mattoon were operating within a few hours after the storm had passed. A short line between Mattoon and Charleston which was partly destroyed is also being replaced rapidly. At the Charleston power house George Kilgore and Jesse Huddleston, engineer and fireman, were killed by the falling of the power house building. It is impossible as yet to arrive at a definite figure for the entire damage, but when the severity of the cyclone and the wide area covered are considered the Central Illinois Public Service Company is fortunate to have escaped with no greater loss. That the transmission lines could be repaired so rapidly is further evidence of the value of interconnected systems.

Jovians Promote Business

To promote the idea that business must continue actively during the war the Jovian Order has designed a large sticker for free distribution. The sticker is 2 in. in diameter and it is printed in red and white. Copies of the sticker in desired quantities will be forwarded upon receipt of a request by the Jovian Order, 1415 Syndicate Trust Building, St. Louis, Mo. As shown by the illustration, the sticker is distinctly Jovian in appearance.



DINNER POSTPONED BY ASSOCIATED MANUFACTURERS

On Account of National Registration Day, Meeting with Chairmen of the Sections Is Postponed to June 20

The proposed dinner by the board of governors of the Associated Manufacturers of Electrical Supplies to the chairmen of the various sections has been postponed from June 5 to the evening of June 20. The dinner will be at Delmonico's, New York, at 7.30 p. m. on the latter date. The change was made because June 5 is registration day under the universal service law.

The board of governors will meet at 2.30 p. m. on June 20 at the association offices.

The meeting of the fan motor section is to be held at the Marlborough-Blenheim Hotel, Atlantic City, N. J., on June 7 and 8 instead of at the offices of the association, New York.

The meeting of the lighting fixture section, scheduled originally for June 5, has been postponed to 2 p. m. June 8, at the association offices, New York.

ELECTRICAL SUPPLY JOBBERS PLAN TO INCREASE MEMBERSHIP

Conditions in Jobbing and Contracting Trade in New York City Revealed by W. L. Goodwin, Who Found Lack of Organization There

At the concluding sessions of the meeting of the Electrical Supply Jobbers' Association at Hot Springs, Va., last week, inspirational and thoughtful addresses were made by Arthur H. Elliott of Oakland, Cal., secretary of the Pacific Division of the association, and W. L. Goodwin, formerly vice-president and sales manager of the Pacific States Electric Company and now with the General Electric Company in New York City. The former told of electrical commercial conditions on the Pacific Coast in a very interesting manner. The latter spoke of his recent work among the jobbers and contractors in New York City, and the situation he unearthed came as a revelation.

Mr. Goodwin's reputation as an organizer and the excellent work he did for the electrical industry on the Pacific Coast are very well known, so that his remarks were listened to with a great deal of attention. On coming to New York, Mr. Goodwin delved deeply into the condition existing in the jobbing and contracting trade with a view to getting at the bottom of things. He discovered that there are forty-two jobbers in the greater city and only fifteen of these were members of the Electrical Supply Jobbers' Association. There are also fifteen contractor organizations, having a total membership of 310. However, the great bulk of the contractors and dealers in New York are not affiliated with any organization whatsoever, Mr. Goodwin having so far succeeded in discovering 6200 contractor-dealers. In his attempt to clean up the situation Mr. Goodwin has already succeeded in convincing the contractor-dealers of the necessity for organization, and many are now being enrolled in an association which meets weekly. Speaking specifically of jobbing, he emphasized the necessity of the association increasing its membership in Greater New York and harmonizing conflicting interests so as to bring order out of chaos and stabilize jobbing conditions.

At the final session the recommendation of the Atlantic division to reduce the initiation fee from $1,000 to $500 was passed, and it is the expectation of the division to strengthen its local organization.

BIRTHDAY TRIBUTE TO HENRY L. DOHERTY

Occasion of Forty-seventh Birthday Recognized by a Dinner Attended by 117 Members of the Organization

On the occasion of the forty-seventh birthday of Henry L. Doherty, 117 members of the Doherty organization met at an anniversary dinner in Delmonico's downtown restaurant, New York.

Dewey C. Bailey, Jr., of the firm of Frueauff, Robinson & Sloan; H. D. Williams of Buffalo and Leslie



BIRTHDAY DINNER TO H. L. DOHERTY

M. Shaw, former Secretary of the Treasury, paid tributes to the guest of the evening. Frank W. Frueauff was toastmaster. Peter D. Vroom, editor *Doherty News*, read a birthday ode, "When Time Wins Out."

OKLAHOMA MUNICIPAL ELECTRIC AND WATER PLANTS

Investigation by H. V. Bozell Shows That Twenty-two of Twenty-four Publicly Owned Combination Electric and Water Plants Showed Deficit

A report of an investigation of the principal municipally owned combination electric and water plants in Oklahoma shows that twenty-two out of twenty-four such enterprises finished the fiscal year ended June 30, 1914, with a deficit. The investigation was made by H. V. Bozell, director of the School of Electrical Engineering at the University of Oklahoma. The following summary of Mr. Bozell's findings is based on exhibits making provision for depreciation and interest on investment, but not including sinking-fund reserves:

City	Deficit	†Cents per Kw.-Hr.	City	Deficit	†Cents per Kw.-Hr.
Blackwell	$9,530	10	Perry	$9,889	15
Cherokee	*320	12½	Ponca City	15,715	10
Claremore	6,809	10	Purcell	9,041	15
Clinton	3,087	14	Sallisaw	12,273	15
Cordell	1,693	16	Sayre	4,548	15
Edmond	8,526	12½	Snyder	11,870	15
Fairview	17,424	12	Stillwater	*1,474	10
Kingfisher	5,106	10	Tonkawa	7,081	10
Marlow	5,162	12	Wagoner	24,604	Flat
Newkirk	9,043	10	Weatherford	5,709	10
Pawhuska	8,373	10	Woodward	6,793	10
Pawnee	1,998	10	Wynnewood	2,585	15

*Surplus. †Electric base rate.

Selling the Liberty Loan

Plans of Various Companies in the Electrical Industries to Help the Government Float the Bonds—Aggregate Subscription Enormous

FRANK A. VANDERLIP, president National City Bank of New York, listed in last week's issue of the ELECTRICAL WORLD four ways in which electrical companies can assist in placing the Liberty Loan, in substance as follows:

By subscribing themselves; by making it easy for employees to subscribe; by sending inclosures with all bills and notices; by giving facilities gratuitously to the local advertising committees.

In all of these ways electrical companies are giving service. Reports to the ELECTRICAL WORLD show that the response of the companies to the patriotic call is general and that there will be an enormous subscription from the different elements of the great electrical industries.

Among the subscriptions and plans, in addition to some mentioned in previous issues, are the following:

ARRANGEMENTS OF GENERAL ELECTRIC COMPANY

As stated in last week's issue of the ELECTRICAL WORLD, the General Electric Company has set aside $5,000,000 for the purchase of Liberty Loan bonds.

In addition to this investment, as a means of assisting the Liberty Loan, the company will purchase Liberty Loan bonds for its 79,000 employees on subscription, in all denominations, to any amount, and give the subscribers extended time in which to pay for them. The company will pay for its employees' subscription bonds as required by the government and will permit the subscribers to pay for them on the installment plan as follows: $50 bond, $1 per week; $100 bond, $2 per week; $500 bond, $10 per week; $1,000 bond, $20 per week; or by monthly payments of 10 per cent of subscription each month.

COMMONWEALTH EDISON COMPANY'S PLAN

The Commonwealth Edison Company of Chicago has bought $1,500,000 of the Liberty Loan bonds. It will offer bonds to employees on terms even more liberal than those allowed by the government. The bonds purchased from the company may be paid for under any of three plans:

Under plan No. 1 the employee will pay for any bond subscribed for by him in full on or before July 15, 1917, and the company will deliver to the employee the bond or bonds as soon as practicable after the payment of the par amount and interest thereon at the rate of 3½ per cent per annum from June 15, 1917, to the date of payment.

Under plan No. 2 the employee will pay for any bond subscribed for by him upon practically the same terms as those allowed by the government to persons subscribing for bonds directly and paying for them in installments—that is, 2 per cent on the date upon which the employee subscribes, which must be on or before June 15, 1917; 18 per cent on June 28, 1917; 20 per cent on July 30, 1917; 30 per cent on Aug. 15, 1917, and 30 per cent on Aug. 30, 1917. No bond or bonds will be delivered to the employee subscribing until the bond is fully paid for, and upon delivery of the bond an adjustment of interest will be made so that the employee will receive the same interest as he would receive if the bond were purchased directly from the government on the installment plan.

Under plan No. 3 the employee will pay for any bond subscribed for by him in installments as follows: 20 per cent on July 2, 1917, and 10 per cent on the first day of each of the next succeeding eight months, and

TO THE EMPLOYEES OF THE COMPANY

¶ Some time ago the Company addressed a communication to its employees, urging them to subscribe to the "Liberty Loan" of the United States Government, but at that time the exact terms of the loan had not been fixed. Now that all the details of the loan are known it seems desirable to supplement what was said in the former communication by a more definite statement.

¶ The bonds, payable to bearer and with interest coupons attached, will be issued in denominations of $50, $100, $500 and $1,000, will be dated June 15, 1917, and will bear interest at the rate of 3½ per centum per annum from that date, payable semi-annually on December 15 and June 15.

The bonds will mature June 15, 1947, but may be redeemed at the option of the Government on or after June 15, 1932, in whole or in part, at par and accrued interest. The bonds will contain provisions permitting them to be exchanged, par for par and without cost to the holders thereof, for any other bonds which the United States may subsequently issue during the present war bearing a higher rate of interest, and the bonds will be exempt, both as to principal and interest, from all taxation excepting inheritance taxation.

¶ Altogether the bonds are very attractive and, of course, an investment in them is the safest investment that can be made. Moreover, it is the patriotic duty of every citizen of the United States to share in the loan by purchasing as large an amount of these bonds as he is able to purchase.

¶ The Government, in issuing the bonds in denominations as low as $50, has made it possible for every employee of the Company to take at least one bond.

¶ Feeling confident that all its employees will want to do their full share in supporting the Government by purchasing as many bonds as possible, and desiring to lighten their burden as much as possible, the Company has decided to buy a large amount of the bonds outright and sell them to employees on terms even more liberal than those allowed by the Government. Bonds purchased from the Company may be paid for under three plans, which are fully explained on page 3 of this circular. An employee purchasing a $50 bond under Plan No. 3 is required to pay $10 on July 2 and $5.00 on the first of each of the following eight months, and on all payments the employee is allowed interest at the rate of 3½ per centum per annum.

¶ Every employee of the Company is requested to read this circular carefully and do all that he feels he can afford to do in purchasing bonds.

¶ The Company will be glad to give employees any further information that they may desire.

¶ Each employee is requested to return to the Company, without delay, a subscription for the amount of bonds desired. A form of subscription follows the statement of each of the three plans on page 3 of this circular. If the employee desires to subscribe, for example, under Plan No. 3, he should sign the form of subscription following the Statement of Plan No. 3 and return it to the officer of the Company to whom the subscription is addressed.

¶ *In order to insure their acceptance by the Company, the signed subscriptions of employees should be in the hands of the Company before noon on June 15, 1917.*

COMMONWEALTH EDISON COMPANY.

Samuel Insull

President.

the employee will receive interest upon all installments so paid at the rate of 3½ per cent per annum from the date of payment.

PLAN OF WESTINGHOUSE COMPANY

E. M. Herr, president Westinghouse Electric & Manufacturing Company, in a letter to the company's employees says:

"Every employee making a subscription to the Liberty Loan will not only secure a safe investment, but will perform a patriotic duty. It is the savings from to-day on that are going to supply the funds for the war because the savings of the past have already been invested, and if you are willing to save a small amount

each week and invest it in these Liberty bonds you will help at the source, which will be the most effective kind of financial assistance that can be given."

The terms of payment to employees will be as follows: For those who are paid semi-monthly 5 per cent of the face of the subscription will be taken from each regular pay, beginning with the last pay made in June. This will mean 10 per cent per month. For those who are paid only at the end of each month 10 per cent per month, beginning with the pay at the end of June. Adjustment of accrued interest at 3½ per cent will be made at time of final payment.

The Westinghouse Electric & Manufacturing Company has subscribed to $2,500,000 of the bonds.

Plan of Doherty Organization

Provisions have been made by Henry L. Doherty & Company whereby subscriptions of $20 can be made and receipts issued for this amount. Subscription may be made on the following bases:

Class 1 may pay immediately for their total subscriptions by having full payment accompany subscriptions. Bonds will be delivered to subscribers of this class as soon as issued by the government.

Class 2 may pay for their subscriptions by cash remittances on the dates stated by the government, which are as follows: 2 per cent June 15, 1917 (deposited when subscribing); 18 per cent June 28, 1917; 20 per cent July 30, 1917; 30 per cent Aug. 15, 1917; 30 per cent Aug. 30, 1917.

Class 3.—To enable employees to purchase amounts of United States Liberty bonds without imposing undue burdens upon themselves, Henry L. Doherty & Company have made arrangements that permit the purchaser to pay for bonds by the following installment method: Payments can be made in ten monthly or forty weekly installments, beginning June 15, through the payroll department or by check. Interest coupons as received will be credited to the account. Interest at the rate of 3½ per cent per annum will be charged monthly on unpaid balances. Payments may be made at a more rapid rate if the purchaser so desires.

New York Companies

Two hundred and fifty officials and department heads of companies of New York and vicinity held an enthusiastic meeting in the auditorium of the Consolidated Gas building on May 28 to inaugurate a campaign among employees on the Liberty bond. The companies were: Consolidated Gas Company, New Amsterdam Gas Company, New York Mutual Gas Company, Standard Gas Light Company, New York Edison Company, United Electric Light & Power Company, Westchester Lighting Company, Northern Westchester Lighting Company, New York & Queens Electric Light & Power Company, Peekskill Railway & Lighting Company, Yonkers Electric Light & Power Company, Municipal Lighting Company, and National Coke & Coal Company.

R. A. Carter, a member of the Liberty Loan committee, is chairman of the new committee, and F. W. Smith, vice-president United Electric Light & Power Company, is chairman of the sub-committee on promotion.

The plan enables the employee to purchase the bond on a deferred payment basis, $1 each week being deducted from his wages for each fifty-dollar bond purchased. If paid monthly, twelve monthly payments are made.

Edison Companies

Thomas A. Edison, in a statement to the Liberty Loan committee in New York, said:

"Pay what it's worth to you to be an American citizen. Figure it cold-bloodedly—if you are built that way. Consider what this country has meant to you, what it will mean to your children and to humanity in future generations. Then when you have thought over these things take pen in hand and do your bit for the Liberty Loan.

"From the highest to the lowest the uppermost idea should be how we can serve our common country. Some of us are going to make the supreme sacrifice of our lives on the battlefields of France and on the high seas. Some of us are working night and day to solve the scientific questions involved in conquering our German foes. Some of us are expected to do our bit on the farms or in the factories. There is a niche for almost all of us if we will but look for it with patriotic eyes."

Mr. Edison telegraphed to President Wilson that 200 clerks and workmen, organized by a German-American, had subscribed $30,000 to the loan and pledged themselves to raise $300,000 among their fellow-workmen in the Edison laboratories.

Liberty Bonds in New England

New England electrical interests are actively supporting the purchase of Liberty bonds. The Cumberland County Power & Light Company, Portland, Me., has put in effect a plan under which these bonds may be secured by installment payments at rates below the government installment schedule. The company advances money at 5 per cent interest and allows the employee to pay for the bonds in small monthly installments as follows:

Initial payments upon subscription of $5, and eleven installments to be paid the first day of every month beginning July 1, 1917, of $4.12 each on a fifty-dollar bond.

These amounts are based on 5 per cent interest on the balances, less the Dec. 15, 1917, coupon for 87 cents, which is retained as part of the interest. Under this plan the bond becomes the property of the employee upon payment of the last installment, due May 1, 1918.

Employees of the Pittsfield (Mass.) works of the General Electric Company subscribed to a larger amount of these bonds than any other concern in the city on a recent Liberty Loan day, and every one of the 250 employees of the Boston office of the company has subscribed to the issue.

Other Subscriptions Reported

Niagara Power Company, $1,500,000.

Public Service Company of Northern Illinois, $250,000.

Middle West Utilities Company, $100,000.

Western Union Telegraph Company, $2,500,000.

The Mutual Investment Credit Union of the Postal Telegraph Company has arranged to purchase bonds for employees, to be paid for in installments.

Montana Power Company, $500,000.

McGraw-Hill Publishing Company, Inc., publisher of the ELECTRICAL WORLD, $100,000.

Consolidated Gas, Electric Light & Power Company, Baltimore, $100,000, to be followed by another substantial subscription on behalf of employees.

REDUCED ELECTRICAL RATES IN PORTLAND, ORE.

Public Service Commission of Oregon Orders New Schedule, Although "Fair Return" on the Investment Is Not Being Earned

In a decision handed down on May 21, the Public Service Commission of Oregon ordered a reduction in the light and power rates of the Portland Railway, Light & Power Company.

This decision came as a result of a succession of investigations, valuations and hearings that have been held during several years past. The reduction on domestic lighting will amount to between 10 and 15 per cent, or from $60,000 to $65,000 a year, according to estimates made by the commission. If the Northwestern Electric Company, a competitive concern, meets the new rates, another $10,000 or $12,000 a year will be cut off from the domestic service charges in Portland.

The Portland Railway, Light & Power Company has announced publicly that it will accept the rates, although it is thought that they will work some hardship on the company. It is not yet apparent that the order applies to the rates of the Northwestern Electric Company.

As a general proposition, the commission decided that while the company at present was not earning a fair return on its investment, it felt that the main reason for this was the competitive condition that existed and, inasmuch as the Portland company was not meeting its competitor's rates, it could not put forward the excuse that it was not getting a fair return.

The total valuation of the property furnishing electrical energy owned by the utility as found by the commission amounts to $18,866,985, and during the last four and one-half years the return from utility operations has been 5.27 per cent. The average return for the last one and one-half years has been 4.16 per cent. The commission specifically states that this return is below that generally expected and received by investors in the Pacific Northwest.

The present lighting rate of the Portland Railway Company provides for a charge of 9 cents per kilowatt-hour on the first 6 per cent used of the monthly maximum consumption; 7 cents per kilowatt-hour is charged on the next 6 per cent used of the monthly maximum consumption, and 4 cents for all over that. As a general rule the number of kilowatt-hours used on the primary and secondary steps amounts to 10 or 15 for each step.

The new rates are as follows:

Residence Lighting

First 20 kw.-hr. per month for first 600 watts or less of installation, plus 1 kw.-hr. per month for each additional 30 watts of installation (in excess of 600) will be at the primary rate.

All consumption in excess of that at the primary rate will be at the secondary rate.

Primary rate—First 13 kw.-hr. or less, $1; excess over 13 kw.-hr., per kilowatt-hour, 7 cents.

Secondary rate—First 50 kw.-hr., 3 cents per kilowatt-hour; excess over 50 kw.-hr., 2 cents per kilowatt-hour.

Discount of 5 per cent will be given for payment within ten days from the date of the bill.

Minimum bill for lighting service, $1 per month; minimum bill for lighting service, in combination with heating, cooking and small domestic power loads having a possible connected capacity in excess of 2 kw., $2 per month.

Lighting equipment in excess of 1 watt per square foot of floor area in any room will not be considered in determining the size of the installation.

No heating, cooking or power appliances will be considered in the determination of installation in the lighting rate.

Commercial Power

First seventy-three hours' use per month of the consumer's demand will be at the primary rate. All consumption in excess of that at the primary rate will be at the secondary rate.

Primary rate—First 500 kw.hr., 5 cents per kilowatt-hour; next 500 kw.-hr., 4 cents per kilowatt-hour; next 4000 kw.-hr., 3 cents per kilowatt-hour; excess over 5000 kw.-hr., 2 cents per kilowatt-hour.

Secondary rate—For installations with a demand of 10 kw. or less—First 1000 kw.-hr., 2.0 cents per kilowatt-hour; excess over 1000 kw.-hr., 1.25 cents per kilowatt-hour.

For installations with a demand of from 10 to 20 kw.—First 2000 kw.hr., 1.75 cents per kilowatt-hour; excess over 2000 kw.-hr., 1 cent per kilowatt-hour.

For installations with a demand of from 20 to 35 kw.—First 3000 kw.hr., 1.5 cents per kilowatt-hour; excess over 3000 kw.-hr., 0.9 cent per kilowatt-hour.

For installations with a demand of from 35 to 50 kw.—First 6000 kw.-hr., 1.25 cents per kilowatt-hour; excess over 6000 kw.-hr., 0.8 cent per kilowatt-hour.

For installations with a demand of from 50 to 100 kw.—First 9000 kw.-hr., 1 cent per kilowatt-hour; excess over 9000 kw.-hr., 0.8 cent per kilowatt-hour.

For installations with a demand of over 100 kw.—First 10,000 kw.-hr., 1 cent per kilowatt-hour; next 20,000 kw.-hr., 0.8 cent per kilowatt-hour; next 40,000 kw.-hr., 0.7 cent per kilowatt-hour; next 80,000 kw.-hr., 0.6 cent per kilowatt-hour; excess over 150,000 kw.-hr., 0.5 cent per kilowatt-hour.

Minimum charge—$1 per month per kilowatt of demand; no minimum less than $1 per month.

Any consumer operating under a secondary rate schedule with demand limits higher than his actual demand, shall pay a minimum bill indicated by the lowest demand provided in that schedule.

When the demand of any consumer is determined monthly, the minimum bill shall be based upon the kilowatts of service capacity contracted for by the consumer.

Application of Secondary Rate

At the time of contract the consumer shall be placed upon that secondary rate which his load conditions indicate as the most economical. If, at the end of a period of twelve consecutive months of service thereafter, or a shorter period caused by the termination of a contract, it is found that a lower total charge for the period could have been obtained under any other secondary rate, the consumer shall be credited with the amount of the difference and shall be entitled to continue service under the more advantageous rate, subject to similar correction at the end of each succeeding period of twelve consecutive months of service thereafter, or after a shorter period caused by the termination of his contract.

As far as the power rates are concerned, they are substantially the same as the company now charges, and it is not believed that a material reduction in earnings will result.

The commission has criticised the company for certain practices in reference to combining light and power business on power schedules, and this will be investigated more extensively by the commission. Another subject of criticism was the application of wholesale rates to apartment house managers who in turn retail to their tenants, and in addition to the wholesale rate a further discount of 10 per cent has been given to the apartment house managers. The commission contended that the allowances to apartment house managers were too large and that if a wholesale rate was given the additional 10 per cent was not justified. This matter, it is understood, will be investigated by the commission as well as the question of adjusting commercial lighting rates.

FACTORY COST COMPARED WITH ELECTRIC LIGHTING

Interesting Conclusions in Discussion of Ward Harrison Before Chicago Section, Illuminating Engineering Society

BY J. R. CRAVATH

At the last meeting of the Chicago Section, Illuminating Engineering Society, Ward Harrison of Cleveland gave figures on factory lighting and modern possibilities in that line which should furnish food for thought to all owners of growing industrial plants and illuminating men as well.

A number of typical Cleveland factories were investigated and it was found that the daylight illumination values were surprisingly low at the actual points of work as compared with the values which can be obtained very near windows, which latter are often quoted as daylight values. While values of several hundred foot-candles were common very near windows, the measurements taken by Mr. Harrison and his associates at actual points of work showed that in the main the intensities were from 1 to 20 foot-candles, the average of the minimum and maximum values being 4 and 18 respectively. Now with light flux produced as cheaply as it is with modern lamps, artificial illumination of the same order of intensities as such daylight can be produced at a very reasonable expense. In some respects this artificial illumination could be made superior to daylight because it could be distributed so much more uniformly. As to diffusion and freedom from glare it would be somewhat inferior. Averaging advantages and disadvantages it would compare very favorably with daylight.

Operating Factory with Two Shifts

Mr. Harrison then brought up the old question of the relative economy of operating a given factory with two shifts as against a factory of double the size with one shift, daytime only. However, he introduced into the problem the new elements made possible by the modern development of the lighting art. It has been general practice in the past, when the output of a manufacturing plant was to be increased permanently, to increase the buildings, machinery and equipment rather than to work the same equipment more hours per day. The reason for this has been prejudice against night work and the general experience that night-shift laborers do not turn out as much work as those on day shift, presumably because artificial lighting has not been as good as daylight and because restful sleep is more difficult to obtain in daytime than at night. As far as the factory lighting is concerned it is not difficult to show that conditions can be made as good as by daylight.

Figures prepared by Mr. Harrison on the rental value of factory and equipment for increasing the capacity of a factory, as against increasing the output by night work, showed that the cost of lighting with off-peak electrical energy, with modern lamps and costs of production, would be considerably less than the rent or fixed charges on additional factory space and equipment for a factory about to enlarge its output. The old argument that lighting at night is not so good as by day was made necessary by old costs of light and no longer holds.

The objection of difficulty of sleeping in the daytime is then the principal argument left. As to this Mr. Harrison offers the suggestion that the entire night is not now used for sleeping by the average man, and that by an entire rearrangement of hours of work and recreation both shifts of operators in a factory operating two shifts might have nearly as many of the hours of darkness for sleeping purposes as are now enjoyed, and some of the hours of recreation and amusement would be changed so as to throw them more into daylight and also afford a better load factor for places of amusement and recreation as well as for the factory equipment.

ANNUAL CONVENTION OF OKLAHOMA ASSOCIATION

Value of and Necessity for Publicity and Education of the Public in Utility Problems Is Recognized

The sixth annual convention of the Oklahoma Gas, Electric & Street Railway Association was held at the Lee Huckins Hotel, Oklahoma City, Okla., on May 10, 11 and 12.

President C. H. Kretz called attention in his annual address to the value of and necessity for publicity and education of the public in utility conditions.

A. R. Sanson, in his paper on "Small-Plant Troubles," enumerated the many operating and public policy problems incident to small-plant operation. One great source of annoyance mentioned was poor wiring of houses in the small towns, forcing the utility to operate a house-wiring department. He also mentioned the difficulties of small utilities in keeping records required by the Corporation Commission. Good accountants are required and cannot be obtained at the salaries the small plants can afford.

Discussion brought out the fact that some small plants eliminated defective house wiring through incompetent men by having a wiring firm in a larger city do the work.

D. E. Nims, Oklahoma Gas & Electric Company, in his paper on "Industrial Power," advocated talking from the standpoint of so much per unit product of the factory and not in kilowatt-hours, maximum demand. etc. He told of securing business by solving problems of manufacturers.

On Friday morning, May 11, W. B. Clayton, General Electric Company, made an address on "Meters and Meter Testing." One town was losing $144 a month from slow meters in the business section alone. He said that 95 per cent of installed meters will run slow and not fast after a few years' service, and that the expense of buying test equipment will be more than recouped through increased revenue.

Corporation Commissioner Campbell Russell made an address in the afternoon on "Protection of the Utilities in Their Legitimate Investments and Business." He said that speculation had no place in a public utility, and that the commission was for the protection of the utility as well as the public.

J. W. Shartel in the discussion brought out points in which the utilities should be protected. They should not be required to file so many reports containing the same material with so many regulating bodies.

At the annual banquet on Friday evening J. W. Shartel was toastmaster. Talks were made by several

managers on the value of organization and education for public utilities.

On Saturday morning, May 12, Prof. L. C. Lichty read a paper on the "Burning of Coal Under Boilers," and brought out the fact that the United States Bureau of Mines had found that for complete combustion of coal the same amount of air must be put on top of the fuel bed as is forced through the grates.

E. W. Pembleton read a paper on the extraction of gasoline from natural gas and its effect on the B.t.u. content.

The following officers were elected: President, F. D. Shaffer, Chickasha Gas & Electric Company; first vice-president, J. F. Owens, Muskogee Gas & Electric Company; second vice-president, W. H. Vorce, Choctaw Light & Power Company, McAlester; secretary-treasurer, Prof. L. W. W. Morrow, University of Oklahoma, Norman. Directors: F. W. Insull, Public Service Company, Tulsa; R. K. Johnson, Washita Electric Company, Pauls Valley; C. H. Kretz, Okmulgee Ice & Light Company; R. E. Whitenack, Kingfisher light and water plant.

ARKANSAS UTILITY OPERATORS HOLD TENTH CONVENTION

Attendance at Pine Bluff Meeting Larger than at Past Conventions—S. E. Dillon the New President

The tenth annual convention of the Arkansas Association of Public Utility Operators was held at the Hotel Pines, Pine Bluff, Ark., on May 16-18. The attendance surpassed all past conventions in the number of companies represented, thirty-five public utility plants in the State having delegates at the meeting.

The following papers were read: "Commercial Efficiency," by P. T. Phillips, Little Rock Railway & Electric Company, Little Rock, Ark.; "The Electric Range and Its Advantages for Increasing the Central Station Load," by C. A. Meier, Westinghouse Electric & Manufacturing Company, St. Louis, Mo.; "The Application of Electric Drive to Arkansas' Chief Industries," by E. W. Smith, General Electric Company, St. Louis, Mo.; "The Increase of Taxes on Corporations," by S. E. Dillon, Citizens' Electric Company, Hot Springs, Ark.; "Relations of the Jobber to the Central Station," by L. S. Hunt, Commercial Electric Supply Company, St. Louis, Mo.; "Alternating-Current Motors," by Lee B. Roseborough, Wagner Electric Manufacturing Company, St. Louis, Mo., and "Lightning Arresters as Applied to 2300-Volt Distribution Systems," by J. L. Longino, Arkansas Light & Power Company, Arkadelphia, Ark.

The officers elected for the new year are: President, S. E. Dillon, general manager Citizens' Electric Company, Hot Springs, Ark.; first vice-president, E. T. Reynolds, manager Arkansas Light & Power Company, Paragould, Ark.; second vice-president, P. T. Phillips, engineer Little Rock Railway & Electric Company, Little Rock, Ark.; secretary-treasurer, R. B. Fowles, auditor the Pine Bluff Company, Pine Bluff, Ark.

The next meeting will be held in Hot Springs, Ark., in 1918 at a date to be selected by the executive committee. Dean W. N. Gladson of the electrical department of the University of Arkansas was elected to honorary membership.

WESTINGHOUSE COMPANY DOES A LARGE BUSINESS

Value of Unfilled Orders for Regular Products of the Company on March 31, 1917, Increased 80 Per Cent Over Last Year

Sales billed and net income of the Westinghouse Electric & Manufacturing Company in the fiscal year ended March 31, 1917, were greatly in excess of any previous year in the history of the company. Sales billed amounted to $89,539,442, as compared with $50,269,240 in the preceding year, an increase of $39,270,202, or 78.1 per cent.

The value of unfilled orders on March 31, 1917, for the regular products of the company was $39,776,739, as compared with $22,097,995 on the same date last year, a gain of $17,678,744, or 80 per cent.

Report of Chairman Tripp

In the annual report to stockholders Guy E. Tripp, chairman board of directors, said in part:

"The completion of large orders for munitions contributed largely to the results for the year, although sales billed and net income for the regular products of your company show large increases over any preceding year.

"The amount of taxes, federal, state and county, paid or accrued during the year is in excess of $2,000,000.

"Owing to a strike of the employees the main works of the company at East Pittsburgh were closed from April 21, 1916, to May 16, 1916.

"The net income for the year, $18,079,889, increased the surplus of $9,246,707 as of March 31, 1916, to a gross surplus of $27,326,596.

"Dividends were declared for the full year at 7 per cent per annum upon the preferred stock and upon the common stock at the rate of 6 per cent per annum for the first and second quarters and at 7 per cent per annum for the third and fourth quarters.

"For the purpose of increasing the reserve account $5,000,000 has been appropriated from surplus.

"The net surplus as of March 31, 1917, is $18,105,298, as compared with $9,246,707 on March 31, 1916.

"The property and plant account shows a net increase during the year of $1,499,805. This increase is almost wholly accounted for by expenditures for real estate and buildings and equipment of a factory at Milwaukee for the manufacture of incandescent lamps, real estate at Trenton, N. J., for another lamp factory, and real estate at Essington, near Philadelphia, Pa., for a large extension of your general manufacturing facilities. This latter tract of land comprises approximately 500 acres, and the erection of buildings on the site is now in progress.

"Depreciations of buildings and equipment and expenditures for extensions, renewals and betterments of plant and equipment were written off to the amount of $6,473,066.

"Investments in other companies increased $2,493,825, which chiefly represents additional shares of the Electric Properties Corporation and Canadian Westinghouse Company acquired during the year.

"The current and working assets, viz., cash, accounts and notes receivable and inventories, reflect unusual increases due to the greatly increased volume of business completed during the year and orders in hand.

"In addition to current collections the item of ac-

counts receivable will be reduced by a cash payment of more than $11,000,000 from the British government on account of munitions, which will be due on or before July 10 next.

"By the sale in February, 1917, of $15,000,000 additional common stock and the conversion of more than $3,000,000 bonds, the total outstanding stock was increased during the year to $74,812,650. The balance, $2,247,000, of the convertible sinking fund 5 per cent bonds issued in 1915, outstanding on Oct. 1, 1916, were called for redemption on Jan. 1, 1917. All but $71,000 face value of these bonds were converted into common stock before the redemption date.

"Your company has outstanding bank loans to the extent of $15,100,000. These loans were made necessary by the large amount of capital invested in working and current assets, including the amount due from the British government, reference to which has been made above, and the maintenance of a large cash balance in excess of $12,000,000.

"This report does not include the operations of the Westinghouse Machine Company nor are the assets and liabilities of that company included in the balance sheet. By the acquisition during the year of additional shares of stock of the machine company, your company now owns more than 98 per cent of the outstanding share capital of that company. A plan for the merger of the machine company with the Westinghouse Electric & Manufacturing Company is now under consideration.

MUNITIONS ORDERS

"In the manufacture of Russian rifles for the British government, the New England Westinghouse Company encountered serious delays and difficulties, through various causes, most of them beyond its control or responsibility. In October, 1916, the Anglo-Russian Commission located in New York recognized the company's claim for extensions of the original dates of delivery and approved an arrangement based on the new dates proposed by the company. Early in the present year, however, the New England company was advised that this arrangement could not be consummated and that a new arrangement was desired. As the result of further negotiations a modified agreement has now been made under which the initial order has been reduced to 1,000,000 rifles at an increased price per rifle and the time of delivery materially extended. The British government is, however, given an option to increase the number of rifles to the original number, viz., 1,800,000, in which case the original price is to be reinstated.

"The new contract also provides that the British government shares equally with the New England company in all profits and also guarantees your company and the New England company against any loss exceeding $5,000,000 in any contingency whatever under this contract or as the result of the investment in connection therewith. In view of the unusually prosperous year just closed, your directors have thought it a conservative policy to set aside this amount in a special reserve. As this amount is included in the advances already made the New England Westinghouse Company, and as the British government will advance all needed funds hereafter, there will be no further drafts upon the cash resources of your company on account of the rifle contract.

"With the exception of the contracts with the British government for the manufacture of Russian military rifles, which are being carried out by the New England Westinghouse Company under a modified contract hereinbefore referred to, the company has no uncompleted munitions contracts for foreign governments on its books, all such contracts having been completed or canceled.

"The large increase in the volume of business done during the year called for unusual effort on the part of the officers and employees of your company, and the board of directors has pleasure in acknowledging the enthusiastic service and co-operation that made possible the satisfactory results obtained."

Earnings for three years compare as follows:

Year Ended March 31	1917	1916	1915
Gross earnings—sales billed..	$89,539,442	$50,269,240	$33,671,485
Cost of sales—cost of manufacture, including depreciations of property and plant and all selling, administration and general expenses and all taxes.....	72,077,752	40,839,344	31,109,073
Net manufacturing profit....	$17,461,690	$9,429.896	$2,562,412
Other income	1,386,547	1,106.730	1,158,527
Gross income from all sources.	$18,848,237	$10,536,626	$3,720,939
Less—inventory adjustments, inactive apparatus and material scrapped, bad accounts and extraordinary items of expense charged to income	*	*	442,277
Net income applicable to interest and other charges...	$18,848,237	$10,536,626	$3,278,662
Interest charges	768,348	869,837	1,268,918
Net income available for dividends and other purposes..	$18,079,889	$9,666,789	$2,009,744

*Included in cost of sales.

ELECTRIC VEHICLE SECTION MEETING IN CHICAGO

Announcement of Commonwealth Edison Garage Plan and Results of Successful Parking Arrangement Shown—D. M. Simpson Elected Chairman

The feature of the annual meeting of the Chicago Electric Vehicle Section of the National Electric Light Association was the announcement by E. W. Lloyd, general contract agent Commonwealth Edison Company, of the electric-truck garage plan reported on page 1080 of this issue.

W. P. Kennedy, consulting engineer, New York, in speaking of the plan said the impression is abroad that motor trucks have superseded many more horses than they actually have displaced. Only 2 to 3 per cent fewer horses are in use by Chicago trucking interests to-day than there were several years ago. It is true that the increase in business has been taken care of largely by motor trucks, but there are still in the city between 60,000 and 70,000 horses, which might better be replaced by electric vehicles. The time to enter upon such a garage venture is particularly opportune since experience shows that the war has increased electric vehicle business in England 500 per cent. Mr. Kennedy said that he considered the opportunity before manufacturers of industrial electric trucks and tractors to be almost without parallel in the history of any business.

George B. Foster, retiring chairman of the section, spoke highly of the work of committees and praised particularly the results obtained under the electric vehicle parking service. This service handled 3235 cars in 1916, and thus far in 1917 the total is 1221; there

have been practically no accidents worth mention. The average operating expense in connection with the service, which is borne by association members interested, is $72.86 a month.

These officers were elected for the ensuing year: Chairman, D. M. Simpson, General Lead Batteries Company; vice-chairman, W. F. Bauer, Edison Storage Battery Company; secretary, L. C. Spake, ELECTRICAL WORLD.

CHICAGO SERVICE PLAN FOR ELECTRIC PASSENGER CARS

Garage Man Offers Unlimited Mileage Arrangement with New Electric Vehicles—Advantages for the Customer

Harry Salvat of the Fashion Automobile Station, Inc., Chicago, agent for the Milburn electric car, has developed a battery rental and exchange plan in connection with the sale of new cars. This was announced almost simultaneously with the Commonwealth Edison Company's trucking-service plan, but there is no direct relation between them.

Under the Fashion garage plan the Milburn car,



ANNOUNCEMENT OF BATTERY PLAN FOR ELECTRIC CARS

minus the battery, is sold for $1,485. The battery for the car is rented for $15 a month plus $1 per battery change. The cars are equipped with a specially designed battery rack so that the battery may be changed in two and five-tenths minutes, or in less time than it takes to fill a gasoline tank. Changes can be made at any of five stations strategically located in Chicago and its suburbs.

This plan supplies the user with unlimited mileage from a standard battery; it relieves him of investment in a battery; it assures him that his battery will always be under expert care and, should he be out of the city, it permits him to eliminate battery costs and depreciation during periods longer than one month.

ELECTRIC TRUCK SERVICE OF COMMONWEALTH EDISON

Chicago Company Inaugurating a System for Garaging, Charging and Completely Maintaining Electric Trucks on an Annual Contract Basis

The Commonwealth Edison Company, Chicago, has decided to offer complete garage and maintenance service for commercial electric vehicles at specific rates per annum on long-term contracts. This service will be so comprehensive as to cover all the doubtful elements of transportation expense, and will enable a customer to determine all operating costs in advance.

The service will cover first the ordinary garaging or storage charges, including cleaning and care of vehicles. Second, it will include energy for battery charging. It will provide for maintenance or upkeep of the wearing parts of the vehicle, including tires, battery and mechanical parts. "Maintenance" will also cover minor repairs, painting the body at specified intervals, retouching and varnishing at intermediate times. The owner will pay the driver's wages, insurance and the cost of damage by accident.

Only new trucks will be accepted for the service. The rate for each size, equipped with standard battery, will be a flat figure per annum, payable monthly in equal amounts. Trucks equipped with batteries of sizes larger than standard will be charged for at proportionally higher rates. The working radius of the truck which the flat rate is intended to cover is that amount of service which can be procured from one charge of the battery daily. If the work to be done should be greater than this and should require additional charging during the day, or the use of extra batteries, the flat rate will be increased accordingly. Thus the whole system, while based on a flat rate for minimum service, is really a measured-service scheme, depending upon requirements of the user.

The Commonwealth Edison Company is having a large service station erected at Jackson Boulevard and Morgan Street, close to the trucking center just west of the "loop" district. This station should be ready by the end of the summer, and it will render service to 100 electric trucks. Should this space be taken up quickly, additional space will be provided in the same neighborhood for a further trial of the proposed service. The company is planning to establish other stations as the project develops, beginning with one on the north side and one on the south side of the "loop" district, if the first undertaking demonstrates a satisfactory demand for this type of service.

The company will employ a specially qualified staff to develop and conduct this service. Salesmen, supplemented by the service of transportation engineers, will be able to present to prospective customers having large horse-truck equipment facts and figures which will fully satisfy them as to their present expense, and will present subsequent statements which will prove the reduced expense to be effected by substituting electric trucks.

Considerable research work has been done to determine size, location and other characteristics concerning the principal horse-truck equipment now in Chicago. By an intensive campaign the company will be able to show local truck owners how to purchase electric trucks from the manufacturer and operate them at a saving over present equipment.

DISTRIBUTION OF NIAGARA, LOCKPORT & ONTARIO POWER

Company Sells 47 Per Cent to Distributing Properties, 30 Per Cent to Industrials and 23 Per Cent to Railways

Distribution of the power sales among different classes of consumers is shown by the annual report of the Niagara, Lockport & Ontario Power Company for 1916. Reaching a present population of 1,400,000 in a rapidly growing territory, the sales of the company were distributed:

To corporations distributing electricity in Oswego, Syracuse, Rochester, Auburn, Geneva, Batavia, Lockport and numerous smaller municipalities and municipal lighting plants, 47 per cent.

To industrial companies, 30 per cent.

To electric railways operating 1100 miles of track in cities and suburban sections of western and central New York, 23 per cent.

Fred D. Corey, the president, says in the report:

"Having in mind the desirability of a well-balanced power supply, the directors have from time to time by purchase or lease added to the company's sources of supply. At present the power sold comes from four different generating stations, all operating in parallel and located at widely separated points within or adjacent to the territory served by the companies.

PACIFIC GAS & ELECTRIC TO DEVELOP PIT RIVER POWER

Five-Year Construction Program, Involving $17,500,000 and 180,000 Hp., to Be Handled by Large Company

The Pacific Gas & Electric Company announces that it will take over at once construction work on the Big Bend project on Pit River, developing rights secured recently from the Mount Shasta Power Corporation. The power house site is about 60 miles (96.6 km.) northeast of Redding and is served by drainage basins of 4385 square miles (11,357.15 square km.), from which the minimum flow is about 2400 second-ft. (67.2 cu. m. per second). The head utilized will be about 940 ft. (282 m.), and at minimum flow it is expected that 180,000 hp. will be developed. The installed capacity is to be 200,000 kw.

The construction involves a diversion dam which will divert the stream into a 7-mile (11.27-km.) conduit, of which 6 miles (9.36 km.) will be in tunnel and one mile (1.61 km.) in reinforced-concrete pipe. The tunnel is to have a grade of 1 in 1000 and will be kept under a head of about 50 ft. (15 m.). Small storage capacity sufficient for daily load fluctuations will be provided in the forebay.

The present construction schedule calls for the following expenditures: First year, $300,000; second year, $1,500,000; third year, $2,000,000; fourth year, $7,000,000; fifth year, $6,700,000; total, $17,500,000. Waterwheels and generators are to be purchased last so as to afford the advantage of such improvements in design as may take place.

This year's work is to be a continuation of the two exploration tunnels begun by the Mount Shasta Company. These tunnels are now 7 ft. by 7 ft. (2.1 m. by 2.1 m.) in section. They will probably be advanced as the top headings for a larger bore. A tunnel 20 ft. (6 m.) in diameter is to be the size for supplying the plant now proposed. Voltage of the transmission line to connect with the company system has not been decided but will not be less than 110,000 volts. The State Water Commission estimates a total of 412,000 hp. available on the Pit River without storage.

CAPITAL REQUIREMENTS NOT TO BE DIMINISHED

Vice-President Hockenbeamer of Pacific Gas & Electric Company Discusses Construction Outlays, Higher Costs and Rates

At the recent annual meeting of stockholders of the Pacific Gas & Electric Company, San Francisco, Cal., A. F. Hockenbeamer, vice-president and treasurer, showed that, notwithstanding the cessation of the temporary exposition revenue of 1915, the gross business in 1916 increased $85,000 over the total of 1915.

In speaking of the fact that expenses and taxes in 1916 increased $353,000, causing a decline in net operating revenue of $138,000, Mr. Hockenbeamer said:

"We have selected twenty-nine representative articles that are in common use in our gas and electric departments, and taking the actual quantities of these bought by us in 1916 and applying to these quantities prices prevailing before the outbreak of the war, prices a year ago and prices now prevailing, obtained the following results: Cost at prices in January, 1914, $617,000; cost at prices in January, 1916, $796,000; cost at prices in January, 1917, $1,242,000. This excludes oil, which has gone up more than 50 per cent and at present prices will cost us about a million dollars more in 1917 than it cost in 1916.

"It will be noted from the foregoing that between January, 1914, and January, 1916, there was an average advance in the cost of materials of 29 per cent, and between January, 1916, and January, 1917, a further advance of 72 per cent, the total advance for the entire period of three years being 101 per cent. Since this compilation was made prices have gone up still more. There is no public regulation to limit the prices and profits which we are compelled to pay for supplies.

"In 1910 our taxes were $383,000. In 1916 they were $973,000, an increase of $590,000, or 154 per cent in five years. During this period gross revenues increased 35 per cent and net revenues 50 per cent. During the present year there will be a further increase in our taxes, irrespective of any increase brought about by larger earnings or by 'war taxes.'"

Mr. Hockenbeamer expressed confidence that the growth of the future will fully equal that of the past, and that the new money invested in the business during the last five years, pretty close to $25,000,000, is a fair measure of the additional investment that will have to be made in the next five years.

Taking only the more important items of work, the company has to-day more than $2,000,000 of construction under way. Mr. Hockenbeamer added:

"In the circumstances of higher taxes and higher costs for practically everything that enters into their products, including new capital, it is essential that utilities be permitted to recover these greater outlays in their rates unless development is to be arrested or brought to a standstill."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Commission Not Bound to Acquire Information Entirely from Evidence Produced Before It.—The Public Service Commission as an administrative and regulative body is not bound to acquire its information concerning all matters involved in a proceeding before it entirely from the evidence of witnesses or other evidence produced before it, but may take into consideration the results of its general investigations, general information upon a given subject within its powers, and all matters which affect the matter and concerning which it must determine the facts, the Supreme Court of Washington held (163 P. 1143).

Power of Freeholders in Relation to Public Service Commission.—A law authorizing the freeholders of certain cities to form and adopt a charter for their government does not authorize them to assume all powers the State may exercise within the city limits, but only those powers incident to the city as a municipality or which concern matters of purely local government, and the St. Louis charter clauses empowering the city to regulate the construction, maintenance, etc., of public utilities, to compel reasonable extensions of facilities for such service, giving the Board of Aldermen full power to regulate charges and establish necessary requirements to secure efficient use, service and products of public utilities, are invalid as conflicting with the powers given the Public Service Commission over public utilities wherever they may be situated in the State, according to the Supreme Court of Missouri (192 S. W., 958).

Use of Public Lands for Electrical Generating Purposes.—No right to use the public lands as sites for works employed in generating and distributing electric power can be founded upon the provisions of the act of March 3, 1891, relating to rights-of-way for ditches, canals and reservoirs for the purpose of irrigation, and calling for the filing of maps of location which are to be effective and noted upon the public records when approved by the Secretary of the Interior, or upon the provisions of the act of May 11, 1898, permitting rights-of-way "approved" under the earlier statute to be used for certain additional purposes, including the development of power "as subsidiary to the main purpose of irrigation," where no maps of location have been filed or approved and where the rights-of-way are not claimed merely for ditches, canals or reservoirs, and irrigation is neither the sole nor the main purpose for which any part of the asserted rights-of-way is used, it was held by the U. S. Supreme Court (37 S. C., 387). Those who have not conformed to the requirements of the act of Feb. 15, 1901, and have received no permission or license under it can claim no right under such statute to use the public lands as sites for works employed in generating or distributing electric power. The right to use the public lands in forest reservations as sites for works employed in generating and distributing electric power some of which is sold in adjacent or distant towns, or to those who are engaged in mining or milling or in reducing ores, was not given by the act of Feb. 1, 1905, which provided for rights-of-way in forest reserves for ditches, canals, reservoirs and the like (making no provision for power houses, transmission lines or subsidiary structures) "for municipal or mining purposes and for the purposes of the milling and reduction of ores." No understanding and agreement with the officers or agents of the United States can estop the government from questioning the rights to use the public land in forest reservations as sites for works employed in generating and distributing electric power. The United States is not estopped to question the right to use public lands in forest reservations or sites for works employed in generating and distributing electric power because the agents in the Forestry Service and other government officers and employees, with knowledge of what the power companies were doing, not only did not object thereto but impliedly acquiesced therein until after the works were completed and put into operation. Those using the public lands in forest reservation as sites for works employed in distributing electric power without seeking a license or permit under the act of Feb. 15, 1901, or conforming or offering to conform to all lawful administrative regulations promulgated under that statute, are not in a position to complain that some of such regulations go beyond what is appropriate for the protection of the interests of the United States and are unconstitutional, unauthorized and unreasonable. Congressional enactments providing or recognizing that rights to the use of water in streams running through the public lands and forest reservations may be acquired in accordance with local laws have no application to a controversy over the right to use the public lands and forest reservations as sites for works employed in generating and distributing electric power. Appropriate compensation to the United States for the past use and occupancy of public lands in forest reservations as sites for works employed in generating and distributing electric power without the consent of the United States and contrary to its laws should be included in a decree enjoining such use, and should be measured by the reasonable value of the occupancy and use, considering its extent and duration, and not by the scale of charges fixed by administrative regulations promulgated by the act of Feb. 15, 1901, for use and occupancy under a license or permit granted under that statute.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Bonds Limited to Amount of Capital.—In a decision affecting the Kansas City Light & Power Company, the Missouri Public Service Commission holds that manufacturing and business corporations, including public service utilities owning and operating electric light and power plants, are within the terms and subject to the provisions of Section 2981, R. S. 1909, in so far as said section limits the bonded indebtedness of a corporation to the amount of the authorized capital.

Basis of Indiana Purchase.—The Indiana Public Service Commission has decided a proposed purchase and sale case, involving five utilities of southern Indiana. The commission denied the petition of the Indiana Power & Water Company, Edwardsport, Ind., to buy two electrical plants at Vincennes, Ind., one at Dugger, Ind., and one at Petersburg, Ind., through the issuance of $776,000 securities. The commission engineers had reported the present value of the physical properties of the companies as below that of the securities which the company asked to have authorized. The engineers reported the present physical value to be $410,000 and the reproduction value $473,409. In this valuation 12½ per cent was included for overhead charges during construction, but no intangibles were taken into consideration. Engineers for the company checked the valuation of the commission engineers and made the present value total $416,000. The company's attorney claimed added values of $94,000 for cost of securing business, $28,000 for promoter's profit and $53,000 bond discounts and brokerage. The company also asked $385,830 as a "strategic value" because the central station of the company is so located that it can easily handle the service for the four properties to be purchased. The commission denied the petition on the ground that it would not be good public policy to authorize such an amount of securities on the physical value, although it announced that it realized the unusual conditions which now exist. The commissioners also pointed out that the purchasing company in all probability could give the customers of the companies better service and possibly at a lower rate. There was, therefore, no disposition on the part of the commission to stop the progress of the sale, and the only desire was to insure that it was made on a basis that would not work hardship either on customers or on the investing public. The commission suggested that it would permit the company to bond the property to be purchased up to $400,000 and would permit the issuance of stock of not to exceed $200,000.

Further Electrification on St. Paul Railway.—To meet the increasing cost of fuel oil, the Chicago, Milwaukee & St. Paul Railway has begun to electrify the Puget Sound end of the transcontinental line. This part traverses the great virgin forests of Washington, and oil has been used to avoid danger of forest fire from sparks.

Uniform Accounting in Pennsylvania.—The Public Service Commission of Pennsylvania has called a conference of representatives of electric light, heat and power companies for June 6 to arrange plans for the adoption of a uniform annual report by the different utilities. Tentative drafts of the proposed form will be submitted, and a suitable date for general adoption by the companies arranged.

Extension of Washington Water Power Service.—The Washington Water Power Company, Spokane, Wash., is negotiating with mine operators in the north side of the Cœur d'Alene region to furnish power for the operation of mines and mills. Line construction and transformer installation would involve an expenditure of $50,000, according to M. C. Osborn, commercial agent for the company. The lines would total 25 miles. Extensive development of properties in that region has been retarded by lack of power.

New York Edison Company Record Week in New Contracts.—One week's new business secured recently by the wholesale bureau of the New York Edison Company reached a total of 1802 hp. and 28,640 lamps, representing an aggregate of 55,670 50-watt equivalents. Included in these were contracts for five new buildings, the installations of which consisted of 9000 incandescent lamps and 440 hp. of 15,600 50-watt equivalents. Three private plants were closed down with an installation of 6520 incandescent lamps and 220 hp., the equivalent of 9820 30-watt lamps. These and the seven remaining contracts totaled 55,670 50-watt equivalents.

Examination for Cable Tester.—The New York Municipal Civil Service Commission announces an examination for cable tester, for which applications will be received at Room 1400, Municipal Building, New York City, until June 5 at 4 p. m. From the resulting list appointments will be made to the Fire Department. The duties are to locate breaks and test for electrolysis of cables and to make acceptance tests on and inspection of wires and cables, underground conduits, manhole accessories, fire-house and public-building wiring for alarm systems and pole-line equipment. Candidates must be United States citizens and residents of New York State, at least twenty-one years of age, and have had actual factory, laboratory or field experience in cable testing of at least one year, or have completed a full year's laboratory testing course in electricity at a recognized institution, and should have a general knowledge of the principles of electricity and familiarity with the various electrical testing appliances appertaining to this position. The position pays from $1200 to $1500 per annum.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Montana Power Increases Common Dividend.—The Montana Power Company has declared a quarterly dividend of 1¼ per cent on common, and a regular quarterly dividend of 1¾ per cent on preferred, both payable July 2 to stock of record June 15. This places common stock on a 5 per cent annual basis, compared with 4 per cent heretofore.

Seeks Injunction to Prevent Competition.—The California-Oregon Power Company is seeking in the United States Court an injunction against city officials of Klamath Falls, Ore., to prevent them from submitting an ordinance on the June ballot granting a franchise to a competing electric light and power company. The company alleges that the proposed franchise cannot be legally placed on the ballot because it was prepared in violation of the city charter. It is further declared that the cost of the election would add to expenses of taxpayers, of which it is one of the heaviest. The Keno Power Company is the concern that wishes to enter the field.

Power Resources of Italy.—United States Consul E. T. F. Dumont writes from Florence, Italy, that French engineers have estimated that Italy could develop 5,000,000 hp. from its streams and torrents, and some Italian engineers have estimated the total developed and undeveloped at 4,000,000 hp. If the mean of these estimates, 4,500,000 hp., is assumed to be correct, and the 800,000 hp. already developed is deducted, there remains 3,700,000 hp. yet to be developed. To replace the energy obtained from imported coal used in railways and industries about 1,150,000 hp. must be further deducted, leaving a surplus over all present uses of 2,550,000 hp., more than sufficient to double the power now in use in the country.

Contracts Help United Light & Railways Company.—President Frank T. Hulswit of the United Light & Railways Company, Grand Rapids, Mich., reports that the company and its subsidiaries are affected comparatively little in net earnings by existing high prices in the matter of operating supplies and material because of favorable long-time contracts entered into before present conditions arose. For instance, the company's principal gas contract was negotiated in 1914, to run for a period of five years; its oil contract, at a cost of approximately 40 per cent of the present price, runs until Jan. 1, 1918; its largest steam coal contract, covering three-fourths of its steam-coal consumption for the year, is at a figure appreciably less than $1 per ton f.o.b. mines.

Lignite for Fuel in Australia.—United States Commercial Attaché Philip B. Kennedy writes from Melbourne, Australia, that the city electrical engineer of Melbourne, in delivering his presidential address before the Victorian Institute of Engineers, proposed the construction of a large power plant in Melbourne which would utilize brown coal, or lignite, of which there are large deposits adjacent to Melbourne.

Protective Society of Massachusetts Utility Stockholders.—With the avowed purpose of increasing dividends to stockholders in Massachusetts gas and electric properties, Edwin F. Dwelley and George Nichols of Lynn have organized the "Society of Stockholders of Gas and Electric Light Properties of Massachusetts," with offices at 15 Beacon Street, Boston. A statement explaining the organization contends that the constructive regulative policy of the Massachusetts Gas and Electric Light Commission which prevailed during the life of the late chairman, Mr. Barker, has been completely overthrown and that since July, 1916, when Commissioner Lewenberg was appointed, there has been a loss in the market value of the shares of forty of the principal companies totaling $24,477,000, or $30.30 per share. Taking the Cambridge Electric Light Company as an example, the society promoters claim that the dividends of a stockholder owning seven shares should be paid, not on $700, but on $5,544, the value of property underlying the seven shares. Tabular data are printed showing the relation between par value and property value, dividends, accumulated profits, new stock and market values of the principal gas and electric properties of the State.

Occupations of Electrical Engineering Graduates.—The results of an analysis of the activities of the alumni of the School of Electrical Engineering of Purdue University made during the last year was published in a news letter issued by the university. Of the 705 graduates from the School of Electrical Engineering during the ten years ended June, 1915, the percentage engaged in various lines of work is indicated in the following table: Manufacturing, 250, or 35.4 per cent; operating railway, 138, or 19.6 per cent; telephone and telegraph, 46, or 6.5 per cent; public, 16, or 2.2 per cent; teaching, 43, or 6.1 per cent; non-electrical engineering, 32, or 4.5 per cent; non-engineering, 58, or 8.2 per cent; miscellaneous engineering, 71, or 10 per cent; unaccounted for, 28, or 3.9 per cent; number in class, 705; deceased, 23, or 3.2 per cent. Commenting upon these figures, C. Francis Harding, professor and head of the School of Electrical Engineering, said that during the last few years there has seemed to be a greater tendency for electrical engineers to enter situations of a more or less commercial nature with the utilities and other positions requiring a broader training than was the case ten years ago. The course in electrical engineering is being revised from time to time to meet the changing needs of the engineering profession.

American Society for Testing Materials.—The American Society for Testing Materials will hold its twentieth annual meeting at Atlantic City, N. J., on June 26-29.

Schenectady Section, A. I. E. E.—A. G. Empey addressed the Schenectady Section of the American Institute of Electrical Engineers on May 25 on "Personal Experiences in the European War."

Iowa Section, N. E. L. A.—The annual convention of the Iowa Section of the N. E. L. A., scheduled for May 24-25, was postponed in line with the policy adopted by other national and state organizations.

Atlanta Section, A. I. E. E.—The following officers were elected recently by the Atlanta Section of the American Institute of Electrical Engineers: Chairman, A. M. Schoen; vice-chairman, E. P. Peck; secretary, Thomas C. Talliaferro.

Cleveland Section of the A. I. E. E.—The annual banquet of the Cleveland Section of the American Institute of Electrical Engineers was held on May 25. After the dinner the meeting was addressed by John B. Taylor, consulting engineer of the General Electric Company, on acoustical engineering. The talk was illustrated.

Annual Meeting of the American Society for Testing Materials.—The twentieth annual meeting of the American Society for Testing Materials will be held on June 26 and 29 at Atlantic City, N. J. The subjects scheduled for discussion are: "Tests and Testing," "Steel and Iron," "Non-Ferrous Metals," "Preservative Coatings and Miscellaneous Materials," "Cement and Concrete," "Concrete and Lime," "Ceramics," "Miscellaneous Materials."

The Jovian Electric League of Kansas City, Mo.—Since entering more fully into civic work, this league has appointed a committee to agitate the electrical illumination of the flag recently erected on the Union Station plaza. In addition, a committee has been appointed to investigate city ordinances that involve electrical matters. L. E. Shoemaker, secretary, has resigned because of work connected with the military organization in the Bell Telephone Company, and T. R. Harber has been elected to succeed him.

Fort Wayne Section of the A. I. E. E.—The Fort Wayne Section of the American Institute of Electrical Engineers has deviated from the usual custom of confining lecture subjects to technical matters only and restricting the attendance to members of the section by placing upon the program the names of men unusually qualified to talk upon subjects of interest to the general public. All wide-awake and active clubs of the city, as well as interested individuals, are invited to the meetings. This section recently had an electrical exhibition, known as "The Electrical Home," which was given May 10 and 11. The specific accomplishment of this section has been the education of the public.

Associations and Societies

The Directory of Electrical Associations, which is regularly printed in the first issue of each month, appears on page 1095 of this number.

Engineers' Club of Philadelphia.—An address on "The Engineers' Club of To-day and To-morrow" was given at the recent annual meeting of the Engineers' Club of Philadelphia, by the president, Emmett B. Carter.

Portland Section of the A. I. E. E.—At a recent meeting of the Portland Section of the American Institute of Electrical Engineers R. W. Mastick presented a paper on "A Field Investigation of Inductive Interference in Telephone Circuits Arising from Parallelism with a 55,000-Volt Power Circuit."

Philadelphia Section of the Illuminating Engineering Society.—"A Year's Progress in the Manufacture of Mazda Lamps" was the subject of a talk by Unit Rasin before the Philadelphia Section of the Illuminating Engineering Society on May 18. Dr. H. E. Ives continued his "Elementary Talks," which were started at a previous meeting of the society.

Buffalo Section, N. E. L. A.—Prizes were given for competitive papers prepared by members of the Buffalo Section of the N. E. L. A. at a recent meeting. Following are the prize winners, the title of the papers and the amount of the prizes: First prize ($40), George R. Kinney, subject "Educating the Public Through the Education of the Employee"; second prize ($25), Henry H. Lyon, subject "Demand and What It Means"; third prize ($15), George J. Richert, subject "Plugging Up Some Leaks"; fourth prize ($10), Charles W. Barber, subject "The Life of a Lamp"; fifth prize ($5), Charles L. Smith, subject "Education in Business"; sixth prize ($5), Cromwell McIntosh, subject "Continuity of Service."

Metering of Large Power Installations.—A meeting of the electric meter committee of the Empire State Gas and Electric Association was recently held, the subject of the discussion being "Metering of Large Power Installations." C. G. Durfee, chairman of the committee, presided. In general the discussion related to various types of indoor and outdoor metering installations used by the different companies, the methods and difficulties in testing large meters, the precautions taken to insure against accidents to the men testing and reading meters, the use of various types of meters for measuring demand, and the prevention of errors in reading meters or in billing consumers for an inaccurate number of kilowatt-hours. Representatives of the General Electric Company and the Westinghouse Electric & Manufacturing Company reported progress in the work of improving demand meters.

Connecticut Get-Together Club Will Hold Annual Outing.—The fourth annual outing of the Connecticut Get-Together Club of the National Electric Light Association will be held at Cosey Beach, East Haven, Conn., on June 9.

Association of Iron and Steel Electrical Engineers.—The Cleveland Section of this association will hold a meeting in October, the principal purpose of which is to form a permanent organization out of the Cleveland Section.

Jovian Electric League of Los Angeles.—At the regular luncheon of this association held May 23 Prof. A. T. Atkins spoke of "Choosing a Vocation and the Scientific Placing of Employees." F. T. Maessen, Pacific Power & Light Corporation, acted as chairman of the day.

Spokane Section, A. I. E. E.—On May 18 the Spokane Section of the American Institute of Electrical Engineers held its annual meeting. The following officers were elected for the ensuing year: Chairman, C. A. Lund; vice-chairman, George Nixon; secretary-treasurer, J. E. E. Royer, and executive committee, J. W. Hungate, R. S. Daniels and George Harding. After the business session there was a discussion on "Engineering Education."

National District Heating Association.—The ninth annual convention of the National District Heating Association will be held in Detroit, Mich., June 12 to 15 inclusive. Following are a few of the interesting reports and papers that will be presented: Report of station-operating committee, by J. G. DeRemer, chairman; report of underground construction committee, by H. A. Austin, chairman; underground crossings, by H. R. Wetherell; ash and coal handling problems, by J. L. Hecht and J. C. Martin, and temperature regulation, by H. R. Wetherell.

American Association of Engineers.—On account of the amount of business which had to be handled, the third annual convention of the American Association of Engineers, which was held in Chicago, extended over five days instead of two days, as originally intended. The following candidates were nominated: National director, R. C. Yeoman, dean of engineering, Valparaiso University, Valparaiso, Ind., and William H. Sallwasser, instructor, school of American Bridge Company, Gary, Ind.; national auditing committee, Samuel Morell, Jr., J. T. Mullin and C. A. Gaensslen. Members will have the opportunity to signify their choice by mail. The convention adopted a resolution offering the national headquarters as a recruiting station of the United States Army. In addition, a resolution was adopted extending an offer of membership in the association to all enlisted men who possess the qualifications of membership. Such membership is to be free of all initiation fees and dues during the term of enlistment. All members of the association who enlist will be carried during the term of enlistment without the payment of dues.

F. C. Taylor has been appointed assistant chief engineer of the Tampa (Fla.) Electric Company.

H. J. Sears has been promoted to be system operator of the Mississippi River Power Company, succeeding W. E. Corr.

W. E. Corr, system operator of the Mississippi River Power Company, succeeds B. H. Menke as superintendent of substations.

L. N. Howell, former chief engineer of the Baton Rouge (La.) Electric Company, has accepted a position in the power station at Maryville, Tenn.

H. R. Sharpless, formerly of the Woonsocket (R. I.) Electric Company, is now chief engineer of power station of the Baton Rouge (La.) Electric Company.

Fred E. Sterling, chairman of the Republican State Committee of Rockford, has been appointed by Governor Lowden a member of the State Public Utilities Commission of Illinois, effective July 1, 1917.

Thomas E. Dempcy of East St. Louis has been appointed chairman of the State Public Utilities Commission of Illinois. Mr. Dempcy for the last eleven years has been in the State's service as assistant attorney general.

B. H. Menke, superintendent of substations of the Mississippi River Power Company, has been transferred by the operator, the Stone & Webster Management Corporation, to the Connecticut Power Company, to fill the position of superintendent of transmission lines and substations.

A. S. Nichols, formerly manager of the Fort Madison (Iowa) Electric Company, will shortly become manager of the Paducah companies under the Stone & Webster management, succeeding W. L. Weston, who has been transferred to Houghton, Mich. Mr. Nichols was formerly assistant treasurer of the Mississippi River Power Company.

L. J. Hirt, formerly vice-president of the Pearson Engineering Corporation, has been appointed consulting engineer for the United Gas & Electric Engineering Corporation and will supervise the construction and engineering affairs of the subsidiary companies of the corporation. Mr. Hirt has been connected with the Pearson Engineering Corporation since 1889, and has had a wide experience in that company's enterprises in this country and in many foreign countries as well, embracing all classes of engineering undertakings.

Edward T. Moore, who has been connected with the Westinghouse Electric & Manufacturing Company for a number of years, has recently become connected with the Halcomb Steel Company and the Syracuse Crucible Steel Company, Syracuse, N. Y., as electrical engineer. While with the Westinghouse company Mr. Moore did considerable development work and invented a device used extensively in paper mills known as an automatic grinder regulator. For the last year he has supervised the erection of this apparatus in a large number of paper mills throughout the United States and Canada.

Men of the Industry

Changes in Personnel and Position— Biographical Notes

C. E. Clewell, assistant professor of electrical engineering at the University of Pennsylvania, Philadelphia, has been appointed a member of the National Committee on Lighting Defense representing the Council of National Defense.

Ludwig Kemper, who until quite recently was secretary-treasurer and manager of the Minnesota Gas & Electric Company at Albert Lea, Minn., and later was connected with the Field-Richards Company of Cincinnati, Ohio, has been appointed president, manager and purchasing agent of the Spokane Heat, Light & Power Company. Born in Holland in 1887, Mr. Kemper received his engineering education in Europe and after two years of industrial engineering there came to the United



LUDWIG KEMPER

States, where he was employed by the Pullman company on car-lighting design. In 1903, following a period of consulting engineering, he became assistant electrical engineer for the Baltimore & Ohio Railroad, resigning two years later to become connected with the Albert Lea property. For the last two years Mr. Kemper has been president of the Minnesota Electrical Association.

E. Darrow has resigned as manager of the Spokane Heat, Light & Power Company and is succeeded by Ludwig Kemper of Albert Lea, Minn.

Harry A. Flood has resigned as president of the Spokane Heat, Light & Power Company. Mr. Flood retains the presidency of the holding company.

Howard N. Bates, who has been for many years connected with the commercial department of the Houston (Tex.) Lighting & Power Company, has accepted the position of commercial manager of the Public Service Corporation at Tulsa, Okla.

A. O. Blackman has been appointed superintendent of power and plant of the Yale & Towne Manufacturing Company, Stamford, Conn.

Paul B. Findley, formerly editor of the *Electrical Age*, New York, has accepted a position with the Westinghouse department of publicity, with headquarters at East Pittsburgh.

Victor W. Kliesrath, for many years chief engineer of the Bosch Magneto Company, has severed his connection with that company. Mr. Kliesrath's plans for the future have not as yet been announced.

Paul A. Sinsheimer, who has been head of the stock and bond department of the California Railroad Commission for nearly five years, has resigned to become assistant to the president of the Union Trust Company.

Frank Y. Low has been elected president and director of the General Engineering & Management Corporation and vice-president and director of both the Interstate Electric Corporation and the Commonwealth Light & Power Company. Mr. Low has for many years been associated with H. M. Byllesby & Company, Chicago.

W. Lawrence Weston, for several years local manager of the Stone & Webster properties at Paducah, Ky., the Paducah Light & Power Company and the Paducah Traction Company, has been transferred by the owners to Houghton, Mich., succeeding Otto Snyder as general superintendent of the Houghton County Electric Light Company.

N. P. Zech has been elected vice-president and director of the General Engineering & Management Corporation and the Commonwealth Light & Power Company as well as vice-president of the Interstate Electric Corporation. Mr. Zech was at one time assistant to the general auditor of H. M. Byllesby & Company, resigning to become treasurer and general auditor of the Atlantic Gas & Electric Company, which several months ago was taken over by the Barstow interests.

John F. Wessel was receitly elected a vice-president of the United Gas & Electric Engineering Corporation and will take charge of the operation of the Northern properties, succeeding S. J. Dill. Mr. Wessel, who has been identified with lighting and railway interests for many years, is a graduate of the Massachusetts Institute of Technology. Prior to coming to New York at the end of 1913 he was general manager of the Mahoning & Shenango Railway & Light Company, Youngstown, Ohio.

Obituary

William J. Livingston, chief engineer of the Rankin plant of the Duquesne Light Company, Pittsburgh, Pa., died at his home on May 11 of cerebral hemorrhage. Mr. Livingston was born in Ireland Jan. 14, 1863. He was first employed by the company in 1904, and was appointed to the position he held at his death in 1906.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

NOTE OF CAUTION IN SUPPLY JOBBING MARKET

Belief Prevalent That Peak in Electrical Prices Has Been Reached—Stocks Show Slight Recessions from Former Prices

Conditions have actually changed very little in the electric supplies market during the past month, but nevertheless the entire undertone is far more cautious, and the feeling of uncertainty seems to exist everywhere. There has been no slump in the market, but neither have there been any notable advances. In fact, there has been less change in prices of electrical materials during the past month than in any month during the last twelve. In a few cases there have been slight revisions downward, some of these prices having later gone back.

To the trade in general, however, these signs are as the handwriting on the wall, and they are being heeded without much question as to whether they have any real significance. It is pretty generally felt that the peak in prices of electrical supplies has been reached, although some few items may go higher. Opinion, however, seems divided as to the future trend of prices. Some look for a small drop in the near future, while others feel that the peak will continue for some time. The former undoubtedly base their opinions on the tendency of the price of certain materials to sag during the last few weeks, while the others believe that with the demand and the volume of unfilled orders manufacturers would not be inclined to consider any revisions downward, at least for some time to come.

New England

A slight recession in trade is noted by New England electrical jobbers, but this is not regarded as anything more than temporary. The importance of keeping business at full tide is being realized more and more, and confidence is certain to become greater as the immense weight of the United States is more and more felt in the great world conflict. Prices remain at their former high levels, and still further advances are anticipated. Deliveries are somewhat improved, especially in cases where pressure has been brought to bear upon manufacturers and transportation companies to expedite the completion and forwarding of orders placed some months ago. Some difficulty obtains still in regard to obtaining motors, notably in the larger sizes.

Women are being employed more and more in the New England electrical jobbing industry as junior clerks, and as the selective draft comes into play there will undoubtedly be a considerable development in the extension of feminine capabilities to meet present abnormal conditions. Central stations are still somewhat inclined to hold back as regards development work.

On account of unseasonable weather conditions, electric fans have not begun to move in large volume as yet, but a healthy business in these outfits is anticipated, and is, in fact, forecast by advance orders. The hesitation displayed by the public in regard to appliance purchases is expected to yield soon to the growth of confidence regarding the business future.

East and South

Eastern jobbers are experiencing a good demand, although some cautiousness is noted in buying. While prices have changed but little during the past month, there is a well-defined feeling that the peak has been reached, and until more definite information is available speculation will be far less popular.

Jobbers' stocks are not so large as they were a month ago. They are not low yet, however. Inability of manufacturers to obtain sufficient supplies of raw materials, and railroad embargoes, are given as the chief reasons for lower stocks.

The demand is not particularly large in any direction, but is general. Household appliance sales have fallen considerably.

In the North there seems to be practically no change in the credit situation, but in the South a tendency is noticed toward worse credit conditions.

Optimism still prevails, and it is pretty generally agreed that the immediate outlook is promising. One concern sees in government work a stabilizing factor for the industry. Supplies for government work, it is felt, will constitute no small part of the jobbing trade.

Middle West

In general, jobbing prices in the Middle West are steady and firm. Increases, rather than lower prices, are expected. The last month has brought radical changes in all steel products, both in the price advances and in scarcity of finished goods, including conduit, boxes and their accessories. The jobbers' stocks of these materials are in general about normal. The jobbers' customers are able to buy these materials at the prevailing market for delivery now. To purchase these materials to replenish stocks, the jobber must place orders with manufacturers, subject to shipment at the price prevailing on the day of shipment. For this reason, orders for future delivery are being accepted by the jobbers themselves on practically the same basis. On the general run of schedule material, stocks are about normal, and it is difficult to replenish many lines. From the industrial centers heavy buying is expected on account of the belief that the industrial plants will be large gainers by the government's building program. It is also said that while light and power companies and independent telephone companies are purchasing sparingly for expansion, the Bell telephone interests are in the market for large quantities of goods. The reason for this, it is said, is necessity created by the demand made on the Bell system in the larger industrial communities, where its main strength lies. It is the general belief that buying will continue heavy, as it has been, but no new buying peak is expected. Credits and collections are considered most favorable.

Pacific Coast

In general, conditions on the Pacific Coast are good. There has, as yet, been no marked falling off of business on account of national crisis, and, on the other hand, extension of industrial business, army and navy activity, and shipbuilding needs, have more than offset economies that have been effected.

Practically no change in prices has occurred this month in the Southwest. There were two or three slight decreases. but these were promptly brought back again to the same figures as before. Stocks are in practically the same condition as last month.

It is believed that expenditure for those things which the public considers luxuries—and many classes of socket appliances are still so considered by the general public—will be light. Therefore, in the next few months the orders for the less stable socket appliances will probably be decreased. Extensions to factories and industrial plants generally have kept demands in this line well above normal. Army and navy work is very active, and there has been some pole hardware activity to supply new industrial business. One of the notable features of the present market is the shipbuilding industry, which calls for large quantities of large-sized wire. One large Pacific Coast company is now regularly stocking about 20,000 ft. of wire of this size, whereas a 2000-ft. stock was considered ample in prewar times.

Collections have been good, particularly so with the small concerns. Dealer and contractor credits, however, are being watched more closely than ever, particularly those dealers who depend upon trade in residence districts. It is expected that this class of business will fall off.

The larger electrical supply houses in the north Pacific Coast field report less change in prices during the month of May than for several months past. This does not mean that prices have not changed. Steel has advanced, and the price of wire has decreased noticeably. Other materials remain about the same as reported for April.

The fact that wire is more easily obtained, and has dropped in price, leads many of the dealers to believe that the peak in prices and buying has about been reached. Buying for the future is considerably lighter. Dealers are more or less apprehensive of being caught with an overstock, purchased, in some cases, when materials were steadily climbing upward. It is the belief locally that prices will not go much higher, although this feeling is not predicated on anything more stable than rumors and opinions emanating from those who are presumed to know.

Consequently, if these rumors of "peak has been reached" persist, buying will be light until prices drop or indications point to a further and prolonged increase.

Shipbuilding activities continue unabated, and the wooden-ship construction is booming. Government demands for materials remain strong, and are a valuable asset to the electrical business. Building, particularly of business structures, hotels and apartments, is at a low ebb. This is due to the high prices of building materials.

Collections are good. There is plenty of money in evidence.

EXCELLENT DEMAND FOR SEWING-MACHINE MOTORS

Some Manufacturers Forced Temporarily to Discontinue Production, or Else Have Ceased to Push Sales Owing to Market Conditions

Electric sewing-machine motors have had a large demand since the publicity campaign, which was started almost simultaneously by a number of manufacturers and distributers, has been in effect. While electric sewing-machine motors have been on the market for a number of years, it was not until recently that any movement was made in a large way to promote the sale of this class of equipment.

Some manufacturers who have been producing motors for this use have quite recently either discontinued temporarily their manufacture or have ceased for a time to push their sale, owing to the demand for motors for other purposes, for which there has been a well-defined and established market.

Those who still continue to market sewing-machine motors find that the market has exceeded first estimates, and that it is only with difficulty a sufficient number of motors can be obtained to supply the demand.

AMERICAN EQUIPMENT FOR NEW ZEALAND

The Exclusion of Electrical Apparatus of German Manufacture Leaves Fair Opening for Other Exporting Nations

The exclusion of Germany as a supplier of electrical equipment has afforded a fair opening for American enterprise in this direction in New Zealand, according to a recent British report. British manufacturers being otherwise engaged at the moment, American houses are taking opportunity further to consolidate their already extensive business connections in New Zealand in the matter of electrical supplies. There is yet to be considerable development of water-driven electric power and lighting systems in New Zealand for industrial and municipal purposes. The country is generally rich in watercourses suitable for the purpose, and this in both islands. Already at Whangarei, in the Auckland province, the largest cement works in the Dominion are about to start operations, relying solely upon electric power, the turbines being at Wairua Falls, 17 miles distant. The plant is almost wholly American and the cement-making plant is also from the United States. The value of the electrical equipment is about $2,000,000. The possibilities of the profitable use of electric power for hauling in mines and heavy work generally are likely to be great in New Zealand in the near future, especially when the current high rates for manual labor of every description are taken into consideration.

TRADE NOT BACK OF ELECTRICAL MERCHANDISE

Survey Discloses that Wider Distribution Can Be Had if Manufacturers Cultivate Central Stations and Other Selling Organizations

Industrial electrical merchandise because of the attitude of the trade toward it is not having the wide sale that this class of goods should have. Such apparatus, it has been found after a brief survey of the market, is being distributed almost entirely through non-electrical channels.

Central stations have taken up the sale, distribution and advertisement of household electrical merchandise, but when it comes to the industrial appliances few companies have made any real effort to further their sale. It is not thought that the central stations have any prejudice against this class of equipment; rather it is believed that the manufacturers have not yet awakened to the need of selling the idea to the central stations.

Manufacturers, to be sure, have had a good trade, but the goods have really sold themselves. Mill jobbers and the mill trade have been the selling agencies. They are non-electrical and have no more reason for selling an electrical device than some other device.

Recently the opinion has been expressed in different quarters that considerably more business would result if the manufacturers would take pains to cultivate the central stations and the electrical trade.

METALS MARKET CONTINUES FIRM

Not Much Buying, but Short Stocks Have a Tendency to Hold Up Prices

The metals market seemed firmer at the opening of this week than for a long time. There has not been much buying, but stocks are low. Nearby copper went up about a cent a pound because producers are out of June and July copper. There was less buying in lead last week, but stocks were very low. Old and scrap metals now are bringing in many instances almost as high prices as are new metals.

Nominal quotations for electrolytic copper on Monday of this week were as follows: May, 32.5 cents; June, 32.37½ cents; July, 31.37½ cents; third quarter, 29.5 cents, and fourth quarter, 28.5 cents.

NEW YORK METAL MARKET PRICES

	May 22 Selling Prices Bid	May 22 Selling Prices Asked	May 28 Selling Prices Bid	May 28 Selling Prices Asked
Copper:	£ s d		£ s d	
London, standard spot	130 0 0		130 0 0	
Prime Lake	31.50	to 32.50†	31.50	to 32.50†
Electrolytic	32.00	to 32.50†	32.25	to 32.75†
Casting	30.00	to 31.00†	30.50	to 31.00†
Copper wire base	37.00	to 38.00†	37.00	to 38.00†
Lead	10.00		10.00	
Nickel	50.00		50.00	
Sheet zinc, f.o.b. smelter	19.00		19.00	
Spelter, spot	9.42½	to 9.67½	9.42½	to 9.67½
Tin, Straits	65.62½		65.00	
Aluminum, 98 to 99 per cent.	56.00	to 58.00†	56.00	to 58.00†

OLD METALS

Heavy copper and wire	28.50	to 29.50	28.00	to 28.50
Brass, heavy	17.00	to 18.00	17.50	to 18.00
Brass, light	14.00	to 14.50	14.25	to 14.75
Lead, heavy	9.00	to 9.25	9.00	to 9.25
Zinc, scrap	6.75	to 7.00	7.25	to 7.50

†Nominal.

Current Prices of Electrical Supplies

The prices quoted are those prevailing in standard package or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists to contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List, per 1000 Ft. Chicago	N. Y.
No. 14 solid	$61.00	$61.00
No. 12 solid	71.00	71.00
No. 10 solid	90.00	90.00
No. 8 solid	106.00	106.00
No. 6 solid	145.00	145.00
No. 10 stranded	95.00	95.00
No. 8 stranded	115.00	115.00
No. 6 stranded	160.00	160.00
No. 4 stranded	205.00	205.00
No. 2 stranded	266.00	266.00
No. 1 stranded	315.00	315.00

Twin-Conductor

No. 14 solid	104.00	104.00
No. 12 solid	135.00	135.00
No. 10 solid	185.00	185.00
No. 8 stranded	235.00	235.00
No. 6 stranded	370.00	370.00
No. 4 stranded	575.00	575.00

DISCOUNT PER 1000 FT.

Single-Conductor

No. 14 solid:	Chicago	N. Y.
Less than coil	+10%	+10%
Coil to 1000 ft.	—10%	3%
No. 12 solid:		
Less than coil	+10%	+10%
Coil to 1000 ft.	—10%	3%

Twin-Conductor

No. 14 solid:		
Less than coil	+10%	+10%
Coil to 1000 ft.	—10%	3%
No. 12 solid:		
Less than coil	+10%	10%
Coil to 1000 ft.	—10%	3%

ATTACHMENT PLUGS

	Std. Pkg.	List Chicago	N. Y.
Benjamin No. 903	100	$0.25	$0.25
Hubbell No. 5406	250	.30	.30
Bryant No. 706	100	.25	.25
G. E. 50996	250	.22	.22
Discount		Chicago	N. Y.
Less than 1/5 std. pkg.:			
Benjamin No. 903		12%	12%
Hubbell No. 5406		+10%	+20%
Bryant No. 706		+20%	+20%
G. E. 50996		+20%	+20%
1/5 to std. pkg.:			
Benjamin No. 903		20%	20%
Hubbell No. 5406		—10%	20%
Bryant No. 706		Net	20%
G. E. 50996		Net	20%
Std. pkg.:			
Benjamin No. 903		44%	44%
Hubbell No. 5406		—34%	34%
Bryant No. 706		30%	34%
G. E. 50996		—30%	34%

BATTERIES, DRY

Each Net	No. 6 Regular Chicago	N. Y.	No. 6 Ignitor Chicago	N. Y.
Less than 12	$0.35	$0.35	$0.35	$0.35
12 to 50	.30	.30	.30	.30
50 to barrel	.255	.28	.265	.29
Barrel lots	.24	.24	.25	.25

CONDUIT, METALLIC FLEXIBLE

Size, In.	Feet per Coil	List per 100 Ft. Chicago	N. Y.
5/16	250	$5.00	$5.00
3/8	250	7.50	7.50
1/2	100	10.00	10.00
3/4	50	13.00	13.00
1	50	21.00	21.00
1 1/4	50	26.00	26.00
1 1/2	25-50	35.00	35.00
2	25-50	45.00	45.00
2 1/2	25-50	52.00	52.00

CONDUIT, METALLIC FLEXIBLE—CONTINUED

	3/8" Single Strip Chicago	N. Y.	3/8" Double Strip Chicago	N. Y.
Less than coil per 1000 ft.	Net	Net	Net	Net
Cost to 1000 ft. per 1000 ft.	1%	1%	4%	4%
	1/2" Single Strip Chicago	N. Y.	1/2" Double Strip Chicago	N. Y.
Less than coil per 1000 ft., net	$100.00	$100.00	$105.00	$110.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, in.	List, per Foot Chicago	N. Y.	Size, in.	List, per Foot Chicago	N. Y.
7/32	$0.05 1/2	$0.05 1/2	1	$0.25	$0.25
1/4	.06	.06	1 1/4	.33	.33
3/8	.09	.09	1 1/2	.40	.40
1/2	.12	.12	1 3/4	.47	.47
5/8	.15	.15	2	.55	.55
3/4	.18	.18	2 1/4	.65	.65

Per 1000 Ft. Net.	7/32 In. Chicago	N. Y.	1/4 In. Chicago	N. Y.
Less than $15.00 list	$55.00	$55.00	$60.00	$60.00
$15.00 to $60.00 list	27.50	24.50	30.00	27.00
$60.00 to $150.00 list	24.75	21.50	27.00	23.50

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

(*Card No. 38*)

Size, in.	Conduit, List per Foot Chicago	N. Y.
1/4	$0.08 1/2	$0.08 1/2
3/8	.08 1/2	.08 1/2
1/2	.08 1/2	.08 1/2
3/4	.11 1/2	.11 1/2
1	.17	.17
1 1/4	.23	.23
1 1/2	.27 1/2	.27 1/2
2	.37	.37
2 1/2	.58 1/2	.58 1/2
3	.76 1/2	.76 1/2

Size, in.	Couplings, List, Each Chicago	N. Y.	Elbows, List, Each Chicago	N. Y.
1/4	$0.05	$0.05	$0.19	$0.19
3/8	.06	.06	.19	.19
1/2	.07	.07	.19	.19
3/4	.10	.10	.25	.25
1	.13	.13	.37	.37
1 1/4	.17	.17	.45	.45
1 1/2	.21	.21	.60	.60
2	.28	.28	1.10	1.10
2 1/2	.40	.40	1.80	1.80
3	.60	.60	4.80	4.80
	Discount,		Discount,	

	1/4 In. to 1/2 In. Chicago	N. Y.	3/4 In. to 3 In. Chicago	N. Y.
Less than 2500 lb	3.8%	6%	6.8%	9%
2500 to 5000 lb	5.8%	8%	8.8%	11%

(For galvanized deduct six points from above discounts.)

FLATIRONS

	Chicago	N. Y.
List	$5.50	$5.00
Discount	30%	30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List Chicago	N. Y.
3-amp. to 30-amp.	100	$0.25	$0.25
35-amp. to 60-amp.	100	.35	.35
65-amp. to 100-amp.	50	.90	.90
110-amp. to 200-amp.	25	2.00	2.00
225-amp. to 400-amp.	25	3.60	3.60
450-amp. to 600-amp.	10	5.50	5.50
600-Volt			
3-amp. to 30-amp.	100	$0.40	$0.40
35-amp. to 60-amp.	100	.60	.60
65-amp. to 100-amp.	50	1.50	1.50
110-amp. to 200-amp.	25	2.50	2.50
225-amp. to 200-amp.	25	5.50	5.50
450-amp. to 600-amp.	10	8.00	8.00

FUSES, INCLOSED—CONTINUED

Discount	Chicago	N. Y.
List	28%	28%
Discount	38%	38%

FUSE PLUGS

3-Amp. to 30-Amp.

Per 100 Net.	Chicago	N. Y.
Less than 1/5 std. pkg.	$6.25	$5.25
1/5 to std. pkg.	5.25	4.50

Standard package, 500. List, $0.07.

LAMPS, MAZDA

105 to 125 Volts

Regular, clear:	Std. Pkg.	List, Each—Chicago	List, Each—N. Y.
10 to 40-watt—B	100	$0.27	$0.27
60-watt—B	100	.36	.36
100-watt—B	24	.65	.65
75-watt—C	50	.65	.65
100-watt—C	24	1.00	1.00
200-watt—C	24	2.00	2.00
300-watt—C	24	3.00	3.00
Round bulbs, 3½-in., frosted:			
15-watt—G 25	50	.50	.50
25-watt—G 25	50	.50	.50
40-watt—G 25	50	.50	.50
Round bulbs, 3¾-in., frosted:			
60-watt—G 30	24	.72	.72
Round bulbs, 4⅝-in., frosted:			
100-watt—G 35	24	1.05	1.05

Discount	Chicago	N. Y.
Less than std. pkg.	Net	Net
Std. pkg.	10%	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

	Per 1000 Ft. Net—Chicago	Per 1000 Ft. Net—N. Y.
Less than coil (250 ft.)	$37.52	$35.17
Coil to 1000 ft.	28.14	26.73

LAMP GUARDS, WIRE

Per 100 Net	Chicago	N. Y.
Less than 50, Matthews 16-cp	$20.00	$20.00
Less than 1/5 std. pkg. Hubbell	28.35	29.00
Less than 36, 60-watt Loxon	25.00	20.00

OUTLET BOXES

Union Cat. No.	Black, List, per 100—Chicago	Black, List, per 100—N. Y.
101	$30.00	$30.00
102	30.00	30.00
103	25.00	25.00
106	20.00	20.00

Union Cat. No.	Galv., List, per 100—Chicago	Galv., List, per 100—N. Y.
101	$30.00	$30.00
102	30.00	30.00
103	25.00	25.00
106	20.00	20.00

Discount	Black—Chicago	Black—N. Y.	Galvanized—Chicago	Galvanized—N. Y.
Less than $10.00 list	40%	List	35%	List
$10.00 to $50.00 list	50%	42%	45%	37%

PIPE FITTINGS

Condulets, V.V., Unilets and Similar

Discount	Chicago	N. Y.
Less than 1/5 std. pkg.	10%	10%
1/5 to std. pkg.	20%	20%
Std. pkg.	30%	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

	Per 1000 Net—Chicago	Per 1000 Net—N. Y.
Less than 1/5 std. pkg.	$18.00	$20.00
1/5 to std. pkg.	13.00	15.80

Standard package, 2200. List per 1000, $20.

PORCELAIN KNOBS

Per 1000 Net	5½ N.C.—Solid Std. Pkg. 3500 Chicago	5½ N.C.—Solid Std. Pkg. 3500 N. Y.	Nail-it—N.C. Std. Pkg. 4000 Chicago	Nail-it—N.C. Std. Pkg. 4000 N. Y.
Less than 1/5 std. pkg.	$18.00	$24.30	$28.00	.....
1/5 to std. pkg.	18.00	12.15	21.50	.....

SOCKETS AND RECEPTACLES

	Std. Pk.	List—Chicago	List—N. Y.
⅛-in. cap key socket	500	$0.33	$0.33
⅛-in. cap keyless socket	500	.30	.30
⅛-in. cap pull socket	250	.60	.60

Discount	Chicago	N. Y.
Less than 1/5 std. pkg.	Net	Net
1/5 to std. pkg.	15%	20%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

Perkins or Trumbull Type A:	List—Chicago	List—N. Y.
30-amp. S. P. S. T.	$0.80	$0.80
60-amp. S. P. S. T.	1.20	1.20
100-amp. S. P. S. T.	2.25	2.25
200-amp. S. P. S. T.	3.48	3.48
300-amp. S. P. S. T.	5.34	5.34
30-amp. D. P. S. T.	1.20	1.20
60-amp. D. P. S. T.	1.78	1.78
100-amp. D. P. S. T.	3.38	3.38
200-amp. D. P. S. T.	5.20	5.20
300-amp. D. P. S. T.	8.00	8.00
30-amp. 3 P. S. T.	1.80	1.80
60-amp. 3 P. S. T.	2.68	2.68
100-amp. 3 P. S. T.	5.08	5.08
200-amp. 3 P. S. T.	7.80	7.80
300-amp. 3 P. S. T.	12.00	12.00
Perkins Type B or Trumbull Type C:		
30-amp. S. P. S. T.	0.42	0.42
60-amp. S. P. S. T.	0.74	0.74
100-amp. S. P. S. T.	1.50	1.50
200-amp. S. P. S. T.	2.70	2.70
30-amp. D. P. S. T.	0.68	0.68
60-amp. D. P. S. T.	1.22	1.22
100-amp. D. P. S. T.	2.50	2.50
200-amp. D. P. S. T.	4.50	4.50
30-amp. 3 P. S. T.	1.02	1.02
60-amp. 3 P. S. T.	1.84	1.84
100-amp. 3 P. S. T.	3.76	3.76
200-amp. 3 P. S. T.	6.76	6.76

DISCOUNT

Type A, Perkins or Trumbull:	Chicago	N. Y.
Less than $10 list	List	Net
$10 to $25 list	15%	15%
$25 to $50 list	18%	18%
Type B, Perkins, or Type C, Trumbull:		
Less than $10 list	10%	10%
$10 to $25 list	20%	20%
$25 to $50 list	28%	28%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List—Chicago	List—N. Y.
5-amp. single-pole	250	$0.28	$0.28
5-amp. single-pole, ind.	250	.32	.32
10-amp. single-pole	100	.48	.48
10-amp. single-pole, ind.	100	.54	.54
5-amp., three-point	100	.56	.56
10-amp., three-point	50	.76	.76
10-amp., 250-volt, D. P.	100	66	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List—Chicago	List—N. Y.
10-amp. single-pole	100	$0.45	$0.45
10-amp. three-way	50	.70	.70
10-amp. double-pole	50	.70	.70

Discount	Chicago	N. Y.
Less than 1/5 std. pkg.	+20%	Net
1/5 to std. pkg.	Net	15%
Std. pkg.	30%	28%

SWITCH BOXES, SECTIONAL CONDUIT

C. F. Mfg. Co.	List, Each—Chicago	List, Each—N. Y.
No. 155	$0.34	$0.34
No. 160	0.60	0.60

Discount	Black—Chicago	Black—N. Y.	Galvanized—Chicago	Galvanized—N. Y.
Less than $2.00 list	25%	Net	15%	Net
$2.00 to $10.00 list	25%	50%	15%	40%
$10.00 to $50.00 list	35%	60%	25%	52%

TOASTERS, UPRIGHT

	Chicago	N. Y.
List	$5.00	$5.00
Discount	30%	30%

WIRE, ANNUNCIATOR

Per Lb. Net	Chicago	N. Y.
No. 18, less than full spools	$0.65	$0.62
No. 18, full spools	0.55	0.53

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

No.	Price per 1000 Ft. Net—Less than 500 Ft. Chicago	Less than 500 Ft. N. Y.	500 to 1000 Ft. Chicago	500 to 1000 Ft. N. Y.	1000 to 5000 Ft. Chicago	1000 to 5000 Ft. N. Y.
14	$18.00	$18.00	$16.00	$14.50	$14.00	$12.50
12	29.89	27.05	25.62	22.85	21.35	20.95
10	41.51	39.27	35.58	33.66	29.65	24.68
8	60.13	51.44	51.54	48.42	42.95	33.51
—	82.20	89.57	75.35	76.80	68.50	50.63

WIRE, WEATHER-PROOF

Solid-Conductor, Triple-Braid, Sizes 4/0 to 8. Inc.

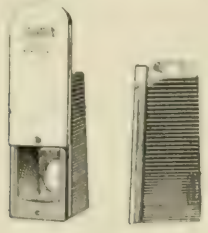
	Per 100 Lb. Net—Chicago	Per 100 Lb. Net—N. Y.
Less than 25 lb.	$45.00	$40.25
25 to 50 lb.	44.00	39.25
50 to 100 lb.	43.00	38.25

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Entrance Fitting

Service entrance L's that are weatherproof and do not require a gasket have been developed by the Adapti Company of Cleveland, Ohio. Attention is called to the fact that this fitting allows the conduit to lie close

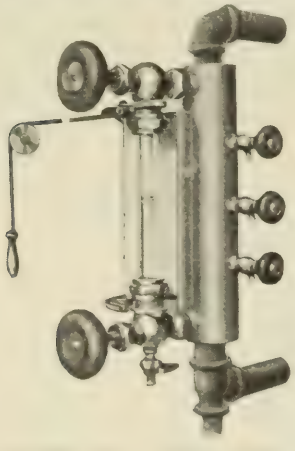


SERVICE-ENTRANCE L

against the side of the buildings and not some distance away, as is generally the case. The cover is held in position by a screw and an overlapping flange on the fitting. These fittings are for use with conduit from ½ in. to 1¼ in. (1.27 cm. to 3.17 cm.) in diameter.

Gage Glass Guard

A water-gage guard that consists of a semi-cylindrical sheet-metal shutter, which can be rotated about the gage tube as an axis has been developed by the Simplex Safety Boiler Gauge Glass Company at Springfield, Mass. To the shutter is attached a piece of lamp cord which passes through an eye on the outer periphery of the upper circular tracks and from there extends to any point within convenient reach of the



WATER-GAGE GLASS GUARD

fireman. When a gage glass breaks, the cord may be pulled and the circular shutter moved through half a turn, thereby deflecting the escaping steam and making it possible to shut off the valves on the gage cocks without danger of being burned, it is claimed. When this has been done the shutter may be removed from its tracks to permit replacing the broken gage tube by moving the shutter another quarter turn.

Elevator Control Equipment

Magnetic three-speed elevator controllers that govern the reversal and speed control of elevator motors have been developed by the Cutler-Hammer Manufacturing Company of Milwaukee, Wis. No more current than is necessary to hoist the maximum load is permitted by this apparatus, thus protecting the motor against injury due to excessive currents. When the elevator which is controlled approaches the top and bottom limits of its travel it is automatically slowed down and



A MAGNETIC THREE-SPEED ELEVATOR CONTROLLER

smoothly brought to rest. The design and arrangement of connections are such that no combination of grounds or short circuits can cause the car to run into the overhead beams or into the pit, it is claimed. Provisions are made so that the occurrence of slack in the hoisting cable will immediately stop the car. An overspeed governor with a safety guide grip is employed so that should the car run over its rated speed of 400 ft. per minute (133 m. per minute) the current to the motor will be interrupted and the guide grips will act to stop the car immediately. Two magnetically operated brakes are mounted on the hoisting machine, one for braking the drum shaft and the other for the motor shaft.

Household Iron

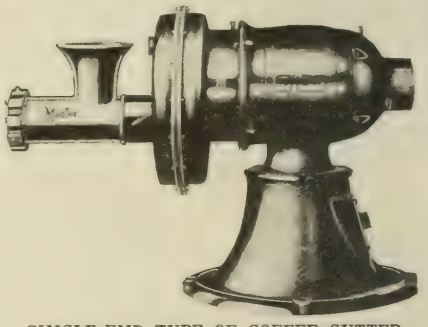
The Western Electric Company of New York City has developed a 6½-lb. (2.7-kg.) electric iron for household purposes in which every part is a complete unit, made so as to be interchangeable. Attention is called to several features of this iron. It has a black and white cord in which the conductors are stranded, not braided, producing a long-wearing flexible cord. The pressure plate holds the heating element firmly against the bottom of the iron, keeping the heat distributed where it will be most effective. The heating element is made of chromium-nickel ribbon, and the contact pins, which are easy to replace, of non-corroding German silver. A separable two-piece socket plug is furnished.

Switch and Cut-Out

Quick-break safety switches and cutouts, constructed so as to prevent accidental contact with current-carrying parts, are manufactured by the Palmer Electric & Manufacturing Company of Boston, Mass. The apparatus is designed so that no live parts are exposed when the switch is being operated or when the cutout is being re-fused. This feature is assured by a sliding shutter which is mounted on the main box cover and interlocked with the switch handle. When the fuse chamber is open the switch is locked open and when the switch is closed the fuse chamber is locked closed.

Coffee Cutters

Coffee-cutting machines operated by totally inclosed, low-speed Westinghouse motors designed for heavy duty and having no complicated mechanism



SINGLE-END TYPE OF COFFEE CUTTER

to need adjustment are manufactured by the Master Cutter Machine Company of Cincinnati, Ohio. Owing to the fact that a low-speed motor is employed no gears are necessary. The motors are equipped with radial and thrust ball

bearings which minimize friction and prevent wabbling of parts. The only parts needing lubrication are the ball bearings, and these only once a year. Thus there is no oil to accumulate in the burr case, none to get into the coffee, and all the nuisance of oiling is removed.

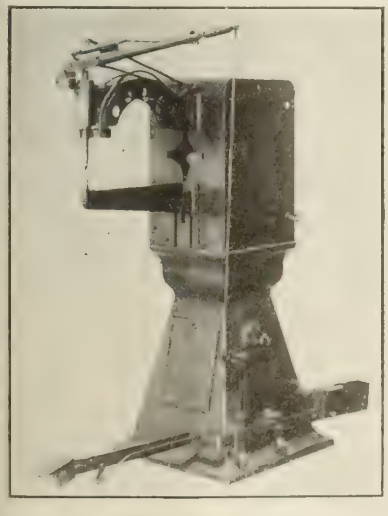
This line of cutters consists of single-end and double-end styles and a "three-in-one" machine which besides granulating and pulverizing the coffee can be used for chopping meat. The single-end machines are made in two sizes and are of sufficient capacity for most stores.

Pipe Straps

The Central Distributing Company of Detroit, Mich., has brought out a complete line of lead-covered pipe straps in sizes of from ¼ in. to 4 in. (0.64 cm. to 10.2 cm.) inclusive. These straps are not affected by acids, atmospheric conditions, lime, etc., it is claimed. Weights for the different sizes have been adopted so that the line throughout is uniform in strength for the work required. These standards insure that the customer will get the same weight and size strap at all times.

Spot Welder

Spot welders made in two standard types of various ratings are manufactured by the Pacific Electric Welder & Manufacturing Company of Seattle, Wash. One of the types is adapted to work on clean stock measuring thirty-gage to eleven-gage while the other is for thirty-gage to three-gage material. The largest opening between points on these machines is 3½ in. (8.9 cm.). The distance between the upper arm and the lower horn is 7 in. to 15 in. (17.8 cm. to 38.1 cm.). The machines are equipped with hollow welding points



ELECTRIC SPOT WELDER

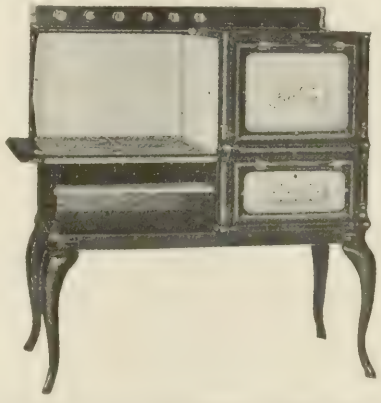
through which water is allowed to circulate to keep them cool and increase the life of the points. To use the apparatus the material to be welded is placed between the electrodes or welding points and pressure applied thereto either with the hand or foot lever, thus completing the circuit and heating the metal to the welding temperature.

Immersion Heater

The Russell Electric Company has placed upon the market an immersion heater the inclosing tube of which is made of a heavily nickel-plated brass tube. In this unit a brass tube has been used instead of the usual steel or aluminum, since it has been found that steel rusts and aluminum, if operated in the open, will melt. The tube is 3/16 in. (0.48 cm.) in diameter, 6 in. (15.2 cm.) long, and contains an element rated at 250 watts. It is claimed that this device will in one minute heat a glassful of water as hot as it can be drunk and will boil a glassful of water in three minutes. The cord is detachable at the unit.

Electric Stove

In the accompanying illustration is shown an electric stove, the baking capacity of the upper oven of which can be increased 50 per cent without increasing the maximum demand of the range. This stove is a product of the S-P Stove Company of Wilmette, Ill. It has four outside top burners, 8-in (20.3 cm.) in diameter and of 900 watts each, maximum demand. It also has one inside lower oven burner, 8 in. (20.3 cm.) in diameter, with a maximum demand for boiling or roasting of 660 watts. In the upper oven, which is suitable for all kinds of baking, are three adjustable and removable square burners rated at 550 watts each. The size of the oven is 15 in. by 16 in. by 12 in. (38.1 cm. by 40.6 cm. by 30.5 cm.) The splashers, back, oven side and door panels are white-enameled.



RANGE WITH FOUR OUTSIDE BURNERS AND TWO OVEN BURNERS

Drink Mixer

The Wisconsin Electric Company, in conjunction with Horlick's Malted Milk Company, both of Racine, Wis., has placed an improved drink mixer on the market. The entire base and column is finished in white porcelain enamel. The motor which drives the mixing spindle is stationary on the head of the column, only the mixing spindle moving up and down. The spindle is light and the mixer is very easily operated.



RAPID DRINK MIXER

The current is automatically turned on when the spindle engages with the driving disk on the motor and is shut off instantly when the spindle is raised. Another advantage of the mixer is that the spindle rises to a height of 7.5 in. (19.05 cm.), enabling the largest container or mixing glass to be set under the spindle without tipping the container.

Window Reflector

A glare-reducing reflector for exposed windows such as island, open, or mirrored-backed, narrow-entrance windows, etc., is the latest addition to the Holophane line of prismatic reflectors produced by the Glass Company, Inc., New York City. The reflector consists of a special asymmetric prismatic reflector with an annular prismatic plate over the front half of the opening. The plate is held in place by a U-shape steel band that engages a flange on half of the circumference of the reflector. The edge of the reflector is recessed, so that the plate has a positive position. This makes the assembling easy. The ring is fitted to the plate, placed in position and sprung over the flange of the reflector. Sufficient room has been provided for inserting the lamp without removing the plate.

The addition of a refracting plate is an innovation in window-lighting reflectors, and the advantages claimed for it are that it shields the eye from the bright lamp filament and at the same time increases the efficiency by reflecting the light down into the window that would otherwise escape at high angles and cause glare.

The reflectors, which are 10 in. (25.4 cm.) in diameter and 6⅞ in. (17.4 cm.) high, are designed for standard 2¼-in. (5.7-cm.) holders with the 100-watt type C or C2 lamps. The maximum intensity of light is delivered at about 27 deg. from the vertical. Practically all of the light is delivered in useful directions for lighting the goods, while a small amount is directed upward for brightening the top of the window and lighting valances and transparencies.

Trade Publications

IRONS.—The Western Electric Company of New York City is mailing an illustrated folder descriptive of its No. 1 iron.

PAINT.—"Red Lead and How to Use It" is the title of a book published by A. H. Sabin, 111 Broadway, New York City.

FIXTURES.—Samuel Frost of 301 Bowery, New York City, is distributing a folder descriptive of complete house-lighting sets.

FUSES.—The Chicago Fuse Manufacturing Company of Chicago has prepared a bulletin descriptive of auto fuses, contact clips, cut outs and boxes.

MOTORS.—Bulletin No. 511, descriptive of ball-bearing, splash proof washing machine motors, has been prepared by the Domestic Electric Company of Cleveland, Ohio.

HARD RUBBER.—The B. F. Goodrich Company of Akron, Ohio, has prepared a bulletin descriptive of its hard rubber goods for battery jars, tires, tubes, insulated wire, etc.

BATTERIES.—The Electric Storage Battery Company of Philadelphia is distributing a folder descriptive of its new eight story building now in the course of construction.

REFLECTORS.—The National X-Ray Reflector Company of Chicago is distributing a temporary catalog page for catalog 19. This page describes X-ray floodlighting projectors.

CHAIN DRIVE.—The Link-Belt Company of Chicago is distributing a decorated folder on which a section of the President's proclamation is given. A copy of the folder will be sent to any one applying for it.

POWER MACHINERY.—MacGovern & Company of 114 Liberty Street, New York City, have prepared a catalog on electrical, hydraulic, steam and gas machinery. Contractors' equipment is also included in this catalog.

PROTECTIVE PREPARATION—The McGraw Company of Omaha, Neb., is distributing a leaflet descriptive of "Neutraline," designed particularly for protection of the skin against sulphuric acid, such as is used in storage batteries.

MOTOR PUMPS.—The Hawkeye motor pump, an automatic pump to take the place of water lifts and for use with open tanks or pressure tanks, is described and illustrated in a bulletin prepared by the Chandler Pump Company of Cedar Rapids, Iowa.

CHAIN DRIVE.—The Link-Belt Company of Chicago, Ill., is distributing a booklet entitled "Ideal Drive for Cement Mill Equipment." This book describes the operating cement machinery at the plant of the Nazareth Cement Company, Nazareth, Pa.

GENERATORS.—The Crocker-Wheeler Company, Ampere, N. J., has prepared bulletin No. 178, descriptive of its three-wire generators. This company is also distributing bulletin No. 177, descriptive of its form W rolling-mill motors, 220 or 230 volts, direct-current, sizes 6.5 hp. to 200 hp.

ELECTRIC TOOLS.—The Stow Manufacturing Company of Binghamton, N. Y., is distributing bulletin No. 101, descriptive of its portable electric tools, electric motors and special machines. This company is also distributing bulletin No. 102, descriptive of flexible shaftings. These are miniature copies and are very complete.

SAWMILL SUPPLIES.—Link belt and sprocket wheels for sawmills are described and illustrated in book No. 260, now being distributed by the Link-Belt Company of Chicago, Ill. This booklet describes those classes of link belts most commonly used in sawmills, and presents only a few of the many types this company can supply.

CHAINS.—The Link-Belt Company of Chicago has prepared book No. 125, which is descriptive of the link-belt style of chain for efficient transmission of power. This data book takes into consideration the various uses of these chains and the method of using them. List prices are also given in this book. The data forms contained in the book will present the facts in such a way as to render "checking up" easy. The book is well illustrated and has been prepared with care.

ELECTRIC FURNACES.—The Society for Electrical Development, Inc., New York City, is publishing a book entitled "Industrial Heating as a Central Station Load." The object of this publication is to give in compact form for ready reference facts and data on the various uses and applications of commercial electric heating as practised in the United States to-day. The data include both the high-temperature furnaces of the metal industries and those various forms of electric heaters which have already found wide application in large and varied industrial fields.

ROTARY CONVERTERS.—Siemens Brothers Dynamo Works, Ltd., Palace Place Mansions, Kensington Court, London, W. S., have issued a new pamphlet dealing with rotary converters. The pamphlet contains not only a description of this company's machines, but also a certain amount of information of a general nature in regard to rotary converters. Special attention is drawn to the section which deals with the control of voltage on rotary converters, and which is intended to convey to the reader an appreciation on the one hand of the capabilities and on the other of the limitations of this type of plant.

New Incorporations

THE AMERICAN INSULATION COMPANY of Philadelphia, Pa., has been incorporated with a capital stock of $100,000 by B. T. Conwell, Jr., and associates.

THE OSBORNE (PA.) ELECTRIC LIGHT COMPANY has been chartered with a capital stock of $5,000 by E. S. Haymond of Wilkinsburg, Pa., and others to operate in Osborne.

THE GREAT LAKES ELECTRIC MANUFACTURING COMPANY of Chicago, Ill., has been chartered with a capital stock of $25,000 by G. A. Johnson, George A. Chritton and C. C. Becker.

THE ROTARY SCRAPER COMPANY of New York, N. Y., has been chartered with a capital stock of $10,000 to do general electrical work and deal in rotary brushes, scrapers and other devices.

THE ELECTRIC SERVICE COMPANY of Beaver Falls, Pa., has been incorporated with a capital stock of $5,000 by Walter P. Rice, Constantine J. Freund and Robert Cunningham of Beaver Falls.

THE LEETSDALE (PA.) ELECTRIC COMPANY has been chartered with a capital stock of $5,000 to furnish electricity in Leetsdale. E. S. Haymond of Wilkinsburg, Pa., is interested in the company.

THE MOON (PA.) TOWNSHIP LIGHT COMPANY has been incorporated with a capital stock of $5,000 by E. S. Haymond of Wilkinsburg, Pa., and others. The company proposes to operate in Moon Township.

THE SEWICKLEY (PA.) ELECTRIC LIGHT COMPANY has been granted a charter with a capital stock of $5,000 to operate in Sewickley. E. S. Haymond of Wilkinsburg, Pa., is interested in the company.

THE ALEPPO (PA.) TOWNSHIP ELECTRIC COMPANY has been incorporated with a capital stock of $5,000 to operate in Aleppo Township. E. S. Haymond of Wilkinsburg, Pa., is interested in the company.

THE FAN-FLAME SPARK PLUG COMPANY of Yonkers, N. Y., has been chartered with a capital stock of $15 000 by Lura B. Galbraith, Bowman B. Tottingham and John J. Gill. The company proposes to manufacture spark plugs.

THE GUY V. WILLIAMS COMPANY of New York, N. Y., has been incorporated with a capital stock of $15,000 to deal in electric lamps, chandeliers, wires, etc., by Guy V. Williams, H. H. Williams and Thomas Cole, 116 Broad Street, New York City.

THE OZONE-AQUA ELECTRIC HEATER CORPORATION of New York, N. Y., has been incorporated by John J. Von Hentzel, Dr. Alfred Starr and Dr. B. W. Kirschner. The company is capitalized at $100,000 and proposes to manufacture electric appliances.

THE KEYSTONE ELECTRICAL APPLIANCE COMPANY of Philadelphia, Pa., has been incorporated by Stephen D. Large, C. C. Davis and Horace S. Jones, all of Philadelphia. The company is capitalized at $5,000 and proposes to manufacture electrical switches, etc.

THE EUREKA BOAT & AIRPLANE BUILDING CORPORATION of New York, N. Y., has been incorporated by Albert H. Morris, George W. Wagner and Adam Finck. The company is capitalized at $10,000 and proposes to manufacture boats, airplanes and dynamos.

THE EQUITABLE LIGHT, HEAT & POWER COMPANY has been incorporated with a capital stock of $5,000 to operate in Kimmel Township by D. E. Brumbaugh of Claysburg, Pa., and W. H. Rohm and John H. Zinn of Osterburg, Pa. The office of the company will be in Queen.

THE BIRCHER COMPANY of Rochester, N. Y., has been incorporated by E. A. Bircher, H. W. Rippey of Rochester, N. Y., and J. B. Abbott of Geneseo. The company is capitalized at $40,000 and proposes to manufacture mechanical and electrical apparatus, office specialties, etc.

THE NITROGEN ELECTRIC COMPANY of Newark, N. J., has been chartered by Eugene A. Eppstein, 38 Spring Street; Albert F. Jacques and Rudolph H. Amberg, all of Newark, N. J. The company is capitalized at $15,000 and proposes to manufacture electric lamps.

THE ESSANKAY ELECTRIC & NOVELTY COMPANY of New York, N. Y., has been incorporated by J. S. Cumming, M. F. Slupsky and H. Knoch, 540 West 112th Street, New York City. The company is capitalized at $10,000 and proposes to do a general electrical contracting business and to manufacture novelties.

THE ZIOLA MANUFACTURING COMPANY of Milwaukee, Wis., has been incorporated with a capital stock of $20,000 to manufacture electrical devices, including X-ray machines and electro-therapeutic apparatus. The incorporators are: H. A. Ziola of Madison, Wis.; Dr. Theodore H. Rolfs and E. W. Bentzien.

THE UNITED STATES FUSE CORPORATION of Buffalo, N. Y., has been incorporated with a capital stock of $500,000 to manufacture electric fuses, appliances and devices. The incorporators are: H. H. Baker, 52 Oxford Avenue; J. W. Charters, 540 Walden Avenue, and C. F. Booth, 52 Woodward Avenue, Buffalo, N. Y.

THE NEW HYDRAULIC MACHINERY COMPANY of Montreal, Que., has been incorporated by George R. Drennan, Alexander G. Yeoman, Herbert W. Jackson, Francis G. Bush and others. The company is capitalized at $200,000 and proposes to manufacture hydraulic presses, pumps, accumulators, paper mill machinery, etc.

Trade Notes

THE MONITOR CONTROLLER COMPANY of Baltimore announces that E. Wesley Vaughan has joined the sales organization of its New York office.

KELLOGG BIRDSEYE has resigned as treasurer and general manager of the George C. Lynch Company, manufacturer of electric lamps, 236 Fifth Avenue, New York.

THE WESTERN ELECTRIC COMPANY has recently moved the general offices of its Seattle (Wash.) branch from 907 First Avenue to 84 Marion Street, where it will occupy a two-story brick structure erected especially for the concern.

THE RADIUM LUMINOUS MATERIALS CORPORATION, manufacturer of radium lighting devices, 123 North Third Street, Newark, will erect a two-story plant at 154 Alden Street, Orange, N. J. The new structure is estimated to cost about $12,000.

J. H. RISSER, who has been manager of the central-station department of the Globe Stove & Range Company, Kokomo, Ind., has been appointed manager of electric sales with full and complete charge of the company's future electric-range development work.

THE PACKARD ELECTRIC COMPANY, Warren, Ohio, has established a district office on the fourth floor of the San Fernando Building, Los Angeles, Cal., in charge of J. G. Monahan, district manager. This office will handle southern California—from Fresno south—and the State of Arizona on all products of the company's transformer department.

GEAR MANUFACTURERS' CONVENTION.—The recently organized American Gear Manufacturers' Association held its first convention at the Hotel Schenley, Pittsburgh, Pa., on May 14 and 15. S. L. Nicholson, sales manager of the Westinghouse Electric & Manufacturing Company, spoke on "The Ins and Outs of an Industrial Organization," James E. Gleason presented a paper on "The Spiral or Curved-Tooth Bevel Gear," Frank Burgess a paper on "Job Gearing—To What Extent Can It Be Standardized?" and William Ganschow a paper on "Advantages of Gear Standardization." George L. Markland discussed the "Difficulties of Gear Standardization." The delegates visited the works of the Westinghouse Electric & Manufacturing Company at East Pittsburgh, where they saw methods of manufacturing Bakelite micarta for gears, after which they were the guests of the Westinghouse company at a dinner in the club rooms of the Pittsburgh Athletic Association.

New England States

BRIDGTON, ME.—The Western Maine Power Company, which recently took over the plant of the Bridgton Water & Electric Company, will soon erect a transmission line to connect the local plant with the transmission lines of the Cumberland County Power & Light Company.

FORT FAIRFIELD, ME. The Limestone (Me.) Light & Power Company, represented by Aubrey C. Frost of Limestone has petitioned the Public Utilities Commission for authority to furnish electricity in certain portions of the town of Fort Fairfield.

BOSTON, MASS.—An agreement has been reached between the city officials and the insurance men whereby a relatively small high-pressure-service pumping station will be built as soon as possible under the Copp's Hill burial grounds and that a few years hence another small station will be erected on the Charles River Esplanade. Plans have already been prepared for the Copp's Hill station which provide for a capacity of 13,000 gal. per minute, to cost about $165,000. It will be operated by electricity furnished from the power house of the Boston Elevated Company, with arrangements for a reserve supply from the Edison Electric Illuminating Company. The entire cost of the work, including station, laying additional water mains, etc., is estimated at about $1,000,000.

HOLYOKE, MASS. — The contract for the construction of the new power house for the Valley Paper Company has been awarded to the P. K. Kennedy Company. The new building will be equipped with modern power plant machinery.

SPRINGFIELD, MASS.—A permit has been granted for the erection of a new substation for the Springfield Street Railway Company, to cost about $30,000.

WESTFIELD, MASS. — Arrangements have been made for erecting electric lamps along Frederick Street.

PROVIDENCE, R. I.—The Narragansett Electric Light Company has applied to the City Council for permission to place manholes and conduits in Second Street.

Middle Atlantic States

ALBANY, N. Y.—Preliminary plans are being prepared by the J. G. White Engineering Corporation, 43 Exchange Place, New York City, for the construction of a hydroelectric power plant for the Albany Southern Railroad Company of Albany, to be located in the Catskill Mountains, to cost about $3,000,000.

BEACON, N. Y.—Bids will be received by James M. Carter, superintendent of prisons, Capitol, Albany, until June 12 for construction, heating, plumbing and drainage and electric work for the new dining room and kitchen for women's group at the Matteawan State Hospital, Beacon, N. Y. Drawings and specifications may be consulted at the Matteawan State Hospital, Beacon; at the New York office of the Department of Architecture, 1224 Woolworth Building, and at the Department of Architecture, Capitol, Albany. Lewis F. Pilcher is state architect.

BAYONNE, N. J.—Bids will be received by the Board of Education of Bayonne until June 14 for construction of new public school building, including electrical work, heating and ventilating, etc., to be erected on Avenue B near Forty-seventh Street. D. G. Anderson, Avenue E and Thirtieth Street, is architect. James D. Boyd is secretary of board.

NEWARK, N. J.—Preparations are being made by Victor A. Rohner of Newark to establish an electrical repair plant to work on generators, motors, armatures, etc.

NEWARK, N. J.—Bids will be received by the Board of Education, City Hall, Newark, until June 11 for electrical work, heating and ventilating, pipe covering and smoke breeching for various school buildings. R. D. Argue is secretary.

NEWARK, N. J.—Bids will be received by the Board of Freeholders until June 6 for coal and ash-handling equipment and steamfitting at the boiler plant at Overbrook Hospital. Runyon & Carey, 845 Broad Street, Newark, N. J., are consulting engineers.

NEWARK, N. J.—The Board of Freeholders has awarded the contract for new generator, engine and switchboard panels at the power plant of the Caldwell penitentiary to the Watson Flagg Engineering Company, 27 Thames Street, New York, at $9,500, and for boiler equipment to the Salmon Heating & Contracting Company, 259 New York Avenue, Newark, at $16,789.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

NEWARK, N. J.—Bids will be received by the Passaic Valley Sewerage Commissioners, 31 Clinton Street, Newark, N. J., until June 19 for electric equipment for the Newark Bay pumping station, including three 60-kva., two-phase, 60-cycle, 220-volt alternating-current generators directly connected to and mounted on the same bases with vertical compound steam engines with automatic lubrication, operating at 150-lb. gage pressure and 26-in. vacuum; also for a directly connected exciter for each set, with generator and feeder switchboard panels, field rheostat and auto-transformers for 220/110-volt lighting service, with electrical connections, steam supply, exhaust piping, etc. J. H. Quigg is clerk of commission.

PLAINFIELD, N. J.—Contract has been awarded by the Niles-Bement-Pond Company for the erection of a two-story, 85-ft. by 125-ft. addition to plant, to be used as an office building. The company, it is reported, has purchased equipment for a power plant which will be built later on.

HARRISBURG, PA.—Bids will be received by the Department of Safety until June 4 for municipal lighting throughout the city, including streets, city buildings, filter plant, pumping plant, etc., for a period of five years. The plans call for 350-watt magnetite electric arc lamps or incandescent lamps of 60 cp. or 100 cp.

TITUSVILLE, PA.—Bids will be received by the city of Titusville until June 4 for furnishing and installing one 3,000,000-gal. pump at the city water works, driven by gas or oil engine power. Specifications may be obtained from Karl R. Kightlinger, city engineer.

BALTIMORE, MD.—The City Electrical Commission is contemplating extensive additions to the municipal underground conduit system during the present year. Raleigh C. Thomas is chief engineer.

MORGANTOWN, W. VA.—Orders have been placed by the West Virginia Traction & Electric Company for four Taylor stokers for its local power house. Two of these stokers will be installed under the new 500-hp. boilers now being erected and the other two will be installed under the present gas-fired boilers, for these boilers can be operated with coal at a higher rating than at present.

ROANOKE, VA.—The Roanoke Railway & Electric Company is rebuilding its Walnut Street power station, at a cost of about $300 000. The output of the plant will be increased from 6000 hp. to 19,075 hp.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 28, for furnishing the various federal buildings, marine hospitals and quarantine stations under the control of the Treasury Department, portable desk lamps during the fiscal year ending June 30, 1918. For details see proposal columns.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Washington, D. C., Schedule 1184—miscellaneous electrical equipment; rammers, powder hoists, shell hoists, etc.; Schedule 1182—400 each high-resistance and non-adjustable type, radio-head receivers with cord; Schedule 1168—three 2-ton battery crane trucks. Philadelphia, Pa., and Norfolk, Va., Schedule 1186—furnishing and installing complete 14 furnaces and blowers. St. Juliens Creek (Norfolk), Va., Schedule 1164—two Diesel-engine-driven generating sets. New York, N. Y., or Mare Island, Cal., Schedule 1171—one motor truck. Mare Island, Cal., Schedule 1179—19,030 lb. admiralty metal condenser tubes, 3040 lb. sheet condenser tube. Boston, Mass., Schedule 1167—one motor-driven hobbing machine for worm wheels. Applications for proposals should designate the schedule desired by number.

North Central States

PORT HURON, MICH.—The City Commission has awarded the Port Huron Gas & Electric Company a contract for lighting the streets of the city for a period of seven years, under the terms of which the company will install a new street-lighting system. The contract provides for 152 lamps of 600 cp., 89 lamps of 400 cp. and 36 lamps of 100 cp.

BARBERTON, OHIO.—The City Council has adopted an ordinance providing for an issue of $50,000 in bonds for additions to the municipal electric power plant, including the installation of additional machinery and an extension to the power house.

CINCINNATI, OHIO.—The Diem & Wing Company of Cincinnati is planning to erect an addition to its plant on Eggleston Avenue most of which will be used as a power plant.

CINCINNATI, OHIO.—Application has been made by the Charles Boldt Company for a permit to erect a power plant and a sorting room addition to its new paper plant now under construction.

CLEVELAND, OHIO.—Plans are being prepared by William R. McCormack, architect of board of education, for a power house for the Norwood School, to cost about $50,000.

CLEVELAND, OHIO.—The State Utilities Commission has granted the Cleveland Electric Illuminating Company permission to issue $2,000,000 in bonds, the proceeds to be used for improvements.

GUNNERSVILLE, OHIO. — Right of way has been secured by the Dayton Power & Light Company of Toledo for the erection of an electric transmission line from Xenia to Gunnersville, a distance of 15 miles.

ST. MARYS, OHIO.—Contracts have been awarded by the Board of Control for the construction of the municipal electric-light and water-works plant and distribution system, including ornamental street lamps, to the Skeldon Engineering Company and the National Supply Company of Toledo, and Charles I. Zahm of Detroit, Mich. The cost of the work will be about $47,000.

YOUNGSTOWN, OHIO.—The Mahoning & Shenango Railway & Light Company of Youngstown is erecting a new electric transmission line from Lowellville to Masury. Work has begun on the construction of a large outdoor substation at Masury at which the line will terminate.

YOUNGSTOWN, OHIO.—Contract has been closed by the Brier Hill Steel Company with the Mahoning & Shenango Railway & Light Company for energy to operate its two plate mills, soon to be erected. The mills will be equipped throughout for electrical operation. The electrical equipment will include a number of motors of several thousand horse power each, and also one or two motor-generator sets with a rating of 1500 hp. each. The contract calls for 10 000 hp.

HARDINSBURG, KY.—The Hardinsburg Electric Light Company, recently organized, contemplates the construction of an electric plant here. Alfred Taylor and others are interested.

LA GRANGE, KY.—The Kentucky Utilities Company of Lexington is reported to have offered to purchase an electric light and power franchise and to enter into a contract for street lighting. Service is to be established on or before Dec. 1, 1917.

WHITESBURG, KY.—The Whitesburg Electric Light Company, recently organized by W. C. Daniels and others of Monica, is planning to erect electric transmission lines to nearby coal-mining plants. Work will be started at once on erection of the line.

KENDALLVILLE, IND.—Bids will be received by the Common Council of Kendallville, Ind., until June 12, for improvements to waterworks system, including the construction of a 500,000-gal. reinforced concrete reservoir, 40 ft. by 85 ft. by 20 ft.; one motor-driven, low-service centrifugal pump, 400-gal. per minute capacity; one motor-driven fire service centrifugal pump, 1000-gal. capacity per minute, with pipings, valves and fittings. George Champe of Toledo, Ohio, is civil engineer.

MARTINSVILLE, IND. — The power house of the municipal water-works system was recently destroyed by fire, causing a loss of about $25,000.

ROCHESTER, IND.—The Council has appropriated $8,000 to purchase a turbine pump with electric auxiliary for the municipal water-works system.

TIPTON, IND.—The plant of the H. Clauss Manufacturing Company, which was recently destroyed by fire, is being rebuilt. The plant will be equipped throughout with electrically operated machinery. Energy will be obtained from the municipal electric plant.

CALUMET, ILL.—Bids will be received by the clerk of the Sanitary District of Chicago, Room 700, Karpen Building, 910 South Michigan Boulevard, Chicago, until June 28, for furnishing and erecting equipment at the Calumet sewage pumping station as follows: (A) For six vertical centrifugal pumps of nominal capacity, one at

at 6 c.f.s., two at 7 c.f.s. and three at 2½ c.f.s.; (3) three vertical synchronous induction motors and three vertical induction motors (prime movers for above pumps); (4) two turbogenerator units with aggregate of nominal capacity of 3000 kw. each; (5) eight water tube boilers with furnaces, chain-grate stokers, steam superheaters, and one blower of nominal rating of 200 hp. each. John McGillen is clerk of board.

GIBSON CITY, ILL.—Plans are being considered by the City Council for the installation of a municipal electric light plant to cost about $12,000, for which bonds have been authorized.

LINCOLN, ILL.—Bids are being asked by the City Commissioners for the installation of an ornamental lighting system on Lincoln and Wyatt Avenues. At an election to be held June 19 the proposal as to whether the city will acquire and operate the Lincoln Street Railway and issue $50,000 in bonds for same will be submitted to the voters.

BIRNAMWOOD, WIS.—The Charles W. Fish Lumber Company of Birnamwood, it is reported, will soon be ready for bids for construction of a power plant 35 ft. by 115 ft., and steam generating equipment.

SCHLEISINGERVILLE, WIS.—The transmission line from the village of Schleisingerville to Hartford is reported to have been purchased by the Milwaukee Electric Railway & Light Company, which is extending its system in this section.

WEST MILWAUKEE, WIS.—A special election will be called to submit to the voters the proposal to install an electric street-lighting system in the village. An estimated cost of a system has been prepared by Arthur J. Sweet, consulting engineer.

ST. PAUL, MINN.—Improvements are being made to the plant of the St. Paul Foundry Company, involving an expenditure of about $1,000,000. Several fireproof buildings have been erected and new equipment and electrical apparatus will be installed.

CENTERVILLE, IOWA.—The Centerville Light & Traction Company, which has purchased a number of small electric operating companies in the vicinity of Centerville, contemplates the erection of 13,200-volt transmission lines to connect these plants with its central power station.

DES MOINES, IOWA.—Work has started on the foundation for the installation of the new 5000-kw. turbo-generator at the plant of the Des Moines Electric Company. A battery of boilers and a new switchboard will also be installed.

FORT DODGE, IOWA.—Bids will be received at the office of W. L. Tang, city clerk, Fort Dodge, until June 5 for furnishing material and erecting an electric transmission line in the city of Fort Dodge. Specifications may be obtained from Burns & McDonnel, consulting engineers, Inter-State Building, Kansas City, Mo.

MOREHEAD, IOWA.—At an election held recently the proposal to issue bonds for the installation of an electric lighting system was carried.

MOUNT VERNON, IOWA.—Preliminary plans are being prepared by the Wapsi Power & Light Company for an extension of its electric transmission lines out of West Branch, a distance of 8 or 9 miles, which will take in the villages of Centerdale and Springdale.

ST. LOUIS, MO.—The Union Electric Light & Power Company has awarded the contract for construction of a new substation three stories high, to the Fruin-Colnan Construction Company of St. Louis. The station will be equipped with five 3000-kw. transformers and 30 outgoing circuits. The total cost of the work is estimated at $500,000.

BONESTEEL, S. D.—Plans are being prepared for the installation of an electric light plant and water-works system. Bruce & Standeven, Bee Building, Omaha, Neb., are engineers.

LARNED, KAN.—Bids will be received by the Commissioners of Pawnee County, Larned, Kan., until June 26, for the construction of a court house, including electric wiring, heating, vacuum cleaner, ventilating fans, etc. The cost of the building is estimated at $125,000. W. E. Hulse & Company, National Bank Building, Hutchinson, are architects.

LONG ISLAND, KAN.—Bonds to the amount of $8,000 have been voted for the installation of a municipal electric-lighting system. The work will include the erection of a 13,200-volt, three-phase, electric transmission line (9 miles long) to connect with the electric plant at Phillipsburg; a pole type transformer substation will be built, equipped with three 10-kw. transformers and multiphase meter; the street-lighting system will consist of 77 series lamps with transformer, meter and time clock. The lamps will be suspended by cable over the center of the streets. The distributing system will cost about $2,000 and will include three 7½-kw., 7200-220-110 volt transformers and one 2-kw. transformer. About 12 buildings will be wired and the meters will be purchased by the city. Bids for the above work will be received by the city. Charles F. Sturtevant of Holdredge, Neb., is engineer in charge. Ira C. Young is Mayor.

McPHERSON, KAN.—Bids are being received by the Water and Light Department of McPherson for furnishing and installing a 250-hp. water-tube boiler and a 500-hp. open heater, with all small piping and attachments; also a steam-driven generating unit (directly connected) of not less than 300-kva. capacity, and switchboard panel with instruments and switches. Arthur Groesbeck is superintendent.

Southern States

RALEIGH, N. C.—Application has been filed with the Secretary of State by the Western Carolina Power Company for an amendment to its charter increasing its capital stock from $300,000 to $1,500,000 and removing its headquarters from Hickory to Charlotte.

CARTERSVILLE, GA.—Arrangements have been made whereby the Georgia Railway & Power Company of Atlanta will supply energy for operating the local system.

CHAUNCEY, GA.—The Georgia & Southern Utilities Company, recently granted a franchise in Chauncey, is planning to erect an electric transmission line to Chauncey and thence to Milan and Ryan, a total distance of 18 miles. The company proposes to construct an electric plant and develop about 200 hp. C. R. Hodgson of Eastman is manager. The company, it is understood, will do the work and no contracts will be awarded.

MILAN, GA.—The Georgia & Southern Utilities Company is contemplating extending its electric transmission line to Milan.

CHATTANOOGA, TENN.—The Chattanooga Railway & Light Company is planning to build at once an additional electric railway line to the Chickamauga Park Army Camp, following the Rossville Road.

COLUMBIA, ALA.—Work has been started on a hydroelectric development at Kelso, 2 miles west of Columbia. The proposed plant will develop from 5000 to 10,000 hp., which will be transmitted to Dothan, Headland, Newville, Ashford and Columbia in Alabama, and Blakely in Georgia. J. E. Foy and Dermot Shemwell of Lexington, N. C., are promoters. A company has been organized under the name of the Southeast Alabama Power Company to operate the plant.

OKARCHE, OKLA.—The installation of an electric lighting plant is under consideration by the City Council.

OKLAHOMA CITY, OKLA.—The State Capitol Commission is considering the construction of a power house and heating plant for the Capitol Building. A. N. Leecraft is secretary.

EL PASO, TEX.—Bids will be received at office of depot quartermaster, El Paso, Tex., until June 14 for alterations in construction and new electrical and pumping equipment at present pumping station, reinforced concrete reservoir and water pipe lines at Fort Bliss, Tex.

PAINT ROCK, TEX.—The Interstate Electric Corporation, which controls and operates the San Angelo (Tex.) Water, Light & Power Company, contemplates extending its electric transmission lines from Miles to Paint Rock, a distance of 18 miles, to furnish electrical service here.

Pacific and Mountain States

OHESAW, WASH.—The installation of an electric lighting system in Ohesaw is reported to be under consideration.

SEATTLE, WASH.—The Puget Sound Traction, Light & Power Company is planning to erect a substation at First Avenue South and Spokane Street, to be equipped with a 500-kw. motor-generator, to be increased to 1000-kw. The cost of the building and equipment is estimated at $12,000.

SEATTLE, WASH.—Work has been started to make surveys for the proposed power plant and nitrogen products plant of the American Nitrogen Products Company of Seattle on the Sauk Suiattle River in Snohomish County, 60 miles northeast of Seattle. The cost of the plant is estimated at $1,000,000.

SEATTLE, WASH.—The Board of Public Works has set July 20 as the date for opening bids for construction of the proposed addition to the municipal hydroelectric power system, and at this time bids from owners of power sites will be considered. In addition to the above, the following work is planned for this year by J. D. Ross, superintendent of lighting, as follows: Central substations, $50,000; distributing stations, $75,000; pipe line No. 1, $75,000; underground system, $100,000 and stores and shop buildings, $100,000.

SPOKANE, WASH.—The Washington Water Power Company will conduct tests on six new types of street lamps recently purchased by the city.

SPOKANE, WASH.—The Washington Water Power Company of Spokane is negotiating with mine operators on the north side of the Coeur d'Alene region to furnish them with energy for the operation of mines and mills. Line construction and transformer installation, it is estimated, would cost about $50,000. The several lines would have a total length of 25 miles. The service, it is stated, could not be furnished before next year, due to delay in obtaining transformers.

ASTORIA, ORE.—The Commissioners of the Port of Astoria have decided to install their own power plant to supply power for operating the machinery at the port elevator and coal bunkers.

FONTANA, CAL.—Plans are being prepared for the construction of a hydroelectric power plant for the Fontana Power Company, near Rialto, the initial installation to have an output of 18,000 kw. McKeen & Miller, Monadnock Building, Chicago, Ill., are engineers.

FRESNO, CAL.—The San Joaquin Light & Power Company is planning to double the output of its substation at Henrietta and is contemplating other improvements to its system. Work is under way on the construction of a new substation for the company at Chowchilla.

SAN BERNARDINO, CAL.—Work will soon begin on the erection of a mechanical plant in San Bernardino, to cost about $50,000. This plant is to handle all lines in southern California east of Upland.

VISALIA, CAL.—The Mount Whitney Power & Electric Company, it is reported, is making surveys for its proposed new power plant to be erected near the forks of Tule River, about 30 miles east of Porterville.

SALT LAKE CITY, UTAH.—The contract for erecting another electric transmission line from the Grace (Idaho) power plant of the Utah Power & Light Company to Salt Lake City has been awarded to the Phoenix Construction Company.

GOODSPRINGS, NEV.—Preliminary work has begun for the construction of a hydroelectric development on the Colorado River, just above Bend, to supply electricity for the Goodsprings and Yellow Pine District. It is proposed to transmit energy generated at the plant to many places in Arizona and in Nevada to points as far north as Ely and Pioche. Henry C. Schmidt of Tonopah is reported interested in the project.

Canada

PENTICTON, B. C.—The Canada Copper Corporation is planning to equip its mine at Copper Mountain for a production of 2000 tons daily. A power plant will be installed.

CAMPBELLFORD, ONT.—The Town Council has passed a by-law appropriating $19,000 for extensions and improvements to the electric-lighting and power system.

KINGSVILLE, ONT.—The local power plant and carhouse of the Windsor, Essex & Lake Shore Rapid Railway Company was recently damaged by fire, causing a loss of about $150,000.

ST. THOMAS, ONT.—The construction of an extension of the St. Thomas municipal railway to Pinafore Park is under consideration by the City Council.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing agent, the Panama Canal, Washington, D. C., until June 15 for furnishing electric cable and wire, battery zincs, detonators, transformers, electric motors, fiber duct, etc. Blanks and general information relating to this circular (No. 1147) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; Audubon Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

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AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 8 West 40th St., New York.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa. Annual convention, Pittsburgh, Oct. 3-6.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, INC. Secretary, F. A. Molitor, 35 Nassau St., New York City.

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ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, A. J. Burns, 318 West Tenth St., Kansas City, Mo.

ELECTRICAL CONTRACTORS' ASSOCIATION OF THE STATE OF PENNSYLVANIA. Secretary, M. G. Sellers, 1518 Sansom St., Philadelphia. Annual convention, Philadelphia, June 19-21.

ELECTRICAL CONTRACTORS' ASSOCIATION OF WISCONSIN. Secretary, J. C. Staff, 578 Jackson St., Milwaukee, Wis.

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ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, 34 Ellis St., San Francisco, Cal.

ELECTRIC POWER CLUB. Secretary, C. H. Roth, 1410 West Adams St., Chicago. Meeting, Hot Springs, Va., June 11 and 12.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Affiliated with the N. E. L. A. Secretary, A. Jackson Marshall, 29 West 39th St., New York.

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WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, E. N. Layfield, 1735 Monadnock Block, Chicago.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, 1410 First National Bank Building, Milwaukee, Wis.

1,226,637. Resistance Unit. Thomas E. Eatonin, Milwaukee, Wis. App. filed May 11, 1914. Grid type.

1,226,643. Electromagnetic Vibrator. Frank E. Brinton, Manitowoc, Wis. App. filed Aug. 21, 1916. For vibrating pattern plates disposed in molds.

1,226,649. Electric Welding. Spencer C. Cary, Brooklyn, N. Y. App. filed Feb. 19, 1914. Two pressure and current carrying electrodes are employed, both of which may be movable in a definite path relatively to the work.

1,226,696. Thermostat Operating Circuit. Wellington A. Ramseur, Gainesville, Ga. App. filed March 9, 1916. For operating a valve for controlling the supply of water to a house or dwelling.

1,226,717. Lighting Fixture. Merton P. Stevens, East Orange, N. J. App. filed April 22, 1915. Means for holding a shade.

1,226,734. Electric Fan Attachment. Willis I. Work, Boston, Mass. App. filed Dec. 5, 1914. To diffuse heat throughout a room.

1,226,748. Solenoid; George A. Burnham, Saugus, Mass. App. filed July 1, 1915. Provides means to deaden or reduce the shock.

1,226,780. Multiple Refillable Fuse. Fremont J. Cleaver, Carnegie Borough, Pa. App. filed Oct. 5, 1915. Improvements.

1,226,795. Insulator Press; William Newby, Youngstown, Ohio. App. filed March 25, 1913. Improvements.

1,226,804. Driving Mechanism for Treadle-Operated Machines; Frederick J. Osius, Racine, Wis. App. filed Jan. 8, 1915. Such as an ordinary sewing machine.

1,226,808. Sealable Fuse Plug; Clarence D. Platt, Bridgeport, Conn. App. filed Feb. 29, 1916. For the protection of small branch circuits.

1,226,813. Electric-Wiring Connection; Harold Rowntree, Kenilworth, Ill. App. filed Dec. 3, 1914. Permits the ready and easy application of electric fixtures such as lamps, fan motors or the like at any desired location in a room.

1,226,816. Primary Battery; Charles N. Schoenmehl and Martin L. Martus, Waterbury, Conn. App. filed May 15, 1916. Improved form of insulating block whereby the two electrodes may be insulatively secured together and suspended from a single suspending rod.

1,226,837. Variable-Resistance Unit; Benjamin F. Williston, Detroit, Mich. App. filed May 17, 1916. Soldered joints are eliminated.

1,226,849. Electric Water Heater; Joseph B. Brookman, Manhattan, Nev. App. filed June 5, 1916. Provides safety means for operation when liquid is not being withdrawn from the tank.

1,226,901. Synchronous Dynamo-Electric Machine; Samuel H. Martin, Chicago, Ill. App. filed June 2, 1913. Improvements.

1,226,921. Connection for Electric Conduits; George L. Stewart, Syracuse, N. Y. App. filed July 2, 1912. Guards against the entrance of moisture into the conduits at the joints.

1,226,925. Ductile Filament; Orlando M. Thowless, Newark, N. J. App. filed Aug. 9, 1915. Free from all undesirable and deleterious substances and which shall not darken the containing bulbs while lighted.

1,226,926. Electric Flashlight; Joseph Tiscione, New York, N. Y. App. filed July 1, 1915. Pocket.

1,226,956. Mercury Motor-Meter; Albert L. Emens, Springfield, Ill. App. filed May 3, 1915. Provides a construction by which complete protection is secured against the loss of mercury through the armature shaft opening or passage.

1,227,012. Flashlight; Max H. Spielman, New York, N. Y. App. filed April 11, 1916. Avoids the usual thumb switch which is placed on the side of the cylindrical battery case of electric torch.

1,227,038. Resistance Unit for Electric Circuits; William A. Chryst, Dayton, Ohio. App. filed Aug. 4, 1913. Adapted to be combined with the circuits of an ignition system.

1,227,091. Speed-Regulating Apparatus; John B. Taylor, Schenectady, N. Y. App. filed Dec. 1, 1914. For use with musical instruments.

1,227,111. Insulator-Block Cable Bracket Hanger; Ellsworth J. Burdick, Detroit, Mich. App. filed June 4, 1915. Protects the armor of a supported cable from contact with the bracket or cable support and against all stray currents, auto-electrolysis or galvanic action that might otherwise take place.

Record of Electrical Patents

Notes on United States Patents issued on May 22, 1917

1,227,149. Method of Charging Secondary Batteries. Edward B. Jacobson, Pittsfield, Mass. App. filed Dec. 3, 1913. "Foolproof."

1,227,177. Motor Controller; Niels L. Mortensen, Milwaukee, Wis. App. filed Nov. 15, 1911. Control of electric motors used for hoisting and lowering where dynamic braking and power reversal or kick-off are desired for lowering.

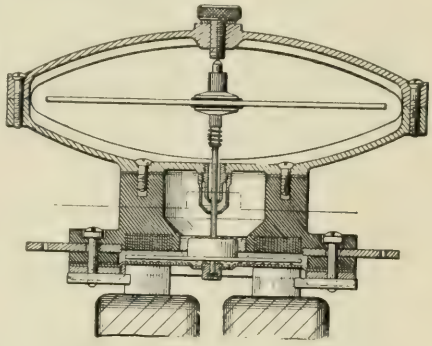
1,227,185. Induction Device; Alfons H. Neuland, New York, N. Y. App. filed Sept. 1, 1915. Will change the low torque and high speed of the driven shaft.

1,227,195. Push-Button Switch; Clarence D. Platt, Bridgeport, Conn. App. filed March 17, 1914. Single or multiple-pole design.

1,227,210. Method of Operating Flaming-Arc Lights for Projectors; Elmer A. Sperry, Brooklyn, N. Y. App. filed June 28, 1915. Employs a direct-current arc of a different sort and possessing very different qualities from the direct-current arcs ordinarily used.

1,227,211. Means for Preventing Current Leakage in Electric Cables; Severn D. Spring and Walter E. McCoy, New York, N. Y. App. filed Dec. 12, 1916. Improvement.

1,227,228. Cut-out for Electric Sterilizers; William L. Woerner, New York, N. Y. App. filed Jan. 13, 1915. Means for interrupting or breaking the electric circuit serving to energize the heating element.



1,226,956—Mercury Motor-Meter

1,227,230. Electric Pump Governor; Burton S. Aikman, Milwaukee, Wis. App. filed Dec. 24, 1914. Governor in which no movements of the parts takes place until the predetermined maximum and minimum pump pressures are reached.

1,227,241. Electrical Appliances; Carl J. Bissell and Elda S. Smith, Syracuse, N. Y. App. filed Aug. 7, 1914. Adapted for storage-battery charging stations in railroad terminals and coachyards.

1,227,256. Multiple-Fuse Plug; Frederick A. Feldkamp, Newark, N. J. App. filed Jan. 18, 1916. Stationary base member and a member axially movable and rotable with respect thereto.

1,227,270. Circuit-Closing Push Button; Robert J. Jackson, Philadelphia, Pa. App. filed April 17, 1916. Uses a brass coil spring.

1,227,286. Draft Indicator; John Maher, Cleveland, Ohio. App. filed July 6, 1914. Provision of a wholly automatic control instead of a co-operating manual control.

1,227,295. Storage-Battery Electrode or Grid; William Morison, Des Moines, Iowa. App. filed Aug. 8, 1913. Maximum of surface exposed to the electro-chemical action for a given weight of metal.

1,227,302. Means for Controlling Alternating Currents; Mendel Osnos, Berlin, Germany. App. filed July 8, 1915. Improvements.

1,227,314. Transformer; Emerson G. Reed, Wilkinsburg, Pa. App. filed Nov. 5, 1913. Insures adequate cooling for the transformer coils and at the same time will require a minimum amount of active material.

1,227,320. Demand Apparatus. Lewis T. Robinson, Schenectady, N. Y. App. filed Sept. 29, 1916. For recording the character and magnitude of the demand made by an electrical installation upon a certain generating station.

1,227,321. Regulator for Dynamo-Electric Machines; Paul Rose, Berlin, Germany. App. filed Feb. 20, 1911. Contact making regulators.

1,227,324. Air Heater; Percy Russell, Brooklyn, N. Y., Frank J. Sepas, Philadelphia, Pa., and Edward B. Wilford, Merion Borough, Pa. App. filed Jan. 30, 1914. Heats a flowing body of air as required in dental syringes and like instruments.

1,227,326. Electric Time Switch; George E. Schindler, Ashland, Wis. App. filed Aug. 9, 1916. Movable elements are so associated as to minimize the resistance to the flow of current.

1,227,341. Electromagnetic Device; Harry F. Stratton, Cleveland, Ohio. App. filed Dec. 22, 1915. Means for accelerating the decay of magnetism in the magnetic circuits of such devices upon their de-energization.

1,227,367. Latching and Tripping Mechanism; Victor S. Beam, Maplewood, and Ernest C. Otto, Elizabeth, N. J. App. filed Oct. 2, 1913. For circuit breakers.

1,227,385. Circuit-Interrupting Means; Frank E. Case, Schenectady, N. Y. App. filed June 29, 1914. Particularly concerned with the mounting and inclosure of such means.

1,227,400. Electric Motor; Michael Dolivo-Dorbowolsky, Wilmersdorf, Germany. App. filed March 25, 1914. For driving a lock mechanism.

1,227,404. Expansion Chamber for Electrical Apparatus; Delafield Du Bois, New York, N. Y. App. filed Nov. 1, 1913. Provides for the free normal expansion and contraction of the materials within the tank as their temperature changes in such a manner that it is impossible for the outside air to reach the fluid of the tank.

1,227,414. Dynamo-Electric Machine; Allan B. Field, London, England. App. filed Dec. 31, 1913. Magnetizable core for dynamo-electric machines which shall permit of ready and rapid winding of the coils therein and shall embody means for easily and securely maintaining the coils in position.

1,227,415. Transformer; Charles Le G. Fortescue, Pittsburgh, Pa. App. filed Aug. 7, 1911. Three-phase transformer which shall be so arranged and proportioned as to utilize its magnetizable core member to a maximum extent.

1,227,417. Circuit-Interrupting Device; Charles Le G. Fortescue, Pittsburgh, Pa. App. filed June 30, 1915. Automatic means for interrupting a circuit upon either the occurrence of a short circuit or a gradually increasing overload.

1,227,433. Relay; Max Hartenheim, Pittsburgh, Pa. App. filed Aug. 10, 1915. Hot-wire relays that are utilized for controlling the operation of dynamo-electric machines.

1,227,434. Switching Device; Stephen Q. Hayes and Charles McL. Moss, Pittsburgh, Pa. App. filed May 1, 1913. Swinging-blade disconnecting switches.

1,227,468. Electrical Measuring Instrument; Paul MacGahan, Pittsburgh, Pa. App. filed May 1, 1913. Bearings and pole pieces which are simple and inexpensive to construct.

1,227,479. Relay; Paul MacGahan, Pittsburgh, Pa. App. filed June 11, 1915. Object is to provide a relay having time element.

1,227,472. Circuit Interrupter; Joseph N. Mahoney, Wilkinsburg, Pa. App. filed Sept. 28, 1912. Auxiliary devices which may be employed for actuating the movable parts of the interrupter with great rapidity.

1,227,488. Electric Cooker; Stanley B. Oakes, Flint, Mich. App. filed Jan. 17, 1916. Toasters.

1,227,529. Radiator-Heater; Albert R. Clarke, Sheridan, Wyo. App. filed Feb. 21, 1916. Relates to combustion engines, and particularly to the cooling systems thereof.

1,227,538. Flexible Electrical Conduit; Courtney Hyde, Brooklyn, N. Y. App. filed March 15, 1916. Does not include as an element a supporting helix of semi-flexible material.

1,227,553. Plural Lamp Socket; Adolph C. Becker. Oakville, Conn. App. filed March 2, 1917. Avoids the use of assembling screws.

Electrical World

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Co-ordination with Electrical Contractors

FORMATION by the larger electrical contracting companies of "the Conference Club," described elsewhere in this issue, is of far-reaching importance in the closer organization of the industry. It is a step toward the finely knit co-ordination of commercial interests which the Electrical World discussed in its issue of May 19, 1917. It is intended to be, in purpose and execution, a stabilizer for the electrical contracting branch of the industry. So rapid has been the growth of this section of the industry that it faces problems of policy which are distinctively its own to solve. The jobbers have long realized the necessity of a strong central organization; the manufacturers, approaching the solution more slowly, have worked out by evolution the very effective plan of three organizations with representatives serving on a central council. The contractors have their national organization, which well meets the needs of the great body of its members and is supplemented by able local organization. Into this situation the Conference Club has entered as a medium for exchange of views between contractor and manufacturer, for raising the standard and public estimation of the contractor, for taking up large questions and by fair solution giving stability to a business which involves a tremendous annual turnover.

Agricultural Needs of the Far West

THE war has opened up great opportunities in agriculture, and these opportunities are nowhere half so apparent as on the Pacific Coast. There is the soil, there is the climate, and all that is lacking is the rain. The quickest way to get water is to pump it, and west of the Rockies that means by electricity. As a result the power companies have been besieged with demands for more service lines, but the business cannot be taken on because small transformers and motors are not to be had. Interwoven as is the subject of increased crops with the national situation, a remedy ought to be forthcoming quickly. Electricity on the Pacific Coast is the most economical source of power available and, being generated from falling water, there is no waste of fuel involved. Moreover, the lines of the power companies are so interconnected that there is little waste of electricity either. The demand for motors and transformers is about three times normal, but this is offset by a subnormal demand for generating equipment. Animated by a desire to keep down the cost of electricity and still make the supplying of it profitable, co-operation between the electricity supply companies has reached a higher level in California than in any other state in the Union. In fact, by the installation of less than twenty-five miles of transmission line the interconnected network would embrace every important city in the State from Oregon to Mexico. Thus the companies are in a position to supply all demands for energy at minimum cost and with the utmost reliability of service. The tillers of the soil in the great fertile valleys are anxious to do their part in the national crisis; the generating companies are likewise anxious and willing to contribute their share, but the manufacturers of electrical equipment are not equal to the emergency. Crops must be had, and the farmers will find a means for obtaining water by other than electric means if they are driven to it. Gasoline and oil engines are plentiful in California, and there is no dearth of oil there. What we desire particularly to call attention to is that if the necessary motors and transformers are not forthcoming manufacturers will not be the only ones to suffer but very valuable business will be lost to the central stations, jobbers and contractors as well.

A Solution of the Coal Problem

OUR readers will find an excellent summary of the present condition of the oil-engine situation in Prof. A. A. Potter's brief paper. We have discussed the matter repeatedly in these columns from the commercial standpoint, but it is an excellent thing to have the fundamental facts brought together in so clear a form as here. Broadly, the state of the case is this, that there are in use a vast number of small engines using gasoline and the lighter distillates. They are fairly efficient, enormously convenient, and would be even more widely used than at present were it not for the fact that the demand for gasoline and the like has run up the price and will increase it still further in the near future. The result is that this type of engine, which almost universally follows the so-called Otto cycle, is relatively somewhat expensive to run, despite its good thermodynamic properties.

On the other hand, a good many engines of the Diesel type, of capacity running to some hundreds of horsepower each, are employed, using the heavier oils, operating at a high efficiency, and giving excellent economic results. The practical trouble with the Diesel type of engine is its very high initial expense. In rough terms, it costs rather more than a first-class steam plant per horsepower, or perhaps three times as much as the engines of the light-oil or gasoline type. It is complicated and requires not so much constant care as intelligent care. On account of the cheapness of fuel supply in this country, steam engines even of uneconomical

type have been in the past operated at moderate expense, and particularly with very small overhead charges. Consequently, few users of power are keen about installing a type of machinery which, while highly economical, means the investment of a large amount of capital. As solid fuel gets higher in price, the Diesel engine, which from a thermodynamic standpoint is extraordinarily good, would stand a greater and greater chance of more general use. From the commercial standpoint the makers of such engines have not yet put them fairly into competitive relations with steam equipment, so that it may reasonably be expected that the price of the oil engine will be likely to fall somewhat as it becomes more appreciated and more familiar. The time has now come, however, when the cost of coal and the irregularity of supply compel the use of high-economy power-producing plants, whether steam or oil. And therefore we may expect gradually to see the better grade of oil engines come into increasing use, particularly for the units of moderate size for which high-efficiency steam engines are difficult to obtain.

Testing Insulation Under Load

ABILITY to keep continuous record of the insulation strength when a machine is in action gives an insight into its operating conditions that is extremely valuable, and also may give indications of impending trouble in time to avert unpleasant results. The armature insulation of the generator is its weakest point, upon the maintenance of which in standard condition depends the usefulness of the machine. Now, measuring the insulation resistance of an armature is a perfectly simple matter when the machine is at rest. When it is running the insulation is sometimes under very heavy voltage stress, experiences severe mechanical strains, and is affected by high temperature and atmospheric conditions. E. O. Schweitzer's paper in the current issue gives a very ingenious and useful method of keeping the armature insulation of a high-voltage generator always under observation. The connections and method of using the apparatus are excellently shown in his paper. The principal difficulty which was encountered was due to the effect of static charge in giving false readings on the megger. This difficulty was overcome by connecting the megger to the circuit before the armature was energized, thus sufficiently dissipating the static charge to avoid trouble.

Preliminary tests showed that in armature resistance there was a steady decrease in the megohms indicated as the voltage rose. With the insulation very dry and in first-class condition this decrease was small, while if the initial value had been lowered by the absorption of moisture the change with rise of voltage was unpleasantly rapid. The experiments went far enough to show that the scheme would develop important information regarding the condition of insulation resistance with very little trouble, and it deserves application on a wider scale. We may go further and say that insulation measurements in general should be made as far as practicable under working conditions and with working voltages, with the limitation that in some cases there seems no way of avoiding the use of direct current for the insulation test on account of the capacity effects. Megohm resistances tested under a potential strain of only a few hundred volts cannot be considered a fair measure of what the insulation will do when worked at 20,000 volts under practical conditions of mechanical stress and temperature. There needs to be a considerable development of apparatus for measurements at high pressure, for every year the working voltage on cables and machinery tends steadily upward, so that the testing methods of fifteen or twenty years ago are obsolete. We are glad Mr. Schweitzer has taken up the matter seriously with so good a prospect of solving a difficult problem with practical success.

What Good Lighting Means to Industry

UNDER the stress of war conditions, with many plants operating in three shifts, still greater emphasis must be laid on the effect of illumination upon working efficiency. It is not only necessary to improve lighting conditions temporarily, but to bring them to a point of effectiveness where the night shifts will turn out as much and as good work as can normally be expected from a day shift. Professor Clewell's notes on industrial lighting summarize excellently well the conditions which have been brought about within recent years. The main source of improvement lies in the very low cost of luminous flux with present lamps and at present rates. The change in the specific consumption of lamps in ordinary use from 3.5 watts per candle to 1 watt, with the simultaneous downward tendency in prices of energy, has made light one of the cheapest of useful commodities. From a purely practical standpoint, too, the work of the illuminating engineers and the manufacturers in getting modern lamps down to a businesslike basis as producers of illumination has been very effective. The production of the new lamps of fairly large power and great intrinsic brilliancy has compelled many changes of the methods of installation. These have come about sometimes rather tardily, but there is no excuse at the present moment for poor illuminating appliances either on the ground of availability or of cost.

The beginning of improvement came with the metallic-filament lamp and has been continued by the introduction of the big gas-filled units which bring the cost of light to an extremely low figure. For certain purposes arc and mercury-vapor lamps still find a useful place, the first chiefly in very large areas, the second especially in metal-working establishments where the particular color characteristics of the light are sometimes of great service in facilitating the detection of blemishes which might otherwise escape notice. But the backbone of industrial lighting at the present time is the gas-filled lamp of power between those common with the old tungsten lamps and those found in the arc. As Professor Clewell points out, there has been a certain amount of standardization in the matter of fixtures, but this has not yet gone far enough to enable a fixed system to be

laid out for a factory building irrespective of the uses to which it is to be put. A good many failures have resulted from the notion that standardization has really been accomplished. What can be said, however, is that the two or three general methods in use are so familiar and effective that wide departures from ordinary practice do not have to be made, although the lighting has to be laid out skillfully to fit the individual case. From a purely practical standpoint the manufacturer has learned that good lighting means more and better output, as we have many times pointed out—enough more and enough better to pay handsomely for the investment in light.

Maximum-Demand Meters

A STUDY of the common types of maximum-demand meters and of the possible instrumental errors which their use may show brings out many interesting points. Many contracts being based on the maximum demand, usually over a specified length of time, the demand-reading meter has a useful and legitimate field. In certain classes of installations where the time of the maximum demand is approximately known the relation of this demand to station economics becomes very simple, and the customary instruments are very well suited to the work. By general average one can take account even of the rapidly intermittent loads with reasonable fairness, although the results must necessarily contain a large factor of experience in the relation between instrument readings and the resulting effect on the station. In fact, once the characteristics of a consumer's load are known, suitable applications can be found for the types of maximum-demand instrument now on the market. The point which we wish to emphasize, however, is that unless the real nature of the fluctuations in any given case is known from observation or experience, the demand instrument is liable to be somewhat misleading. The upshot of the matter is that in the case, for instance, of taking on a factory load of an unfamiliar kind nothing except a curve-drawing instrument with charts taken over an adequate period can give a really accurate idea of the load characteristics in their relation to station performance. Whatever instruments are at hand for use, when conditions permit the curve-drawing instrument should be the court of last resort in the study of new conditions and the interpretation of records otherwise obtained.

Help the Liberty Loan

ONLY by selling securities regularly can the electric central station provide the enormous capital needed for expansion; but to-day it, with other elements in the industry, is in the position, not of selling, but of buying. With other factors in the industry, it is investment buyer of government bonds; it is banker for employees who are pledging savings to the "Liberty Loan"; it is publicity agent for Uncle Sam, who is raising the strong sinews of war. The industry is giving public service in a new form by helping along the sentiment that leads every one to do his "bit." Concrete advice to electrical companies by F. A. Vanderlip, president National City Bank of New York, published in the ELECTRICAL WORLD of May 26, is in effect: Subscribe on your own account; make it easy for employees to subscribe; send out with bills and notices a Liberty Loan inclosure; grant free advertising facilities to the Liberty Loan local committees. It cannot be expected that electrical companies will do as much to help as the banking agencies which make a business of placing securities with investors, for they lack the necessary training; it is expected that they will do what they can, be it little or much, without loss of time. They cannot turn a plant or a generator into the government treasury in payment for bonds, but they can show employees the meaning of subscription; they can lend the aid of their organizations and resources; they can in a great many instances invest according to their individual means. The opportunity to render public service, which after all is their real business, stands before us merely clothed in new garb. Shall we do our part? It is the largest duty and privilege, the greatest public policy problem which the industry ever faced. Wisdom and patriotism point the way clearly.

The Coming Issues

IN THIS and past issues we have suggested how increased expenses due to the high cost of materials and labor can be offset by interconnecting favorably situated systems, by the use of low-grade fuels, by the installation of inexpensive forms of transmission lines, etc. The next issue will contain the results of an analysis which may be applied quite generally for determining how distribution transformers may be installed with respect to each other so that the voltage drops and consequently the line loss shall be kept within permissible limits and so that the transformers shall not be overloaded. Curves are presented to enable a study of this kind to be made with the least calculation. An article which deals with the mutual inductance of parallel reactors and the forces exerted between them should also be of interest, as these adjuncts to electric-service equipment are coming to be used more and more where disturbances must be confined to the sections in which they originate. Applications of the principles discussed are taken up in specific examples, and comparisons are given of the results obtained by formulas and actual test data. The third installment of Professor Clewell's articles on industrial lighting is especially significant, as it shows what an important factor adequate illumination is in preventing accidents. This article should be of interest to central station salesmen seeking new lighting contracts and to factory managers who seek to reduce accidents. Among other interesting articles in the coming issue will be short accounts of schemes used by different operating companies for improving plant economy and bettering service. A timely article will be published on the relation between coal cost and power rates in a small central station plant. In the fourth issue of June there will be discussed the value of grain elevators as central station loads. This article will contain data of value to power salesmen, consulting engineers and contractors.

Oil Engines as a Relief Against Coal Prices

Advisability of Considering Them as a Means to Reduce Standby Expenses—Characteristics of Various Types of Internal Combustion Engines and Their Different Fields of Application

BY A. A. POTTER

Dean of the Engineering Division and Professor of Mechanical Engineering, Kansas State Agricultural College, Manhattan, Kan.

INCREASED prices of coal, the difficulty of securing deliveries and the high cost of labor have made many operating companies seek new methods of reducing the cost of generating electricity. In large plants these new conditions are being met by using stokers that can burn low grades of coal and by operating boilers and prime movers that are very efficient. Smaller plants, however, which do not have loads that will justify the expense of installing such equipment must look elsewhere for relief. While many such companies may improve their plant economy by removing the sources of waste which have heretofore been left unhindered, many of these companies can consider the use of internal-combustion engines as a means of reducing labor, fuel and standby expenses. This is especially true at this time, as there is every likelihood that the price of coal will go higher.

Oil engines using various fuels are beginning to play a very important rôle in the Southwest, where large quantities of oil are available at a cost which compares favorably with the cost of coal in the same territory. Several recent installations of oil engines using the heavier fuels are even competing with steam prime movers in power plants rated at 200 kw. to 1000 kw. The fact that internal-combustion engines are equally economical in all sizes makes this type of prime mover especially advantageous for small power plants, where several oil engines can be made to carry the load, with the consequent high load factor of each unit and the increased reliability of service. The oil engine is also used to some extent as an auxiliary for small hydroelectric power plants and as an emergency peak-load unit in steam-electric power plants.

Petroleum distillates are used chiefly in liquid-fuel engines, although alcohol, tar, tar oil, shale oil and phenoloid (liquid fuel from blast furnaces) are also employed to some extent. The first successful internal-combustion engines using liquid fuels were gasoline engines, as gasoline is the lightest of all commercial hydrocarbons and is easily vaporized at ordinary atmospheric temperatures. Gasoline engines consume one-eighth to one-tenth of a gallon of gasoline per brake-hp.-hr., this being equivalent to a heat consumption of 11,000 to 16,000 B.t.u. per brake-hp.-hr. Owing to the development of light-weight high-speed oil engines for automobile and for aeroplane use, there has been such an increase in the demand for gasoline that the price of this distillate will remain high in spite of the new and more efficient processes developed for the extraction of gasoline from crude petroleum and for the liquefaction of natural gas. Nevertheless gasoline will remain the most important fuel for small stationary and portable engines for many years to come because of the ease of starting and the greater reliability of engines driven by this fuel compared with other internal-combustion engines.

Kerosene, which can be secured in greater quantities than gasoline and which has a rather limited market, ranks next to gasoline among the products of crude petroleum for use in oil engines. This fuel is more difficult to vaporize at ordinary temperatures and presents more serious operating problems, however, than gasoline. Engines operating with kerosene must be started with gasoline, or must be provided with some form of hot-plate vaporizer which will prepare the kerosene for combustion. As a fuel, kerosene is used at the present time in stationary engines of 5-hp. to 75-hp. rating. The fuel consumption of kerosene en-

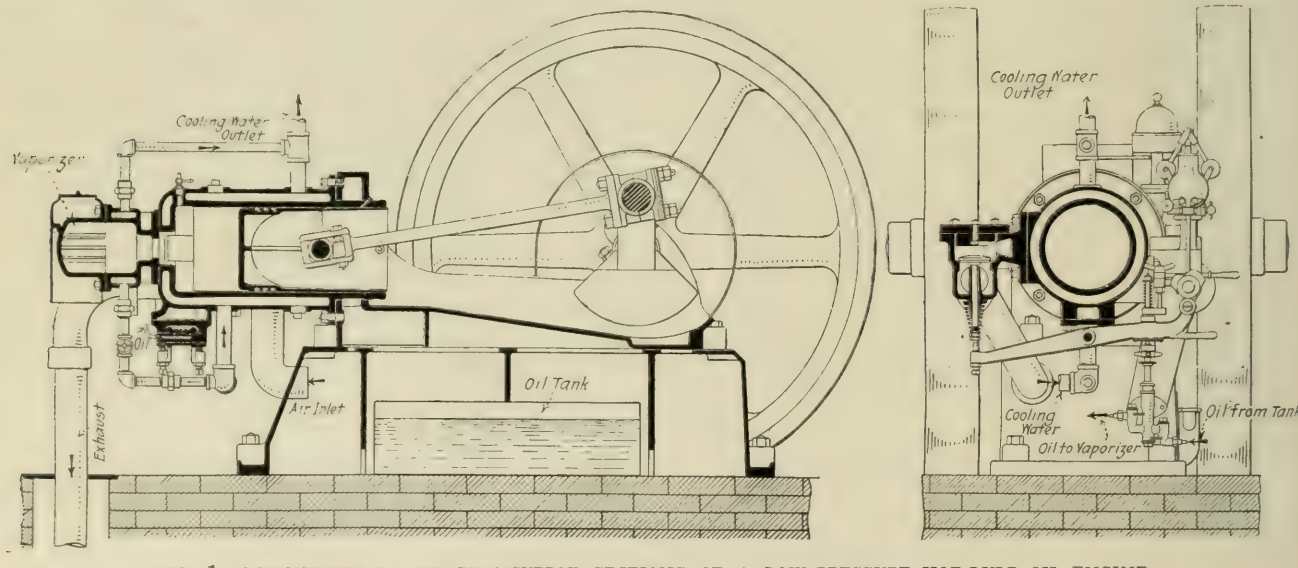


FIG. 1—LONGITUDINAL AND TRANSVERSE SECTIONS OF A LOW-PRESSURE HOT-BULB OIL ENGINE

gines is about one-tenth of a gallon per brake-hp.-hr., or 14,000 to 18,000 B.t.u. per brake-hp.-hr.

In general liquid fuels even as heavy as 35 deg. Baumé, which corresponds to a specific gravity of about 0.849, can be used in engines differing only slightly from ordinary gasoline engines. Experience demonstrates that the heavier the fuel the more difficult it is

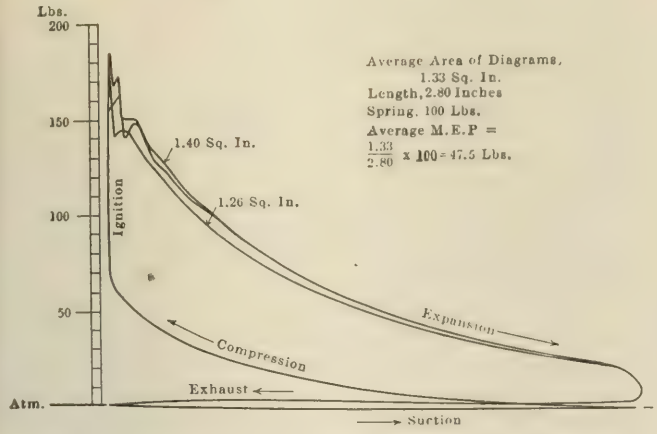


FIG. 2—INDICATOR CARD TAKEN WITH A LOW-PRESSURE HOT-BULB OIL ENGINE

to start the engine, and the more frequently valves and pistons will have to be cleaned.

Oil engines which employ electric ignition cannot operate satisfactorily on petroleum fuels heavier than about 30 deg. Baumé. Several of the so-called "hot-bulb" types of oil engines (Fig. 1) are found to give fairly satisfactory service with petroleum oils as heavy as 28 deg. Baumé. For the use of still heavier oils either the hot-bulb type engines must be designed to operate as semi-Diesel engines (Fig. 3) at compression pressures of about 300 lb. per square inch (21.09 kg. per sq. cm.) or some form of oil engine operating on the Diesel internal-combustion engine cycle must be used (Fig. 4).

Alcohol has received considerable attention in this country and in Europe for internal-combustion engines. This fuel is very nearly inexhaustible in quantity and is favored in that alcohol extends the markets for fuel supply beyond the control of certain monopolies. Investigations with alcohol as fuel indicate that engines designed for that fuel and operated at compression pressures of about 180 lb. per square inch (12.65 kg. per sq. cm.) will develop as much power per gallon of fuel as engines of the same size and speed designed for and operated with gasoline as fuel. When used as a fuel in ordinary gasoline engines and with the compression pressures ordinarily allowed for gasoline, however, alcohol will show a much poorer economy than gasoline or kerosene. Furthermore, the high price of alcohol as compared with petroleum fuels puts the alcohol engine out of competition with oil engines, at least for the present.

Oil engines operate either on the Otto or on the Diesel internal-combustion engine cycles.* Engines operating on the Otto cycle are cheaper to build, require less supervision and are the standard type for gas and oil engines in this country. Diesel types of engines give better fuel economy and are capable of operating with the very heaviest petroleum fuels as well as with tar oil and with gas-house tar. Under ordinary conditions Diesel engines will have a thermal efficiency of about 30 per cent, while oil engines operating on the Otto cycle will usually convert less than 20 per cent of the total heat contained in the fuel into useful energy.

The first cost of Diesel engines is from two to four times greater than that of Otto engines of the same size. In this country the availability of enormous fuel resources has prevented a demand for an engine which has a very high first cost. The comparative demands for Diesel engines in the United States and in Europe are evident from the fact that only about 100,000 hp. is developed by Diesel engines in this country as compared with more than 1,500,000 hp. in Europe before the war. The ratio of labor cost to fuel cost is responsible for this difference, but the use of Diesel engines is greatly increasing in the United States, and especially in the Southwest. The oil fields recently discovered in the southwestern parts of this country and in the adjacent parts of Mexico should still further increase the demand for heavy oil engines.

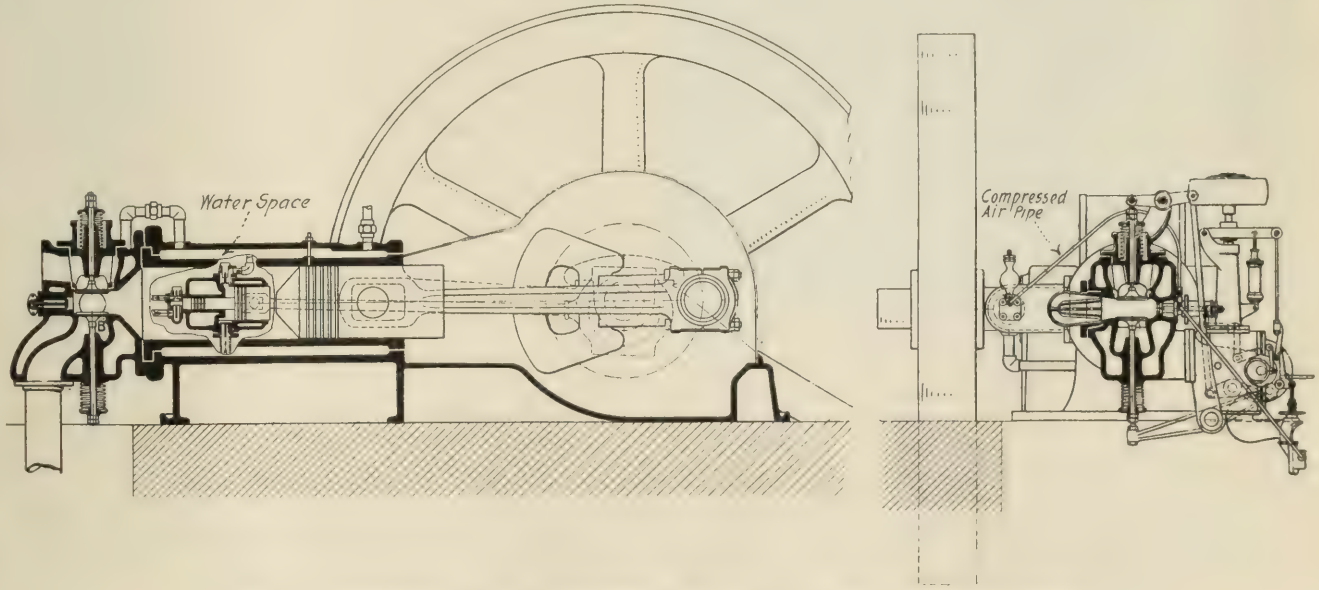


FIG. 3—LONGITUDINAL AND TRANSVERSE SECTIONS OF A SEMI-DIESEL OIL ENGINE

The Otto as well as the Diesel cycle comprises five

*The term cycle is applied to a series of events which are essential for the transformation of the heat energy of a fuel into work.

events: Suction, compression, ignition, expansion and exhaust. Engines of both types can be designed either as four-stroke-cycle engines or as two-stroke-cycle engines. Engines operating on either the Otto or the Diesel cycle have poor starting torque and must operate at a high load factor. The chief differences between the Otto and the Diesel cycle are as follows:

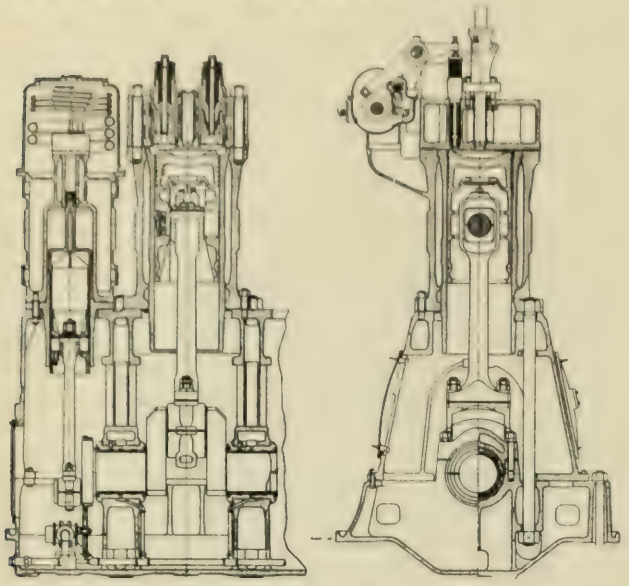


FIG. 4—SECTIONAL VIEW OF A DIESEL OIL ENGINE

In order to carry out the Otto internal-combustion engine cycle, air is mixed with the fuel in definite proportions and the combustible mixture is subjected to the process of compression. Thermodynamic considerations indicate that the thermal efficiency of an engine operating on this cycle depends upon the amount of compression before ignition. Danger from pre-ignition of this combustible mixture limits the practical compression pressures for petroleum fuels to less than 100 lb. per square inch (7.03 kg. per sq. cm.).

In the Diesel-engine cycle only air is admitted to the cylinder during the suction stroke, so that compression pressures as high as desired can be permitted without danger of pre-ignition. The compression pressures used with the Diesel engines vary from 450 lb. to 500 lb. per square inch (31.6 to 35.1 kg. per sq. cm.). The higher compression-pressure limit in this case is not dependent upon the composition of the mixture within the cylinder but upon construction difficulties. At the end of the compression stroke of the Diesel-engine piston oil fuel is injected into the cylinder by air from a special air compressor. The oil enters the cylinder in the form of a fine spray, mixes with the highly compressed air, which is at a temperature of about 1000 deg. Fahr. (537 deg. C.), and burns at nearly constant pressure. The duration of the oil injection is governed by the load upon the engine, and this period of oil injection, as well as the compression pressure of the air before ignition, influences the thermal efficiency of the Diesel engine.

The combustion of the mixture in the Otto cycle is produced at a practically constant volume. Compared with gunpowder, the explosive mixture in the Otto gas-engine cylinder has a much slower rate of flame propagation, and the maximum pressure at the end of combustion will rarely be greater than four times the compression pressure before ignition.

The relatively high cost of Diesel engines is due partly to the fact that the maximum pressures in this type must be produced by compression, and this requires great accuracy of piston fits and the most careful alignment of parts. The fuel in the Otto types is prepared in a carburetor or in a vaporizer outside of the engine cylinder. In the Diesel engine the fuel preparation and injection process takes only about 0.04 second under ordinary loads, so that design of the fuel valve becomes a most difficult and important problem. Furthermore, the air compressor used with a Diesel engine must not only supply air for starting but must compress air to a pressure of about 1000 lb. per square inch (70.3 kg. per sq. cm.) to be used for injecting the oil fuel into the cylinder. All these factors account for the necessary high cost of Diesel engines.

In large sizes of Diesel engines the increased cost is compensated for by the higher fuel economy and by the ability of this type to operate on any liquid fuel without leaving any appreciable residue. This form of engine is now operating successfully in Texas, in California and in other States with the Western oils, which have an asphalt base and are much poorer than the Eastern oils. According to several tests on record, the fuel economy of Diesel engines is about 0.45 lb. of fuel oil per brake-hp.-hr.

Medium-compression types, often called the semi-Diesel engines (Fig. 3), also have an important field in the utilization of the heavier oils. This type of engine is being built by several companies in this country in sizes ranging from 75 hp. to 400 hp. Like the Diesel types (Fig. 4), these engines compress only air, but have a lower pressure range, depending partly on hot surfaces to ignite the charge. During the earlier developments of the Diesel engine in this country the semi-Diesel types played a prominent rôle in the utilization of the heavier liquid fuels. The new designs of the Diesel engines limit the field of the semi-Diesel types, the somewhat lower cost of the latter being greatly offset by the greater economy of the Diesel types. The heat consumption of semi-Diesel types will vary from 8700 to 13,000 B.t.u. per brake-hp.-hr., while the heat consumption of a Diesel engine will range from 7000 to 9500 B.t.u. per brake-hp.-hr.

Data based on engines operating at full load showing approximate comparative fuel costs per brake-horsepower-hour for various fuels and various types of engines are given below. It should, however, be remembered that the economy of an oil engine is greatly

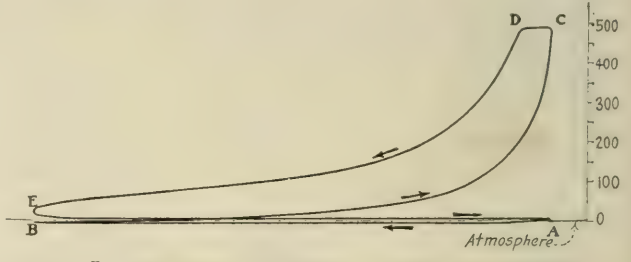


FIG. 5—INDICATOR CARD FROM A DIESEL OIL ENGINE

decreased at light loads and is best when the greatest amount of charge at its maximum density is admitted to the engine cylinder.

Fuel	Cost in Cents per Gal.	Cost in Cents per Liter	Cost per Brake-Hp.-Hr. (Cents)
Gasoline	20	5.3	1.5 to 2.5
Kerosene	6	1.59	0.6 to 1.0
Fuel oil	2	0.53	0.11* to 0.15*
Fuel oil	2	0.53	0.15† to 0.20†

*Using Diesel engine. †Using semi-Diesel engine.

The approximate first costs, in normal times, of various types of oil engines are as follows:

Type of Engine and Rating	Cost per Hp.
Diesel (1000-hp. and 75-hp.)	$50 and $85
Semi-Diesel (60-hp. and 400-hp.)	50 and 70
Light-fuel type up to 75-hp. with throttling governor	35
Gasoline type with hit-and-miss governor	15 to 30

Summarizing the status of the oil engine briefly: Engines operating on the Otto cycle are more practical for gasoline, kerosene, alcohol and petroleum fuels, even as heavy as 30 deg. Baumé. For the heavy petroleum fuels and for other low-grade liquid fuels either the Diesel or the semi-Diesel types should be selected. In general the oil engine is bound to be a very important factor in the future of power development in the United States.

Testing Insulation of Generators in Motion

Importance of Studying State of Insulation Under Operating Conditions—Features of a Test Method Involving Use of Non-Inductively Wound Exploring Windings on End Turns of Apparatus

BY E. O. SCHWEITZER
Chief Testing Engineer, Commonwealth Edison Company

BREAKDOWN of a generator is not a pleasant prospect under any conditions, but it is particularly to be avoided when the size of the units used is very large, when the amount of reserve equipment is small, or when all equipment is being utilized, as may happen during peak loads. Under such conditions the breakdown of one machine may mean the loss of considerable revenue and possibly some valuable industrial consumers, in addition to the inconvenience of getting the equipment in operating condition once more.

At this time, when every bit of available power should be made ready for manufacturing purposes, it is particularly important that such trouble be prevented. Since insulation is probably the most vulnerable part of generators, it is necessary that its condition be known at all times. Of course the resistance of the insulation can be easily measured when a generator is at rest, but this value is vastly different from that when the generator is subjected to service stresses of voltage, current, temperature and atmospheric conditions. Furthermore, it is the condition while the machine is running that is important.

NATURE OF INVESTIGATION

To avoid the difficulties of measurement heretofore experienced in determining the condition of insulation while a generator is in motion the following investigation was conducted under the supervision of the writer: A representation of a three-phase alternator was devised by connecting the high-voltage sides of three 110/11,000-volt potential transformers in a star. In series with each potential transformer was connected an armature coil such as is used in a large 9000-volt, 25-cycle turbo-generator. These coils represent the last coil on each phase of the generator winding. The portion of each armature coil which in actual service would be embedded in the generator core was wrapped with tinfoil, and the tinfoil on all of these coils was tied together and grounded. From the copper of each armature coil a tap was taken off to each of three Y-connected potential transformers which represented those used in practice for metering purposes. The neutral point of these transformers was connected with the generator neutral, which in turn was connected to ground through a switch. With this switch closed the generator neutral, generator core and generator potential-transformer neutral are brought to the same potential.

On that part of the armature coil which corresponds to the end turn was placed a non-inductive winding of No. 19 bare copper wire. The non-inductive windings, or exploring coils, were placed on the end turns, as these constitute the part of a generator winding which is subjected to the greatest destructive action of vibration, condensation, windage, electrostatic strains and, in the case of short circuit, mechanical strains. The three exploring windings were connected in series so that the entire winding formed a closed loop, an insulated lead being connected to it and brought out to a terminal. The other terminal of the circuit was brought out from the generator potential-transformer neutral. Across these two terminals a high voltage direct-current supply was connected. The electric circuit thus formed is as follows: From the direct-current source to the winding on the end turns, through the insulation to the copper of the coils, through the phase leads to the potential-transformer windings, and from the neutral point of these transformers to the direct-current source. The

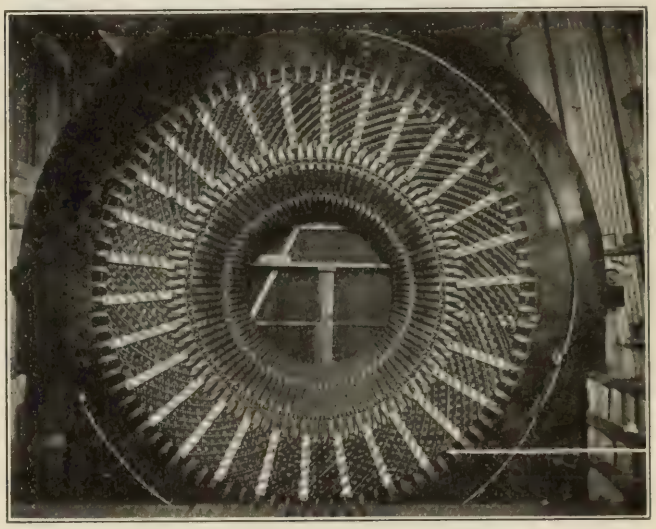


FIG. 1—GENERATOR WITH END-COIL EXPLORING WINDINGS

The white line indicates where one terminal of the megger is applied when testing the resistance of insulation on the armature coils.

direct-current supply used in this case was a 1000-volt megger. The instrument is calibrated to indicate resistance directly in megohms. The potential transformers which were used to represent the generator winding were excited from a three phase, 60-cycle supply which was arranged to give 5000 volts to 15,000 volts delta pressure on the generator.

RESULTS OF TESTS WITH EXPLORING WINDINGS ON END TURNS OF 9000-VOLT GENERATOR WINDING

Delta Pressure Volts	Insulation Resistance in Megohms Between Potential Transformer Neutral and Exploring Winding with		Insulation Resistance (in Megohms) Between Potential-Transformer Neutral and Ground. Generator Neutral Open from Ground
	Voltage On	Voltage Off	
15,000	550	800	800
14,000	560	800	800
13,000	580	800	800
12,000	600	800	800
11,000	620	800	800
10,000	630	800	790
9,000	630	800	800
8,000	680	800	800
7,000	710	800	800
6,000	730	800	790

With the higher pressures of 9000 volts and up, the formation of static electricity on the copper exploring windings introduced considerable difficulty when the armature coils were energized and the megger was connected to the circuit. Although the static energy was small, the megger acted as an electrostatic voltmeter and showed a deflection of the indicator. To eliminate this trouble several schemes were tried whereby it was sought to eliminate the effect rather than the cause. A spark gap was shunted across the iron-core reactance coils in series with the megger, whereby a path to ground was afforded for the high-frequency static charges. Apparently the frequency was so high, however, that the energy passed over the surface of the reactance coil instead of through it, and thus the scheme was a failure. A condenser shunted across the megger eliminated the static through it, but when the megger was operated it measured the insulation resistance of the condenser in parallel with the insulation resistance of the armature windings.

After several trials of the nature mentioned it was found that by connecting the megger to the circuit first and then energizing the armature the disturbance in the megger reading due to static electricity was eliminated. Apparently the energy of the static charge was so small that upon shunting it through the megger before closing the circuit the charge had no chance to build up.

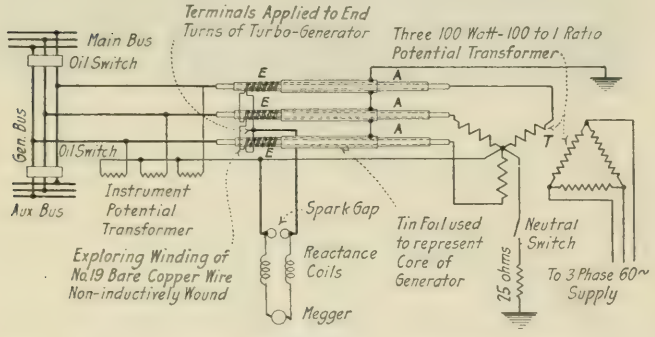


FIG. 2—CONNECTIONS EMPLOYED IN MEASURING INSULATION RESISTANCE OF GENERATOR IN SERVICE

With the insulation on the armature coil very dry, tests were made with different pressures (6000 volts to 15,000 volts) between phases. Under these conditions the insulation resistance decreased with an increase in voltage, but the decrease was small. With 2000 megohms insulation resistance the resistance decreased to about 1850 or 1900 megohms with 15,000 volts between phases. The insulation on the coils under the exploring winding was then moistened until the insulation resistance was reduced to 800 megohms with no pressure on the coils. A series of measurements was made with the coils in this condition, and it was found that the insulation resistance was lower at 15,000 volts by 250 megohms than it was with no voltage applied. The values obtained in this test were duplicated under the same conditions thirty minutes later. From the accompanying curve, which was drawn to show the relation between insulation resistance and delta voltage, it may be seen that the insulation resistance decreases following a straight line from 6000 volts upward.

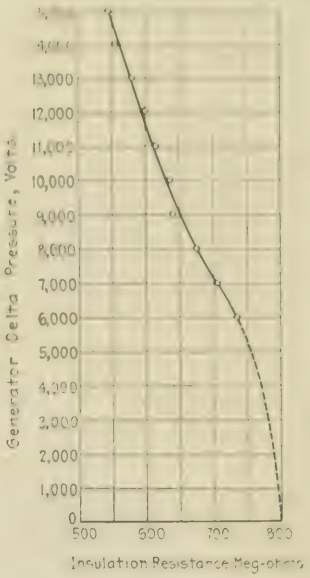


FIG. 3—EFFECT OF VOLTAGE ON INSULATION RESISTANCE

To give a measure of the static formation on the exploring winding a spark gap with a setting of about 1/32 in. (0.8 mm.) was shunted across the exploring winding and the potential transformer neutral. It was found that the lower the insulation resistance the greater and more violent the static discharge became; that is, with 15,000 volts between phases and the insulation at 550 megohms the static charge was greater than with 15,000 volts applied and the insulation on the coils dry with a resistance of 2000 megohms. From this observation it may be seen that the static discharge from a winding such as described would in itself be a reasonably accurate measure of the insulation resistance of a generator winding.

The measurements proposed in this scheme should preferably be made with the neutral closed to ground to afford maximum protection for the operator and to prevent disturbance due to a possible difference of potential existing between the generator neutral and ground. As shown in the sketch, the leads from the generator potential-transformer neutral to the spark gap and the two elements of the gap are very heavy in order to insure a large heat-dissipating capacity. These leads are fused with low-rated fuses so that in the event of a breakdown of the insulation under the exploring winding the dynamic energy would cross the gap to ground, which would open the fuses and clear the megger circuit.

In case of a weak point occurring in the insulation within the slot, the measurement path to the fault is not the leakage surface over the coil to the fault, but rather from the exploring winding to the core and from the core to the fault in the slot. Hence a fault occurring within the slot insulation would also be measurable with the proposed scheme.

UTILIZING COAL-MINE WASTE

Test Plant for the Burning of Powdered Coal Built by Pacific Coast Company—Results of Test

BY HENRY HULL

Prompted by the large amount of unmarketable fine coal which is piled up at numerous nearby coal mines, the Puget Sound Traction, Light & Power Company has investigated the practicability of burning powdered coal. This coal is a form of lignite particularly adapted to use in the powdered form owing to the high volatile constituent and the very high fusing point of the ash. To prepare this coal for burning it must first be thoroughly dried and the moisture content reduced to approximately 1 per cent before it can be properly pulverized. It must then be ground until approximately 85 per cent will pass through a 200-mesh screen and 95 per cent through a 100-mesh screen if the best results are to be obtained. It should then be fed directly to the furnace, or if transportation or storage is necessary it should be kept air-tight so far as possible to prevent absorption of moisture.

TEST OF 300-HP. B. & W. BOILER BURNING POWDERED COAL

Coal Analysis

Moisture	Volatile	Fixed Carbon	Ash	Sulphur	B.t.u.
5.4	37.2	47	10.4	0.56	11,760

Ash Analysis

SiO_2	44	CaO	7.75
FeO	10.45	MgO	2.40
Al_2O_3	32.88		

Screen Test of Coal

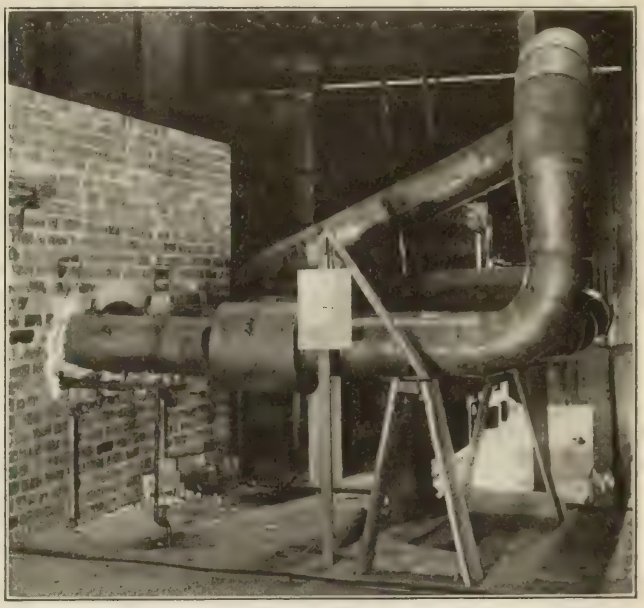
	Per Cent of Coal Passing
On 100 mesh	5.8
Through 100 on 200	34.6
Through 200	59.6

Duration of test (hours)	12.8
Average boiler-hp. developed	357
Total water evaporated (lb.)	143,231
Average temperature of feed water (deg. Fahr.)	185
Average steam pressure (lb. gage)	106.5
Average temperature of steam (deg. Fahr.)	399
Average flue-gas temperature (deg. Fahr.)	528
Average draft at uptake (in. water)	0.17
Average flue-gas analysis in per cent:	
CO_2	17
Oxygen	2
CO	0
Total coal burned (lb.)	18,389
Actual evaporation per lb. of coal (lb.)	7.8
Equivalent evaporation from and at 212 deg. Fahr. (lb.)	8.6
Boiler efficiency (per cent)	71

The coal which has been investigated by the Puget Sound company is dried and pulverized by the Pacific Coast Coal Company at its briquetting plant, near Renton, which is equipped with a Raymond pulverizing plant. It is then loaded in a box car having a metal-lined hopper. The car is spotted at the steam plant over a chute which is connected to the car by a flexible hose. The chute feeds a small metal-housed conveyor which elevates and dumps the coal into a bunker adjoining the power plant. From the bottom of this the fuel is fed by means of two motor-driven screws into a 3-in. (7.62-cm.) supply pipe, through which it is then blown to the front of the furnace. At this point the fuel is discharged into the side of an injector consisting of a 16-in. (38.1-cm.) drum surrounding a nozzle on the end of a 10-in. (25.4-cm.) air-supply pipe. Dampers are provided in the drum and air pipe to regulate the amount of air supplied to the combustion chamber. In starting operation the coal dust is allowed to drop on an oil flame, although any small fire built under the fuel discharge pipe would have the same effect. An extended Dutch oven with a broad arch is used to assist ignition as considerable combustion space is required to secure satisfactory results, a parabolic shape being most desirable. Fire cannot travel back into the fuel supply pipe as long as the rate of air supply is greater than that of fuel propagation.

A record of a 12.8-hour test on the equipment is given herewith. The duration of the test was limited by the facilities for storage and handling of the fuel. The coal was weighed in the car as delivered to the plant and the net weight determined by a subsequent weighing of the car after unloading. The test was run until all coal was consumed. The water was measured by a Venturi water meter installed in an individual feed line to the boiler, and all instruments were checked for accuracy before starting.

During the test it was noted that the boiler could be forced to 200 per cent of rating without any apparent damage to brick setting or tubes. The stack was perfectly clear under these conditions and there was no fusing of the ash. About one-third of the ash was found deposited in the second and third passes of the boiler, none whatever being found to have collected on the tubes.



ARRANGEMENT FOR BURNING POWDERED COAL UNDER A 300-HP. BOILER FORMERLY FIRED WITH OIL

The results of the experiment tend to refute most of the adverse criticism of this method of burning coal. There was no formation of slag in the furnace or on the tubes, there was no shower of cinders and ashes emitted from the smokestack, and there was no damage done the boiler from heavy overload under these conditions.

From the experiments in burning these various fuels it was found that—assuming pea coal at $1.60 per gross ton ($1.76 per t.)—the prices which could be paid for other fuels on the basis of equal heating values are as follows: Pea coal on chain grates, $1.60 per gross ton, delivered; fuel oil, 56 cents per barrel, delivered, and powdered coal, $2.20 per gross ton, delivered.

The temporary plant was designed by E. B. Powell of the Stone & Webster Engineering Corporation of Boston, Mass.

War a Stimulating Influence

Careful Direction and Distribution of Our Great Resources Is Necessary, Says A. L. Salt, Vice-President Western Electric Company— Combination Should Be Permitted

Upon the conclusion of peace I expect that this government will follow a humanitarian course, directing and distributing our great resources so that the whole world, sorely needing materials and commodities of every nature, will be served here on equitable terms.—A. L. Salt.

AT THE request of the ELECTRICAL WORLD, A. L. Salt, vice-president and general purchasing agent of the Western Electric Company, has given the following statement of his views concerning raw material and commodity prices and conditions affecting production:

"When the first move toward peace came from Germany toward the close of 1916 I felt that the end of the war was definitely forecast by that action, and that however long a period might be required to settle the details of a peace agreement a gradual liquidation in material and commodity prices was inevitable. Since that time, of course, the complexion of the war has been changed by the renewal of the submarine campaign and the consequent entrance of the tremendous industrial momentum of the United States in the conflict against the discredited government of Germany.

Sharp Fluctuations Likely

"While the war lasts and for some time thereafter it is my opinion that there will be sharp fluctuations in the prices of various commodities, due to scarcity or abnormal demands in one direction or another. If prices take the natural course dictated by the law of supply and demand, it appears to be likely that for some time the general average price of all commodities combined will be high.

"Just now the various sources of supply in this country are filled with orders to the limit of their capacity. We have had to work along the safest and most conservative lines in placing orders ahead, and it is not prudent to fail to protect requirements to at least a reasonable extent in advance. The industries of the country are still practically sold ahead through the present year. Consumers have had to go into the market freely, not because they felt that prices were inviting at the current level, but because it was necessary for them to have a place on the delivery schedule of all large industries. In the iron and steel industry, for instance, if no new business should be taken, I believe that the orders in hand could not be filled in less than eighteen months, so enormous and unprecedented is the demand.

Stimulates Every Line of Trade

"Of course, the entrance of our country into the war is a large factor in stimulating nearly every line of trade. There is scarcely a commodity of which I have knowledge where the government will not have to appear as a buyer. That means that it will have to have preference in delivery and preference in price. It means, furthermore, that all industries will have to be coordinated so as to give the government the best service and materials at the lowest practicable prices. Smaller consumers will have to take what is left after government requirements are met in full.

"Something in the way of a well-defined government and business policy governing these matters is essential and it is being worked out carefully. It is to be hoped that under this policy that very large part of the world which is now to so great an extent dependent upon our country will be taken care of economically and expeditiously.

To Restore War's Material Waste

"Yet fair provision for our allies is only a part of the great program which it appears to me the government should undertake in following the irreproachable motives which carried it into the war. Upon the conclusion of peace I expect that this government will follow a humanitarian course, directing and distributing our great resources so that the whole world, sorely needing materials and commodities of every nature, will be served here on equitable terms. This policy will lead us, I believe, to be of service, not only to our present allies but also to the German nation freed from slavery to the menacing Prussian militarism.

"In other words, our resources will be co-ordinated with those of other nations and the entire world will be working in close co-operation to restore with all possible speed the terrible material ravages of the war.

"It is a time of greatest perplexity to the buyer of materials. On the one hand, he realizes that whatever he buys greatly increases his capital investment. On the other hand, he faces the necessity of going ahead and doing business because orders were never larger or more insistent and consumers were never more in want of supplies. The problem is to keep supplied with materials under conditions which mean for a given amount of materials twice the investment that would have been required a few years ago. The company which kept $1,000,000 of stock on hand three years ago now pays $2,000,000 for the same stock. It not only takes more money but it means a permanent increase in cost, and it involves also the chance of depreciation if prices should react materially.

Combination Should Be Permitted

"No company wants to expand its business unless it can see some reasonable return on its capital invested. High prices, slow delivery, embargo, car shortages, etc., are influencing to a great extent the industrial situation of the future. On the other hand, government expenditures in this country alone will reach billions of dollars, and to these must be added the equally large expenditures of the allied European countries. It is the most insistent buying which the world has ever seen.

"Supply and demand are so inexorable in normal operation that it seems to me that now, of all times, the producers of raw materials and the manufacturers of finished products should by combining be permitted to establish fair maximum prices which would yield only a fair return on their invested capital."

Modern Lamps and Industrial Applications

Solution of Lighting Problems Rests to Great Extent on Use of New Types of Lamps —Progress in Industrial Lighting Depends on Emphasizing Availability of Considerable Light at Fair Cost

BY C. E. CLEWELL
Assistant Professor of Electrical Engineering, University of Pennsylvania.

SUMMARY.—This article treats of the importance of modern lamps in the field of industrial lighting. Representative modern types of electric lamps are illustrated, and throughout the text references are made to the field of usefulness of the various lamps now on the market. With the aid of typical diagrams, four general schemes—known as local lighting, a combination of local and general lighting, localized general lighting and general lighting—are compared and their relative merits discussed. The remarkable developments in factory lighting practice in the recent past, and the future of this work, depend so largely on the lamps available that these features become of unusual importance.

FIVE broad factors stand out as the basis for the marked improvements in industrial lighting dur the last few years. These are:

First—The reduced cost of luminous flux which accompanied the appearance of lamps with reduced specific consumptions in contrast with older types. More light for the same energy consumption brought about the possibility of using higher working intensities of illumination, with an expenditure for energy well within reach of the most conservative factory managements.

Second—The gradual decrease in rates for electrical energy has still further reduced the cost of light, thus making it possible to use quantities of illumination economically to-day which only a few years ago would have been looked upon as extravagant.

Third—The appreciation on the part of engineers of many refinements in the methods of supplying light for various purposes.

Fourth—The work which has been done to reduce these refinements to a practical working basis. Thus it is proper to include here such items as the manufacture of lamps in a wide variety of sizes so that the size of the unit may be adapted to the conditions surrounding its installation; the design of reflecting devices for distributing the light effectively to working surfaces, and

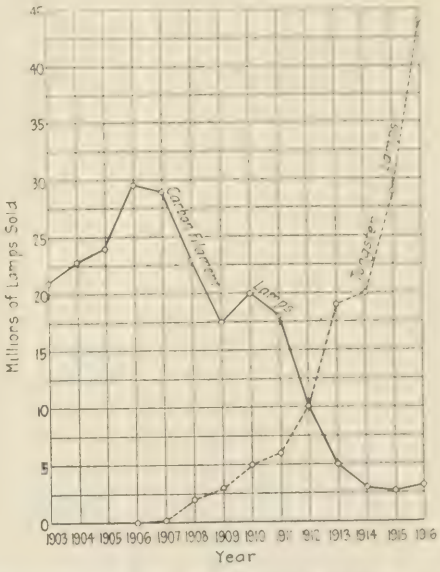
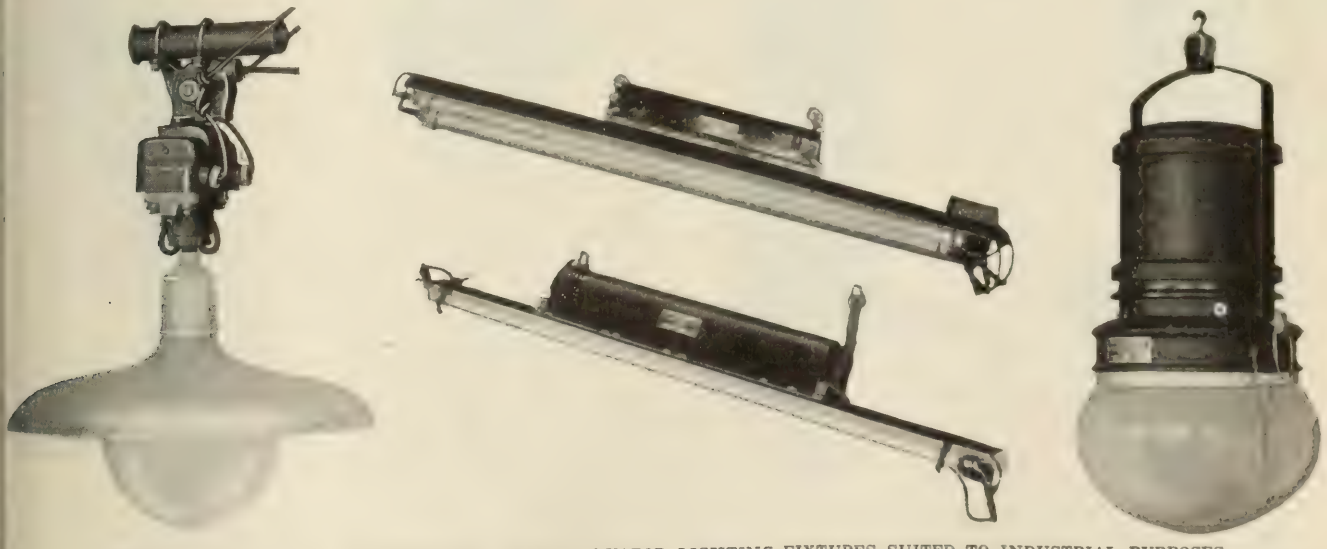


FIG. 1—DECREASE IN USE OF CARBON-FILAMENT LAMPS AND INCREASE IN TUNGSTEN LAMPS

the development of lamps possessing given spectral characteristics for producing special results as in color matching and the like.

Fifth—The growing tendency of factory owners and executives to look upon good light as a considerable asset among the list of those factors which contribute to the efficiency of production. Other influences might be



FIGS. 2, 3, 4 AND 5—TUNGSTEN AND MERCURY-VAPOR LIGHTING FIXTURES SUITED TO INDUSTRIAL PURPOSES

The tungsten lamp (Fig. 2) is equipped with an automatic safety disconnecting hanger. Fig. 3 represents an automatic starting d.c. mercury-vapor lamp for high mounting which requires little attention except for cleaning. Fig. 4 is an automatic starting, non-tilting a.c. mercury-vapor lamp with special reflector for modifying the light. Fig. 5 is a quartz-type mercury-vapor lamp with a globe which is opaque to ultra-violet light and which is especially adapted to high mounting and yard lighting.

included, for example, recent legislation governing intensities of illumination for factory operations, etc.

If the owner of almost any well-lighted factory were asked at random what prompted the adoption of an adequate system of illumination, it is probably safe to say the answer would be that new types of lamps had been the basis for the interest in and decision on an improved plan of lighting as a substitute for older inferior conditions. For this reason it is natural to turn briefly to a review of the present conditions of lamp manufacture as an underlying influence of the past and probable future progress in this field of lighting.

TABLE I—DATA ON VACUUM-TYPE TUNGSTEN LAMPS*
(1 to 3 Effective Lumens per Watt Possible)

Rated Watts	Total Lumens	Mean Spherical Candlepower	Mean Horizontal Candlepower	Watts per Spherical Candlepower	Lumens per Watt
25	226	18.0	23.0	1.39	9.04
40	372	29.6	38.0	1.35	9.31
50	472	37.6	48.2	1.33	9.45
60	575	45.6	58.4	1.31	9.59
100	995	79.4	102.0	1.26	9.97

TABLE II—DATA ON GAS-FILLED TUNGSTEN LAMPS*
(.5 to 7 Effective Lumens per Watt Possible)

Rated Watts	Total Lumens	Mean Spherical Candlepower	Watts per Spherical Candlepower	Lumens per Watt
75	865	69.0	1.09	11.53
100	1,260	100.0	1.00	12.57
150	2,050	163.0	0.92	13.66
200	2,920	233.0	0.86	14.61
300	4,850	385.0	0.78	16.11
400	6,150	490.0	0.82	15.32
500	8,050	640.0	0.78	16.11
750	12,800	1,020.0	0.74	16.98
1000	18,000	1,435.0	0.70	17.95

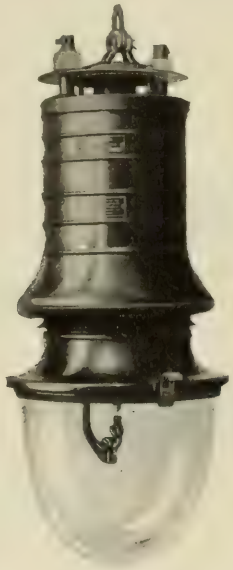
*Published through courtesy of Edison Lamp Works of General Electric Company.

The dimensions of a great majority of factory spac make them adapted in a peculiar manner to lighting lamps of medium size. Hence the logical tendency is limit a great deal of industrial lighting to the use mercury-vapor and tungsten lamps, both of which a made in sizes particularly suitable for mounting at mo erate heights. The phenomenal growth in the use tungsten lamps and decline in output of carbon-filame lamps are shown in a striking manner in Fig. 1. Wh these curves refer to lamps used for all lighting pu poses, it is fair to assume that there has been a simil increase in the use of tungsten lamps for factory ligh ing as a substitute for the older forms of lamps e ployed, notably the carbon-filament and older carbo arc lamps, which have so generally disappeared fr the average factory, except in old installations or f special purposes.

Unlike its forerunner, the carbon incandescent lam the tungsten unit, as installed for general lighting, h the characteristics of an individual unit requiri special means of suspension and auxiliaries in the fo of reflectors and shade holders. Sometimes even spec disconnecting hangers, one type of which is shown Fig. 2, are required for the purpose of lowering the u for renewals and for cleaning. Moreover, renewal a maintenance do not merely consist of replacing an i expensive lamp bulb, but involve the renewal of t larger and more expensive tungsten unit, periodic clea ing of lamp and reflector, and the renewal of the refle tor, if of glass, when broken, and, if of metal, wh the reflecting surfaces deteriorate to such an extent th they are no longer effective. While this work is mu less troublesome than the frequent trimming associat with the older forms of arc lamps, the various items upkeep taken together are by no means inconsiderab

Another important lamp in the industrial field is t mercury-vapor unit in its various types. This lamp h priority over the tungsten lamp in the time duri which it has been in the field. The quality of its lig has been one of its greatest advantages as well as t target of numerous prejudices. Many of the adver statements which are made concerning the quality of i







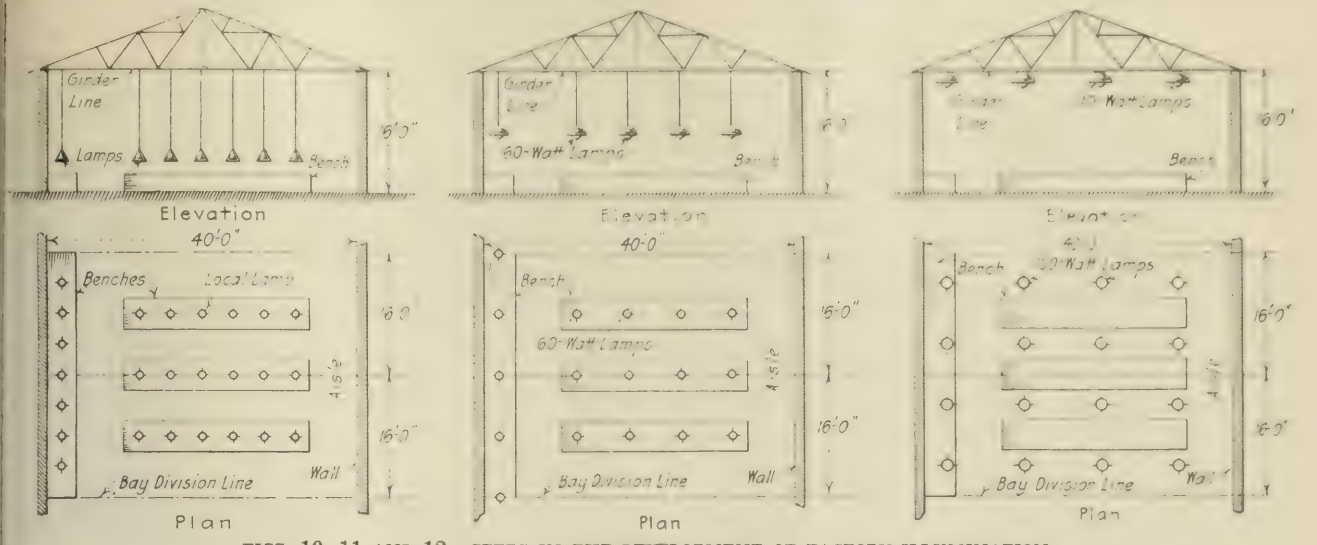


FIGS. 6, 7, 8 AND 9—INDUSTRIAL ARC LAMPS, FLOODLIGHTING UNIT AND COLOR-MATCHING LAMP

The long-burning multiple flame-carbon arc lamp in Fig. 6 is adapted to yard lighting and mounting inside at high elevatio While designed for a.c. circuits, it is also available for direct-current use. A d.c. metallic-flame arc lamp with broad distribution char teristics that make it especially suitable for yard lighting is shown in Fig. 7. The projector in Fig. 8, which is designed for any la rated at 300 to 1500 watts having a mogul base, is suitable for floodlighting yards and buildings for use at night or protective purpos Fig. 9 is a carbon-dioxide daylight lamp especially useful in dyeing establishments and where color selection or comparison is necessa

ght are not only totally without reasonable foundation, ut without warrant. Almost any group of employees ho work under this light, if approached impartially, ill testify to its superior merit as a means to clear ision and accurate visual perception. Its greatest claim able at the present time for protecting industrial plants, as approaches which would otherwise be difficult to guard can be illuminated so as almost to equal daylight.

The employment of special units for color matching and color distinction is becoming an important feature



FIGS. 10, 11 AND 12—STEPS IN THE DEVELOPMENT OF FACTORY ILLUMINATION

In Fig. 10 local lamps are used. To secure illumination of overhead space a large lighting unit may be installed in the middle of each bay at the girder line. An arrangement of localized lamps is shown in Fig. 11 which gives better general illumination as the units are further above the benches than in Fig. 10. The illumination afforded by the arrangement of lighting units in Fig. 12 permits work wherever the benches are placed. Furthermore, the overhead space is free of drop cords.

o success at the present time depends on the vast factory areas which have been illuminated for years by this ype of lamp and the many new modern plants which ave selected it as the principal illuminant.

The quartz-type mercury-vapor unit, shown in Fig. 5, y virtue of its relatively high candle-power rating in omparison with the other types, has its greatest field f usefulness for yard lighting from the tops of high oles, or in factory spaces where it is possible to mount he lamps well overhead. The outer glass globe of this amp is opaque to the ultra-violet rays which are present n the light which leaves the quartz element. Actual ests and observation of the illumination produced by hese lamps when mounted 90 ft. (27.4 m.) above yard paces show it to be superior for such purposes.*

While the arc lamp has been replaced very generally for industrial purposes by tungsten and mercury-vapor types, it is justly entitled to consideration for certain uses in some of its more recent forms. In this connection special mention may be made of the flame-carbon long-burning multiple lamps, one of which is shown in Fig. 6. Because of its large volume of luminous flux, it is suitable for certain cases of factory aisles having considerable overhead clearance as well as for yard lighting. From the standpoint of light distribution, it is superior in general to the metallic-flame or magnetite lamp (Fig. 7). The latter, with its characteristically wide light distribution at small angles below the horizontal, is adapted chiefly to those cases of lighting for vast yard spaces where the conditions approximate those of street lighting.

Still another interesting development is the adaptation of the tungsten lamp for projection purposes, notably for floodlighting large yard spaces or building fronts. Aside from the spectacular uses of floodlighting units, one of which is shown in Fig. 8, they are proving valuable in certain cases—for example, in dye works, celluloid and other plants. Considerable development work has been done in supplying lamps with spectral characteristics similar to those of natural light so that such work can be conducted in a satisfactory manner at night or on dark days. One of these units is shown in Fig. 9, this particular lamp being the carbon-dioxide tube color-matching outfit. The blue-bulb artificial daylight units, together with the various tungsten equipments, which make use of glass color screens for accomplishing the same general purpose, add to the possibilities.

To show some of the methods of using modern lamps, the diagrams of Figs. 10, 11 and 12 have been designed to apply to typical factory spaces, the same manufacturing conditions being shown in each of the four cases

TABLE III—DATA ON MERCURY-VAPOR LAMPS†

Type of Lamp	Name	Circuit	Watts (Tube)	Mean Spherical Cp.	Watts on Tube per S. Cp.	Total Watts	Mean Hemispherical Cp.	Total Watts per H. Cp.
H	Mercury vapor	D.C.	126	200	0.63	193	300	0.64
P	Mercury vapor	D.C.	252	550	0.47	385	850	0.45
PP	Mercury vapor	D.C.	504	1100	0.47	770	1500	0.51
F	Mercury vapor	A.C.	252	550	0.47	385	850	0.45
Z	Quartz	D.C.	525	1500	0.35	725	2400	0.30

†Published through courtesy of Cooper Hewitt Electric Company.

TABLE IV—DATA ON ARC LAMPS‡

Name of Lamp	Circuit	Type	Watts	Carbons	M. L. H. Cp.	M. S. Cp.	Watts per M. S. Cp.
Flame carbon.....	110-volt a-c.	Multiple	500	White	920	695	0.72
Metallic flame....	4-amp. d-c.	Series	272	Standard	495	250	1.09

‡Published through courtesy of Westinghouse Electric & Manufacturing Company.

*At the present time, owing to the lack of the necessary amount of quartz tubing from abroad, lamps of the quartz type are not available.

for convenience of comparison. These diagrams are merely representative, it being possible to carry out the scheme in a variety of ways with different types of units. The diagrams also represent graphically the development in industrial lighting from the early form of local lighting to the modern system of general illumination. In Fig. 10 a representative case of local lighting is shown, where the space immediately in front of each workman is illuminated by the small lamp housed in a deep cone-shaped metal shade. This is a decidedly poor arrangement for a number of reasons, chief of which is that the entire area is in practical darkness at night or on very cloudy days, save for the small spaces under each lamp.

With the arrangement shown, it is necessary in order to rearrange the benches for the accommodation of a change in method of manufacture to change the location of lamps correspondingly. Furthermore, an accident hazard is introduced in using the aisles as passageways, and in repairing overhead belting and line shafting, because the aisles and overhead space are in darkness. The lamps, being within easy reach, lend themselves to abuse from rough handling and to removal by any passing workman who may be in need of an extra lamp bulb. An additional disadvantage is the presence of a maze of long drop cords which detract from the openness and freedom of the space between benches and girder line. With this arrangement it is almost impossible to "keep tab" on whether the light is being wasted or not, since small lamps in such deep metal shades can burn all day long without being noticeable unless rather carefully inspected. Briefly, then, such a scheme is considered poor because of the lack of flexibility in the location of benches and work, increased accident hazard and maintenance, and the unfavorable appearance of the building, together with the likelihood of waste of light.

One of the common methods for improving this scheme in earlier practice was to install a large lighting unit here and there at the girder line. This scheme obviously has the advantage of reducing liability to accident in aisles and in overhead repair work, but it has many of the other disadvantages mentioned in connection with the arrangement shown in Fig. 10.

A plan embodying somewhat of a compromise is shown in Fig. 11, where tungsten lamps are mounted higher than the local lamps of Fig. 10, their positions being dictated, however, by the location of the benches. The permanency in the location of certain classes of machinery sometimes makes this scheme of localized general lighting desirable, and, aside from the unsymmetrical arrangements of lamps which may result from their adaptation to particular machine or bench positions, the more general distribution of light and the higher mounting of the lamps at a point overhead make this plan better than the arrangement shown in Fig. 10 or its modified form using a large lighting unit in the middle of the bay at the girder line.

The most approved plan, however, and the one now generally adopted, is that known as general lighting and indicated by Fig. 12. This is clearly distinct from Fig. 11, in that the lamps are spaced symmetrically over the working floor area and thus furnish uniform illumination on the entire space. By this means the benches or machinery may be located independently of the lighting facilities and the factory space is rendered effective throughout for manufacturing operations. It is apparent that lamps of moderate size but with luminous flux ratings greater than the carbon-filament lamp possessed have made possible a scheme like that of Fig. 12.

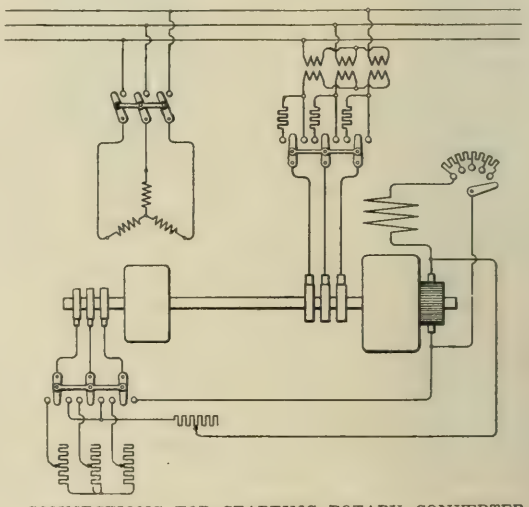
Mercury-vapor lamps may be substituted for tungsten lamps in an arrangement similar to that of Fig. 12. Instead of direct reflecting units, semi-indirect or indirect systems may be employed with tungsten lamps where the ceiling affords a good reflecting surface. The increasing luminous-flux ratings of gas-filled tungsten lamps are beginning to make themselves felt in the use of indirect lighting in such factories as textile mills, where the quality of the light for such work fills a need in the particular operations involved.

Taken as a whole, the solution of lighting problems has hinged largely on the use of new lamps. These units, in turn, have given an impetus to the discovery of ways and means for using them to the best advantage. Manufacturers are quick to perceive the wisdom of sufficient light when they realize its availability at a fair cost, and future progress must largely rest, therefore, in setting forth these advantages in a convincing manner.

STARTING ROTARY CONVERTERS

Connected to Alternating-Current Circuit So as to Apply Full Voltage Without Disturbance

A method of starting rotary converters whereby a machine may be brought up to synchronism without causing any appreciable disturbance in the supply mains is described in patent No. 1,224,729, assigned to the General Electric Company by Lionel Fleischmann. The method applies to a rotary converter which is mechanically connected with an induction motor having a phase-wound secondary. For starting, the motor is connected to the alternating-current mains as an induction motor. The slip rings of the converter are also connected to the mains but through resistance so as to apply only a portion of the normal voltage to the windings. The direct-current end of the converter is then connected to the



CONNECTIONS FOR STARTING ROTARY CONVERTER

secondary of the induction motor to supply alternating current of slip frequency. A large torque is thus produced in the motor which pulls it and the converter into synchronism. The converter may then be connected directly to the alternating-current mains, as it will be in phase, and to the direct-current buses, as it will have the correct polarity.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

PROVIDING FUEL RESERVE

Springfield (Mass.) Company Plans Coal Storage to Take Advantage of Market Prices

To insure a larger fuel reserve and permit taking advantage of the market when possible, the United Electric Light Company of Springfield, Mass., has begun the construction of a 50,000-ton (45,300-t.) coal-storage installation at Indian Orchard, 7 miles (11.3 km.) east of the generating headquarters in Springfield. Open-air storage will be provided, the field being served by three virtually parallel spur tracks aggregating 1650 ft. (502.9 m.) in length. An electric locomotive crane of 6000 lb. (2721.5 kg.) capacity with a 45-ft. (13.7-m.) boom will operate upon one track in distributing and reclaiming service. The track is carried 12 ft. (3.7 m.) above the field on reinforced concrete beams and vents. Shipments of coal will be made to the new State Street riverside station in Springfield, now under construction, according to load requirements. McClintock & Craig, Springfield, are engineers for the company.

INSTRUMENT AND SWITCH TABLE FOR USE IN TESTING

Outfit Which Does Not Have Disadvantages of Testing Set-Ups Requiring the Assembly of Numerous Devices

BY A. M. HOLCOMB

Shown herewith is a generator and motor-testing table which is extremely simple in its connections, capable of holding the necessary instruments, and so arranged that both alternating-current and direct-current readings can be made accurately and quickly. The wiring diagram and view of the table show how the circuits and table are arranged. When used with direct-current motors and generators the upper wire carries the field current and the armature circuits pass through the two lower wires. The middle switches are for ammeter protection.

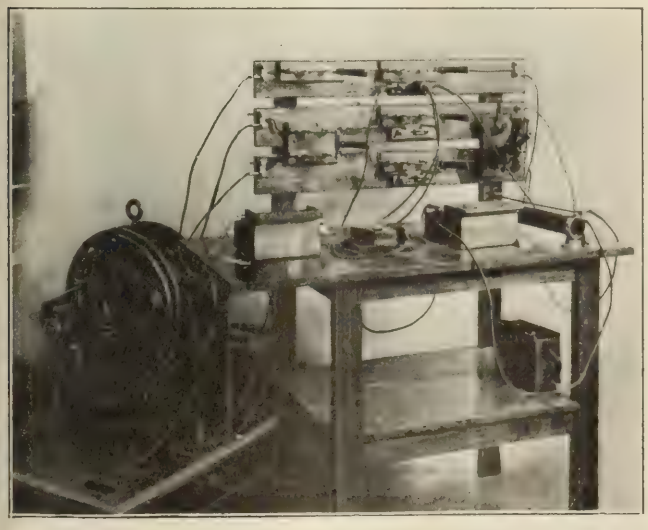


FIG. 1—SIMPLIFIED TESTING TABLE

For three-phase tests the wiring arrangement shown in Fig. 2 is used. The plug has two brass projections which fit into blocks beneath the short-circuiting switches. When reading power by the two-wattmeter method, the plug must be placed in circuit *C* with switches *Ag* and *Kl* open. This arrangement protects the current coils of both wattmeters when *Ag* and *Kl* are closed. Under ordinary circumstances, if the potential circuit is opened, the meter is sufficiently protected and the current coils can be in the lines beyond *D* and *F*. All terminal blocks have two holes with knurled set screws. Voltmeter leads and line leads are held under these set screws. The tables have been in use for some time and are very satisfactory.

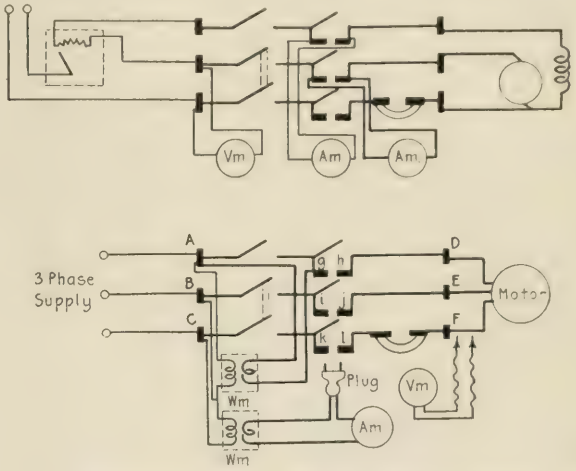


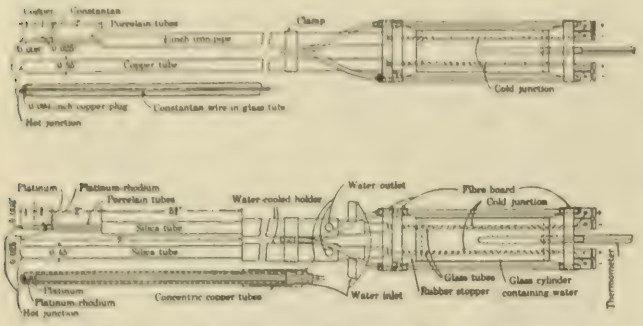
FIG. 2—CONNECTIONS FOR TESTING DIRECT-CURRENT AND THREE-PHASE MACHINES RESPECTIVELY

MEASURING FURNACE HEAT

Thermocouples Made with Two Combinations of Metals Found Satisfactory

Two kinds of thermocouples were recently used in measuring temperatures of gas-fired boilers which might be considered by central station engineers for permanent attachment to boiler furnaces. One couple, made of copper and constantan, was used for temperatures up to 900 deg. Fahr. (500 deg. C.), and the other, consisting of platinum and rhodium, for all higher temperatures. The details of both of these couples are shown herewith. The hot junctions in both of the small couples were made of short pieces of wire, 0.008 in. (0.2 mm.) in diameter, welded to larger wires in order to obtain mechanical strength and to prevent sagging of the projecting parts. In each couple the dissimilar

wires forming the hot junction are kept uniform in diameter without the formation of the usual head. The large copper-constantan couple consists of a thin-walled copper tube, 0.550 in. (14 mm.) outside diameter, having a cup-shaped copper plug rolled into one end. Constantan wires, 0.025 in. (0.53 mm.) in diameter, were peened into these plugs to make the hot junctions.



CONSTRUCTION OF COPPER-CONSTANTAN AND PLATINUM-RHODIUM THERMOCOUPLES

Glass tubing was used to insulate the constantan wires placed in the copper tubes. The large platinum couples were made of wires 0.025 in. (0.53 mm.) in diameter. The hot-junction end of the couples was placed in a closed-end silica tube about 11 in. (27.9 cm.) long and fitted into a water-cooled metal holder. The closed-end silica tubes had an outside diameter of 0.450 in. (1.14 cm.). Inasmuch as it was the outside surface of these tubes which received and radiated heat, this construction gave the same readings as would have been obtained with couples made of a large platinum tube the same size and shape as the copper tube. The length of the silica tubes was sufficient to make negligible any lowering of temperature of the closed end due to conduction of heat to the water-cooled holder. The water-cooled holder of the platinum couple was made of three concentric copper tubes arranged in such a way that the cooling water flowed through a circuit twice the length of the holder. The outside tube had an outside diameter of 0.75 in. (1.9 cm.). The cold junctions of the couple were placed in a water bath attached to the cold end of the couples. These thermocouples were described by Henry Kreisinger and J. F. Barkley in a paper presented at the spring meeting of the A. S. M. E.

SELECTION OF COAL

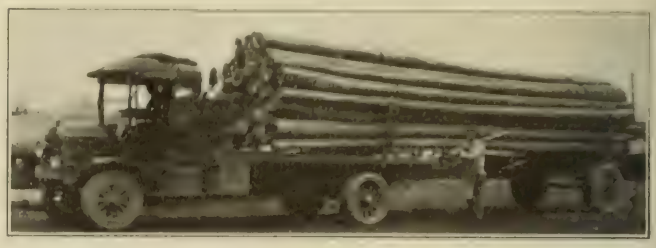
Advisability of Basing the Specifications for Coal on the Fusibility of the Ash

Coal the ash of which does not melt below 2400 deg. Fahr. (preferably a little above this figure) is a very good power-house coal because the ashes remain in small particles, form small clinkers, and do not fuse together and make a big sheet of slag over the grate. An ash which clinkers below 2400 deg. causes a great deal of trouble through obstruction to the air supply feeding the fire. The New York Edison Company, Commonwealth Edison Company of Chicago and other companies have been studying the ash content of coal with a view to the possibility of incorporating in coal specifications a laboratory test of fusibility of ash. These points were brought out recently by C. H. Parker, assistant superintendent of generation Boston Edison Company.

TRUCK FOR HAULING POLES

Motor Truck Equipped with Trailer and Removable Bolster Upon Which Entire Load Swings

The stores department of a large company uses the truck shown in the accompanying illustration for hauling poles, especially where it is necessary to haul less than a carload of poles to some suburban pole yard. It is also used occasionally in an emergency to help out the maintenance department. The only changes which were



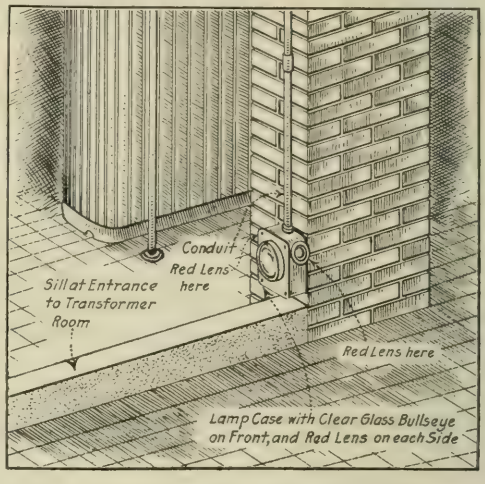
TRUCK EQUIPPED WITH TRAILER FOR HAULING POLES

made in the truck were the addition of a device in the rear for attaching the tongue of a trailer and the use of a removable swivel bolster upon which the entire load swings, thus enabling the truck to turn corners easily. The truck and trailer shown herewith are loaded with forty-six 30-ft. (9.1-m.) poles with 6-in. (15.2-cm.) tops. With shorter poles the load is about evenly divided between the truck and the trailer, while with longer poles the trailer carries most of the load.

PREVENTING ACCIDENTS

Electric Bull's-eye Used to Illuminate Sill at Entrance to Transformer Room to Prevent Stumbling

At the State Street station of the United Electric Light Company, Springfield, Mass., a transformer-room floor is separated from the rest of the station by a concrete door sill 4 in. (9.16 cm.) high, to guard



LAMP FOR ILLUMINATING RAISED SILL, WITH RED LIGHT SUGGESTING CAUTION

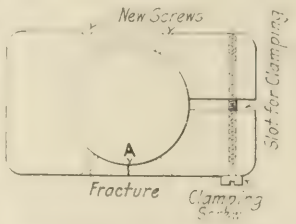
against the flow of oil in case of trouble. To prevent stumbling at the sill an 8-cp. 140-volt pilot lamp has been installed in an iron box at one end of the sill, as shown. Red bulls'-eyes are set in the box at the sides, to serve as a warning, and a clear-white glass is provided at the front to illuminate the sill. By running the lamp at 115 to 120 volts its life is greatly increased.

REPAIRING CRACKED FIELD-POLE SHOE

Fracture Is Welded, Clamping Screws Are Removed and Set Screws Are Inserted in Order to Hold Shoes to Pole

BY H. L. HEARVEY

A cast-iron field-pole shoe of a ½-hp. bipolar direct-current motor cracked as shown at *A*, allowing the shoe to rub against the armature. The frictional heat which developed soon completely ruined the armature coils, necessitating their rewinding. The shoe was taken off and welded with an acetylene torch. Further examination revealed a crack similarly situated in the other shoe, but it had not moved while the motor was in use as it fitted the pole more tightly than the shoe which had caused the trouble. These weak places were reinforced by building them up while welding.



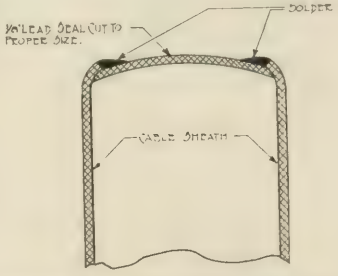
CRACKED POLE SHOE THAT WAS REPAIRED

In order to prevent the recurrence of this accident it was decided to hold the shoes in place with screws passing through their sides and into the poles instead of by the clamping screws which had been employed up to this time. To facilitate this work the field coils were removed, and the armature was inserted so that the shoes could be properly placed. Then the shoes were clamped in position and drilled and tapped for No. 8 flat-head iron screws. The coils were then replaced, the shoes were screwed permanently in position, and the motor was put back in service, where it has given no more trouble.

SEALING ENDS OF CABLES

Lead Disk Laid in Recess Made in End of Cable and Soldered to Sheath Belled Over It

Proper sealing of cable ends is of importance because of the danger of absorption of moisture by the cable insulation when sealing is not properly done. Several large operating companies use the following simple and effective method of sealing cables. The first step is slightly to bell out the lead sheathing around its entire circumference. Then, approximately ¼ in. (0.64 cm.) of the core of the paper insulation around the conductors is removed. A lead disk, ⅛ in. (0.32 cm.) thick and slightly convex, is carefully scraped to insure the solder taking hold and is placed over the end of the cable inside the projecting sheath. The belled edge of the sheath is bent up over the edge of the cap, which is then thoroughly soldered to the sheath, as shown in the accompanying illustration. The solder, which increases the thickness of the cap, makes a water-tight joint and is strong enough mechanically to protect the cable from injury. This method of sealing cables was described in the report of the N. E. L. A. committee on underground construction and electrolysis, of which E. B. Meyer is chairman.



METHOD OF MAKING LEAD SEAL FOR CABLES

DISTRIBUTION-LINE ECONOMIES

How to Balance Transformer Expense Against Copper Expense in Laying Out a System

Some interesting views on considerations influencing selection of transformers were brought out in a recent paper, by S. B. Hood of the Minneapolis (Minn.) General Electric Company. Since the price per kilovolt-ampere of transformer rating decreases as the size increases it naturally follows that the larger sizes should be used wherever practicable. This can be accomplished usually by stringing heavier and longer secondary bus lines and feeding them with a smaller number of units. The most economical balance is obtained as regards initial investment when the cost of secondary bus lines plus transformers is a minimum. There is, however, a very wide difference between the depreciation on copper wire and on transformers. Wire depreciates very slowly and has a high fixed salvage value. Transformers have an uncertain life and their scrap value is low. Taking these conditions into consideration, it is good practice to spend considerably more on bus copper than is actually required to strike an economical balance. An excess copper investment equal to 50 per cent of the transformer cost is not too much to allow.

As an example, take two secondary bus sections, each fed by 5-kva. transformers, the investment on which, in position, will be about $150. By connecting these bus lines and substituting a 10-kva. transformer, advantage is taken of the diversity on the bus, thereby permitting the connecting of more load. The new transformer investment will not exceed $95, showing a saving of $55 that can be spent for connecting and increasing the size of the secondary bus and still maintain a balance as regards investment. Assuming interest at 6 per cent and depreciation at 7.5 per cent, the annual charges will be $20.25 and $12.82 respectively, showing an annual saving of $7.43 by using one unit in place of the two. Now, if interest is assumed at 6 per cent and depreciation at 2.5 per cent on copper wire, and this saving is capitalized, it will be possible to spend $87 plus the $55, or $142, on the secondary bus and still maintain an economical balance. This makes no allowance for the saving due to lower core loss with the single unit as compared with two smaller units. If this were taken into consideration, a still greater secondary investment could be justified. In purchasing transformers it is very poor policy to stock the small units. A 5-kva. unit is small enough to use regularly on any system of distribution.

As regards ratios and taps for distribution transformers, 2300-volt primary and 115-230-volt secondary windings without taps give the best all-around results. These will operate over a primary range of 2200 to 2400 volts. Taps have no real advantage and introduce complication in the end turns where the greatest strength is required. The double primary winding used in earlier days is of no use at present, and its omission together with that of taps makes possible the elimination of the primary terminal board which has been the cause of so many transformer failures.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

GETTING THE ANSWER ON NEWSPAPER ADVERTISING

How an Analysis of a Community's Habits Helped Make Central Station Advertising More Effective

An exact reproduction in one city of advertising used with great success in any other city would not necessarily be successful in the same measure. At least this is the opinion of the commercial department of the Mahoning & Shenango Railway & Light Company of Youngstown, Ohio. The men who plan the advertising for this company believe that local conditions in each city must be analyzed, and then the advertising must be written and used in accordance with the conditions found to bring the greatest success. An analysis was made at Youngstown.

It was formerly believed that selling electrical goods entailed so much educational effort that any over-the-counter merchandising attempt was ultra-expensive. But a great deal of the buying in this city is over-the-counter buying. Youngstown is a great Saturday-buying city. Counters and aisles are literally lined with buyers on Saturday afternoon and evening after the steel mills have paid employees. Friday newspapers consequently carry the heaviest advertising sections of the week.

A study of the general run of this advertising showed that it was very black, heavy and closely set. When it was decided that the central station should also try to get some of this Saturday business it was planned to make the advertising different and to attempt to promote the sale of only the merchandise which is readily salable over the counter. Accordingly all advertisements were set in type which would give them a light, readable appearance in contrast with the remainder of the black, heavy page. Some experimenting with different sizes of space was tried, but it was soon discovered that four inches deep and five columns wide gave the best results for the money. That the method of analysis was correct has been proved by the increase in the sales of the goods advertised.

Educational advertising is still done occasionally, but such material never appears in the Friday papers. It is run in Sunday papers or earlier in the week, when people are taking more time to read and think and are therefore in a receptive mood.

WHERE TO START YOUNG MEN WHO WANT TO MAKE PROGRESS

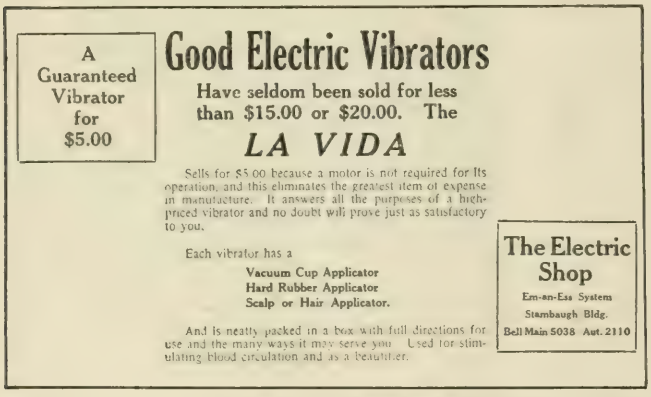
Letting Them Read the Meters Affords Companies Opportunity for Making Better Contact with Their Customers

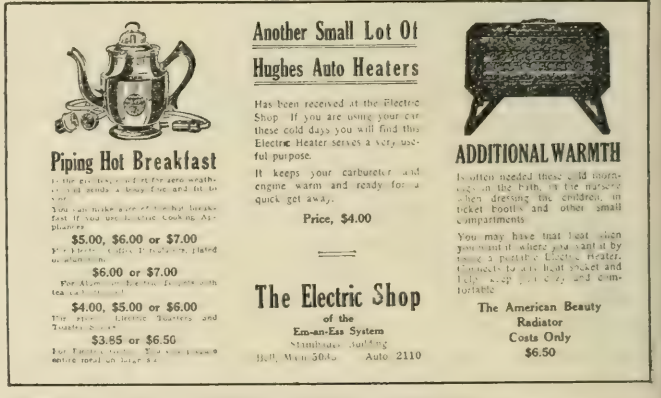
It is frequently difficult to decide where to start promising young men who have no special technical training. Central stations, like other concerns, are continually having applications from young men who are just starting out. Some of these fellows appear promising, but the company is frequently at a loss to know what to do with them. Undoubtedly in a few years they will develop into valuable employees if they can only get the proper start.

Two companies, one in the East and one in the Middle West—undoubtedly there are more—have found the way out of this difficulty, and very satisfactorily too. All intelligent and eligible young fellows are started in the meter department. The men are given to understand that they are expected to grow and develop. In fact, they receive every opportunity to do so.

Incidentally these companies make contact with customers through ambitious young men who have the best interests of their company at heart. Better meter readers are obtained, better and more careful meter reading results, with fewer mistakes, and consequently there are fewer complaints—all the result of employing men who do not consider meter reading the maximum of attainment.

The point of contact with the customer is very important. If a bright, clean young fellow shows up to read the meter, the impression left with the customer is much more favorable to the lighting company than it





SAMPLE ADVERTISEMENTS USED TO GOOD EFFECT BY OHIO CENTRAL STATION COMPANY

vould be if a man whose appearance suggested an earn-ng power of about $10 a week knocked at the door. Certainly the customer would be less likely to suspect he meter reading.

STEEL METER RECORD FILE ARRANGED TO RUN ON WHEELS

Convenient Fireproof Contrivance So Designed that It Can Be Wheeled Into the Vault at Night for Safekeeping

Meter records, of course, are invaluable to a central tation, and therefore every precaution is taken by care-ul companies to keep them safe. Where cards are used n excellent device for keeping these records may be atterned after the steel card file used by the Rockford Ill.) Electric Company.

The file consists of sixteen 5-in. by 8-in. (12.7-cm. by



A RECORD FILE THAT RUNS ON WHEELS

0.32-cm.) and eighteen 3-in. by 5-in. (7.62-cm. by 2.7-cm.) drawers. The over-all dimensions are: Width, 1 in. (104.14 cm.); height, 53 in. (134.62 cm.), and epth, 18 in. (45.72 cm.).

On the front of each drawer is a combination handle nd card frame allowing the insertion of a card desig-ating the contents. The whole file is mounted on a set four rubber-tired wheels set with ball bearings, two arrying the greater part of the weight and mounted rectly upon the axle. The other two, which act as ide wheels, are mounted directly underneath and are swivel type, readily turning in any direction. To ch end is fastened a handle used in pulling or pushing desired. Every morning the file is wheeled into the eter department, and every evening it is taken into e vault for safety.

RATE TENDENCIES AND RECOMMENDATIONS THEREON

Rate Research Committee Discusses Point of Incidence of Follow-On Rate and Variation of Rates with Fuel Costs and Power Factor

One of the very valuable reports presented at the annual convention of the National Electric Light Association is that of the committee on rate research. This year's committee, headed by Alex Dow of Detroit, discusses rather fully three topics of more than passing interest: (1) the point of incidence of a follow-on rate; (2) rates varying with the fuel costs, and (3) rates varying with power factor. In connection with these topics the committee has the following to say in part:

THE POINT OF INCIDENCE OF A FOLLOW-ON RATE

"The mistake is often made of comparing the maximum rates of different companies without considering the conditions of application of a secondary or follow-on rate. With the differentiations and careful adjustments of electric rates now in force in the industry, it becomes necessary, in order to a proper understanding of rate schedules, to take into account not only the base or maximum rate, but the secondary or follow-on rate and its point of incidence. The fact that, for instance, the base rate of a company is 12 cents per kilowatt-hour is not sufficient justification for the inference that its rates are higher than those of a company charging 10 or 9 cents per kilowatt-hour, because in the former case the secondary rate may apply after a shorter number of hours of use of the demand per month or for a lesser number of kilowatt-hours' consumption per month than in the latter case.

"There is a wide divergence in the practice of different companies with regard to the point of incidence of the secondary or follow-on rate. In some instances it may be effective after, say, twenty-five hours' use of the demand; in other cases after 120 hours' use of the demand. In the former case the company may intentionally have selected as the point of incidence the point corresponding to economical use of light, with intent to encourage liberal use of lamps or of appliances. In the latter case the prior maximum rate may have been unduly low, but the divergence may indicate a lack of comprehension of the conditions which should determine the point at which the follow-on rate should apply, and the matter is therefore well worth special attention by those who may be considering changes in their rates.

"Perhaps the most common method has been to select the point of incidence according to the amount of reduction of earnings desired to be effected.

"The point of incidence may be separately determined as between different classes of customers: thus, if it is desired to promote larger use by individual customers of all classes, and if it has been determined that the commercial lighting class has a condition of load factor, or average use, different from that of the residential lighting class of customers in the same company, it would be perfectly proper to apply the secondary or follow-on rate for all consumption by commercial customers over a number of hours' use of the demand which is considerably greater than the lesser number of hours' use required of residential customers; or, if it is determined that a certain class of commercial customers, to whom it is desired that a stimulus be applied in the

form of a low follow-on rate, can be counted on to use, say, 150 hours of the demand per month normally, and if the similar normal use by residence customers proves upon investigation to be thirty hours, then it would be proper to apply the secondary rate for the respective classes only when the consumption reaches such number of hours' use.

"Several methods of treating this point of incidence of the follow-on rate have been used in actual practice, with the desirable effect of minimizing the number of meters, the number of contracts, the expense of billing, and the investment and maintenance costs in connection with meters, the intention being to enable customers to receive a differentiation in rate between lighting service and power service and yet supply the entire service through a single meter.

Rates Variable with Fuel Costs

"The present high cost of fuel demands that earlier rates for large blocks of energy generated by the combustion of fuel be reconsidered. The variations in fuel costs from month to month, and almost from day to day, make impossible any permanent or semi-permanent readjustment of such rates. The committee suggests that a 'standard rider,' attachable to existing forms of contracts and forming part thereof, and providing for variation of rate with variation of fuel cost, is the most convenient method of dealing with the present problem. Such a rider may state a normal price for a specified fuel having a thermal value within certain limits, f.o.b. at a recognized receiving point, and an additional charge per kilowatt-hour when cost exceeds that normal price. If there is a coal exchange or similar institution, whose published average prices per month are accepted locally as authoritative, these published prices may be made the basis of the billing; but in almost every case the actual price paid by the member company, averaged for the month or other billing period, and certified to by its auditor, will be the only available basis. If the 'normal' price for fuel is specified at any figure above a certain minimum, of course the rider should provide for reduction as well as for increase of rate.

Rates Varying with Power Factor

"The committee has discussed at length the merit of a power-factor specification in contracts for the supply of energy in large quantities. It appears that such a specification is seldom written in, and when written is not always enforced. It also appears that there should be a difference in our dealings with the power factors ordinarily associated with industrial power loads and those exceptionally bad power factors which not only cause excessive investment in generating apparatus and transmission copper but disturb the service to consumers other than the offender. It should be remembered that at 70 per cent power factor the heating of all conductors is doubled, in comparison with the heating at 100 per cent, and presumably the carrying capacity is likewise halved. Certainly the regulation of a transformer or a transmission system is less than half what it would be at 100 per cent.

"The unbalancing of polyphase circuits due to large single-phase loads was, in committee discussions, considered to have a like undesirable standing with low power factor. For instance, the use of several single-phase welders or a group of small single-phase furnaces which could be balanced out, one against the other, more or less completely by sequent connections on the different phases of the system was held to be reasonable, but a demand that we should serve a large single-phase furnace or a single-phase railway at the rates quoted for balanced loads was held to be unreasonable. The burden of balancing such loads should be the consumer's.

"The committee suggests that there is a limit to correction or compensation of these disturbing influences by rate making alone, and that certain disturbances should be debarred by penalties rather than measured and settled for as incidents of service.

"The committee suggests, as a basis for discussion only, and not as a fully considered recommendation, that a satisfactory power factor rule should (a) accept without charge or penalty power factors from unity down to (say) 85 per cent; (b) increase the rate suitably for power factors from 85 per cent down to 75 or possibly 70 per cent, and (c) penalize by a rapidly increasing surcharge all power factors of 70 per cent or less.

"Unbalancing of a character and extent which will cause disturbance and expense is usually accompanied by very low power factor and would be collaterally penalized; but it is properly a subject for corrective engineering rather than corrective rate making. Such a serious case of lack of balance as power supply to a single-phase railroad is not to be dealt with by any general schedule."

THE PROFIT TO A COMPANY ON A LAMP SALESMAN

Indiana Sales Manager Points Out that Seven-Hundred-and-Fifty-Dollar Man Earns Practically Double His Salary for the Utility

In a campaign to sell 100 reading lamps new to Indianapolis one of the local lighting companies, the Merchants' Heat & Light Company, with twenty salesmen on the outside, disposed of sixty lamps the first day and the remaining forty the next. The campaign was considered quite successful, in spite of the fact that the department had had no special previous training in selling reading lamps.

The reason the sale is considered so successful is given by R. A. MacGregor, sales manager of the Merchants' company, as follows: "A residence salesman who will produce an average of one and one-half new customers a day is considered a crackajack. His salary is usually $750 a year. One and one-half customers a day gives a total of 450 a year, which on the average revenue of $12 per customer a year means $5,400. In other words, the central station company is glad to spend $750 for a man who will produce $5,400 a year revenue.

"The men selling reading lamps for the first time averaged three lamps apiece a day, so that it does not seem too much to expect that they with training could sell 1000 lamps a year. The profit to a central station on 1000 lamps is $1,450. The equivalent revenue would be $6,000 a year. From these figures it is pointed out that the same effort devoted to the service of the regular customer would develop $600 more revenue per year and the salesman would pay the company $700 in profit for holding his job at the same time. In addition to this the selling of lamps has the additional feature that it goes where a service and meter are already installed and requires no additional line investment."

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

PHOTOMETRY OF LIGHTS OF DIFFERENT COLORS

Experiments with the Flicker Method Seem to Establish for It Advantages of Accuracy in Measurement and Reduction of Labor

IN RECENT years photometry is being looked upon more as an exact science, and in some cases tenths of 1 per cent are considered important quantities. However, it is only when conditions are most favorable, and in particular when the lights compared are closely similar in color, that accuracies of this order can be approached. As soon as any perceptible difference of color appears the certainty of measurements is distinctly reduced. For example, in the most careful interlaboratory comparisons made with a standard Lummer-Brodhun photometer systematic differences of nearly 2 per cent have occurred when the color difference involved was that between the primary carbon standards and vacuum tungsten lamps. This particular difficulty was satisfactorily met by tacit general agreement on certain values for vacuum tungsten standards, but it arose again in aggravated form with the advent of gas-filled lamps, which give decidedly whiter light than the vacuum lamps. Still greater color difference is involved in rating arc lamps, gas mantles and other selectively radiating illuminants, reaching the extreme in the mercury-vapor lamp and in the comparison of monochromatic lights.

Necessity for Improved Method

It has become increasingly evident that if any systematic and general method of comparison of lights is to be established, some method other than that of the accepted standard photometers must be used. Of all the other possible means of measurement, the only one which has apparently given promise of being a decided improvement is the use of the flicker principle. The work of H. E. Ives established the practicability of the flicker method and gave a fairly complete experimental basis for specifications covering the procedure to be followed.

In 1915 the Bureau of Standards, in collaboration with the research committee of the Illuminating Engineering Society, undertook an extensive trial of the flicker instrument, following in general the proposals of Ives and his collaborators. A report on this work was given before the Illuminating Engineering Society in 1916 by Crittenden and Richtmyer (see ELECTRICAL WORLD, Vol. 67, page 415, Feb. 19, 1916). Since that time the flicker method has been further tried out at the Bureau of Standards on a considerable variety of work, and a proposal has now been made that the research committee formally recommend the adoption of that type of photometer as the standard one for the comparison of lights of different colors. The bureau is issuing as Scientific Paper No. 299 the report mentioned above, with the title "An Average Eye for Heterochromatic Photometry, and a Comparison of a Flicker and an Equality-of-Brightness Photometer."

The results emphasize the fact that for accurate heterochromatic measurements a systematic choice of observers is essential. The method proposed by Ives and Kingsbury appears to be practical and reliable, at least for color differences of the type dealt with in these tests. The ratio of transmission found for specified yellow and blue solutions is a test as to whether the individual eye agrees with the average, and if not, correction to a comparison of lamps made by an individual eye can be applied from the data given in the paper. Hence for color differences of this type any observer may be used and his results corrected to the normal.

With regard to certainty of measurement the flicker photometer shows a decided advantage, even with small color differences. With regard to relative results, for sources having relatively high intensity in the blue the values given by the flicker photometer differ from those obtained by the Lummer-Brodhun photometer as generally used. Besides increased certainty, the flicker method reduces considerably the labor necessary to attain a given accuracy.

AVERAGE RELATIVE VISIBILITY OF RADIATION
(125 OBSERVERS)

Wave-Length, Microns	Visibility, Per Cent	Wave-Length, Microns	Visibility, Per Cent
0.40	0.010	0.58	0.898
0.41	0.017	0.59	0.800
0.42	0.024	0.60	0.687
0.43	0.029	0.61	0.557
0.44	0.033	0.62	0.427
0.45	0.041	0.63	0.302
0.46	0.056	0.64	0.194
0.47	0.083	0.65	0.115
0.48	0.125	0.66	0.065
0.49	0.194	0.67	0.034
0.50	0.316	0.68	0.018
0.51	0.503	0.69	0.0085
0.52	0.710	0.70	0.0040
0.53	0.862	0.71	0.0020
0.54	0.954	0.72	0.0010
0.55	0.994	0.73	0.0005
0.56	0.998	0.74	0.0003
0.57	0.968	0.75	0.0002

One of the fundamental facts involved in photometry is the variation of visibility of light with its wave length. This also has been studied recently at the Bureau of Standards, and the results will soon be issued under the title "Relative Sensibility of the Average Eye to Light of Different Colors, and Some Practical Applications to Radiation Problems," by W. W. Coblentz and W. B. Emerson.

The determination of a visibility curve requires the measurement of the radiant energy—or, more properly, power—distributed through the spectrum, as well as the light. The facilities available were such that the measurements of the radiation in this case were more

reliable than in any previous work of this kind, in the opinion of the investigators. The light was measured by a flicker photometer following the proposed standard specifications except in regard to brightness of field. The field was a magnesium-oxide surface with an illumination of 50 meter-candles, viewed through an artificial pupil measuring 0.5 mm. by 2.6 mm.

Taking an average of data obtained with 125 observers, the relative visibility of radiation of different wave lengths was found to be as shown in the accompany table, the maximum value (at 0.5576 μ) being taken as unity.

The data given agree very closely with the transmission of the most recent physical-photometer luminosity solution proposed by Ives and Kingsbury, except in the green. A modified solution, in which the transmission coincides more closely with the observed visibility curve, is described in an appendix to the paper. Comparison of the spectral energy distribution of the acetylene flame used in this work with that used by Nutting indicated that the outstanding differences between the Nutting visibility curve and that mentioned were largely due to differences in the energy measurements. If the Nutting curve is corrected in accordance with these later measurements of the energy, the agreement becomes as good as could be expected in view of the known variations of individuals from the mean curve. Measurements at five points in the spectrum were also made by equality-of-brightness settings. These were so much more erratic than the flicker measurements that no very definite conclusions could be drawn, but there seemed to be a tendency toward a broader curve than that given by the flicker photometer.

Generators, Motors and Transformers

Deterioration of Turbine Blades.—A. Fenwick.—Conclusion of an abstract from the *Proceedings* of the South African Institution of Engineers. In summarizing the behavior of materials used for turbine blades it was pointed out that 5 per cent nickel-steel, brass and aluminum bronze in suitable stages will have a life of 40,000 hours, and perhaps 50,000 or more, which, if the turbines are run continuously, means five or six years. Nozzles with thin cast-iron vanes should be abolished, but if cast-iron is used the design should be such that there is no possibility of pieces becoming detached. High-percentage-nickel steel has been more extensively used and for a much longer period than non-nickel steel. The evidence is, however, very much in favor of mild steel. The cast-in method of attaching blades is very simple and requires a minimum amount of machining and fitting, so that it would be preferable to retain the design if satisfactory results can be obtained. The author believes that considerable improvement can be made by the use of thicker blades of mild or low-percentage nickel steel. The behavior of aluminum bronze and high-percentage nickel-steel running blades in various stages indicates that these materials are unsuitable for use at high temperatures. The first indication of the cracking of guide blades is always at the inlet side of the blade, and these cracks then extend cobweb fashion over the surface of the blade. There was a considerable amount of evidence to show that deterioration was more rapid on machines which carry a fluctuating load.—London *Elec. Review,* May 11, 1917.

Generation, Transmission and Distribution

High-Tension Overhead Transmission Lines.—G. V. Twiss.—The second installment of the author's paper on this subject. Among subjects discussed therein are the factors of safety required in Great Britain, Canada and the United States, relative merits and fields of pin-type and suspension-type insulators, and the mechanical design and testing of insulators. Curves are given that facilitate the calculation of line costs.—London *Electrician,* May 11, 1917.

Phase Transformation.—G. Faccioli.—An article which demonstrates how both voltage and current at quadrature with a single-phase source of supply can be obtained by means of inductance. By this method it is impossible to derive a balanced polyphase system because in each case where quadrature current is derived there is an excess of power delivered to one phase.—*General Electric Review,* May, 1917.

Installations, Systems and Appliances

Coherers.—E. C. Green.—Early observations of coherer action, description of a new type of coherer developed recently for lightning-arrester and high-frequency alarms, and comments on some theories that have been advanced to explain coherer action.—*General Electric Review,* May, 1917.

Rating of Auto-Starters.—A long editorial in which attention is called to the great variety in the methods of rating auto-starters. Five such methods are described as follows: (a) Starting motors of their rated horsepower against full-load torque during a maximum period of one or one and a half minutes in the starting position, to be followed by a running period or rest period of not less than ten times the starting period. If the starting period is, say, only half a minute, then two starts may be made with one-minute rating, or three with a rating of a minute and a half. (b) Starting with twice full-load current from the line, with the motor connected to the 50 per cent tap, at intervals of thirty minutes for a starting period of one and a half minutes, with a temperature rise not exceeding 70 deg. Fahr. (21.1 deg. C.). (c) Auto-transformers are rated to take from the mains a current not exceeding two and a half times the full-load current of the motor, with the motor connected to any tapping, for a period not exceeding one minute or one and a half minutes, followed by a cooling period of at least ten times the starting period, for an indefinite number of times, with a maximum temperature rise not exceeding 100 deg. Fahr. (37.8 deg. C.) (measured by the increase of resistance of the winding). (d) With full-line voltage applied to line terminals and current taken from taps giving between 40 per cent and 60 per cent of the normal line voltage, 300 per cent of full-load current applied for the first fifteen seconds of each four-minute period for not more than one hour must show no resultant flaming or molten droppings. The oil, if any, in which the transformer windings are immersed shall not overflow the containing case. (e) With full-line voltage applied to line terminals and current taken from taps giving between 40 per cent and 60 per cent of the normal line voltage, 250 per cent of full-load current applied for three minutes, followed by a cooling period of one hour with a maximum temperature rise not exceeding 100 deg. Fahr. (37.8 deg. C.) measured by thermometer. Some of these methods are briefly criticised,

and it is urged that the engineering standards committee should bring the makers and users together and draw up specifications acceptable to both.—London *Electrician*, April 27, 1917.

Electrochemistry and Batteries

Electrolytic Treatment of Zinc Ores.—E. E. WALTS.—From experiments outlined in this paper the following conclusions were made: (1) Successful electrolysis is impossible in the presence of sulphurous acid or zinc sulphite. (2) Successful electrolysis is possible with an electrolyte of zinc sulphate to which zinc oxide prepared in any suitable manner is charged to compartments surrounding the anodes of the cell. (3) Lead forms a satisfactory anode, and copper, zinc and aluminum form satisfactory cathodes. (4) With current densities of from 2.5 amp. to 4.5 amp. per square decimeter, a current efficiency of approximately 100 per cent can be maintained. (5) Depending upon the current density, the voltage varies from 3.5 volts to 6 volts. (6) The extraction of zinc from zinc oxide varies from 95 to 100 per cent. On the basis of a steady production of 60,000 lb. per month, or 2000 lb. per day, the writer estimates that the cost of producing zinc electrolytically could be 4 cents per pound when power is available at $14 per horsepower-year. The cost in cents per pound would be distributed as follows: Crushing, pumping, filtering and purifying, 0.6; electrolysis, including power, labor and repairs, 2.3; melting 0.8, and general, 0.3.—*Met. and Chem. Engineering*, June 1, 1917.

Electrophysics and Magnetism

Electrostatic Capacity of Three Parallel Cylinders.—F. E. PERNOT AND E. N. D'OYLY.—J. J. Thompson has shown how to determine the capacity per unit of length of two infinitely long parallel cylinders by the method of successive images. The present authors show how to apply the same method to the determination of the electrostatic capacity of three parallel cylinders. The paper is of a highly mathematical nature.—*University of California Publications, in Engineering*, Vol. I, No. 10, Feb. 10, 1917.

Fatigue of Nickel and Iron Wires Under the Influence of Transverse Alternating Magnetic Fields.—W. BROWN.—Experiments were made on the fatigue of nickel and iron wires when subjected to the influence of transverse alternating magnetic fields of a frequency of 50 cycles per second. One nickel and one iron wire were tested. The nickel wire was a No. 16, s.w.g., of simple rigidity 790×10^6 gm./cm.^{2}, the load on the lower end being 1.5×10^5 gm./cm.^{2}. The magnetic field in the solenoid surrounding the wire was 20 c.g.s. units, and a current of 1 amp. was sent through the wire. It was found that the maximum fatigue due to a transverse alternating magnetic field is about 8.5 per cent less than that due to a longitudinal alternating magnetic field, and that it takes about double the time to attain that maximum. The iron wire tested was a No. 16 s.w.g. of simple rigidity 810×10^6 gm./cm.^{2}, the longitudinal load on the lower end being 10^5 gm./cm.^{2} The magnetic field in the solenoid surrounding the wire was 2.5 c.g.s. units, and the current through the wire tested was 1 amp. In the case of iron wire the maximum fatigue due to transverse alternating magnetic fields is about 25 per cent less than the maximum obtained with longitudinal alternating magnetic fields of the same strength, and it takes about twice as long to attain the maximum. Experiment indicates that what is called fatigue and is measured by the magnetic twisting of the wire is not accompanied by any effect on the resistance.—*Royal Dublin Society Proceedings*, Vol. XV, page 163, January, 1917; abstracted in *Science Abstracts A*, Feb. 26, 1917.

Electrical Applications

Electricity for Enameling and Japanning.—WERT S. SCOTT.—How electric heating of enameling and japanning ovens reduces fire hazards and improves quality of product. The type of equipment and method of installation best suited to this service are also discussed.—*Electric Journal*, May, 1917.

Electric Vehicle as a Central-Station Load.—C. A. ROHR.—Among desirable features of an electric-vehicle load are that it may be made off-peak, and that is, has a high load factor, 30 to 35 per cent compared with 10 per cent for motors. The author favors the car-mile system of electric-service charges and suggests that rates be offered by power companies for every standard battery in any standard vehicle, instead of only for certain makes of batteries.—*General Electric Review*, May, 1917.

Units, Measurements and Instruments

Chromium-Steel Magnets.—E. GUMLICH.—A preliminary account of an investigation carried out at the German Reichsanstalt, the object of which was to investigate the suitability of chromium steels for permanent magnets. While tungsten steels have been used for such purposes in the past, the scarcity of tungsten due to the present war has suggested a substitute. Numbers are given for five bars of chromium steel 22 cm. by 0.6 cm., these being compared with other five bars made of tungsten steel, the product of remanence and coercive force being taken as a criterion of quality. The remanence of the chrome-steel bars was further tested under twenty hours' heating at 100 deg. C., six heatings up to 100 deg., and twenty falls from a height of 2½ m. onto a wooden block. Details of analysis and hardening temperatures are withheld. It is concluded that carefully prepared chromium steel is a suitable substitute for tungsten steel.—From *Elek. Zeit.*, Nov. 2, 1916; abstracted in *Science Abstracts*, Section B, March 31, 1917.

Roentgen Rays from Sources Other Than the Focal Spot in Tubes of the Pure Electron Discharge Type.—W. D. COOLIDGE and C. N. MOORE.—An article illustrated by many diagrams giving a description of tests which were undertaken to determine the source and amount of extraneous radiations from the electrodes of the Coolidge X-ray tube, and to what extent these radiations affect roentgenograms of the human body. Roentgenograms of the target of tubes in which different methods of screening the extraneous rays are employed are shown, and in most cases the target of the standard tube, made under identical conditions, is also shown for comparison. The conclusion arrived at is that if the shortest exposure consistent with satisfactory density of image is employed, the special tubes show no particular advantage over the standard tubes. With the present roentgenographic technique the use of other but the present standard type of tube is, therefore, not thought to be warranted.—*General Electric Review*, April, 1917.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

BILL TO LICENSE USE OF ENEMY-OWNED PATENTS

Introduced in House of Representatives, It Would Give Rights to American Citizens Under Federal Trade Commission License

A bill introduced recently in the House of Representatives, Bill No. 4704, proposes that the Federal Trade Commission license American citizens under enemy-owned patents, with ample provision giving to the owners of the patents the right of recovery of a reasonable royalty to be fixed by the court in a suit in equity to be brought at any time within one year after the close of the war and requiring a deposit of 5 per cent as security.

This is simply a limited compulsory license bill applicable to enemy-owned patents.

POWER CONTRACT REVISED TO MEET EXIGENCY IN COAL

Edison Electric Illuminating Company of Brockton, Mass., Drafts New Form, with Increase or Decrease, as Coal Moves

The Edison Electric Illuminating Company of Brockton, Mass., has joined the ranks of New England central stations which have been obliged to recognize the rising cost of fuel in power rates. It has drawn up a new form of power contract in which a comprehensive coal clause provides for coal cost fluctuations.

The clause states that whenever during the continuance of the contract the cost to the company of Pocahontas, New River or other coal of equivalent grade, of approximately 14,800 B.t.u. per pound dry, is more than $5 per ton of 2240 lb. (this cost to include delivery in the company's storage and to be the average price for all coal carried in this storage, together with coal received from time to time) during any period exceeding three consecutive months, then for each 5 cents' increase in cost over and above $5 per gross ton the purchaser will pay an additional amount of $0.00006 for each kilowatt-hour of electrical energy used during those three months and during the period that the cost of coal exceeds $5 per gross ton.

Whenever the cost to the company is less than $4.25 per gross ton as above, the price of energy will be reduced $0.00006 per kilowatt-hour for every 5 cents' decrease below $4.25 per ton. If the quality of the coal differs from that above specified, the average cost of coal determined as above is to be corrected to an equivalent of 14,800 B.t.u. per pound dry.

COAL CLAUSE

Whenever during the continuance of this agreement the cost to the Power Company of Pocahontas, New River or other coal of equivalent grade of approximately 14,800 B. T. U. per pound dry, is more than $5.00 per ton of 2240 pounds (this cost to include delivery in the Power Company's storage and to be the average price for all coal carried in said storage, together with coal received from time to time) for any period exceeding three consecutive months, then for each five cents increase in cost over and above $5.00 per gross ton, the Purchaser will pay an additional amount of $0.00006 for each kilowatt hour of electric energy used during said three months and during the period that said cost of coal exceeds $5.00 per gross ton.

Whenever during the continuance of this agreement the cost to the Power Company of Pocahontas, New River or other coal of equivalent grade of approximately 14,800 B. T. U. per pound dry is less than $4.25 per ton of 2240 pounds (this price to include delivery in the Power Company's storage and to be the average price for all coal carried in said storage, together with coal received from time to time) for any period exceeding three consecutive months, then for each five cents decrease in cost below $4.25 per ton, the Power Company will reduce its price $0.00006 for each kilowatt hour of electric energy used during the said three months and during the period that said cost of coal is less than $4.25 per gross ton.

If the quality of the coal purchased by the Power Company differs from that above specified, the average cost of coal determined as aforesaid shall be corrected to an equivalent of 14,800 B. T. U. per pound dry.

HOW THE COAL SITUATION IS PROVIDED FOR

INDIANA COMMERCIAL MEN ARE TO DISCUSS WAR AND BUSINESS

Program of Meeting for June 20 Shows Also Papers on Organization, Increasing Load Factor on Existing Lines and Appliances

"War Times and the Central Station Business" will be the topic on which F. S. Hunting, general manager Fort Wayne (Ind.) works of the General Electric Company, will address commercial men of the Indiana Electric Light Association at Fort Wayne on June 20.

Thomas Donahue of Lafayette will present a paper entitled "Organization of New-Business Departments," which will be discussed by S. T. Sharp, Evansville; C. B. Young, Rochester; Samuel Mott, Noblesville, and P. C. Pfenning, Indianapolis.

The paper on "Increasing Load Factor of Existing Lines," by N. A. Perry of Indianapolis, will be discussed by M. S. Caldwell, South Bend; E. S. Goodrich, Winchester; C. M. Poor, Clinton, and C. A. Nash, Lafayette.

Discussion of a paper on "Development of the Sale of Socket Appliances," by Milton Hennoch, East Pittsburgh, Pa., will be led by H. C. Goldbrick, Chicago; W. H. Crawford, Hammond, and M. V. Stagg, Fort Wayne.

The association will probably hold a one-day convention in July instead of the usual three-day session in September.

WAR CONFERENCE FOR NEW ENGLAND SECTION

Proposed September Annual Convention Will Be Abandoned, but Discussion on War Problems Will Be Substituted

At a meeting of the executive committee of the New England Section of the National Electric Light Association it was voted, on account of war conditions, to cancel the ninth annual convention, scheduled to be held at New London, Conn., on Sept. 11-14, 1917. A meeting in Boston is planned, but the date has not yet been determined. The meeting will be in the nature of a war conference on important problems.

HYDRO-ELECTRIC COMMISSION BUYS ONTARIO POWER COMPANY

Canadian Body Buys Physical Assets and Power Contracts of Property at Niagara Falls, Ont.—Control Passes on Aug. 1

The Hydro-Electric Power Commission of Ontario has acquired the assets of the Ontario Power Company of Niagara Falls, Ontario.

It is stated that the company agrees to deliver its Canadian properties, including physical assets and power contracts, on Aug. 1, and that the commission is to issue $8,000,000 of its debentures for the $10,000,000 stock of the company and to assume the bonds of $14,690,000 secured by first mortgage on the property.

The commission states that municipalities will receive power at $9 per horsepower-year and estimates that the plant will pay for itself in twenty-five years.

SOUTHERN CALIFORNIA CONSOLIDATION APPROVED

Commission Authorizes Southern California Edison Company to Acquire Pacific Light & Power Corporation Properties

The Railroad Commission has rendered a decision authorizing the Southern California Edison Company to acquire the properties of the Pacific Light & Power Corporation and the control of the Ventura Power Company.

ORGANIZATION OF NEW COMPANY

The new organization follows:

Board of Directors—John B. Miller, H. E. Huntington, W. A. Brackenridge, Albert W. Harris, W. E. Dunn, George I. Cochran, J. C. Drake, William R. Staats, Arthur H. Fleming, Henry M. Robinson, J. H. Fisher and Howard E. Huntington.

Officers—John B. Miller, president; W. A. Brackenridge, vice-president and general manager; R. H. Ballard, vice-president and assistant general manager. George C. Ward, George I. Cochran, J. C. Drake and William R. Staats, vice-presidents; H. H. Trowbridge, general counsel; S. M. Kennedy, general agent; A. N. Kemp, comptroller; W. L. Percey, treasurer; A. E. Morphy, secretary; B. F. Pearson, general superintendent of the southern division; E. R. Davis, general superintendent of the northern division; John Otto, purchasing agent; D. M. Trott, assistant comptroller; B. T. Story, assistant treasurer; C. P. Staal, auditor.

The Edison company for $4,000,000 cash and $12,029,900 par value of second preferred 5 per cent cumulative non-participating stock is authorized to purchase:

Second preferred stock of Pacific Light & Power Corporation	$9,660,200
Common stock of Pacific Light & Power Corporation	10,468,500
First and refunding bonds of Pacific Light & Power Corporation	5,000,000
Notes and accounts of Pacific Light & Power Corporation	1,096,048
Preferred stock of Ventura Power Company	341,750
Common stock of Ventura Power Company	704,500

The Edison company is also authorized to purchase all of the properties and franchises of the Pacific Light & Power Corporation, and issue in exchange therefor $11,421,800 par value of its common stock. The properties are acquired subject to outstanding bonds.

The Edison company will acquire all of the stock of the Pacific Light & Power Corporation except $382,500 first preferred, $314,800 second preferred and $91,000 common. Of the Ventura County Power Company's stock, it will acquire all but $9,030 par value of preferred and $1,560 par value of the common.

The Pacific Light & Power Corporation and the Southern California Edison Company, through A. R. Kelley and George L. Hoxie, engineers, claimed an investment cost of their properties as follows: Southern California Edison Company as at present, $30,311,328; Pacific Light & Power Corporation as at present, $32,921,392; both companies as at present, $63,232,721; both companies consolidated, $63,547,522. The difference between the investment cost of the property as at present and after consolidation, amounting to $314,800, represents the value placed upon the stock of the Ventura Power Company which the Edison company proposes to acquire.

Richard Sachse, chief engineer for the commission, without making a detailed examination of the properties of the Pacific Light & Power Corporation, estimates reproduction cost of the combined properties as of Oct. 31, 1916, at $54,018,235, and the reproduction cost less depreciation at $45,266,386. The capitalization of the companies prior to and after consolidation is shown in the following table:

	Bonds and Debt	Stock Outstanding	Total Capitalization and Debt
Southern California Edison Co.	$19,843,101	$14,405,500	$34,248,601
Pacific Light & Power Corp.	25,573,996	25,534,500	51,108,496
Both, as at present	45,417,097	39,940,000	85,357,097
Both, as proposed	44,321,049	27,020,572	71,341,621
Difference between No. 3 and No. 4	1,096,048	12,919,428	14,015,476

Combined net earnings of the Pacific Light & Power Corporation and the Southern California Edison Company for the calendar year 1916, after the payment of fixed charges, taxes and an ample allowance for depreciation, are reported at $1,500,969.

ELIMINATION OF ELECTRIC TAX BY SENATE COMMITTEE

Bill Is to Go Before the Senate and Then to Conference Committee, and House Provision May Be Raised Again

The Senate finance committee has agreed to eliminate from the war revenue bill the provision in the House measure which would create a tax upon electricity. Senator Simmons, chairman of the committee, stated to a representative of the ELECTRICAL WORLD on Wednesday evening of the present week that he does not know what the Senate will do with regard to the striking out of the electricity tax when the measure comes on the floor for decision. It is possible, the chairman of the committee says, that other Senators will move to restore to the Senate bill the provision of the House measure.

It is doubtful whether the question of a proposed electricity tax will be settled short of a conference between the upper and lower houses. It is not yet settled whether there will be three or five conferees on the part of the Senate. In case there are five conferees on the part of the Senate, the chairman of the committee stated in Washington on Wednesday night, they will consist of Senator Simmons, Senator Stone, Senator Williams, Senator Penrose and Senator Lodge.

There is usually an agreement among Senators and Representatives to do a little "swapping."

Helping to Sell the Liberty Loan

Companies in Different Branches of the Electrical Industry Using Their Resources Freely to Aid the Government Financing Program

MANY of the smaller electrical companies as well as the larger properties are contributing effectively to the success of the Liberty Loan. Reports to the ELECTRICAL WORLD from all sections of the country continue to show that many plans are being executed to promote company and individual subscription and general public interest in the government financing program.



WAGNER URGES ACTION

President Herbert A. Wagner of the National Electric Light Association sends the following to member companies:

"Public service companies, by reason of their broad and close touch with a very large proportion of the population in the districts which they serve and through their large number of employees, are in a position to exercise leadership in public welfare and patriotic movements. In the present emergency it is incumbent upon them to do all in their power, by action and example, to assist the government in its plans to prosecute the war.

"The success or failure of this loan must be determined by June 15. There is no time to lose. Your local banks would, no doubt, assist you in financing the aggregate subscription. In order to take care of carrying costs the company may, if it chooses, detach one or two six months' coupons from each bond before delivery to employees."

PLANS OF DIFFERENT COMPANIES

Arrangements are being made by managers of each of the local companies operated by the W. S. Barstow Management Association for active co-operation in the work of placing the Liberty Loan. Practically the same method of organization is being followed in each locality.

The Penn Central Light & Power Company, Altoona, Pa., has announced that an allotment of Liberty Loan bonds as subscribed by employees will be purchased by the company and distributed to the men on a time-payment plan.

A large electric torch, adopted by the employees of Thomas A. Edison, Inc., and affiliated companies, West Orange, N. J., as the emblem of the Edison Liberty Loan Club, has been erected on Building No. 21, in connection with an improvised thermometer to indicate the progress of subscriptions among employees. The torch is supplemented by the caption "Edison Liberty Loan Club," being erected near the large electric flag recently presented to Mr. Edison by the workers at the plant. Employees of the companies have pledged themselves to raise at least $300,000 for the Liberty bonds.

The Public Service Corporation, Newark, N. J., has issued a notice to employees of its electric, gas and traction companies urging support of the Liberty Loan bonds with the hope that every employee will be a bond buyer. The company has offered to accept subscriptions from $50 upward and take payment at the rate of $1 per week or $5 per month, for weekly and monthly employees respectively. The payments are to be due on regular pay days.

HENRY L. DOHERTY FINANCES FLYING TOUR

Ruth Law started from Cleveland on the morning of June 5 on a ten days' flying tour in behalf of the Liberty Loan. She will drop paper bombs over the cities of the Middle West and Southwest.

Henry L. Doherty offered to defray the expense, which Miss Law could not personally afford, and placed his entire organization at the disposal of the director of publicity of the Liberty Loan to arrange landing and supply stations.

WINDOW DISPLAYS WILL HELP

The illustration shows a way in which every central station and dealer can "get behind the government" and aid the final drive for the Liberty Loan.

The large shield against the background is cut from corrugated board and covered with blue sateen or cardboard. Across this is a band of red, white and blue paper or ribbon. In the upper section stars are lettered "L-i-b-e-r-t-y L-o-a-n."

Directly in front of the shield is a large question



THE USE OF WINDOW DISPLAYS IS SUGGESTED

mark 4 ft. high cut from cardboard and hung from the ceiling with fine wire. It is lettered "Have *you* bought your Liberty bond?"

Shield-shaped cards of white lettered in red and blue are inscribed: "It's your patriotic duty to buy a Liberty bond now." "The safest, surest investment in the world." "Free from all taxation except estate or

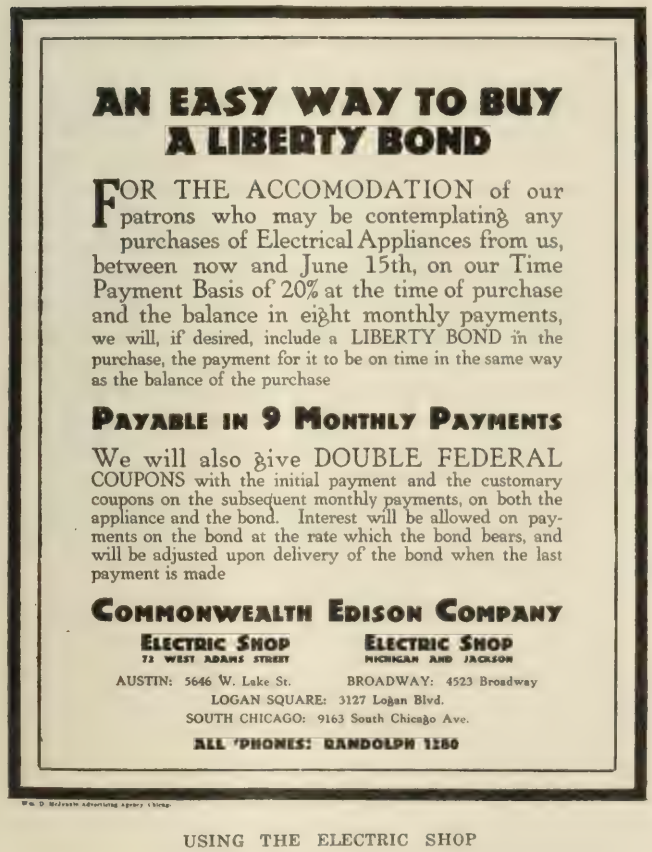
inheritance taxes." "Backed by the entire resources of the richest country on earth." "Denominations, $50 and up. Interest, 3½ per cent." "Buy now and urge others to buy."

Flags are draped from the background out to the front corners. Liberty bond posters can be obtained from local banks. Making a display of this kind to-day may be the means of adding a few more thousands to the subscription total of your city.

BONDS OFFERED TO CUSTOMERS BY COMMONWEALTH EDISON COMPANY

The Commonwealth Edison Company of Chicago has purchased $1,000,000 of Liberty Loan bonds and is offering customers as well as employees an opportunity to subscribe. When a customer purchases an electrical appliance from the company's electric shop he may also include in the purchase a Liberty Loan bond. The entire amount is paid on a deferred-payment plan in which 20 per cent is paid down and the balance is paid in eight monthly payments of 10 per cent of the original amount. Interest at 3½ per cent is allowed on the payments from the time at which they are made. An interest adjustment is made at the time of the last payment.

Dividend coupons are also a feature of this offer, double coupons being given on initial payments and single coupons on the remainder. These coupons are redeemable in the electric shops of the company for electrical appliances and are worth from 2 to 4 cents on the dollar.

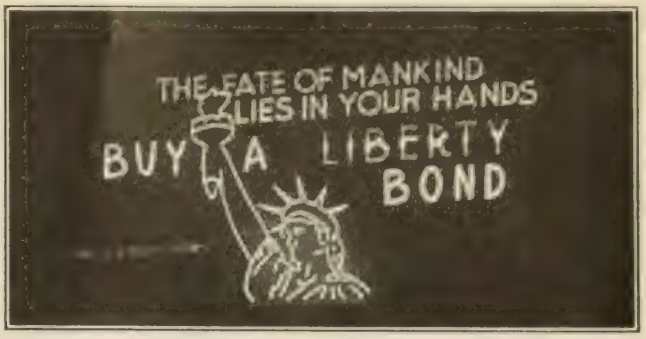


USING THE ELECTRIC SHOP

GUDE COMPANY FURNISHES WHITE WAY SIGN

The O. J. Gude Company, New York, gave a large electric sign, erected in the Times Square district at Forty-third Street and Seventh Avenue, New York. This was erected for the government free of all expense.

The original plan was to erect an exceptionally artistic sign, but the time was too short so that R. W. Woolley, director of publicity of the Treasury Department, suggested the design as used. The phrase



THE ELECTRIC SIGN IS A GREAT ADVERTISEMENT

"The Fate of Mankind Lies in Your Hands" is his thought.

There are 3800 lamps in the sign, and the structure is 50 ft. (15 m.) high and 125 ft. (37.5 m.) long.

SECTION OFFICIALS OF ASSOCIATED MANUFACTURERS

Several Sections, Meeting in New York This Week, Elect Officers to Act During the Coming Year

At meetings of sections of the Associated Manufacturers of Electrical Supplies, held at the headquarters in New York during the present week, officers were elected as follows:

Snap Switch Section—E. Whitmore, Manhattan Electrical Supply Company, elected chairman; F. E. Watts, Hart Manufacturing Company, re-elected secretary; J. C. Dallam, General Electric Company, re-elected treasurer.

Knife Switch Section—J. H. Trumbull, Trumbull Electric Manufacturing Company, re-elected chairman; T. A. McDowell re-elected secretary, W. T. Pringle re-elected treasurer.

Lamp Receptacle and Socket Section—W. D. Steele, Benjamin Electric Manufacturing Company, elected chairman; C. P. LaShelle, W. R. Ostrander & Company, re-elected secretary; F. H. Chapman, Yost Electric Manufacturing Company, elected treasurer.

Molded or Formed Insulation Section—The election of officers was postponed until the next meeting.

OHIO ASSOCIATION ABANDONS ANNUAL CONVENTION PLAN

All Activities of the Organization, However, Will Be Continued in Full Force During the Year

The executive committee of the Ohio Electric Light Association, meeting in Cleveland on June 1, decided in view of the existing war conditions to cancel the date of the annual convention at Cedar Point in July and not to hold a convention in 1917. This action was taken after very careful consideration, and excepting for canceling the annual convention all activities of the association will be continued in full force and vigor during the coming year.

ELECTRICAL CONTRACTORS FORM A POLICY CONFERENCE CLUB

Organization Is to Improve Status of the Business and Stabilize the Electrical Contracting Industry as a Whole

An organization has been formed by some of the larger electrical contractors to improve the status of their business and to serve, so far as is possible, as a stabilizer for the electrical contracting industry generally. The movement is not opposed to existing organizations or to any electrical contracting interest, large or small. It has been started by the larger companies whose interests have become interstate in character to provide a means for discussion of common problems. The meetings will be informal and to a large extent social in nature. A number of cities are represented in the membership, including New York, Chicago, Boston, Philadelphia, St. Louis, San Francisco, Los Angeles and Indianapolis.

The title selected, "the Conference Club," really indicates the purpose of the organization, although the objects are to be set forth specifically by a committee appointed at the last meeting, held at French Lick Springs, Ind., on May 21 and 23.

To accomplish more effectually the general purpose of the organization, executives of the manufacturing companies, jobbers, consulting engineers and others associated with the electrical industry are to be welcomed at the meetings. It is the plan to encourage their attendance for the discussion of policies affecting the relations of the electrical contractor with other branches of the industry.

Electrical Contracting Industry in War

At the French Lick Springs meeting a special committee was appointed to consider the relations of the electrical contracting industry as a whole to the war situation, that is to say, to the subject of handling either direct or indirect work for the government. This committee was directed to go to Washington to meet the authorities. It is composed of J. G. Livingston, W. Creighton Peet, F. E. Newbery, F. W. Lord, L. K. Comstock, Ernest Freeman, G. M. Sanborn and T. B. Curtis.

Another committee which was appointed at the same meeting will consider the position of the electrical contractor with respect to national advertising and publicity campaigns affecting the electrical industry as a whole. It has been suggested that the business of the contractor could be included in some effective way in such campaigns, which directly or indirectly touch the service of all of the different elements of the industry.

Speakers at the French Lick Springs meeting were W. L. Goodwin, General Electric Company, and J. Nelson Shreve, Electric Cable Company.

Previous meetings of the club were held at Hot Springs, Va., on Nov. 16 to 18, 1916; Chicago Beach Hotel, Chicago, Dec. 20 and 21, 1916, and Hotel Traymore, Atlantic City, Feb. 13 to 15, 1917.

At the organization meeting, held at Hot Springs, the object was set forth as the formulation of a plan for closer co-operation among the so-called interstate contractors for the general uplift of the business and united action in the solution of the many problems which are of mutual and peculiar interest. It was presented more in detail as follows:

"There is much to be done by us collectively in raising the standard of our work, our trade, our profession. No calling requires greater skill than ours, and yet we are regarded as mediocre; no trade in the building business is more important, yet we are regarded with a fine degree of that tolerance accorded an unremovable nuisance; no profession is more honorable, yet we are reviled as thieves and robbers; no trade is more indispensable, and yet those who employ us would have it appear that we deal in fancy goods and frivolities.

Co-operative Competition

"Price fixing used to be the order of the day and the principal function of trade organizations. It has never been very successful, except in isolated cases. It is not founded on sound, economic principles and has recently many times been declared illegal by the courts. We should not be interested in and should discountenance any attempts at price fixing.

"Co-operation in competition should rest on a firmer foundation. In a relatively small body like this the bottom of that foundation should be acquaintance with one another, an understanding through social intercourse of one another's motives and ambitions, and an appraisement at something like its true value of the power of each one to work for the good of all. Respect for the good will each has been able to establish for himself will go far toward the establishment of co-operation. Exchange of views on questions of management, organization, financing, selling, advertising, credits, forms of contracts, collections, proper volume of business, overhead expense, and its relation to price quotation, all make for intelligent co-operation.

"There is no thought expressed here, or implied, of criticism of the national association, nor is there any desire to accomplish anything contrary to the aims or ambitions of the national; there is no reason why the two organizations should not work along side by side. The thoughts suggested here are questions which occur to the interstate contractor, and the great majority of the national association does not come within this category. The national association can never raise these questions and settle them, because by making such an attempt it would be trying to legislate for a large class of its membership not in the least interested and not capable of being interested, because they choose to operate in restricted areas."

In connection with the Chicago meeting an address was heard by Arthur J. Eddy, originator of the so-called "open price" plan.

Organization and Membership

Organization of the club has been effected by the election of L. K. Comstock, New York, as permanent chairman and W. Creighton Peet as secretary. The membership, as represented at the French Lick Springs meeting, follows:

Lord Electric Company, New York and Boston—F. W. Lord, T. B. Curtis.

Hatfield Electric Company, Indianapolis—T. B. Hatfield.

Sanborn Electric Company, Indianapolis—G. A. Sanborn.

Johnston Livingston Company, New York—J. G. Livingston.

F. E. Newbery Electric Company, Chicago, St. Louis and San Francisco—F. E. Newbery, B. H. Bendheim.

L. K. Comstock & Company, New York and Chicago—L. K. Comstock, E. E. Van Cleef, G. E. Stewart.

Peet & Powers, New York—W. Creighton Peet.
United Electric Construction Company, Chicago—William F. McGuineas.
White City Electric Company, Chicago—W. B. Akeley.
Schulman Electric Company, Chicago—A. S. Schulman.
Freeman-Sweet Electric Company, Chicago—Ernest Freeman.
William A. Corrao Electric Company, St. Louis—E. P. Allison.

E. J. Ellis and Wilson McCandless of the United Electric Construction Company, Philadelphia, were unable to attend the French Lick Springs meeting.

SECRETARY LANE SAYS: "USE WATER POWER; SAVE FUEL"

Immediate and Necessary Conservation of Fuel Can Be Accomplished Best by Using All Available Water Power

Secretary Franklin K. Lane of the Department of the Interior, in reply to a letter from the manager of an electric light and power company, made the following statement as to the policy which such companies should follow during the war in the production of electrical energy:

"The unusual demands arising from the entrance of the United States into the war and the necessities of the allied governments have made the situation in this country acute. We must not only supply large additional amounts of fuel for the manufacturing industries, including munitions of war, but we must to a certain extent furnish fuel to our allies. The stimulation of production, the regulation of distribution, and, within economic limits, the elimination of unnecessary consumption of fuel, are therefore problems of national interest and of immediate concern.

"Although it will be necessary to use the coal and oil now being produced to the highest possible advantage, it must be recognized that the requirements of the nation for energy are increasing rapidly, especially in regions of great industrial activity. Obviously, immediate conservation of fuels can best be accomplished by utilizing all available water power. New requirements for power should therefore be met so far as practicable by the installation or enlargement of hydroelectric plants; present requirements should be satisfied by substituting all available water power for steam-generated energy requiring coal and oil for its production. This means that all water available at water-power plants should be made to produce energy up to the practicable hydraulic capacity of the works and the requirements of the population and industries within transmission distance of the site. In regions where water power can be made available steam-power plants should be operated only to carry loads in excess of those that can be carried by water-power plants. In my opinion this course should, under existing conditions, be followed by all power companies, regardless of the fact that at the moment it may cheaper for the company to produce steam power."

Michigan Convention Abandoned

The Michigan Section of the National Electric Light Association has abandoned its 1917 convention.

I. E. S. POPULAR LECTURE ON STORE LIGHTING IS READY

Manuscript Is Accompanied by Lantern Slides Illustrating Actual Lighting Equipments—"Home Lighting" to Follow

The Illuminating Engineering Society announces that the popular lecture on store lighting is now ready for delivery to those who wish to present this phase of the art and science of lighting. The lecture is designed to fit the need of any one who is called upon to present the principles and advantages involved.

The manuscript covers twenty typewritten pages and is accompanied by sixty lantern slides illustrating actual lighting equipments and diagrams of various types of lamps, globes, shades, reflectors and fixtures.

It is expected that there will be a demand for this lecture among proprietors, managers, decorators and others convinced of the importance of correct illumination. The lecture is well adapted for presentation before salesmen, fixture manufacturers and those who manufacture and distribute lighting accessories. Still another field is that of municipal authorities.

The lecture may be reserved for presentation upon application to the Illuminating Engineering Society, 29 West Thirty-ninth Street, New York. A number of advance reservations already have been made. The society provides the lecture and slides at a nominal service charge for maintenance and postage.

Another lecture, on home lighting, will be available within a short time, while the committee on popular lectures is actively engaged in the completion of lectures on other phases of illumination.

WASHINGTON CONFERENCE OF BUSINESS PAPER EDITORS

Government Authorities Address Representatives of Technical and Trade Papers on Questions of National Organization

Editorial representatives of business papers, in a conference at the New Willard Hotel, Washington, on May 25, were addressed by the following:

George Creel, chairman committee on public information.
Francis S. Peabody, chairman Fuel Board, Council of National Defense.
Dr. R. A. Pearson, president Iowa State College.
Franklin K. Lane, Secretary of Interior.
Newton D. Baker, Secretary of War.
Josephus Daniels, Secretary of Navy.
William C. Redfield, Secretary of Commerce.
Frank A. Vanderlip, President National City Bank, New York.
William B. Wilson, Secretary of Labor.
Van H. Manning, Director Bureau of Mines.
Herbert C. Hoover, Food Administrator.
Walter S. Gifford, Director Council of National Defense.
Frank Scott, Chairman Munitions Board, Council of National Defense.
Dr. Franklin H. Martin, in charge of Red Cross Work, Council of National Defense.
Howard Elliott, railroad executive committee, Council of National Defense.
George Otis Smith, director Geological Survey.
R. W. Woolley, director of publicity, Liberty Loan of 1917.

Among those who attended were representatives of papers of the McGraw-Hill Publishing Company, Inc.

FLOODLIGHTING STATUES IN LINCOLN PARK, CHICAGO

Figures of Civil War Heroes Illuminated for First Time on Evening Before Registration for Selective Service

The great bronze statues of Lincoln and Grant at Lincoln Park, Chicago, were lighted for the first time on the evening of June 4. The lighted statue of Lincoln



PRESIDENT LINCOLN

is visible at night for more than a mile. Four 1000-watt projectors supply the illumination. They are mounted in pairs just below the globes on the concrete lighting standards, which were already in place along a



GENERAL GRANT

drive running about 100 ft. (30 m.) in front of the statue.

The statue of Grant, astride a mammoth bronze war horse, occupies a high pedestal set on a hill. The lighting presented a problem, as the seven 1000-watt projectors had to be mounted below on the pedestal at distances ranging from 15 ft. to 25 ft. (4.5 m. to 7.5 m.) from the figure.

The lamp equipment for this work, which was undertaken as a patriotic step, was supplied gratis by the American Lighting Company. The electrical department of Lincoln Park did the wiring, supplied transformers and furnished the energy. The 2300-volt circuits, placed underground, are laid out so that they can be utilized in the future as part of the park's driveway lighting system.

A. I. E. E. PROGRAM FOR THE SPECIAL NEW YORK MEETING

Five Sessions to Be Held on June 27 and 28—Formal Introduction of the President-Elect, E. W. Rice, Jr.

As announced previously in the ELECTRICAL WORLD, the board of directors of the American Institute of Electrical Engineers voted at its last meeting to hold a special Institute meeting in New York on June 27 and 28, for the presentation and discussion of papers that were to have been presented at the annual convention, which has been canceled.

The meetings and papers committee has arranged for five technical sessions, which will be in the morning and afternoon of each day and on Wednesday evening.

The monthly meeting of the board of directors will be held Wednesday afternoon at 4.30 o'clock. The program is as follows:

FIRST SESSION, WEDNESDAY, JUNE 27, 10.30 A. M.

Subject, "High-Tension Cables."—"Problems in Operation and Maintenance of Underground Cables," by John L. Harper; "High-Tension Cable Joints," by D. W. Roper; "The Influence of Dielectric Losses on the Rating of High-Tension Underground Cables," by A. F. Bang and H. C. Louis; "Insulation Characteristics of High-Voltage Cables," by W. S. Clark and G. B. Shanklin.

SECOND SESSION, WEDNESDAY, JUNE 27, 2 P. M.

Subject, "High-Tension Insulators."—"The Insulator Situation," by W. D. Peaslee; "Expansion Effects as a Cause of Deterioration in Suspension-Type Insulators," by J. A. Brundige; "Present Practice in Design and Manufacture of High-Tension Insulators," by A. O. Austin.

4.30 p. m.—Monthly meeting of the board of directors.

THIRD SESSION, WEDNESDAY, JUNE 27, 8.30 P. M.

President's annual address.
Introduction of President-elect E. W. Rice, Jr.
Reports of technical committees.

FOURTH SESSION, THURSDAY, JUNE 28, 10.30 A. M.

Subject, "Mining."—"Forms of Power Best Suited for Various Loads Encountered in the Operation of Bituminous Coal Mines," by R. L. Kingsland; "Test of a Large Mine Hoist," by R. S. Sage.

FIFTH SESSION, THURSDAY, JUNE 28, 2 P. M.

Subject, "Water Power and Heating of Electrical Machinery." — "Economical Combination of Water Power and Steam Plants and a Convenient Method of Solution," by H. S. Putnam; "Cooling of Oil-Immersed Transformer Windings After Shutdown," by V. M. Montsinger.

LIGHTING RATE INCREASED IN HARTFORD, CONN.

On Account of Higher Operating Costs, Maximum Rate Is Advanced 0.5 Cent per Kilowatt-Hour—Expansion Necessary

On account of increased operating costs the Hartford (Conn.) Electric Light Company has announced a rate increase beginning July 1, 1917, of 0.5 cent per kilowatt-hour in the maximum net price of energy for lighting. A 10 per cent increase in flat-rate lighting prices is announced. The first 1000 kw.-hr. of lighting will be billed at 8.5 cents, the first 500 kw.-hr. of power at 5 cents, and energy for heating at 3.5 cents.

Vice-president Samuel Ferguson points out in a statement that throughout its history the company has conducted its business on the basis of a large volume of sales at a small margin of profit. If coal conditions become no worse, he stated, the average price paid this year will be almost $7 per ton as compared with $3.60 in 1916. The company's business is growing rapidly and a capital increase of $1,500,000 has been voted to meet the cost of further enlargement at the Dutch Point generating station.

JOVIAN ORDER ANNOUNCES PLAN TO INSURE MEMBERS

Method by Which They May Save Money on Insurance Premiums Is Worked Out with Health and Accident Insurance Company

Since last October, when Jovian dues were increased from $2 to $4 per year, the Jovian Order has felt the need for a tangible benefit. To meet this need a new feature has been created. To get this benefit a Jovian buys his accident insurance or accident and health insurance through the Jovian central office instead of through an insurance salesman. The policies secured are identical with those issued by three of the largest accident companies. The minimum actual saving through the purchase of a policy is $13; the maximum, through the purchase of more than one policy, is $41.

This saving is made possible because the insurance is direct from the underwriter to the individual, minus agents' commissions and office detail expense. The Jovian central office is filling the place usually occupied by general agents and sub-agents and is taking care of office and collection details without charge. The company writing this insurance is the Employers' Indemnity Corporation, which is serving the National Electrical Contractors' Association members and hundreds of utility companies.

"There has always been plenty of justification for the payment of Jovian dues for those who have dipped deeply into the order's constructive influence upon the electrical industry, or for those who have taken an active part in the work of the order," said Mercury Ell C. Bennett. "Unfortunately, however, not all allow their minds to travel far enough with the general good Jovianism is doing to see that eventually, although perhaps indirectly, their full share of benefits returns to them. Hence there was the need for a tangible benefit.

"When the present plan was proposed it seemed to fill the need. There are no exemptions in Jovian policies, and no additional assessments or charges are possible.

"As an example it may be stated that the Jovian accident policy covering such risks as traveling men, clerks, executives and others not engaged in hazardous occupations may be had for $12 a year. This policy, which is regularly a twenty-five-dollar policy, provides for a payment of $5,000 for loss of life, with a twenty-five-dollar weekly indemnity for total disability and a ten-dollar weekly indemnity for partial disability."

NEW ENGLAND HYDROELECTRIC SERVICE COMES TO AID OF COAL

Many Mill Owners Are Buying Energy at Rates Above Cost of Production in Their Local Plants

The coal shortage in New England has led to unprecedented activity in hydroelectric circles. President Harriman of the New England Power Company informed a representative of the ELECTRICAL WORLD this week that many mill owners are now purchasing electrical energy at rates even above the cost of production in their local plants and that these installations are likely in many cases to become permanent. Water conditions at the hydroelectric stations of the company are favorable, and the Somerset Reservoir, which is the most important storage basin in the combined Deerfield and Connecticut River systems, is nearly as well filled as in 1916. It has not been necessary lately to purchase electricity from central stations or other organizations operating steam plants. Last week the company took a contract for the supply of 7000 kw. in steam-plant territory. In common with other power organizations it has experienced some difficulty in obtaining motors.

It is estimated that the cold weather in May increased the consumption of anthracite coal in New England by about 800,000 tons. At a hearing on Monday of this week Mr. Harriman urged the Public Service Commission of Massachusetts to approve a curtailment of passenger service on the New England steam-railroad lines in the interest of releasing rolling stock for coal transportation and military service.

The New England Power Company is in an exceptionally strong position at this time as regards flexibility of transmission system, each group of connected generating-plant facilities being tied together by a double loop of 66,000-volt lines affording unusual insurance against interruptions. Bids are now being received by the Metropolitan Water Board for the construction of a 66,000-volt tie line between the Clinton and Sudbury stations of the State. Connections with an aggregate rating of 10,000 kw. will be completed soon between the New England and Boston Edison systems via the Framingham-Southboro district.

OHIO COMPANIES ARE TO INCREASE RATES FOR POWER

Electric Subsidiaries of Cities Service Company in That State Will Increase Schedules on Account of Higher Costs

Owing to the high cost of operation, all of the Ohio electric subsidiaries of the Cities Service Company will file schedules of increases in power rates with the Ohio Public Utilities Commission. The Massillon Electric & Gas Company and the Toledo Railways & Light Company already receive higher rates on new power business.

BASE ELECTRIC RATES ON THE COST OF COAL

Effect of Variable Expenses for Fuel on Operations of Ten Plants in Cities of 3000 to 15,000 Population

John A. Porter, vice-president Light & Development Company, St. Louis, before the convention of the Missouri Public Utilities Association, said:

"It is my purpose to draw attention to the injustice that is being done both to the public and the utility by a continuance of fixed rates. If the variables in the cost of electric service cost more, the utilities suffer; if they cost less, the public suffers, and the extent of the injury is measurable by the amount prices fluctuate.

PER CENT OF FUEL COSTS TO MANUFACTURING COSTS AND GROSS EARNINGS

Year 1915. Ten Cities with Population 3000 to 15,000

Plant No.	Per Cent Coal to Manufacturing Cost	Per Cent Coal to Gross Earnings	Plant No.	Per Cent Coal to Manufacturing Cost	Per Cent Coal to Gross Earnings
1	69.0	15.4	6	60.6	20.3
2	51.9	17.2	7	52.1	17.3
3	67.3	21.2	8	64.9	29.0
4	49.7	13.4	9	56.4	31.8
5	62.5	13.2	10	45.7	13.4

Gross receipts	$378,048
Manufacturing cost	110,273
Coal costs	65,213
Manufacturing costs to gross receipts, per cent	29.2
Coal costs to gross receipts, per cent	17.2
Coal costs to manufacturing costs, per cent	59.1

By the word 'variables' I refer to such elements as coal or its substitute fuel—oil, labor, oils, repairs, taxes, maintenance and supplies of any character entering into the cost of operating a public utility.

"The importance of coal as a variable element will be clearly shown by considering the accompanying tables, which were compiled through the courtesy of operators of ten utilities with a view of showing actual conditions. The figures were provided by utilities in this and adjoining states, four of which were straight electric plants and six operating also gas, water or ice plants. Coal conditions obtaining with them are fairly representative of other small plants in cities of 3000 to 15,000 population.

"From the data above secured a calculation will show the percentage increase in manufacturing costs and the relation to gross earnings as the price of coal advances, it being assumed that all other expenses and revenues remain stationary.

"The minimum freight rate paid by any of the ten utilities above referred to is 75 cents per ton, maximum rate $2. It is well known that the Interstate Commerce Commission has tentatively agreed to an advance in freights of approximately 15 per cent, and it may be confidently assumed that this advance will be applied at an early date.

"Advances in the price of fuels are almost always accompanied by advances in nearly all lines, and a brief consideration of the above facts should warrant an effort to abandon once and for all the antiquated system of 'fixed rates' for utility service and the substitution therefor of a 'variable factor' in the rate column that will compensate somebody when prices change.

"The public should receive the advantage of reduced prices and should pay at least the amount sufficient to cover the cost of materials when they advance. Should equitable rates be provided at this time they would, of course, be based upon the present markets, but unless some automatic scheme is designed in connection with the rates that would lower them when lower markets obtain, there would be a tendency on the part of the public to anticipate the falling market and raise the rate question long before the utility can effect savings.

"The tables indicate that the amount to be added to or deducted from the gross revenues in order to realize the same return is 1.72 per cent for each 10 per cent increase for coal, if coal is the only element of advance. Since advances in coal are always accompanied by higher costs for other things entering into production, it would be necessary to make a complete analysis of all the variables, but coal is the barometer of the manufacturing costs of utilities.

PER CENT INCREASE IN MANUFACTURING COSTS, ETC., AS COAL PRICES ADVANCE, OTHER ELEMENTS STATIONARY

	Old Prices	10 Per Cent	20 Per Cent	30 Per Cent	40 Per Cent	50 Per Cent	100 Per Cent
Coal to manufacturing costs	59.1	61.4	63.4	64.9	66.9	68.5	74.3
To gross receipts	17.2	18.6	20.0	21.2	22.5	23.8	25.6
Amount increase	None	$6.521	$13.042	$19.563	$26.085	$32.606	$65.213
Per cent gross to equalize the advance in coal	None	1.72	3.44	5.16	6.90	8.62	17.2

COST F.O.B. MINES OF SCREENINGS IN SOUTHERN ILLINOIS COAL FIELDS BY YEARS

1913—April to Sept.	$0.50 to $0.75	Sept. to April, 1914..	$0.60
1914—April to Sept.	0.75 to 0.80	Sept. to April, 1915..	0.60
1915—April to Sept.	0.90 to 1.00	Sept. to April, 1916..	0.70
1916—April to Sept.	1.00 to 1.10	May prices, 1917...	1.25 to $2.00
		Future prices.....	(?)

"It would involve monthly adjustments to meet changes in present market conditions, but the period of adjustment of the variable constant of the rates should perhaps be semi-annual or annual, unless such radical and violent changes of markets should occur as to make earlier adjustment necessary. A maximum charge should be determined upon, and agreed to by the parties interested, not as to the rate but as to the condition of the markets, before any change is made in billing customers."

FRANKLIN MEDAL PRESENTATION BY THE FRANKLIN INSTITUTE

Medal Awarded to Admiral David Watson Taylor and to Prof. H. A. Lorentz, University of Leiden

Franklin Institute, Philadelphia, made the annual presentation of the Franklin medal recently.

The Franklin medal, founded in 1914 by Samuel Insull, was presented to Admiral David Watson Taylor, chief constructor, chief of the Bureau of Construction and Repair, United States Navy, and to Hendrik Antoon Lorentz, president Royal Academy of Sciences, Amsterdam, professor of mathematical physics, University of Leiden.

The award to Professor Lorentz was made in recognition of his "researches, which have so largely contributed to laying on a new foundation our knowledge of the nature of light and in developing our ideas concerning the ultimate constitution of matter."

VALUE OF WATER RIGHTS AND GOING CONCERN IN CALIFORNIA

Supreme Court Upholds Decision of Railroad Commission in San Joaquin Case—Statement of President Thelen

The Supreme Court of California has sustained the order of the Railroad Commission establishing all the electric rates to be charged by the San Joaquin Light & Power Corporation. The San Joaquin corporation attacked the commission's order on the ground that insufficient allowance had been made for the values of the corporation's water rights and "going concern" value. The court sustains the commission on both points.

The court says that the evidence presented by the corporation did not justify a value for water rights higher than that allowed by the commission, which fixed the sum at the moneys actually expended by the corporation in its purchases.

The court holds that when a property is valued by the commission in a rate case as a "going concern" or business actually in operation no additional allowance need be made for "going concern" value.

The court also holds that where a public utility has repaid itself out of its earnings for development expenditures no allowance need be made by the commission in a rate case for so-called development expense.

There is no justification in the evidence, says the court, for the corporation's claim that it had been allowed a return of only 6½ per cent on fair value of its property. But, says the court, if the return allowed had been at this rate only, it would not be confiscatory and would not warrant a reversal of the order.

The commission fixed the value of the property useful or used in electric business at $10,054,540, and on this allowed 8 per cent as a fair and reasonable return. The company contended that the commission should allow $650,000 for water rights and $1,651,021 for "going concern," and that with these sums the interest on its investment would be 6½ per cent.

The opinion of the commission declares, says the decision, and the record sustains the statement, that since the development period the earnings over and above the 8 per cent standard have been sufficient to balance deficits of the development period, with interest thereon. Under these circumstances the commission was fully justified in excluding development cost as an element of going concern value.

STATEMENT OF PRESIDENT THELEN

Max Thelen, president of the Railroad Commission of California, made the following statement to the ELECTRICAL WORLD on the decision:

"The court says, as to water rights, that a public utility must prove claimed value for water rights, and that in the San Joaquin case 'no fair estimate of the value of a water right can be based upon such broad and unsupported generalizations as underlie the appellant's argument.'

"Going-concern value has been a bone of contention in a number of public utility valuations before the California commission. In more than one case very large sums have been claimed for this intangible value beyond that fixed for the property as an operating concern.

"The court's decision in the San Joaquin case effectually sets at rest all such contentions. The court makes it plain that a company serving customers is a 'going concern,' and that when a public service board fixes the amount on which the company should rightfully be allowed interest in rates as a business in operation the board has taken into full and just consideration the entity in value known as 'going concern.'

"The Supreme Court in discussing the water rights claims of the San Joaquin company says: 'These water rights are property, and the company is unquestionably entitled to have their value considered in the fixing of its rates. The Railroad Commission made an allowance for such value, based upon the cost incurred in the acquisition of these rights. The petitioner claims that a further allowance should have been made. Concededly the burden is upon the public utility, in cases of this kind, to show the existence of any value claimed by it.'

"Both these points, hitherto moot, are settled by the Supreme Court's decision. They remove from the field of claim and argument two principal sources of litigation before the Railroad Commission."

NEW STREET-LIGHTING PLANS FOR CINCINNATI

Incandescent Lighting of Increased Intensity to Replace Arc Lamps on Fourteen Miles of Streets—Total Cost $140,000

The director of public service of Cincinnati has asked for bids on the installation and maintenance of lighting equipment on thirteen streets. This will necessitate the installation of 913 new lamps and the displacement of 294 old arc lamps now being operated at a cost of $55 per year. It is estimated that the new lamps will cost about $60 a year to operate. The city will pay the cost of installations at intersections and a percentage of the cost, less the cost of intersections; the remainder is to be assessed on a front-foot basis against abutting property. It is expected that the assessment will be about 70 cents per foot. A rough estimate of the total cost is $140,000. Fourteen miles of street will be improved.

Under the specifications the lighting system shall consist of a constant-current 6.6 amp. alternating-current primary circuit with maximum pressure of 5000 volts. By means of individual transformers at each lamp this energy shall be converted for use in a secondary circuit operating at 20 amp. and approximately 14.1 volts. The transformers are to be placed in the base of the standards and are to be similar to the General Electric Company's type IL. The standards are to be placed approximately 80 ft. apart and located directly opposite each other on both sides of the street. They are to be of cast iron of a design similar to those already in use on Sixth Street, Cincinnati. They are to be of such height that the lamp filament will be approximately 13 ft. 4 in. above the surface of the sidewalk. All standards are to be painted a verde antique green. The lamps to be used will be of a 16-cp. tungsten-filament, nitrogen-filled type of 20-amp., 14.1-volt rating. Sockets of the mogul skeleton type to fit lamps with screw bases will be used. The number of lamps per circuit is limited to seventy-five. The entire underground installation is to be carried in conduits. Conductors are to be either varnished cambric or rubber-covered cables.

The contract will be dated from the time the system is placed in service and will expire on June 1, 1922.

IRON WIRE FOR RURAL LINES IN CONNECTICUT

State Public Utilities Commission Approves Petition of Central Connecticut Power & Light Company, Due to High Copper

The Connecticut Public Utilities Commission has formally approved a request of the Central Connecticut Power & Light Company to use iron wire for certain rural extensions on account of the high price of copper. Three hearings were held.

L. P. Perry, general manager of the company, said in part in his petition to the commission:

> The use of iron wire for the transmission of high-tension electric current is not specifically approved by the rules of your commission.
>
> On account of the high cost of copper wire your petitioner desires to secure approval for the use of double-galvanized iron wire in the transmission of electric current on certain of its rural distribution lines.
>
> The proposed method and details of construction of such distribution lines are as follows: Double-galvanized No. BB grade No. 6 iron wire to be used, attached to poles spaced 250 ft., sagging the wire sufficiently to give a factor of safety of two with "Class B" loading, viz., ½-in. coating of sleet on the wire and a wind pressure equaling 8 lb. per sq. ft. of exposed surface of wire and sleet, at a temperature of 0 deg. Fahr. Such iron wire to be used only where the energy to be transmitted is so small that the voltage drop will be inappreciable. Said iron wire to be replaced with copper wire if and when such iron wire depreciates to a point where it is unsafe.

In its decision the commission says:

> Most of the standard specifications for construction of electric transmission lines require the use of copper wire or wire of other non-corrosive metal, and the commission has not heretofore approved the use of iron wire for the purposes designated in this petition. Petitioner alleges, however, that under present conditions the price of copper makes it impracticable for the company to construct numerous lines in rural districts where the amount of energy to be consumed is limited. For this reason petitioner seeks approval of the use of iron wire under specifications which are claimed to provide equal safety and under which such lines can be constructed at a material saving in cost.
>
> It was stated that on account of the relatively low conductivity of iron wire as compared with copper wire it has been only in occasional instances that iron wire has been used heretofore for transmission of electric current, and the commission has no record of such form of construction being approved by a regulative body. Petitioner cited the use by the Hydro-Electric Power Commission of Ontario, Canada, of steel cable on 500-ft. spans for the transmission of current at 110,000 volts.
>
> Evidence was submitted tending to show that the objection to the use of iron or steel wire was more on account of the loss of power due to low conductivity than to any danger involved through the possibility of corrosion and consequent failure of the line. On this question of corrosion, however, there appears to be some difference of opinion among electrical authorities, some of whom are of the opinion that iron wire should not be used, except when great care is taken in inspection of lines, on account of the possibility of breakage at points of attachment to poles or at other places where deterioration is liable to be excessive. There seems to be an agreement among electrical experts that where iron wire is used the tensile strength of such wire should at least equal that of the copper wire which would ordinarily be used in the same class of construction. In the specifications outlined in the petition it is proposed to guarantee safe construction by allowing sufficient sagging of the wire to give a factor of safety of two, with so-called "Class B loading," which is described as ½-in. coating of sleet on the wires with a wind pressure equaling 8 lb. per sq. ft. of exposed surface of wire and sleet in a temperature of 0 deg. Fahr. There is no request made in this petition for approval of the use of iron wire in joint construction with other companies.

Upon consideration of all the facts shown at the hearing and upon information independently secured, the commission decided to approve the use by the company of iron wire for transmission purposes in the manner and under the specifications set forth in the petition upon certain prescribed lines.

The commission also prescribed rules for construction.

TEN YEARS' GROWTH OF THE BALTIMORE COMPANY

Consolidated Gas, Electric Light & Power Company Issues Booklet Showing Its Progress During a Decade

A ten-year review dealing with the present status and prospects of the Consolidated Gas, Electric Light & Power Company of Baltimore has been issued to shareholders, with a letter from President Herbert A. Wagner.

Electric gross and net earnings are now 57 per cent of the total business. Regarding its hydroelectric supply and steam-electric capacity the company says:

"The company is in a very fortunate position in that

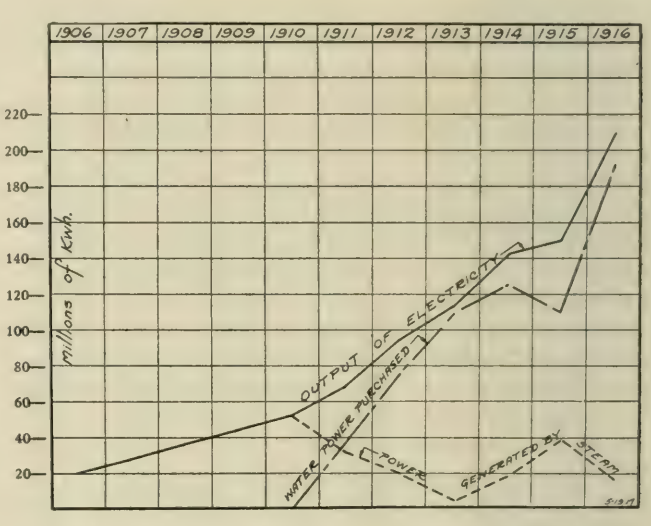


CHART SHOWING GROWTH OF BALTIMORE COMPANY

it has available under a long-term contract, at favorable rates, a great amount of the electricity generated at the hydroelectric plant of the Pennsylvania Water & Power Company. The present capacity of the water-power company is 84,000 kw. Foundations are ready for two more units, which when installed will give a total capacity of 114,000 kw. The amount of hydroelectric energy purchased by this company for the fiscal year ended June 30, 1916, was 92 per cent of its total output for the period. The company's steam generating capacity is 90,000 hp., which will be augmented by 100,000 hp. now under contract for its Westport plant, thus placing the company in a strong position with respect to electrical equipment."

Gross income from electric operations was $1,216,305 in 1906 and $4,336,240 in 1916, a gain of 256.5 per cent.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Higher Rates Ordered in Pennsylvania.—The Pennsylvania Public Service Commission ordered the Raystown Water Power Company and the Penn Central Light & Power Company, beginning June 1, to furnish electrical energy at Huntingdon and vicinity at 9 cents per kilowatt-hour with discount of from 10 to 20 per cent according to the amount used. During the past four years both companies have competed for business in this territory, with the Raystown company charging 6 cents per kilowatt-hour and the Penn Central company 3 cents.

Consolidation in New Jersey.—The Board of Public Utility Commissioners of New Jersey has granted the application of the Monmouth Lighting Company and the Middlesex & Monmouth Electric Light, Heat & Power Company to merge and consolidate. The Monmouth company operates at Freehold, Farmingdale, Englishtown and vicinity, and was formed by a consolidation of the concern of that name and the Farmingdale Lighting Company in January, 1916, with authorized capital of $500,000; the Middlesex & Monmouth company, with capitalization of $50,000, operates in the northern portion of Monmouth County from South Amboy to Freehold, where it furnishes electric energy to the Monmouth company. The board has also issued an order granting the Jersey Central Traction Company permission to transfer its power house, transmission lines and substations to the Monmouth Lighting Company for a consideration of $701,200. This authority is given in order to divorce, as far as possible, the traction from the lighting business, and upon the condition that the traction company will use the proceeds in the retirement of outstanding securities.

Competition in Pennsylvania.—The Schuylkill Electric Company has made application to the Pennsylvania Public Service Commission for approval of a ten-year contract awarded by the borough of Girardville to furnish municipal and commercial lighting. The Eastern Pennsylvania Light, Heat & Power Company has filed a protest against the proposed contract, holding that the territory, with population of about 6000 persons, does not warrant competition. In this the company sets forth: "The borough advertised for bids for street lighting in January, stipulating that the successful bidder must agree to furnish electricity for commercial purposes at a flat rate of 25 cents per month per 16-cp. light. The Eastern Pennsylvania company bid $3 a year lower on the street lighting than the Schuylkill company, and $1 lower for 100-cp. and 60-cp. incandescent lamps; moreover, such bid specified a well-known, efficient and modern type of lamp, while that of the Schuylkill company did not specify any type of lamp. The Schuylkill company was the high bidder, and, moreover, does not have any poles or wires for street lighting in the borough, and yet the Borough Council awarded the contract to such company. This action, if the Public Service Commission approves the contract, will mean a duplication of facilities and result in the borough paying more for its electric lighting than with the present facilities."

Flat-Rate Schedule in Illinois.—In the matter of proposed electric rates filed by the Lincoln Water & Light Company for Brainerd Park, the Illinois Public Utilities Commission approved a flat-rate form of schedule for electric service rendered in a situation peculiar to the case. The facts disclosed by the evidence are that the petitioner is rendering electric service to certain consumers at Brainerd Park, among which one is known as the Country Club, another is the Chautauqua Association, and there are those who possess cottages or tents at the Chautauqua grounds or in the vicinity thereof; that the locality known as Brainerd Park is between 2 and 3 miles from the city of Lincoln proper; that the locality known as the Chautauqua grounds is at or near the said Brainerd Park; that the so-called Country Club is in the same vicinity; that heretofore consumers on the Chautauqua grounds have been charged on a flat-rate basis during the approximate two weeks of the so-called Chautauqua season; that the installation of meters in tents and cottages at the Chautauqua grounds would necessitate an undue investment in meters compared to the relatively small revenue derived therefrom during the fourteen days of the Chautauqua season; and that such meters would be jeopardized by the inherent risks of the installations. In justification for making a departure from its customary practice of requiring meters on all electric services, the commission calls attention to the very special circumstances which warrant the establishing of flat rates in the case of Brainerd Park. Alluding to the peculiar conditions which prevail at Chautauqua resorts, it makes this statement: "Although this commission has committed itself in the policy of requiring general meter service wherever practicable, the case here appears to be one wherein the requirement of complete meter installations is quite impracticable and unduly costly. Meters on Chautauqua services would have to be installed and taken out once every year and would be in service during fourteen days only each year. To provide meters at the tents and cottages in the Chautauqua grounds would necessitate unavoidable fixed charges, would almost double the minimum flat rate proposed herein, and would, consequently, throw a severe burden upon those consumers who desire to utilize electric service during their summer outing at the Chautauqua grounds."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Property Devoted to Public Use.—Property not yet actually devoted to a public use but purchased and held by a public service corporation in reasonable anticipation of future needs is deemed "devoted to a public use" although not actually in use, the Supreme Court of Washington held (163P.15).

Review of Commission's Orders.—The Supreme Court will not substitute its judgment for that of an administrative board as to matters within its province, and so will not interfere with an order of the Public Utilities Commission where it does not appear from the record that the action of the commission is unlawful or unreasonable, was the opinion of the Supreme Court of Ohio (114 N. E., 1036).

Rights in City Streets.—General statutory provisions authorizing telephone companies to use state highways do not give them unrestricted right to erect their apparatus in cities and villages, it was held by the Supreme Court of Michigan (161 N. W., 982). While municipalities cannot annul general statutory provisions authorizing telephone companies to use state highways, they may reasonably direct upon what streets and in what manner the lines shall be installed.

Eminent Domain.—The fact that an electric light company is a public service corporation, and that its property through which a street is to be opened is dedicated to the public purpose of supplying electric energy, does not prevent the jury, in proceedings to open a street, from determining the increased market value caused by such opening under the Baltimore City Code, requiring jury to find the market value of the remainder of the tract after the street is opened, according to the Court of Appeals of Maryland (99 A., 968).

Action for Employee's Injury. — Where defendant offered evidence that the superior of deceased ordered plaintiff to "get up on the wagon and cut the wire," it was competent for the plaintiff to prove that the wagon was not a place of safety, the Supreme Court of Pennslyvania held in Foster versus Butler County Light Company (100A. 452). On an employer's appeal from a verdict against it, in an action to recover for the death of an employee, the evidence should be viewed in the most favorable light for plaintiff, and he should receive the benefit of every reasonable inference therefrom on the question of contributory negligence. Where an employee was working under a superior who was urging haste he was not required to use the same measure of care he otherwise would have been required to exercise.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Mahoning & Shenango System Power Contracts.—The Brier Hill Steel Company has closed a contract with the Mahoning & Shenango Railway & Light Company, Youngstown, Ohio, for 10,000 hp. to operate a large new plate mill which will be constructed immediately. Within two weeks the Mahoning & Shenango System has closed power contracts for a total of 13,600 hp.

City Council of Portland, Ore., Declines to Put Purchase Proposition on Ballot.—The City Council of Portland, Ore., refused to place on the ballot at the June election the proposition of C. P. Church that the city purchase electrical energy at wholesale from the two large electric companies and distribute it among consumers, and also purchase the Home Telephone Company and operate it as a public utility.

Large Power Contracts for New York Edison Company.—Two contracts totaling an installation of 1215 hp., one of which closed down a large steam engine plant, are included in one week's work of the power bureau of the New York Edison Company, of which C. K. Nichols is in charge. One contract calls for service for an installation of 540 hp. to supplant steam equipment that has been operated for some time by the Ice Manufacturing Company. The second contract, with the Bare Wire Company, calls for 675 hp. to operate a variety of big motors to be used in the work of drawing wire. The company will use power estimated at 1000 hp. in addition to the initial installation when a huge rolling mill in finally put into operation.

Features in New Business of Lehigh Valley Company.—The Lehigh Valley Light & Power Company, Allentown, Pa., has begun work on several large power installations. A modern pumping installation is to be made for the Bethlehem City Water Company, South Bethlehem. A 900-hp. connection for the Lehigh Portland Cement Company, between Allentown and Slatington, is the first installment of a total of 12,500 hp. to be supplied eventually. Construction of the transmission line is under way. A number of silk mills in the district are abandoning steam plants and installing electric motors. The Phoenix Silk Company, Allentown, will require 600 hp. in its broad-silk plant and 200 hp. in the ribbon plant. The Lehigh Valley silk mills, South Bethlehem, will receive service for 500 hp.; the McBride Brothers' silk mill, Fullerton, 150 hp.; the Gallia silk mills, South Bethlehem, 200 hp., and the Allentown Silk Company, 600 hp. The plant of the Lehigh brick works near Allentown will have 400 hp. Plants of the National Slag Company at Hokendauqua, the Emanuel Slag Company at Catasauqua, and the Kurtz Furniture Company at Fullerton, with an aggregate of approximately 600 hp., are also being completed and will receive service soon.

Garage Men Visit Vehicle Factory.—On June 5 Harry Salvat of Chicago, owner of the Fashion electric garages and local sales agent for the Milburn electric cars, took Chicago's fifteen electric garage owners to the Milburn factory at Toledo. The trip was planned to give these men a real insight into manufacturing methods that enter into the modern electric passenger car and to imbue them with a first-hand knowledge of the Milburn organization as a whole. It is thought particularly necessary at present to have each one able conscientiously to recommend the light electric passenger car, since without this co-operation the Fashion Garage Company's new salesroom and new battery service plan (see ELECTRICAL WORLD, June 2) could not accomplish its fullest purpose.

Railway Power Contracts in New York.—The Interborough Rapid Transit Company, New York, has agreed to sell power to the New York Municipal Railway Corporation and the New York Consolidated Railroad Company for the operation of the new rapid transit lines of the Brooklyn system in Manhattan. The agreement has been approved by the New York Public Service Commission, First District. Another agreement has been approved between the Transit Development Company, New York Municipal Railway Corporation and New York Consolidated Railroad Company, all Brooklyn Rapid Transit associated companies, under which the Transit company will furnish power for all rapid transit lines in Brooklyn. Both contracts are for approximately ten years. It is estimated that the annual demands of the Brooklyn company from the Interborough company for the first year, Dec. 1, 1917, to Dec. 1, 1918, will be 49,900,000 kw.-hr. direct-current energy at 625 volts, for traction purposes. The Interborough agrees to furnish alternating-current energy of high tension at 11,000 volts for signals and lighting; estimated requirements for this are, for 1917-18, 4,235,000 kw.-hr. For the direct current the Brooklyn company will pay 8¼ mills per kilowatt-hour, delivered at the Interborough substation; the alternating current is to be furnished at 7 mills per kilowatt-hour, also at the Interborough substation. In addition, the Brooklyn company agrees to pay 23 per cent of the actual cost of installing certain minor auxiliary equipment in the Interborough substation. Provision is made for revision in the event that the demand varies from expectations or the price of coal varies from $3.23 per long ton of 2240 lb. The contract with the Transit Development Company provides that for the first six years direct-current energy shall be furnished at 1 cent per kilowatt-hour, and alternating-current energy at 9 mills per kilowatt-hour. For the last four years of the ten-year period the rate for direct current shall be 9.9 mills per kilowatt-hour and for alternating current 9 mills per kilowatt-hour. The rates shall be altered with changes in coal cost.

Associations and Societies

A complete Directory of Electrical Associations is regularly printed in the first issue of each month on the next-to-last text page.

The Jovian League of New York.—The Jovian League of New York will hold its annual outing at the Harlem Yacht Club, City Island, on June 19.

Engineering Club of Columbus.—S. G. McMeen, president of the Columbus (Ohio) Railway, Power & Light Company, delivered an address before the Engineering Club of that city on May 29.

Institute of Radio Engineers.—Prof. M. I. Pupin, president of the Institute of Radio Engineers, read a paper on "Iron at Radio Frequencies" at the meeting of the institute on June 7, at the Engineering Societies Building, New York City.

Engineers' Club of San Francisco.—At the weekly luncheon held by the Engineers' Club on May 24 Dr. Thomas Addison, Pacific Coast manager General Electric Company, who had just returned from the East, gave a talk on "General Impression as to War Conditions, Especially as They Affect the United States."

Cleveland Section, A. I. E. E.—At the annual meeting of the Cleveland Section of the American Institute of Electrical Engineers, held on May 21, the following officers were elected: C. M. Rakestraw, chairman; C. S. Ripley, secretary; G. N. Lindstrom, chairman of the papers committee; board of managers, L. P. Crecelius, I. H. Van Horn and R. B. Chillas, Jr.

St. Louis Jovian League.—Memorial Day addresses were the feature of the St. Louis Jovian League luncheon meeting May 29. Colin M. Self, postmaster of St. Louis, was one of the principal speakers. W. E. Billmeier, who has taken an active part in promoting the recently organized Salesmanship Club, addressed the meeting on the "Need for Closer Co-operation Between All Organizations." The officers of the league submitted a formal application to the Jovian Order for a new charter, and charter No. 20 was assigned to it.

Cleveland Electrical League.—At the annual election of the league on May 31, J. M. Bateman, Cleveland manager of the Western Electric Company, was chosen president. The board of directors are as follows: Prof. H. B. Dates, Case School of Applied Science; W. G. McKitterick, sales manager National Lamp Company; H. L. Martien, president of the Martien Electric Company; M. H. Moffett, district sales manager of the National Carbon Company; E. H. Ott, sales engineer of the Westinghouse Electric & Manufacturing Company; G. E. Rogers, manager electrical department of the Sterling & Welch Company; and Mathias Turner, assistant general manager of the Cleveland Electric Illuminating Company.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

W. J. Rose has resigned as general manager of the Alliance Gas & Electric Company, Alliance, Ohio.

Charles Y. McVey, who was recently elected president of the Ohio State Telephone Company, has resigned as president of the United States Telephone Association owing to his greatly increased duties in his new position.

Fred Sintes, superintendent of electric light and power department of the W. M. Carney Mill Company, Atmore, Ala., has resigned his position, to take effect July 1, and has accepted a position with the Texas Company, Birmingham, Ala.

C. R. Young, Portland, Ore., has been appointed sales manager of the Pacific Power & Light Company, with headquarters in Portland. Mr. Young was graduated from the Leland Stanford University in 1910, after which he became connected with the engineering department of the city of Portland. In 1911 he was appointed assistant purchasing agent of the Pacific Power Company, from which he advanced to his present position.

George W. Robinson, president of the Tri-State Telephone & Telegraph Company, St. Paul, Minn., has been elected president of the United States Independent Telephone Association to succeed Charles Y. McVey, who resigned to devote his entire attention to his new duties as president of the Ohio State Telephone Company. Mr. Robinson entered the telephone business in 1904 with the company with which he is now president. In 1910 he became vice-president and treasurer and in 1914 was elected president.

J. P. W. Brown, for the last twenty years with the lighting department of the Nashville (Tenn.) Railway & Light Company, has been promoted to the newly created position of assistant general superintendent of the company. Mr. Brown began as switchboard boy with the Cumberland Electric Light & Power Company in 1897. Two years later, when the company was merged with the Nashville Railway & Light Company, he was made superintendent of the lighting and power department, which position he has held continuously ever since. He is a graduate of the engineering department of Vanderbilt University and was the first president of the Jovian League of Nashville.

Byron T. Burt, who has been associated with the W. S. Barstow interests for the last two years as operating manager in charge of several of the properties of the General Gas & Electric Company, has accepted a position with the Mexican Light & Power Company of Mexico City as assistant to the chief executive and the receiver, to assist in the management, engineering and operation of the company, with headquarters at Mexico City. Prior to going with the Barstow interests in the spring of 1915, Mr. Burt was connected with the South American Trading Company as manager at Buenos Aires for a few months. Mr. Burt was formerly manager of the old Chattanooga Electric Company until its consolidation with the Chattanooga Railway & Light Company. When the Chattanooga & Tennessee River Power Company was organized to construct the hydroelectric plant at Hale's Bar on the Tennessee River he was made general manager, which position he held until Jan. 1, 1915, when he resigned to go to South America.

R. H. Ballard, who for some time has been secretary and assistant general manager of the Southern California Edison Company, Los Angeles, Cal., on consolidation of the company with the Pacific Light & Power Corporation, has been elevated to vice-president and assistant general manager of the company. Mr. Ballard was born at Hamilton, Ont., in 1875, and when a boy of fifteen entered the employ of the Thomson-Houston Electric Company at Chicago. In 1894 he went to Schenectady on the consolidation of the Chicago company with the General Electric Company. There he was employed in the treasury department. In 1897 he left the General Electric Company to enter the employ of the West Side Lighting Company at Los Angeles as bookkeeper. Three years later he became cashier and office manager of the Butte (Mont.) Electric & Power Company, where he remained until 1904, when he returned to Los Angeles to accept a position as auditor of the predecessor of the company he is now with, namely, the Edison Electric Company. Since then he has passed through successive stages to the position he now holds with the Southern California Edison Company. Mr. Ballard is one of the leading figures in Pacific Coast utility work and was the first president of the Pacific Coast Section of the N. E. L. A. At the recent annual convention of the National Electric Light Association he was elected second vice-president.



R. H. BALLARD

L. A. Bafford, cashier of the Pacific Power & Light Company, Toppenish, Wash., has been promoted to the position of manager for the company at Sunnyside, Wash.

W. A. Brackenridge retains his position of vice-president and general manager of the Southern California Edison Company in its consolidation with the Pacific Light & Power Corporation.

William Hodge, who for the past twelve years has been manager of the Cornwall Street Railway, Light & Power Company and the Stormont Electric Light & Power Company, Ltd., at Cornwall, Ontario, has resigned and will devote his time to consulting work on the local utility properties.

S. E. Dillon, who was elected president of the Arkansas Association of Public Utility Operators at the recent annual convention held at Pine Bluff, is general manager of the Citizens' Electric Company, Hot Springs, Ark. Mr. Dillon took charge of the management of the Hot Springs utilities in 1911.

C. V. Peeling, manager of the Oshawa (Ont.) Electric Light Company, one of the properties operated by the Hydro-Electric Power Commission of Ontario, has been appointed manager of the Cornwall Street Railway, Light & Power Company and the Stormont Electric Light & Power Company, Ltd., at Cornwall, Ont., succeeding William Hodge, resigned.

Dr. William Marconi, who is a member of the commission now visiting the United States in behalf of the Italian government to co-operate with the federal government in laying plans for the war, received on Wednesday the honorary degree of doctor of science from Columbia University in recognition of his contribution to the world's means of transmitting intelligence. Dr. Marconi was born at Griffone, near Bologna, Italy, April 25, 1874. In 1895 he made his first experiments in wireless telegraphy and put them into practical use in England in the following year. He first sent a radio message across the English Channel in 1899 and across the Atlantic in 1901. Since that time he has further perfected long-distance radio-telegraphy, the value of which is now fully recognized. For his research and accomplishment Dr. Marconi has received recognition from many governments and seats of learning. The greatest international prize that can be won by any scientist, the Nobel prize for physics, was shared by him in 1909 with Professor Braun. In 1914 he was elected a senator in the Italian Parliament. Among the various decorations bestowed on him is that of honorary knighthood of the Grand Cross of the Victorian Order.

Obituary

Arthur Gunn, president of the Wenatchee Valley Gas & Electric Company of Wenatchee, Wash., was instantly killed on May 24 when his auto overturned. Mr. Gunn had been associated with the Wenatchee Valley company since 1896, during that time serving for one session in the Legislature.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

PRESENT INDICATIONS POINT TO FAN SHORTAGE

Some Manufacturers Have Already Sold Their Entire Output of 1917 Models—Demand Dependent on Weather

At the present writing indications point to a shortage of electric fans this summer. Already there are reasons to believe that several manufacturers have sold their entire output of 1917 models. Moreover, it is known that certain manufacturers have received a number of excellent orders of late which they have had to turn down. It is, therefore, evident that even at this early date the shortage is beginning to be manifest.

So far as the manufacturers are concerned, the selling season for fans has only a few more weeks to run. Ordinarily the trade has made its purchases by July 1. This year the trade generally entered the market for fans earlier than usual. Last year was fan year, and as a result the stocks of the country were pretty well cleaned out and consequently jobbers made early contracts. Also there was some apprehension on the part of the trade as regards deliveries. It was felt that the earlier the order was placed the better chance one had of receiving stock on time.

The demand from the trade this year has been excellent, and were it not for existing industrial conditions, the business transacted would be much larger. Inability to obtain sufficient raw materials and labor shortage and instability acted in a certain measure to curtail production.

How acute the threatened fan shortage actually will become depends, of course, in large measure on the weather of the coming three months. If there is a prolonged hot, dry spell stocks will undoubtedly be insufficient. On the other hand, if a season similar to the summer of 1915 occurs, then the supply will probably be ample.

ELECTRICAL EXPORTS PASS $5,000,000 MARK IN MARCH

Total for First Quarter of Current Year Amounts to $13,638,356, Which Is at the Rate of $55,000,000 a Year

Another record for electrical exports was smashed in March, when the value of electrical merchandise shipped abroad was $5,199,163. This is the first time that the monthly exports of electrical goods have passed the five-million-dollar mark. In this foreign business the electrical trade is fast making and breaking records. It was only in September last that the four-million-dollar mark for monthly exports was first passed. March exports were more than 80 per cent greater in value than March, 1916, exports.

Exports of batteries, arc lamps, telegraph instruments and miscellaneous merchandise were larger than in any previous month. The exports of miscellaneous equipment were practically one-half the value of the entir month's trade.

For the first quarter of the current year electrical exports amounted to $13,638,356, in comparison with $8,148,238 for the corresponding period of 1916. Should the volume of business transacted during the first three months of this year be maintained during the remaining nine months, the exports for the year will total up in the neighborhood of $55,000,000.

During the nine months ended March, 1917, the value of electrical exports was $36,992,204, which is but a few million dollars less than the record total for the entire twelve months of 1916; for the nine months ended March, 1916, $21,036,098, and for the nine months ended March, 1915, $13,867,092.

While it is evident that electrical goods are being exported more freely and in greater volume than at any time previous to the war, it must not be concluded that the increase is represented truly by the figures here presented. In fact the actual increase in trade, the volume of goods sold, is much smaller than the figures would lead one to believe. The figures show values only, and since numerous increases in price have gone into effect during the last year and a half, a considerable part of the apparent increase shown in the figures is thus accounted for.

That these figures are not larger than they are is owing entirely to the swamped condition of the American factories. The foreign market for American electrical goods has been almost limitless. Domestic demand and inability to produce more than so much prevented American manufacturers from seeking foreign business as actively as otherwise might have been the case.

The accompanying figures were furnished by the Bureau of Foreign and Domestic Commerce, Washington, D. C.:

	March		Nine Months Ended March	
Articles	1916	1917	1916	1917
Batteries	$157,497	$380,992	$1,084,421	$2,150,150
Dynamos or generators	72,022	132,760	1,037,735	1,876,824
Fans	18,376	18,004	252,842	272,768
Insulated wire and cables	269,606	719,639	2,188,763	5,277,206
Interior wiring supplies, etc., including fixtures	69,981	80,579	698,952	776,775
Lamps:				
Arc	3,191	4,015	15,359	11,808
Carbon-filament	9,548	12,505	125,441	109,455
Metal-filament	86,894	176,577	878,973	1,224,751
Meters and other measuring instruments	63,824	99,509	571,945	781,486
Motors	473,771	572,733	3,196,582	4,174,965
Telegraph instruments (including wireless apparatus)	19,703	135,775	115,820	327,487
Telephones	180,534	151,739	734,642	1,306,847
Transformers	87,520	116,347	694,469	856,793
All other	1,372,408	2,597,989	9,440,154	17,844,889
Total	$2,884,875	$5,199,163	$21,036,098	$36,992,204

STANDARDIZATION OF CORDS AND PLUGS FOR APPLIANCES

Recommendations by N. E. L. A. Sub-committee Do Not Specify Any Particular Types for Such Equipment

Standardization of electrical equipment is constantly receiving more attention. Until recently the electrical industry was more than prolific in new devices. When the war was yet young it became more and more apparent that behind the standardization of electrical goods and products there was a well-founded economic as well as an operating reason. The manufacturers have been working as hard as possible on standardization schemes and have made remarkable progress. There has been good co-operation between the American Institute of Electrical Engineers and the manufacturers, but this has mostly been in the larger apparatus.

Quite recently a move was made by the wiring committee of the National Electric Light Association toward standardization of cords and plugs for appliances. A sub-committee on this matter, headed by Dorsey R. Smith, made the following recommendations at the recent annual convention of the association:

"That all table devices such as percolators, toaster stoves

and grills be equipped with a standard cord and plug; that the socket end and the appliance end of such cords be interchangeable; that irons and kitchen utensils such as broilers should have a standard cord and plug interchangeable for like devices; that vibrators, hair dryers and curling irons have a standard plug for the appliance end, and for the socket end the same standard plug recommended for irons and table devices."

SUPPLY OF PLATINUM APPARENTLY ADEQUATE

Census of Immediately Available Unmanufactured Stocks Now Being Taken by United States Government

A census of stocks of unmanufactured platinum in the United States that can be considered as immediately available is now being taken by the United States Geological Survey. From the information already available it would appear that there are supplies of platinum sufficient to meet such extensions of contact-process plants as may be required immediately, while still leaving a surplus for all ordinary requirements.

The available supply of platinum in the United States appears to be adequate to meet immediate needs, but it is emphasized by the Geological Survey that new demands may arise at any time which the present stocks of platinum in this country could not meet.

INCREASE IN VOLUME OF JOBBERS' STOCKS

Canvass of Eastern Supply Men Shows an Average Increase Over Normal in the Neighborhood of 40 Per Cent

Ever since the fall of 1915, when deliveries began to lengthen out, jobbers have been carrying larger stocks of electrical goods than under normal conditions. In order to find out how much, on the average, jobbing stocks had increased in volume a canvass was recently made of Eastern jobbers.

As was to be expected, this canvass showed a wide variation in the amount of additional stock jobbers are required to carry. Some jobbers have been carrying a stock just twice as large as normal, while the stocks of others are no larger to-day than they were prior to the war.

The canvass revealed, however, that on the average it has been necessary for Eastern jobbers to carry a stock in the neighborhood of 40 per cent larger in volume since the fall of 1915. It is doubtful if this figure will hold for other sections of the country. In the Far West and along the Pacific Coast, for example, there is every reason to believe that the average stock is much more than 40 per cent larger than normal. In fact, it would not be surprising if 100 per cent were much nearer the real condition in this section of the country.

The Far West is remote from the manufacturing centers of the country and has to rely almost entirely on long freight hauls for its goods. While deliveries have been so poor and railroad freight service in such a congested condition, with a large shortage in available rolling stock, Western jobbers have found deliveries so long and so uncertain that stocks had to be increased to a great extent in order to be able to supply customers.

In the Central West it is probably true that stocks have had to be increased slightly more than in the East, although in some parts of the South business has been so poor that some jobbers have not thought it advisable to further increase stocks.

These figures, of course, refer to the entire stock. In separate portions of the stock, of course, different conditions exist, dependent largely on volume of demand, distance from source of supply and ability of manufacturer to supply goods in a reasonable time.

Furthermore, it is well known that in certain portions of the stock supplies are far below what is desired. This situation in incandescent lamps and rubber-covered wire has been particularly acute in certain sections of the country at various times.

Of course, owing to the increased cost of supplies and therefore the additional amount of capital that must be tied up in stock, jobbers generally have been very careful not to increase their stocks any more than has been necessary. There have, naturally, been exceptions, but manufacturers through their credit departments early realized that it was dangerous to allow the trade to stock beyond its ability to carry the investment, even though there was a brisk demand, and consequently limited jobbers as far as was advisable to their financial ability to carry this stock.

While deliveries continue to be as long as they now are and as uncertain, it is evident that jobbers will find little opportunity to reduce the amount of stock, provided always, of course, that the demand does not fall off.

The jobbers practically are forced to carry stock for the contractor and dealer. These two elements of the trade, as a rule, buy only as required. They do not stock up ahead to any great amount, and during this period of poor deliveries have made little or no change in the customary practice, but have gone to the jobber for goods as wanted. In fact, owing to the advanced prices numerous instances exist where the contractor and dealer have recently depended more than ever before on the jobber to carry their stocks.

EXISTING CONDITIONS IN THE METALS MARKET

Copper Is Strengthened by Purchases, Tin Is Down Somewhat, and Business in Spelter Market Is Stagnant

A well-defined buying movement for a few days sent copper prices up a bit, but toward the end of last week they receded to a level slightly higher than for the previous week. The market, however, is still wondering what the federal and allied governments purpose to do regarding future requirements. Producers have had no intimation of how much will be needed nor how much the government will be willing to pay. There is a feeling, however, that the price of 16 2/3 cents at which the government contracted for earlier requirements will not hold, but that the government will probably be willing to pay around 25 cents a pound.

Strikes, fires, etc., have held up production somewhat, but at this writing word has been received from most of the prominent producers that the men are going back to work.

The spelter market is stagnant. Neither buyers nor sellers seem inclined to do business. Quotations on tin have fallen from the higher prices of a few days ago. There seems to be little change in the lead market, the high prices still prevailing.

Nominal quotations on electrolytic copper were as follows on June 4: June, 32.75 cents; July, 31.75 cents; third quarter, 30 cents; fourth quarter, 29 cents.

NEW YORK METAL MARKET PRICES

	May 28 Selling Prices Bid	Asked	June 4 Selling Prices Bid	Asked
Copper:	£ s d		£ s d	
London, standard spot	130 0 0		130 0 0	
Prime Lake	31.50	to 32.50†	31.00	to 32.00†
Electrolytic	32.25	to 32.75†	32.50	to 33.00†
Casting	30.50	to 31.00†	30.50	to 31.00†
Copper wire base	37.00	to 38.00†	37.00	to 38.00†
Lead	10.00		10.00	
Nickel	50.00		50.00	
Sheet zinc, f.o.b. smelter	19.00		19.00	
Spelter, spot	9.42½	to 9.67½	9.55	to 9.67½
Tin, Straits	65.00		61.00†	
Aluminum, 98 to 99 per cent.	56.00	to 58.00†	56.00	to 58.00†

OLD METALS

Heavy copper and wire	28.00	to 28.50	28.00 to 28.50
Brass, heavy	17.50	to 18.00	17.50 to 18.00
Brass, light	14.25	to 14.75	14.25 to 14.75
Lead, heavy	9.00	to 9.25	9.25 to 9.75
Zinc, scrap	7.25	to 7.50	7.25 to 7.50

†Nominal.

Current Prices of Electrical Supplies

NEW YORK AND CHICAGO QUOTATIONS

The prices quoted are those prevailing in standard package or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists to contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

Any apparent discrepancies between New York and Chicago quotations can be explained by conditions governing the local markets in each case.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor

B. & S.	Size	List, per 1000 Ft.
No. 14	solid	$61.00
No. 12	solid	71.00
No. 10	solid	90.00
No. 8	solid	106.00
No. 6	solid	145.00
No. 10	stranded	95.00
No. 8	stranded	115.00
No. 6	stranded	160.00
No. 4	stranded	205.00
No. 2	stranded	266.00
No. 1	stranded	315.00

Twin-Conductor

No. 14	solid	104.00
No. 12	solid	135.00
No. 10	solid	185.00
No. 8	stranded	235.00
No. 6	stranded	370.00
No. 4	stranded	575.00

NET PRICE PER 1000 FT.—NEW YORK

Single-Conductor

No. 14 solid:	
Less than coil	$54.90 to $67.16
Coil to 1000 ft.	48.80 to 59.17
No. 12 solid:	
Less than coil	63.90 to 78.10
Coil to 1000 ft.	56.80 to 68.87

Twin-Conductor

No. 14 solid:	
Less than coil	$78.00 to $114.40
Coil to 1000 ft.	75.00 to 100.88
No. 12 solid:	
Less than coil	121.50 to 148.50
Coil to 1000 ft.	108.00 to 120.95

NET PRICE PER 1000 FT.—CHICAGO

Single-Conductor

No. 14 solid:	
Less than coil	$51.85 to $67.10
Coil to 1000 ft.	48.80 to 54.90
No. 12 solid:	
Less than coil	60.35 to 78.10
Coil to 1000 ft.	56.80 to 63.90

Twin-Conductor

No. 14 solid:	
Less than coil	$85.00 to $114.40
Coil to 1000 ft.	77.50 to 93.60
No. 12 solid:	
Less than coil	114.75 to 148.50
Coil to 1000 ft.	108.00 to 121.50

ATTACHMENT PLUGS

	Std. Pkg.	List
Benjamin No. 902	100	$0.25
Hubbell No. 5406	200	.10
Bryant No. 700	100	.25
G. E. 50996	250	.22

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.:	
Benjamin No. 903	12%
Hubbell No. 5406	+10% to 20%
Bryant No. 700	+20% to 10%
G. E. 50996	+20% to 10%
1/5 to std. pkg.:	
Benjamin No. 903	20%
Hubbell No. 5406	10% to 20%
Bryant No. 700	20%
G. E. 50996	20%
Std. pkg.:	
Benjamin No. 903	44%
Hubbell No. 5406	34%
Bryant No. 700	34%
G. E. 50996	34%

ATTACHMENT PLUGS—CONTINUED

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.:	
Benjamin No. 903	12%
Hubbell No. 5406	10% to +10%
Bryant No. 700	+20%
G. E. 50996	+20%
1/5 to std. pkg.:	
Benjamin No. 903	20%
Hubbell No. 5406	10% to 20%
Bryant No. 700	Net
G. E. 50996	Net
Std. pkg.:	
Benjamin No. 903	44%
Hubbell No. 5406	34%
Bryant No. 700	30%
G. E. 50996	30%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.35	$0.35
12 to 50	.30	.30
50 to barrel	.28	.28 to .29
Barrel lots	.24	.24

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.35	$0.35
12 to 30	.30	.30
50 to barrel	.255 to .26¼	.265 to .27¼
Barrel lots	.24 to .24¾	.25 to .25¾

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
5/16	250	$5.00
⅜	250	7.50
½	100	10.00
¾	50	13.00
1	50	21.00
1¼	50	26.00
1½	25-50	35.00
2	25-50	45.00
2½	25-50	52.00

DISCOUNT PER 1000 FT.—NEW YORK

	Less than Coil	Coil to 1000 Ft.
⅜-in. single strip	.....	.....
⅜-in. double strip	.....	.....
½-in. single strip	Net to 20%	4% to 25%
½-in. double strip	Net to 10%	4% to 20%

DISCOUNT PER 1000 FT.—CHICAGO

	Less than Coil	Coil to 1000 Ft.
⅜-in. single strip	$71.25 to $75.00	$60.00 to $63.75
⅜-in. double strip	75.00 to 78.75	67.50 to 71.25
½-in. single strip	95.00 to 100.00	80.00 to 85.00
½-in. double strip	100.00 to 105.00	90.00 to 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, in.	List, per Foot	Size., in	List, per Foot
7/32	$0.05½	1	$0.25
¼	.06	1¼	.33
⅜	.09	1½	.40
½	.12	1¾	.47
⅝	.15	2	.55
¾	.18	2¼	.65

CONDUIT, NON-METALLIC FLEXIBLE—CONTINUED

DISCOUNT PER 1000 FT.—NEW YORK

	Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.	Net to 33⅓%	45% to 50%	53% to 55%
¼-in.	Net to 33⅓%	45% to 50%	53% to 55%

NET PER 1000 FT.—CHICAGO

	Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.	$36.67 to $55.00	$27.50	$24.75
¼-in.	40.00 to 60.00	30.00	27.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Size, in.	Conduit, List per Foot
¼	$0.08½
⅜	.08½
½	.08½
¾	.11½
1	.17
1¼	.23
1½	27½
2	.37
2½	.58½
3	.76½

	Couplings, List	Elbows, List
¼	$0.05	$0.19
⅜	.06	.19
½	.07	.19
¾	.10	.25
1	.13	.37
1¼	.17	.45
1½	.21	.60
2	.28	1.10
2½	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	¼ In. to ½ In.	¾ In. to 3 In.
Less than 2500 lb.	6%	8%
2500 to 5000 lb.	9%	11%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ In. to ½ In.	¾ In. to 3 In.
Less than 2500 lb.	3.8% to 7.8%	5.8% to 9.8%
1500 to 5000 lb.	6.8% to 10.8%	8.8% to 12.8%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

Net	$3.15 to $3.50

CHICAGO

Net	$2.80 to $3.85

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

FUSES, INCLOSED—CONTINUED

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	28%
1/5 to std. pkg.	38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	28%
1/5 to std. pkg.	38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	$5.75 to $6.30
1/5 to std. pkg.	4.50 to 5.25

Standard package, 500. List, $0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	$6.25
1/5 to std. pkg.	5.25

Standard package, 500. List, $0.07.

LAMPS, MAZDA

105 to 125 Volts

Regular, clear:	Std Pkg.	List, Each
10 to 40-watt—B.	100	$0.27
60-watt—B	100	.36
100-watt—B	24	.65
75-watt—C	50	.65
100-watt—C	24	1.00
200-watt—C	24	2.00
300-watt—C	24	3.00
Round bulbs, 3½ in., frosted:		
15-watt—G 25	50	.50
25-watt—G 25	50	.50
40-watt—G 25	50	.50
Round bulbs, 3¾ in., frosted:		
60-watt—G 30	24	.72
Round bulbs, 4⅝ in., frosted:		
100-watt—G 35	24	1.05

105 to 125 Volts

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net list
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$30.00 to $35.17
Coil to 1000 ft.	21.00 to 26.73

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$37.52 to $38.16
Coil to 1000 ft.	28.14 to 28.62

LAMP GUARDS, WIRE

NEW YORK

	Per 100 Net
Less than 50, Matthews, 16-cup	$18.00 to $20.00
Less than 1/5 std. pkg. Hubbell	25.50 to 29.00
Less than 36, 60-watt Loxon	20.00 to 25.00

CHICAGO

	Per 100 Net
Less than 50, Matthews, 16-cp.	$20.00
Less than 1/5 std. pkg. Hubbell	$22.50 to 28.35
Less than 36, 60-watt Loxon	25.00 to 30.00

OUTLET BOXES

Union Cat. No.	Black, List, per 100
101	$30.00
102	30.00
103	25.00
106	20.00

Union Cat. No.	Galv., List, per 100
101	$30.00
102	30.00
103	25.00
106	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	List to 33%	List to 27%
$10.00 to $50.00 list	42%	37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	40%	35%
$10.00 to $50.00 list	50%	45%

PIPE FITTINGS

Condulets, V.V., Unilets and Similar

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	$14.00 to $20.00
1/5 to std. pkg.	13.00 to 15.10

Standard package, 2200. List per 1000, $20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	$14.00 to $18.00
1/5 to std. pkg.	13.00

Standard package, 2200. List per 1000, $20.

PORCELAIN KNOBS

NEW YORK

	5½ N.C.—Solid Std. Pkg. 3500	Nail-it—N.C. Std. Pkg. 4000
Per 1000 Net		
Less than 1/5 std. pkg.	$10.50 to $24.50	$21.50
1/5 to std. pkg.	9.75 to 12.15	28.50

CHICAGO

	5½ N.C.—Solid Std. Pkg. 3500	Nail-it—N.C. Std. Pkg. 4000
Per 1000 Net		
Less than 1/5 std. pkg.	$10.50 to $18.00	$20.75 to $28.00
1/5 to std. pkg.	9.00 to 9.75	16.30 to 21.50

SOCKETS AND RECEPTACLES

	Std. Pk.	List
⅛-in. cap key socket	500	$0.33
⅛-in. cap keyless socket	500	.30
⅛-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15% to 20%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	Net to 15%
1/5 to std. pkg.	15%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

Perkins or Trumbull Type A:	List
30-amp. S. P. S. T.	$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30 amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Perkins Type B or Trumbull Type C:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

Type A, Perkins or Trumbull:	
Less than $10 list	+50%
$10 to $25 list	11% to 15%
$25 to $50 list	14% to 18%
Type B, Perkins, or Type C, Trumbull:	
Less than $10 list	5%
$10 to $25 list	16% to 20%
$25 to $50 list	24% to 28%

SWITCHES, KNIFE—CONTINUED

DISCOUNT—CHICAGO

Type A, Perkins or Trumbull:	
Less than $10 list	Net to +5%
$10 to $25 list	11% to 15%
$25 to $50 list	14% to 18%
Type B, Perkins, or Type C, Trumbull:	
Less than $10 list	5% to 10%
$10 to $25 list	16% to 20%
$25 to $50 list	24% to 28%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single pole	250	$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp., three-point	100	.56
10-amp., three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	Net to +20%
1/5 to std. pkg.	15% to Net
Std. pkg.	30%

SWITCH BOXES, SECTIONAL CONDUIT

C. F. Mfg. Co.	List, Each
No. 155	$0.34
No. 160	0.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	....	....
$2.00 to $10.00 list	....	....
$10.00 to $50.00 list	....	....

DISCOUNT—CHICAGO

	Black.	Galvanized.
Less than $10.00 list	35% to 50%	15% to 40%
$10.00 to $50.00 list	35% to 64%	25% to 52%

TOASTERS, UPRIGHT

NEW YORK

Net price	$3.15 to $3.50

CHICAGO

Net price	$2.80 to $3.50

WIRE, ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools.	$0.52 to $0.62
No. 18, full spools	0.48 to 0.53

CHICAGO

	Per Lb. Net
No. 18, less than full spools.	$0.56½ to $0.65
No. 18, full spools	0.49½ to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$18.00	12.00-14.50	11.50-12.50
12	21.06-27.05	18.96-22.85	18.01-20.95
10	29.60-39.27	26.64-33.66	24.68-25.31
8	42.40-51.44	38.16-48.42	33.51-36.25
6	72.19-89.57	64.98-76.80	56.63-61.73

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$18.00	$16.00	$14.00
12	25.92-29.89	22.05-25.62	19.44-21.35
10	36.48-41.51	31.92-35.58	27.36-29.65
8	46.20-60.13	42.35-51.54	37.70-42.95
6	72.70-82.20	66.65-75.35	59.40-68.50

WIRE, WEATHER-PROOF

Solid-Conductor, Triple-Braid, Sizes 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	$40.25 to $45.00
25 to 50 lb.	39.25 to 42.00
50 to 100 lb.	38.00 to 38.25

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.	$42.55 to $45.00
25 to 50 lb.	41.35 to 44.00
50 to 100 lb.	40.35 to 43.00

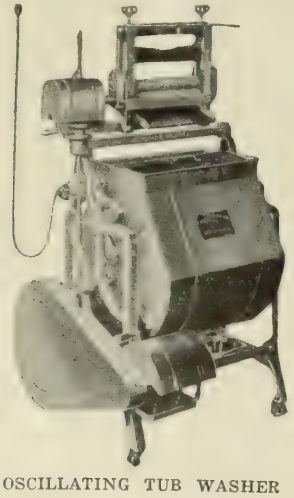
NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Washing Machine

Electric washers have been developed by the Apex Appliance Company, 3223 West Thirtieth Street, Chicago, which operate on the oscillating-tub principle. All-metal tubs, with approximate triangular cross-section and the peak or "apex" at the bottom are used. V-shaped strips are attached horizontally to the sides as well as on the bottom to serve as shoulders and give a positive throw to the contents when the tub is oscillated. At the bottom of the tub is a settling chamber and drainage pipe. All the heavier dirt drops into this and cannot be carried back into the clothes. By drawing off the dirtiest water after each batch of clothes is washed it is unnecessary to renew all the water for each tubful. The tub rests upon two outside bearings so there is no chance of lubricating oil mixing with the clothes. The bearing spindles are attached to the tub through spiders which strengthen the tub and distribute the stresses due to its oscillation, thereby preventing twisting of the bearing at the end where the power is applied.

The lever shown at the left in the accompanying illustration serves to start and stop the motion of the tub. When this lever is put in the running position it engages a clutch. This starts a shaft to which are connected an arm and spring by which the tub is oscillated. The spring serves to retard the motion



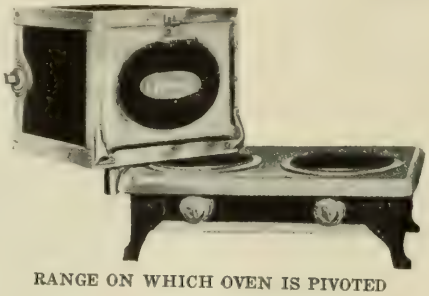
OSCILLATING TUB WASHER

at the end of the oscillation and start the tub back in the opposite direction; thus very little power is required to overcome the inertia of the load at each end of the oscillation.

The main shaft and the wringer shaft, which is gear-connected to it, are in motion continually when the motor is running. The small hand lever at the top is employed to control the wringer. A safety catch is provided which makes it impossible to start the tub until the catch is released. The wringer can be operated in several positions. The outfits are belt-driven by Robbins & Myers special washing-machine motors rated at ⅛, ⅙ or ¼ hp., depending upon the size of the washer.

Kitchenette Range

An electric kitchenette range which is a variation from the ordinary combination of hot plates and oven has been developed by the Standard Electric Stove Company of Toledo, Ohio, to meet the requirements of small kitchens. The oven is pivoted at the outside corner so it will swing over the hot plates and thus not require separate heating elements. There is an open-coil air heater



RANGE ON WHICH OVEN IS PIVOTED

in the top of the oven for broiling, toasting, etc. The oven has double walls, which are insulated and lined with aluminum. With both burners operating at full intensity the oven will attain its maximum temperature in four minutes, it is said. Each hot plate is controlled by a three-heat multiple switch which regulates the power demand to 1000, 500 or 250 watts as desired. To prevent radiation of heat from the bottom of the hot plates they are insulated by bowl-shaped inclosures.

Electric Washers

Two new models have been added to the line of washing machines of the One Minute Manufacturing Company of Newton, Iowa. A feature of one of these machines is the floating motor, which acts as a belt tightener. The motor is hinged to the motor base and thus takes up all slack in the belt. These models are equipped with a high-grade wooden-frame wringer of the swinging style, which is reversible and is provided with a quick-acting safety-release device. All gears are fully inclosed. Two levers control the machine.

Load Box

By various switching combinations any resistance loads from 25 watts to 2000 watts can be obtained with the load box shown in the accompanying illustration, which is made for non-inductive testing of meters. This load box is neat in appearance and weighs



METER-TESTING LOAD BOX

only 5 lb. (2.7 kg.). All metal parts are nickeled and the switch handles and top cover consist of polished ebonite. This box is the product of the William H. Dalton Company, 4 Charlotte Street, Salem, Mass.

Vertical-Type Alternator

An improved vertical-type alternator has been developed by the Electric Machinery Company of Minneapolis, Minn. The lower guide bearing, which resists all lateral stresses on the shaft, is split and is so mounted that it can be removed without disturbing the shaft or coupling. It is provided with an automatic forced-feed oiling system, which is equipped with a sight feed indicator placed where it can be easily observed. The armature frame or stator is a circular iron casting of the lightest practical construction and is designed to allow free circulation of cooling-air currents.

Open-type armature slots are used on these alternators. At both ends of the laminated core are special tooth supports that prevent humming and chafing of the coils. The supports are made of "U" shaped punched-steel strips riveted to each other at the open ends so as to form a continuous chain of loops, each one of which supports one tooth. Being open at the lower end the loop allows free exit of air set in motion by the revolving field. The tooth support is locked in position by two tongues fitting in the annular groove in the clamping ring against which it rests. Ventilation of the

armature core is secured by means of open spaces at intervals along the core and by the open tooth supports at both ends. In case an armature coil is damaged it may be removed by lifting the adjacent coils and replaced immediately by a spare coil if one is on hand. The top-bearing bracket is cast in one piece and is doweled to the thrust-bearing case. The openings between the radial arms are covered with wire-screen frames.

The total weight of the rotor and waterwheel runner, including the water thrust, is suspended from a large hexagonal nut screwed to the upper end of the shaft. This nut rests on a thrust plate which in turn rests on a roller bearing provided with self-aligning washers. These washers insure an evenly distributed load on all the rollers by adjusting themselves to any slight inaccuracies in the support. The rollers are not all of equal lengths. Therefore they may be staggered so that it will be impossible for them to wear grooves or tracks in the steel plates between which they roll. The bearing is completely submerged in oil.

Oil passages are provided in the lower self-aligning washer in order to permit the circulation of oil through the rollers. On the larger machines the upper thrust-bearing case is connected with the oil pump at the lower part of the alternator, thereby permitting continuous flow of cool oil around the bearing. The side thrust of the shaft is resisted by a self-aligning radial ball-bearing.

Sign Flasher

The Reynolds Electric Company, 422 South Talman Avenue, Chicago, has designed a flasher for large electric signs which, it is pointed out, is compact and simple in design. One display operated by this flasher consists of a three overlay sign, flashing first the reading matter, "You Will Do Better in Toledo," with a highly colored revolving border; next a steamship with smoke pouring from the funnels, waving flags, and an ocean-wave effect; lastly, an express train coming on full



CENTER-DRIVE SIGN FLASHER

head, then slowing to a stop and gradually starting up again.

The flasher has 132 switches in addition to the solenoid controls. Center drive is used, which, it is claimed, gives perfect transmission without excessive bearing and gear less. The motor at the end drives a twelve-switch section of the flasher which operates the engine wheels, car wheels and track. The rheostat causes the motor to come up to full speed in graduated steps, giving the accelerating effect in the wheels and track. The solenoids act as master of the control switches.

Weatherproof Sockets

Two molded composition weatherproof sockets, known as Nos. 60,666 and 43,310, have been placed on the market by the Arrow Electric Company of Hartford, Conn. These sockets are grooved for weatherproof shade holders and are equipped with 6 in. (15.24 cm.) of No. 14 B. & S. gage stranded rubber-covered wire.

Portable Oven

The Almur Manufacturing Company of Marion, Ind., has developed a portable oven equipped with a removable heating unit. The heating element is held in place with wing nuts, which makes it convenient to remove the element to clean the stove thoroughly. The heating element is wound for 600 watts



PORTABLE STOVE WITH REMOVABLE HEATING UNIT

and 110 volts. This stove is 12 in. (30.48 cm.) long by 12 in. (30.48 cm.) wide by 16 in. (40.6 cm.) high. A glass door with a nickel-plated cast-iron frame is provided.

Conduit Coupling

A tubular slip coupling for conduit pipes has been developed by M. Blumenthal, 50 Church Street, New York City. The coupling consists of a sleeve

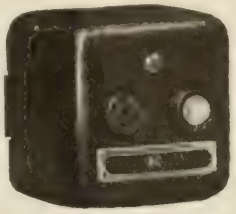


SLIP COUPLING FOR CABLE CONDUITS.

the outer surface of which is tapered toward each end to form cutting edges. These edges facilitate driving the conduit through a wall or partition. The inner surface is beveled at the ends to permit inserting the conduits readily.

Push-Button Switch

Push-button switches designed to be mounted directly on the busbars of standard panels by means of two machine screws which pass through the flexible self-adjusting contacts of the switch into holes tapped in the copper busbars of the panel are made by the



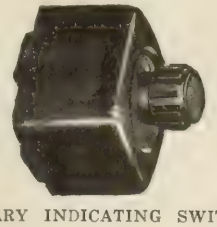
SWITCH FOR BUSBAR MOUNTING

Bryant Electric Company of Bridgeport, Conn. The same screws also serve as the circuit or electrical connection between the switch and the busbars.

The National Electrical Code permits a minimum spacing between busbars of opposite polarity of ¾ in. (1.9 cm.) for 125 volts and 1¼ in. (3.1 cm.) for 250 volts, but as the spacings at the fuses must be 1 in. (2.54 cm.) for 125 volts and 1¾ in. (4.4 cm.) for 250 volts, it is the practice to space the busbars 1½ in. (3.8 cm.) on centers for 125 volts and 2¼ in. (5.7 cm.) on centers for 250 volts.

As the screw holes in these switches are spaced 1¼ in. (3.1 cm.) on centers both ways, it is claimed that the switches can be used on 125-volt panels with straight busbars, and that the space between the ends of the bus of the same polarity may be ¾ in. (1.9 cm.) greater than is necessary with other types of switches—thus effecting an actual saving of 1½ in. (3.8 cm.) of copper bar per switch. On 250-volt panels it is necessary to bend the ends of buses in to reach the switch. The covers of these switches are substantial molded insulation cups, rectangular in shape, with all front edges rounded.

Below the buttons of each switch there is a metal card holder designed to hold a lettered card designating the circuit controlled. These switches are made in both 10-amp. and 20-amp., 250-volt standard push-button types and they can also be procured in the lock type.



ROTARY INDICATING SWITCH

A rotary indicating panelboard switch can also be had, rated at 10 amp. and 250 volts. This switch is attached to busbars in the same manner as the push-button type, and if desired can be readily converted into a lock switch by substituting for the standard form of handle generally employed a universal lock attachment.

Trade Publications

CHAIN DRIVE.—"Ideal Drive for Grain Elevators" is the title of a bulletin prepared by the Link-Belt Company of Chicago.

RANGES.—The Hughes Electric Heating Company of Chicago is distributing a leaflet entitled "Just a Word About Prices on Hughes Ranges."

APPLIANCES.—The Pelouze Manufacturing Company, 232 East Ohio Street, Chicago, has prepared a bulletin descriptive of its electrical devices.

APPLIANCES.—Landers, Frary & Clark of New Britain, Conn., have prepared an illustrated folder descriptive of "Universal" electric summer needs.

SPOT WELDER.—The Pacific Electric Welder & Manufacturing Company of Seattle, Wash., is distributing a folder descriptive of its spot welder.

SWITCHES.—Steel-inclosed switches are illustrated and described in a leaflet distributed by the Detroit Fuse & Manufacturing Company of Detroit.

REFLECTORS.—X-ray standard window reflectors are illustrated and described in the bulletin prepared by the National X-ray Reflector Company of Chicago.

REFLECTORS.—"The Influence of Lighting on Church Attendance" is the title of a bulletin recently prepared by the National X-Ray Reflector Company of Chicago.

PRESIDENT'S ADDRESS.—The Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., is distributing in book form the address by President Wilson before the Sixty-fifth Congress on April 2, 1917.

ELECTRIC RANGES AND HEATING DEVICES.—The Globe Stove & Range Company, Kokomo, Ind., has issued catalog No. 39, which contains complete information on electric ranges and heating devices. In addition to containing the usual catalog information this booklet gives short, concise sales talks about each piece of apparatus.

REFLECTORS.—"Holophane Developments for Type C Lamps" is the title of a bulletin prepared by the Holophane Glass Company, 340 Madison Avenue, New York City. This book is published for the purpose of acquainting the dealer with the developments which have been made in the Holophane system of illumination, particularly with reference to units for type C lamps.

PUMPS.—The De Laval Steam Turbine Company of Trenton, N. J., has just issued, under the title "Progress in Water Works Pumps," a forty-eight-page booklet discussing the general economic and engineering conditions affecting the design and installation of such pumps. Installations in fifteen of the principal cities of this country and Canada are described, including thirty-four units aggregating 999,000,000 gal. per day capacity. The publication should be of value to any one interested in the handling of water in large quantities.

CONTROL EQUIPMENT.—"Booklet E" is the title of the new thirty-two-page booklet just published by the Cutler-Hammer Manufacturing Company, Milwaukee, describing C-H control equipment for electric elevators. This booklet covers the various classes of control, such as hand-rope control, car-switch control and push-button control, for all classes of freight and passenger service. The booklet is well illustrated and also contains information on elevator control accessories, such as door safety switches, phase failure and phase reversal relays, limit switches, slack cable switches, brakes, etc.

ILLUMINATION.—Arrangements have been made for the publication of a lecture course on illuminating engineering which was given at the University of Pennsylvania under the auspices of the Illuminating Engineering Society and the university Sept. 21 to 28, 1916. The lectures treat of the principles and practice of illuminating engineering, with special reference to the practical aspects of the art. These lectures constitute the most comprehensive treatment of the subject that has ever been offered to the practitioner, it is said. The lectures are printed in one volume of approximately 700 pages, illustrated and bound in cloth. It contains twenty-one lectures, all indexed, and a supplement illustrating and describing the exhibition which was prepared in connection with the lecture course. The cost of this volume until July 1, 1917, will be $4.

BUREAU OF MINES.—The Bureau of Mines of the Department of the Interior announces new publications on the following topics: Coal-mine fatalities in the United States, 1916, by A. H. Fay, bulletin 119, analyses of coals purchased by the government during the fiscal years 1908-1915, by G. S. Pope, bulletin 113, abstracts of current decisions on mines and mining, reported from May to August, 1916, by J. W. Thompson, technical paper 87, methods of testing natural gas for gasoline content, by G. A. Burrell and G. W. Jones; technical paper 106, asphyxiation from blast-furnace gas, by E. H. Willcox; technical paper 165, quarry accidents in the United States during the calendar year 1915, by A. H. Fay; technical paper 168, metal-mine accidents in the United States during the calendar year 1915, by A. H. Fay. Only a limited supply of these publications is available for free distribution, and applicants are asked to co-operate in insuring an equitable distribution by selecting publications that are of especial interest. Requests for all papers cannot be granted. Publications should be ordered by number and title. Applications should be addressed to the director of the Bureau of Mines, Washington, D. C.

New Incorporations

THE SEWICKLEY HEIGHTS (PA.) TOWNSHIP LIGHT COMPANY has been incorporated with a capital stock of $5,000 by E. S. Haymond of Wilkinsburg, Pa., and others to operate in Sewickley Heights.

THE CONWAY (PA.) ELECTRIC LIGHT COMPANY has been granted a charter with a capital stock of $5,000 to operate in Conway. E. S. Haymond of Wilkinsburg, Pa., is interested in the company.

THE AMBRIDGE (PA.) ELECTRIC COMPANY has been granted a charter with a capital stock of $5,000 to operate in Ambridge Township. E. S. Haymond of Wilkinsburg, Pa., is interested in the company.

THE OSTERBURG (PA.) LIGHT, HEAT & POWER COMPANY has been chartered to install and operate an electric lighting system in Osterburg and vicinity. D. E. Brumbaugh of Claysburg is interested in the company.

THE STERLING ELECTRICAL CORPORATION of Cleveland, Ohio, has been incorporated with a capital stock of $250,000 by Roy M. Hall, W. H. Fahrenbach, Clarence E. Edson, P. Hess and Antonio Longoria.

THE BADEN (PA.) ELECTRIC LIGHT COMPANY has been incorporated with a capital stock of $5,000 to furnish electrical service in Baden. E. S. Haymond of Wilkinsburg, Pa., is among the incorporators.

THE ALIQUIPPA (PA.) ELECTRIC LIGHT COMPANY has been chartered with a capital stock of $5,000 to supply electricity in Aliquippa Township. E. S. Haymond of Wilkinsburg is among the incorporators.

THE CRESCENT (PA.) TOWNSHIP ELECTRIC COMPANY has been incorporated with a capital stock of $5,000 to operate in Crescent Township. E. S. Haymond of Wilkinsburg, Pa., is among the incorporators.

THE ECONOMY (PA.) TOWNSHIP ELECTRIC LIGHT COMPANY has been chartered with a capital stock of $5,000 to operate in Economy Township. E. S. Haymond of Wilkinsburg, Pa., is among the incorporators.

THE CENTRAL ELECTRICITY COMPANY of Herbertville Station, Que., has been incorporated by J. H. Bassard, J. R. Desbiens, A. Plourde and others. The company is capitalized at $99,000 and proposes to build and operate electric light, heating and power plants.

THE ANTWERP (OHIO) ELECTRIC LIGHT & POWER COMPANY has been incorporated with a capital stock of $20,000 by William J. Peterson, G. M. Bratton, F. L. Armstrong, Charles H. Worden and others. The company proposes to furnish electrical service in Antwerp.

THE PALMETTO POWER & LIGHT COMPANY of Raleigh, N. C., has been incorporated with a capital stock of $300,000 by Charles E. Johnson, H. H. Carr and F. H. Briggs, all of Raleigh. This company is a subsidiary to the Carolina Power & Light Company of Raleigh.

THE BILLINGS (MONT.) RAILWAY, LIGHT & POWER COMPANY has been incorporated by T. A. Snidow, H. W. Rowley, J. B. Arnold, Roy J. Covert and others. The company is capitalized at $300,000 and proposes to take over the local street car system and possibly construct an interurban railway to Laurel and other places.

Trade Notes

THE HUGHES ELECTRIC HEATING COMPANY, Chicago, Ill., has moved to 5669 West Taylor Street.

A. M. COLLINS has been appointed sales manager of the Detroit office of the Western Electric Company.

THE INDEPENDENCE INSPECTION BUREAU, Philadelphia, announces that it is now called the Independence Bureau.

THE DRAEGER OXYGEN APPARATUS COMPANY has moved from Pittsburgh to Penn Avenue and Hay Street, Wilkinsburg, Pa.

THE BLAW STEEL CONSTRUCTION COMPANY, Pittsburgh, Pa., has announced the appointment of G. E. Land as advertising manager.

THE H. W. JOHNS-MANVILLE COMPANY opened on May 20 new and larger showrooms and sales offices on the ground floor of the Westinghouse Building, corner of Ninth Street and Pennsylvania Avenue-Pittsburgh, Pa.

E. C. WOODBURY, for a number of years with the Standard Underground Cable Company as assistant to the manager, has resigned from that company to manage the Southwestern business of the Belden Manufacturing Company of Chicago.

THE WAGNER ELECTRIC MANUFACTURING COMPANY of St. Louis announces the appointment of F. T. Coup, formerly connected with its Chicago office, to take charge of its Milwaukee office in its new location, the First National Bank Building.

THE UNDERWRITERS' LABORATORIES announce as additions to their casualty council the following: Col. Lewis T. Bryant, Commissioner of Labor of the State of New Jersey, Trenton, N. J.; Lew R. Palmer, Department of Labor and Industry, Harrisburg, Pa., and A. H. Young, director of the American Museum of Safety, New York.

C. L. HIGHT and FRANK STOUT have formed a partnership under the name Hight & Stout, 143 Liberty Street, New York City, to operate as factory selling agents, covering the Middle Atlantic States from New York to Virginia. The first account of the new firm will be that of district representative for Henry D. Sears, general sales agent for Webber sockets.

THE MONITOR CONTROLLER COMPANY of Baltimore, manufacturer of automatic starters and controllers for all kinds of motor-driven machinery, announces the opening of a new office in Buffalo, at 718 Ellicott Square, under direction of William G. Merowit. This office will have charge of business in the western New York territory, also Canadian territory adjacent to Toronto and Hamilton.

THE CHARLES A. SCHIEREN COMPANY, New York, manufacturer of "Duxbak" water-proof and steam-proof leather belting, has recently opened branch offices at 72 Congress Street, West, Detroit; 18 South Broadway, St. Louis; 475 South Main St., Memphis, and 272 Marietta Street, Atlanta, in addition to those already established at New Orleans, Dallas, Boston, Philadelphia, Pittsburgh, Chicago, Denver and Seattle.

THE BETTS & BETTS CORPORATION, 511 West Forty-second Street, New York City, has taken over the manufacturing and selling rights of the "Mason Monogram" talking sign and carriage call, which has been exploited in the past by the National Electric Sign Company of Jersey City, N. J. The latter company recently retired from business. James H. Betts, sales manager for the Betts & Betts Corporation, announces that several important improvements have been made in the operating mechanism of the carriage call, incorporating many of the Betts company's own patented features.

RUSSIAN COMMISSION.—A commission representing the National Bank of Commerce in New York has left New York for Russia. This mission is a constructive step toward cementing definite commercial relations between Russia and the United States, and it goes at the specific suggestion of several correspondents of the bank in Russia. The commission will be headed by R. G. Hutchins, Jr., senior vice-president of the bank, who will be accompanied by H. P. Barrand, an assistant cashier from the bank's foreign department, and several assistants. The party will spend some time in Japan and go from there to Russia, where they will remain from two to three months. Prior to their return trip they will spend considerable time in Scandinavian countries.

New England States

DAMARISCOTTA MILLS, ME.—Burges, Lang & Company of Boston, Mass., who are promoting the construction of an electric railway from South Newcastle to Boothbay Harbor, have acquired a controlling interest in the Portland Power & Development Company of Damariscotta Mills. The company, it is understood, is considering acquiring the Wiscasset, Waterville & Farmington Railroad, which is operated by steam.

BURLINGTON, VT.—Steps have been taken by the Burlington Merchants' Association to secure a new street-lighting system in the business district.

LUDLOW, VT.—Contracts aggregating 200 hp. to furnish electricity to some of the local woolen mills from the municipal electric-light plant have been secured by the village of Ludlow. As energy is purchased from the Colonial Power & Light Company of Cavendish, it will be necessary to double the capacity of the substation to supply the service.

WEST DANVILLE, VT.—A new electric power plant to develop 2500 hp., it is reported, is to be erected in West Danville by the Hortonia Power Company of Brandon, Vt. The plans provide for the erection of 30 miles of electric transmission lines, including the line from West Danville to Barnet and the Pike Hill copper mines and connecting the new plant with those of the company at Barnet, Groton and Ryegate. The contract for construction work has been awarded to Pascal Ricci of Rutland.

BOSTON, MASS.—Governor McCall has signed the bill authorizing the Bay State Street Railway Company to sell electrical energy to the Fore River Shipbuilding Corporation during contracts for naval construction.

FALL RIVER, MASS.—The Fall River Electric Light Company is contemplating the construction of a trunk line of conduits through the southeastern end of the city this summer.

WOONSOCKET, R. I.—The Manufacturers' Power Company has purchased a site at Second Avenue and River Street and is planning the construction of a coal pocket for the power plant on Singleton Street.

HARTFORD, CONN.—The directors of the Hartford Electric Light Company have voted to recommend to the stockholders an increase of capital stock from $4,500,000 to $6,000,000.

MOODUS, CONN.—The Public Utilities Commission has approved the petition of the Central Connecticut Power & Light Company of East Hampton for the construction of an electric transmission line, using double galvanized wire, from Moodus to East Glastonbury.

Middle Atlantic States

COHOES, N. Y.—Bids will be received by the Board of Contract and Supply, Cohoes, until June 13 for two motor-generator sets, including switchboards, conduits, cables, etc., for the pumping station and filtration plant.

EARLVILLE, N. Y.—The Public Service Commission has granted the Earlville Electric Light Company permission to erect an electric transmission line to Randallsville; also to erect a line to the town of Lebanon and to exercise franchises granted by the town of Lebanon and to issue $7,000 in bonds of which the proceeds of $5,535 will be used to pay for the new line.

HUDSON, N. Y.—The power plant, blacksmith shop, etc., at the plant of the Atlas Building Material Company, just north of Hudson, was recently destroyed by fire, causing a loss of about $10,000.

PORT CHESTER, N. Y.—Bids will be received by the Board of Trustees of the village of Port Chester until June 12 for sewage-pumping machinery, including one 1000-gal. per minute and two 2000-gal. per minute special centrifugal sewage pumps, one 15-hp. and two 25-hp. horizontal electric motors with switchboards, control apparatus and other appurtenances. Specifications and further information may be obtained at the office of Louis C. A. Lewin, village clerk, or at the office of James C. Harding, consulting engineer, 170 Broadway, New York City.

SIDNEY CENTER, N. Y.—The Town Board of Sidney has granted the Delaware & Otsego Electric Light Company of Franklin permission to install electric lamps in Sidney Center.

WYNANTSKILL, N. Y.—The installation of an electric-light system in this village and along the Wynantskill Flats is under consideration. Electricity to operate the system would be obtained from the Wynantskill Hydraulic Electric Power Company.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

ATLANTIC CITY, N. J.—Arrangements are being made for the installation of powerful searchlights along the beach front in Atlantic City in the near future by W. Frank Sooy, director of public safety. Four sections of the bathing beach will be lighted under the present plan.

ELIZABETH, N. J.—Owing to the increase in cost of material, etc., Runyon & Carey, consulting engineers of Newark, have advised against the construction of a municipal electric plant at the present time.

ENGLEWOOD, N. J.—Bids will be received by the Board of Education of Englewood until June 14 for electrical work and heating and ventilating in the new Lincoln School, to be located on Englewood Avenue, near William Street. Guilbert & Batelle, 665 Broad Street, Newark, are architects.

KEYPORT, N. J.—The Public Utilities Commission has given its approval of the merger of the Monmouth Lighting Company and the Middlesex & Monmouth Electric Light, Heat & Power Company. The commission has also approved the application of the Monmouth Lighting Company to issue $267,000 in capital stock and $440,000 in bonds.

KEYPORT, N. J.—Permission has been granted by the Board of Public Utility Commissioners to the Jersey Central Traction Company and the Central New Jersey Traction Company to consolidate under the latter name. The Jersey Central Traction Company has been given authority to sell its power station, transmission lines and substations to the Monmouth Lighting Company, and stocks, bonds, etc., to the Middlesex & Monmouth Electric Light, Heat & Power Company.

NEWARK, N. J.—Plans are being prepared by the Public Service Electric Company for the construction of an addition to its Essex power plant at Point-No-Point, to cost about $365,000. N. A. Carle is chief engineer.

NEWARK, N. J.—The Public Service Electric Company has been granted permission by the Board of Freeholders to make tests at electric generating plants at the Overbrook and Soho hospitals. The company claims that it can furnish electricity at a lower cost to these institutions than the present isolated plants.

NEWARK, N. J.—The Public Service Electric Company has submitted a proposal to the building committee offering to supply electricity for the City Hall at less than it can be supplied by the City Hall plant. If it is decided to purchase energy from the company some changes to the system, involving an expenditure of $10,000, would be necessary. A committee has been appointed to make investigations.

TRENTON, N. J.—The Empire Tire & Rubber Corporation is planning to build an addition to its power plant on North Clinton Avenue, to cost about $10,000.

TRENTON, N. J.—Bids will be received by Francis H. Bent, state architect, Department of Architecture, State House, Trenton, until June 22, for electrical work in a new building at the Manual Training and Industrial School at Bordentown.

TRENTON, N. J.—Investigations are under way by the State House committee to reduce the cost of fuel at the various state institutions. It is proposed to install new grates, stokers and other equipment as follows: Rahway Reformatory, $60,000; State Hospital, Trenton, $31,000; Morris Plains, $45,000, and Home for Feeble-Minded, Vineland, $7,000.

WEEHAWKEN, N. J.—Bids will be received by the Board of Education, West New York, N. J., until June 13 for electrical work and heating and ventilating in the new addition to be erected at School No. 5. William Mayer, Jr., and Edwin F. Manahan, 711 Bline Avenue, West New York, are architects.

HECHSHERVILLE, PA.—The Philadelphia & Reading Coal & Iron Company has begun work on the extension of its electric transmission lines to Hechsherville to supply energy in this district.

NEWTOWN, PA.—The plant of the Newtown China Company has been acquired by the Imperial Porcelain Company of Trenton and will be used for the manufacture of electric porcelain specialties. A company has been organized, to be known as the Newtown Porcelain Works, to operate the plant as an auxiliary to the Trenton plant.

PHILADELPHIA, PA.—The Lehigh Coal & Navigation Company is equipping its Cranberry mining properties for electrical operation, at a cost of about $250,000.

PHILADELPHIA, PA.—The contract for the erection of a power plant at the city hospital buildings at Byberry has been awarded to the William Linker Company, Reed Building, at $76,900.

PHILADELPHIA, PA.—Plans have been filed by the Philadelphia Electric Company for the construction of a new one-story power station, 50 ft. by 100 ft., at Robbins Street and Delaware Avenue, to cost about $120,000. A new substation will also be erected as an addition to the present plant at Schuylkill Avenue and Christian Street.

PHILADELPHIA, PA.—An electrically operated double-leaf, central-bascule bridge span is to be included in the new combination bridge and viaduct to be constructed by the city over the Schuylkill River at Thirty-fourth Street, connecting South and West Philadelphia. The span will be about 400 ft. long. The cost is estimated at $1,000,000. Plans are being prepared by Chief Albright of the bureau of surveys.

PITTSBURGH, PA.—Bids will be received by the Board of Education, 1326 Fulton Building, until June 14 for electrical work at the Latimer School. George W. Gerwig is secretary.

PITTSBURGH, PA.—Contract has been awarded by the Pittsburgh, Harmony & Newcastle Railway Company to the Faber Engineering & Construction Company for the construction of a new storage dam and addition to power plant at Harmony Junction.

SHAMOKIN, PA.—The local electric plant of the Pennsylvania Lighting Company, it is reported, was destroyed by fire on June 1.

BALTIMORE, MD.—Plans have been approved for the plant which the American Refractories Company of Joliet, Ill., contemplate erecting at Baltimore, Md. The cost of the proposed plant is estimated at $300,000, and it will be equipped for electrical operation.

PLEASANT VALLEY, W. VA.—The West Virginia Traction & Electric Company of Morgantown has applied to the Town Council of Pleasant Valley to construct and operate an electric-lighting system for a period of 50 years. The company has also applied for a 50-year franchise to construct and operate a waterworks system in the town of Edgwood.

NEWPORT NEWS, VA.—Application has been made to the Chamber of Commerce by the Empire Steel Company, now being organized with a capital stock of $4,000,000, for a selection of a site for the erection of large steel works. It is proposed to build a power plant, to cost about $60,000, in connection with the project. Ernest B. Moore of Petersburg, Va., is interested.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 20 for furnishing and installing lighting fixtures in the United States post offices at Ashland, Ohio; Bonne Terre, Mo.; Buckhannon, W. Va.; Charlotte, Mich.; Dowagiac, Mich.; Middletown, Conn.; Nacogdoches, Tex.; Skowhegan, Me.; Warrenton, Va.; Washington, Ind., and Yoakum, Tex.; also the United States post office extension at Evansville, Ind. For details see proposal columns.

WASHINGTON, D. C.—Extensive improvements are contemplated by the Chesapeake & Potomac Telephone Company, involving an expenditure of about $750,000, and will include an exchange to be installed in the main telephone exchange building, at $225,000; improvements to main building to accommodate the new equipment, $80,000; power plant at main exchange, $30,000; additional toll boards, $35,000; additions to switchboards at Lincoln, Columbia and Cleveland exchanges, $75,000; alterations in the Cleveland Building, for cables and other outside plants, $150,000, and for private branch exchange switchboards, stations and equipment, $100,000.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, for supplying equipment at various navy yards and naval stations as follows: F.o.b. works, Schedule 1193—34 electrical equipments for rammer and powder hoists, 16-in. elevating gear. Philadelphia, Schedule 1185—two single-acting circulating air pumps. Schedule 1188—two motor-driven 2¼-in. by 24-in. flat-turret lathes. Brooklyn, N. Y., Schedule 1191—miscellaneous copper wire; Schedule 1199—one motor-

driven, high speed, sensitive 16 in. drill one universal milling machine, one back geared, motor driven, extension screw cutting lathe. Washington, D. C. Schedule 1192—one 15-ton, four-motor, electric overhead traveling crane. Annapolis, Md. Schedule 1193—one steam turbine-driven electric generator. Schedule 1196—seven high speed, universal engine lathes. Norfolk, Va. Schedule 1187—one electrically driven gate shear machine. Applications for proposals should give the schedule desired by number.

North Central States

GOODRICH, MICH.—The Goodrich flouring mills have been purchased by Ashton Jerome and Seth Jerome. The new owners propose to remodel the mills and build a new concrete dam, and also plan to install an electric lighting plant and supply electricity for the town.

BARBERTON, OHIO.—The Electric Rubber & Reclaiming Company is contemplating an expenditure of about $10,000 for new equipment and machinery for its plant.

BRADFORD, OHIO.—Bids will be received by L. E. Harvey, clerk of board of public affairs, Bradford, as follows: (1) For constructing pump well, pumping station, setting machinery and making pipe connections; (2) furnishing and erecting one vertical triplex power pump, 450-gal. per minute capacity. Plans and specifications are on file in the office of the clerk and at the office of A. Elliott Kimberly, engineer, 8 East Long Street, Columbus.

CALEDONIA, OHIO.—The Town Council is considering the purchase of an oil engine for the municipal electric-light plant.

CINCINNATI, OHIO.—The Hamilton County Court House Commission has applied to the Building Commissioner for a permit to install ten elevators in the new court house. The Standard Plunger Elevator Company of Worcester, Mass., has been awarded the contract for the work, at $104,000.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, until June 19 for furnishing coal crusher, steam pipe and fittings and boiler gratings for the division of light and heat. Separate proposals to be submitted on each item. Specifications may be obtained at the office of the division of light and heat, Room 204, City Hall.

COLUMBUS, OHIO.—Plans are being prepared for a power plant to be erected on the campus of the State University, to cost about $200,000. Joseph N. Bradford is chief engineer and supervising architect.

KINGSTON, OHIO.—Arrangements are being made by the Scioto Valley Traction Company of Columbus to rebuild the light and power distributing system in Kingston. Material for the work, it is understood, has been purchased.

MARION, OHIO.—Preparations are being made by the Columbus, Delaware & Marion Railway Company to double the output of its local power plant.

MINERAL CITY, OHIO.—The Village Council has adopted a resolution declaring it necessary to discontinue the operation of the municipal electric-light plant and to authorize a contract with a privately owned electric plant to furnish electrical service in Mineral City. C. H. Sawyer is Mayor.

MONROEVILLE, OHIO.—The Village Council is considering a proposal submitted by the officials of the Lake Shore Electric Railway Company of Cleveland offering to furnish energy to operate the municipal electric-light plant.

SIDNEY, OHIO.—The Sidney Electric Company has filed application with the Public Utilities Commission for authority to issue $100,000 in bonds for improvements to its plant.

YOUNGSTOWN, OHIO.—The power plant of the Republic Railway & Light Company was recently damaged by an explosion, causing a loss of about $100,000. The generator, which was destroyed, will be replaced.

YOUNGSTOWN, OHIO.—Plans have been adopted by the directors of the ten subsidiary companies of the Mahoning & Shenango Railway & Light Company for merging into one company to be known as the Shenango Valley Light Company. The companies that will be included in the merger are: The Shenango Valley Electric Company, the Sharpsville Electric Light Company, the Lackawannock Township Mercer Light & Power Company, the Pymatuning Township Mercer Light & Power Company, the Shenango Township Mercer Light & Power Company, the Hickory Township Light & Power Company, the Wilmington Township Mercer Light & Power Company, the Borough of Wheatland Mercer Light & Power Company, the Borough of Farrell Mercer Light & Power Company and the West Middlesex Mercer Light & Power Company. The consolidation of these companies will be a step in the development and extensions of the company's light and power business in Mercer County.

DIXON, KY.—Steps have been taken by local citizens to organize a company to install an electric lighting plant to cost about $4,000.

HAZARD, KY.—The Kentucky River Power Company is planning to erect an electric transmission line from its Lothair power plant to furnish electricity to the coal mines in the Lott's Creek district.

CARLISLE, IND.—The Wabash Valley Electric Company of Clinton has petitioned the Town Council for a franchise and contract to supply electricity for lamps and motors in Carlisle.

FORT WAYNE, IND.—Plans have been prepared by the Fort Wayne & Decatur Traction Company for the erection of a substation, 23 ft. by 60 ft., in Decatur.

CHICAGO, ILL.—The Central Manufacturing Company, First National Bank Building, contemplates the construction of a power plant at 2015 West Thirty-ninth Street, to cost about $250,000. S. Scott Joy is architect.

EAST MOLINE, ILL.—Dr. G. F. Johnson, Mayor, has suggested to the City Council that a steam plant be installed at the water-works pumping station, and in that connection to establish a municipal electric plant for street lighting.

EDWARDSVILLE, ILL.—Work has begun on the construction of the large power plant for the Indiana Power & Water Company in Edwardsport. The general office of the company is located in Bicknell, Ind.

GALENA, ILL.—The Interstate Light & Power Company of Galena, which has completed the extension of an electric transmission line to the McMillan mine, to serve a connected load of 200 hp. in motors, is negotiating with the owners of the different mines in that vicinity to furnish electrical service.

GILLESPIE, ILL.—The Southern Illinois Light & Power Company is planning to construct a new power house and install a new equipment in Gillespie.

SPRINGFIELD, ILL.—A resolution has been adopted by the City Council authorizing the sale of $60,000 underground city electric light wire bonds and $50,000 water department amortization bonds.

WAUKEGAN, ILL.—The Public Utilities Commission has granted the Chicago North Shore & Milwaukee Railroad Company permission to issue $940,000 in bonds, the proceeds to be used for extensions and general rehabilitation of its system. At least $200,000, it is expected, will be expended for improvements to the lines in Waukegan.

FLORENCE, WIS.—The Peninsula Power Company of Chicago, Ill., it is reported, has selected a site on the Brule River in Florence for its proposed hydro-electric power plant to be built this year. Plans have not been announced. Max Sells of Florence is reported interested.

MILWAUKEE, WIS.—The City Council has granted the Milwaukee Electric Railway & Light Company a franchise for an extension on Mitchell Street to Muskego Avenue, on Muskego Avenue to Burnham Street and on Burnham Street to Twenty-sixth Avenue.

MILWAUKEE, WIS.—The Valley Steel Company is erecting an electric steel foundry and merchant bar and billet plant at St. Francis, a suburb of Milwaukee. The main structure will be 85 ft. by 680 ft. The company will manufacture steel by the electric process. Energy will be supplied by the Milwaukee Railway & Light Company.

SEYMOUR, WIS.—The Seymour Electric Company, recently incorporated, is planning to erect an electric-light and power plant. The company is capitalized at $10,000. The incorporators are: E. P. Daniels, W. E. Daniels and S. D. Newell.

TOMAH, WIS.—Plans are being considered for the installation of additional street-lighting units.

WAUPACA, WIS.—Application has been made to the State Legislature for an appropriation of $60,000 for the construction of a new power house at the Wisconsin Veterans' Home at Waupaca.

BUHL, MINN.—Contracts have been placed by the Village Council for equipment for the municipal electric-light and power plant, to cost about $25,000.

JASPER, MINN.—Edmond Shella of Letcher, S. D., has been granted a franchise to furnish electricity in Jasper for street lighting and commercial purposes.

SOUTH ST. PAUL, MINN.—Bids will be received by the Board of Education of the city of South St. Paul, Minn., until June 19 for the installation of two automatic stokers, of the underfeed type, to be installed in the High School Building at South St. Paul. J. R. Stevenson is secretary of board.

ATHENS, IOWA.—The Public Utilities Commission has granted the Athens Electric Company permission to erect an electric transmission line from Athens to Petersburg.

CORYDON, IOWA.—The Iowa Southern Utilities Company of Mount Ayr is reported to be negotiating for the purchase of the local electric plant.

DAVENPORT, IOWA.—Improvements involving an expenditure of about $400,000 to its local system are contemplated by the Tri-City Railway & Light Company. The work will include the installation of a 20,000-kw. turbine, rebuilding of electric transmission lines, installation of new equipment, etc. Energy will be transmitted from the power station at 13,200 volts instead of 4800 volts, as at present, when the improvements are completed.

EMMETSBURG, IOWA.—The Commonwealth Power Company of Mankato, Minn., has petitioned the Council for a franchise to furnish electricity for lamps and motors in Emmetsburg.

SHELDON, IOWA.—The Henry Runger cement plant is reported to have been purchased by the Sheldon Gas & Electric Company, which, it is understood, will erect a generating station there at once.

THOR, IOWA.—Bonds to the amount of $4,000 have been sold, the proceeds to be used for the installation of an electric-lighting system.

CLINTON, MO.—The municipal electric and water plant is reported to have been purchased by Morrison & McCall of St. Louis. A number of improvements are contemplated by the new owners.

FREDERICKTOWN, MO.—Negotiations are under way between the City Council and the Missouri Public Utilities Company of Cape Girardeau for the purchase of the municipal electric light plant.

HORNERSVILLE, MO.—The Arkansas Light & Power Company of Arkadelphia, Ark., has been granted a franchise to furnish electricity for lamps and motors in Hornersville.

JOPLIN, MO.—At an election to be held on June 12 the proposal to issue $225,000 in bonds for a municipal electric light plant and an alternative proposition to purchase energy from the Empire District Electric Company will be submitted to the voters.

KIRKSVILLE, MO.—At an election held recently the proposal to issue $118,000 in bonds for improvements to the municipal electric-light plant and water-works system was defeated.

LADDONIA, MO.—At an election held recently the proposal to install a lighting system in Laddonia was carried.

ST. LOUIS, MO.—The Manchu Storage Battery Company, incorporated under the laws of the State of Delaware with a capital stock of $300,000, has been authorized to utilize $140,000 to establish a plant in St. Louis.

WEBB CITY, MO.—The Southwest Missouri Railroad Company is planning to extend its electric railway from Baxter Springs, Kan., to Pilcher, a distance of 7 miles.

KEARNEY, NEB.—At an election to be held June 19 the proposal to grant a 25-year franchise to the L. E. Myers Company of Chicago, Ill., which recently took over the property of the Kearney Water & Electric Company, will be submitted to the voters. The new franchise will provide for improvements to the street-lighting system.

ALMA, KAN.—The Alma (Kan.) Light & Ice Company is reported to have been granted a franchise to install an electric-lighting system here.

ATWOOD, KAN.—Plans are being considered by the City Council for the installation of an electric-lighting system in Atwood.

BURLINGAME, KAN.—Plans are being considered by the city of Burlingame for the installation of an additional generator and engine in the municipal electric-light plant.

CONCORDIA, KAN.—The Concordia Electric Light Company is contemplating extending its electric transmission lines to Cuba, Aganda, Haddam and Washington.

HAMILTON, KAN.—The proposal to establish an electric-light system here, to cost about $6,000, is under consideration.

KANOPOLIS, KAN.—The Council is considering calling an election to submit to the voters the proposal to issue bonds for extensions to the municipal electric-lighting and water-works systems.

Southern States

LAURINBURG, N. C.—Surveys, it is reported, are being made by the Palmetto Power & Light Company for the erection of an electric transmission line from Laurinburg to a point on the Wateree River, about 7 miles from Camden, S. C., to secure energy from the plant of the Wateree Power Company. Charles E. Johnson is president.

TUXEDO, N. C.—The Blue Ridge Power Company is reported to have awarded contract for construction of a hydroelectric power plant on Green River to Willard Boggs & Company of Hendersonville. The plans provide for a development of 15,000 hp. and the erection of steel tower transmission lines from the power site to Hendersonville and Spartanburg. John A. Law of Spartanburg, S. C., is president.

BENNETTSVILLE, S. C.—The Southern Power Company contemplates the erection of an electric transmission line through Marlboro County, passing through Bennettsville, McColl and Tatum. The plans provide for the erection of a substation.

COLUMBIA, S. C.—The Columbia Railway, Gas & Electric Company is contemplating building an extension of its electric railway (between 5 and 10 miles long) to the prospective United States Army Camp site east of the city.

PACOLET, S. C.—The Pacolet Manufacturing Company is planning to equip the Pacolet Mills and the Gainesville (Ga.) Cotton Mills for electrical operation. Several hundred motors, ranging from 5 hp. to 150 hp., will be installed. Energy will be supplied by the Georgia Railway & Power Company of Atlanta, Ga., which will erect a 38,000-volt electric transmission line from the Dunlap plant on the Chattahoochee River, 3 miles distant, to the mills. About 6000 hp. will be required for the two mills. The cost of work is estimated at about $200,000.

SPARTANBURG, S. C.—At an election to be held June 12 the proposal to purchase or construct an electric-light plant will be submitted to the voters.

MARION, ALA.—The Alabama Power Company of Birmingham has petitioned the Public Service Commission for permission to purchase the plant and holdings of the Marion Electric Company.

FAYETTEVILLE, ARK.—The Fayetteville Gas & Electric Company is planning to build an addition to its power house and install additional equipment for the purpose of supplying electricity for lamps and motors to the towns of Rogers and Springdale, Ark., which will be transmitted over a transmission line 20 miles long. Specifications, it is expected, will be completed within 30 days. F. L. Oneal is superintendent.

HOXIE, ARK.—The Hoxie-Walnut Ridge Compress Company of Hoxie, recently incorporated with a capital stock of $50,000, is planning to install a power plant. S. C. Dowell, S. E. Spikes and others are interested in the project.

NEW ORLEANS, LA.—The Star Shipyards, recently incorporated, is planning to install electric cranes, pneumatic machinery and other equipment. Walter C. Keenan, Crawford Ellis and others are interested.

BILLINGS, OKLA.—The city of Billings, it is reported, will receive bids until Aug. 1 for construction of an electric-light plant, water-works and sewer system, to cost about $50,000. The Mackintosh-Walton Engineering Company, State National Bank Building, Oklahoma City, has charge of the engineering work.

CLINTON, OKLA.—Plans are being considered for the installation of an ornamental street-lighting system and placing wires underground on Frisco Avenue.

MIAMI, OKLA.—Bids will be received by the Miami Hotel Company until June 18 for the construction of a hotel, seven stories and basement, to cost about $200,000. Separate bids to be submitted on heating, electric wiring and elevators. A. J. Bellis, Orear-Leslie Building, Kansas City, Mo., is architect.

SAND SPRINGS, OKLA.—The Sand Springs Railway Company, it is reported, is contemplating the use of the surface contact system for operating its railway between Tulsa and Sand Springs to replace the overhead system now in use.

TULSA, OKLA.—The Mayor and Board of City Commissioners have approved a new ten-year contract with the Public Service Company of Oklahoma for lighting the streets, which also provides for the installation of an ornamental lighting system, consisting of 72 standards mounted with lamps of 1000 cp.

AUSTIN, TEX.—Bids will be received by Governor James E. Ferguson until June 18 for construction of five additional fireproof and two frame buildings for the State School for the Blind. Separate bids to be submitted for wiring, plumbing, heating, etc. Plans may be obtained on application to Atlee B. Ayres, Bedell Building, San Antonio, architect.

EL PASO, TEX.—The War Department at Washington has requested J. N. Gladding, city engineer, to submit estimates of cost of furnishing electricity for lighting the new cantonment to be established by the army at Fort Bliss. The army officials want to have the plant in operation by July.

SHERMAN, TEX.—The Ferguson Seed Farms have acquired a lot 150 ft. by 300 ft. with gin, consisting of eight stands and power plant, of Scott & McKnown, and have purchased an additional lot, 100 ft. by 175 ft., and will eventually use the latter for warehouses and special plants. It is proposed to overhaul gin and install additional machinery. Electric or oil power will be used.

Pacific and Mountain States

EVERETT, WASH.—According to ruling of the District Forest Department at Portland, Ore., the city of Everett holds priority, with the Pacific Pulp & Development Company second, in the matter of the water power in the Sultan River. It is now proposed that the Pacific Pulp & Development Company locate its plant in Everett, so that some amicable arrangement might be entered into whereby the city and the company could both use the water power of Sultan River.

MONTESANO, WASH. — Negotiations have been closed whereby Marshall & Company, bankers of Boston, Mass., have acquired the principal ownership of the Northwest Electric & Water Works holdings in southwest Washington, to be followed by the consolidation with the Washington Coast Utilities, a Marshall corporation, now operating on the Puget Sound. Improvements are to be made to the local plant, which will include the installation of a 700-hp. steam turbine engine, a 650-kva. generator and other equipment. The Elma and Sylvia Lake hydro plants will be kept in reserve; the local steam plant will supply service in both cities. The Washington Coast Utilities Company's plants are located at Edmonds, Richmond Beach, Vashon Island, Stanwood and Arlington.

SEATTLE, WASH.—Bids will be received by the Board of Public Works of the city of Seattle until July 20 for construction (complete) of a hydroelectric power plant; the proposed plant to have a continuous capacity of 13,000 kw., and a water supply sufficient to generate 25,000 kw. for five hours each day and 10,000 kw. for 19 hours each day. For details see proposal columns.

WALLA WALLA, WASH.—Application has been made to the County Commissioners by the Pacific Power & Light Company for a 50-year franchise to maintain electric transmission lines over certain roads in Walla Walla County.

PORTLAND, ORE.—The County Commissioners have granted the Portland Railway & Light Company a franchise to erect an electric transmission line on the Columbia River highway, subject to the approval of the district attorney, between the automobile club house and Crown Point.

FRESNO, CAL.—The San Joaquin Valley Light & Power Company is reported to be contemplating the construction of a substation, 6 miles south of Alpaugh, at a cost of $80,000. The transmission will be extended from the Corcoran power house. The new station will supply the rice fields just west of Pixley and Alpaugh and Allensworth Counties. The southern end of the new development and of the Tulare Lake Water Company will also be supplied from the new station.

LOS ANGELES, CAL.—The State Water Commission has granted the application of the Sespe Power & Light Company of Los Angeles for permission to appropriate 88 cu. ft. (second) from the Sespe River in Ventura County for power development purposes. The proposed development will involve an expenditure of $2,000,000 and will include a storage dam 175 ft. high, 2000 ft. long at the top.

OAKDALE, CAL.—An agreement has been made by the Oakdale and the South San Joaquin irrigation districts with the Sierra & San Francisco Power Company of San Francisco for furnishing electricity to operate pumps for irrigating large tracts of lands.

PORTERVILLE, CAL.—Preliminary surveys are being made by the Mount Whitney Power & Electric Company of Visalia for the construction of a new power plant near Porterville.

SAN BERNARDINO, CAL.—Plans are being prepared by the Santa Fe Railway System of Los Angeles for extensions to its locomotive and car works at San Bernardino, which will include a blacksmith shop, 45 ft. by 400 ft., a car repair building, 46 ft. by 1200 ft., and a one-story storage plant, 65 ft. by 300 ft., equipped with an electric traveling crane. G. W. Harris, Kerckhoff Building, is chief engineer.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company has purchased the water rights of the Mount Shasta Power Company on the Pit River, which it is estimated will develop 180,000 hp., with a possible later development of 412,000 hp. Work on the proposed development, it is understood, will begin next year. About five years will be required to complete the project.

SONORA, CAL.—Plans have been submitted to the City Trustees for the proposed municipal street-lighting system. The use of 500-cp. lamps on Washington Street and 250-cp. lamps in other parts of the city is now under consideration.

BOVILL, IDAHO.—An election will soon be held to submit to the voters the proposal to issue $5,500 in bonds for the construction of a municipal electric-light plant. The plans call for a 25-kw. Westinghouse direct-current generator, driven by a 40-hp. semi-Diesel engine.

DEARY, IDAHO.—At a special election held recently the proposal to issue bonds for the installation of a municipal electric-light plant was carried.

HOLLISTER, IDAHO. — The Public Utilities Commission has authorized the Idaho Power & Light Company of Boise to extend its transmission lines to the village of Hollister to furnish electricity for lamps and motors.

RONAN, MONT.—Application has been made by W. B. McDonald of the Northern Idaho & Montana Power Company of Sandpoint, Idaho, for a 50-year electric light and power franchise in Ronan. If granted the franchise the company will extend its transmission line down the east shore of Flathead and on to Ronan.

ALBUQUERQUE, N. M.—The Albuquerque Gas & Electric Power Company, recently incorporated with a capital stock of $500,000, will take over the properties of the Albuquerque Gas, Electric Light & Power Company and the Albuquerque Electric Power Company. The incorporators of the new company are: W. P. Southard, Charles S. Twogood, A. B. McMillen, Laurence Lee and D. K. B. Sellers.

Canada

EAST TORONTO, ONT.—The William Davies Company, 521 Front Street, East Toronto, is contemplating the erection of an addition to its boiler house, to cost about $6,000.

ELMIRA, ONT.—The ratepayers have approved a by-law to grant a loan of $15,000 to the Elmira Transmission Company.

PETROLIA, ONT.—The Town Council has given its first and second reading to the by-law authorizing an appropriation of $15,000 for extensions and improvements to the Hydro-Electric system.

PICKERING, ONT.—Electricity will soon be supplied through the Hydro-Electric Power Commission to Pickering Village and Pickering Township. The transmission line is to be extended westward from Whitby along the Kingston Road to the village of Pickering and thence to Claremont.

PORT ARTHUR, ONT.—Work will soon begin by J. J. Carrick, M. P., and associates, it is reported, on the erection of a pulp and paper mill just outside of the city limits of Port Arthur. The initial installation will provide for an output of 360 tons of paper per day, and will call for an expenditure of approximately $1,000,000. The mill when first put into operation will require 18,000 hp. The Ontario Hydro-Electric Power Commission, it is understood, proposes to develop Nepigon power for this purpose. Either a new substation will be erected or the present one on Hill Street will be enlarged.

PORT COLBORNE, ONT.—The Niagara District Hydro-Radial Association has forwarded a resolution to the provincial government asking that body to permit the con-

struction of the proposed electric railway from Fort Colborne to Bridgeburg and from Bridgeville to Fort Colborne immediately instead of waiting until after the war.

ST. THOMAS, ONT.—The Père Marquette Railroad Company has entered into a contract with the Hydro-Electric Power Commission for energy to operate its local shops.

WELLAND, ONT.—The contract for the erection of an electrode building for the Electro Metals, Ltd., at Welland, to cost about $10,000, has been awarded to W. J. Hickey, 91 Main Street, East Welland.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until June 25 for furnishing structural steel, wi rope, brass, copper, copper tubing, co denser tubes, electric wire, electric fixtur flexible joints, washing machines, e Blanks and information relating to this c cular (No. 1148) may be obtained at t above office or the offices of the assista purchasing agents, 24 State Street, Ne York, N. Y.; Audubon Building, New O leans, La., and Fort Mason, San Francisc Cal.

Record of Electrical Patents

Notes on United States Patents issued on May 29, 1917

1,227,568. Electric Switch; Floyd N. Barber, Crafton, Pa. App. filed April 21, 1913. Electromagnetic.

1,227,571. Electric Motor; Gustav Blumberg and John A. Butkus, Baltimore, Md. App. filed Oct. 13, 1915. Motor which can run on direct currents and also on alternating currents of any number of cycles per second within the limits of frequency used in the commercial distribution of electric power.

1,227,588. Electrical Connector; John Cuthbert, Chicago, Ill. App. filed March 8, 1916. Plug.

1,227,605. Electric Switch; John Friis, Chicago, Ill. App. filed Nov. 2, 1914. For use with electric sign.

1,227,721. Electrically Heated Utensil; Louis H. Wilkinson and Walter G. Barker, Meriden, Conn. App. filed Dec. 11, 1916. Electrically heated unit affixed thereto by a spring and covered by a depending skirt.

1,227,726. Cable Terminal; Daniel Woodhead, Chicago, Ill. App. filed Aug. 3, 1916. For use in connection with storage batteries.

1,227,752. Fusible Element for Inclosed Electrical Fuses; Robert C. Cole, Hartford, Conn. App. filed Oct. 27, 1916. Multiple links.

1,227,753. Fuse Block; Robert C. Cole, Hartford, Conn. App. filed Oct. 27, 1916. Spring-conducting clips for receiving the terminals of inclosed fuses, loosely retained in pockets on top of the blocks.

1,227,760. Thermo-Regulator; Achilles de Khotinsky, Chicago, Ill. App. filed April 29, 1916. Provides a thermo-regulator of the type in which a circuit is closed by the expansion of a liquid contained therein and forming one terminal of the circuit.

1,227,766. Sustaining Device for Vapor Converters; Sidney W. Farnsworth, Pittsburgh, Pa. App. filed July 14, 1915. Improvement.

1,227,771. Battery-Charging Equipment; Edward T. Foote, Montclair, N. J. App. filed Feb. 19, 1916. Means for charging batteries by the "across the line" or "constant-potential" method.

1,227,772. Electric Distributing System; Charles Le G. Fortescue, Pittsburgh, Pa. App. filed May 6, 1915. Means for minimizing inductive disturbances in electrical circuits that may be caused by other circuits in proximity thereto.

1,227,789. Electric Switch; Albert J. Horton, White Plains, N. Y. App. filed April 21, 1913. Actuated to connect an ammeter in series with and a voltmeter in shunt with the circuit which is controlled by said switch.

1,227,790. Control Panel; Albert J. Horton, White Plains, N. Y. App. filed June 30, 1913. For use in controlling the charging of storage batteries.

1,227,801. Electric Switch; Charles J. Klein, Milwaukee, Wis. App. filed Oct. 2, 1911. Adapted to make or break a circuit with a quick snap action.

1,227,809. Method of and Means for Transforming Direct Current; John C. Lincoln, Cleveland, Ohio. App. filed Feb. 2, 1912. To effect such transformation with a minimum loss of power.

1,227,810. Motor-Control System; Walter O. Lum, Wilkinsburg, Pa. App. filed April 12, 1915. Means for preventing the reversal of an electric motor while the current traversing its circuit exceeds a predetermined value.

1,227,830. Process of Uniting Metal Bodies; Archer W. Richards, Cleveland, Ohio. App. filed March 31, 1915. By electric welding.

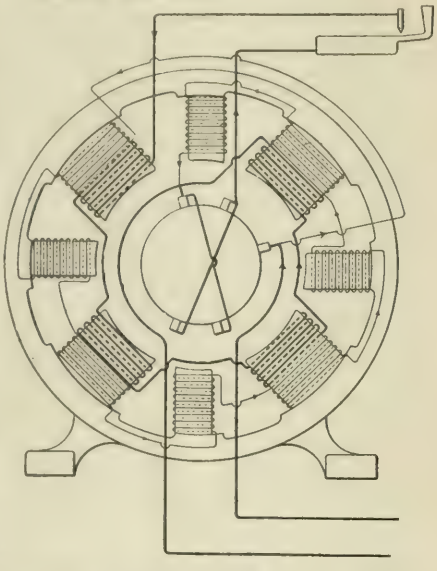
1,227,837. Electric Contact Box; Arthur W. Sclater, Piccadilly, Westminster, England. App. filed Oct. 26, 1914. Provides an adjustable bridge piece.

1,227,844. Variable-Voltage Transformer; Arthur Simon, Milwaukee, Wis. App. filed July 3, 1915. Provides an inclosed transformer of simple, compact and durable construction.

1,227,909. Production of Refractory Materials; Paul R. Hershman, Chicago, Ill. App. filed Oct. 21, 1916. Oxide to be employed is preliminarily mixed with a certain amount of carbon and then compressed to but a slight degree.

1,227,918. Plug and Receptacle Connector; Louis O. Lieber, Los Angeles, Cal. App. filed Feb. 3, 1916. Combination plug connector adapted for universal use.

1,227,921. Electric Regulator; George Machlet, Jr., Elizabeth, N. J. App. filed July 1, 1912. A prime mover to operate the regulating device under the control of the needle of the voltmeter of other indicating apparatus.



1,227,809—Method of and Means for Transforming Direct Current

1,228,028. Casing for Lamp Sockets and the Like; Charles J. Klein, Milwaukee, Wis. App. filed Dec. 18, 1913. Improved interlocking means.

1,228,032. Method of Electric Welding and Apparatus; Laurence S. Lachman, New York, N. Y. App. filed Oct. 24, 1916. Work is clamped by an electrode the pressure of which is applied in the direction of the welding pressure.

1,228,052. Electric Switch; Joseph H. Rusby, Nutley, N. J. App. filed May 22, 1913. Push-button.

1,228,058. Electric Relay; Frederick W. Schmidt, Chicago, Ill. App. filed Oct. 19, 1914. Electromagnetic relay in which the circuit is broken between mercury and mercury.

1,228,065. Current-Indicating Apparatus for Direct-Reading Wave-Meters for High-Frequency Oscillations; George Seibt, Berlin, Germany. App. filed Oct. 18, 1911. Will also serve the purpose of a safety fuse for protecting the wave meter.

1,228,075. Controlling System for Electric Elevators; William S. Smith, Cambridge, Mass. App. filed March 28, 191 Push-button system.

1,228,097. Electric Relay; James B. Cri pen, Chicago, Ill. App. filed Oct. 30, 191 Tensionless armature with but two pos tions of rest.

1,228,127. Conduit Outlet Box; Edwin Olley, Syracuse, N. Y. App. filed May 2 1911. Means for coupling boxes to th conduits without turning the boxes or th conduits.

1,228,142. High-Tension Insulator Sup port for Busbars; Edson O. Session Chicago, Ill. App. filed Aug. 16, 191 Improvement.

1,228,155. Pothead; Paul F. William Chicago, Ill. App. filed Sept. 18, 191 Casing is provided with removable mem bers by which access can be gained to it interior.

1,228,156. Connector for Electrical Con ductors; Paul F. Williams, Chicago, Il App. filed March 17, 1913. Involving tubular or hollow casing or housing fo an end portion of one of the conductor to be terminated or connected.

1,228,169. Manufacture of Electrodes Edmund H. Becker, Washington, D. C App. filed Sept. 27, 1916. Composed of granular copper oxide material, the gran ules consisting of an intimate and homo geneous mixture or combination of cupri oxide and cuprous oxide.

1,228,188. Pressure Regulator; Frederic S. Denison, Minneapolis, Minn. App. file June 29, 1916. Pressure gage havin means connected with the thermostati circuit so that when the pressure reache a predetermined point the circuit will b closed through the motor to shut off th draft, even though the thermostatic ba may still be in contact with the "cold" side of the thermostat.

1,228,195. Automatic Circuit Closer for Electric Heaters; Michael H. Farley Seattle, Wash. App. filed March 23, 1916 Automatic thermostatic switch or con troller for use in connection with an elec tric sadiron.

1,228,243. Water Heater; Frederick Poole Jewell, Kan. App. filed Feb. 2, 1915. In stantaneous.

1,228,250. Storage-Battery Construction; James M. Skinner, Philadelphia, Pa. App. filed May 11, 1916. Maximum proportion of active material in the external surface and parts adjacent thereto in the finished plate or electrode.

1,228,330. Outlet Box; Clyde H. Loughridge and Howard R. Loughridge, Pittsburgh, Pa. App. filed Sept. 24, 1915. Improvements.

1,228,337. Electrical Attachment Plug; Philip S. McLean, Bloomfield, N. J. App. filed April 4, 1916. Swivel type.

1,228,340. Portable Fireplace; Charles Maynard, Milan, Mich. App. filed Oct. 25, 1916. Heater is so designed as to retain foodstuffs in a heated or warm condition.

1,228,354. Electrical Fuse; Harry W. Young, Chicago, Ill. App. filed Sept. 26, 1914. Removable fuse cartridges.

1,228,359. Non-Hydrated Moisture-Containing Manganese Depolarizing Compound; Carleton Ellis, Montclair, N. J. App. filed Oct. 23, 1915. Depolarizers of the type suitable for use in dry batteries of the Leclanché type.

1,228,362. Switchboard or Mounting; John P. Hayes, Pittsburgh, Pa.; App. filed Oct. 5, 1914. Provides ample room and capacity for attachments and connections of the various conductor elements, with economy of material and space.

1,228,368. Wood Separator for Storage-Battery Plates; William Morrison, Chicago, Ill. App. filed Nov. 11, 1916. The pores of the wood are filled to a large degree with the precipitated barium salt.

1,228,369. Separator for Storage-Battery Plates; William Morrison, Chicago, Ill. App. filed April 2, 1917. The pores of the separator are filled to a large degree with the precipitated strontium salt.

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A Lesson from Canada

WHILE central station managers in the United States have been rather restive since war was declared, wondering how they would weather the approaching storm, our Canadian friends have passed through the crisis unscathed. Bereft as some of them have been through the voluntary enlistment of fully 35 per cent of their staff, and faced also with extraordinary difficulties of financing and of securing coal, they have met the situation manfully and, instead of suffering loss, are enjoying a prosperity wholly undreamed of and never before equaled. Happily almost all of the electricity used in Canada is generated from water power so that the scarcity and high price of fuel are not felt universally in the Dominion; but the demands for energy have been so great that all steam reserve apparatus as well had to be pressed into continuous service. In the use of electricity we have much to learn from Canada. Despite the low rates prevailing there, the inhabitants have not made so generous a use of electricity in the household as one would expect, but the industries more than make up for that deficiency. With a population of about 8,000,000, scattered for the most part along the St. Lawrence River and Lake Ontario, the per capita consumption of electricity in Canada is enormous. True, the manufacture of munitions has helped to swell the figures, but the total without that is still very large. The war has caused Canadians to make a virtue out of necessity in a way very much to their credit. Had selective conscription been adopted in Canada from the start, as it has been in this country, many of the highly trained and dependable men would have been spared to the companies to help carry the burden. American managers may therefore take heart. With all their anxieties and perplexities our Canadian friends have been equal to every emergency, and, what is most encouraging, they show no sign of overwork. On the contrary, they are unusually cheerful.

The Spacing of Transformers

THE brief paper by P. O. Reyneau on this subject is well worth a second reading if one is interested in the practical economics of distribution. The general theory of the situation is that while large transformers feeding long secondaries are highly desirable on account of better efficiency and regulation, improved load factor and better diversity conditions, so far as the transformers themselves are concerned, the extension of secondaries brings with it heavy installation cost and line losses which at some point in the development of the secondary system will balance the gains to be made by the larger units. Mr. Reyneau works out from very simple theory a set of curves which furnish a most convenient graphical method for finding the approximate point at which it does not pay further to increase the transformer spacing. As in practically every case of distribution, the complete theory is hard to apply in detail, although it furnishes a convenient method of approximation. As Mr. Reyneau suggests, the curves must be used with a basis of good judgment. The irregular call for energy, the uncertain distribution of the load from week to week and the wandering of the load center of each section from hour to hour make precise application of theory an impossibility save for instantaneous values of the variables, which are not of great practical service. However, a combination of good judgment with the principles laid down by theory may generally be counted on to win. It is the data for this combination that Mr. Reyneau has given us.

Calculating Coal Cost in Power Rates

FOR the last half dozen years electric supply companies have suffered steadily from increasing prices of everything except their own product. With unrestrained speculation thrusting up the cost of living, this in turn forcing up the price for labor, and with coal simultaneously shooting skyward, the supply companies have been quite consistently reducing the price of energy. Since the war began the situation has grown worse and worse; labor is scarcer and more exacting in its demands; owners and producers, transportation men and middlemen have been greedily clutching for more profits, and with these adverse factors in operation the price of coal has surpassed all previous records.

Through this the central stations have stood pat, while all around them transportation companies were calling for help. The time has come, however, when forbearance must be laid aside and some provision made for taking care of the enormous increase in cost of production. Let it be written down to the credit of the central stations of the country that in doing this they have gone ahead logically and fairly to provide for a permanent solution of the economic problem. The method taken is shown in the case of the Rockford Electric Company discussed elsewhere in our columns. It simply amounts to placing the power schedule, in which cost of fuel is always a large item, on a sliding scale, the price to the consumer rising or falling month by month in a perfectly definite way according to the changes up or down in the price of coal. No change is made in the lighting schedule in this case nor is there

any allowance for increase of cost other than in the one vital element of fuel.

This method of dealing with the situation has very much to commend it since it virtually takes the consumer into partnership so that he can get his power cheaply when it can be produced cheaply and shares its increased cost when conditions are adverse. In every way it seems to us a more equitable and desirable way of meeting the higher cost of power due to higher coal cost than an attempt to increase power rates by a flat percentage. Any fair-minded commission should see the justice of such a proposition and authorize its adoption as a fair measure of relief to the only industry which has not taken advantage of the time of stress to try to raise its prices as much as the traffic will bear.

The Photoelectric Cell as a Photometer

THE precision of any single observation of the candlepower of a lamp in a photometer is necessarily relatively low, even with the best of observers using the best of instruments. Thus, the precision of a single measurement of the resistance of a particular sample of manganin wire may easily be one part in ten thousand, so far as concerns accidental deviations and observational errors, whereas the precision of a single photometric measurement is commonly not more than, say, one part in two hundred. In the resistance measurement a zero balance is obtained on a delicate galvanometer, and the eye has only to judge whether the scale image moves or does not move when the galvanometer is thrown into circuit. In the photometric measurement the eye itself is the detecting instrument, and the observer has to make a judgment as to the equality of two adjacent retinal images. It is practically impossible to make a discrimination beyond a certain limit of approach to equality. In order to compensate, in part, for the inherent lack of instrumental precision in the photometric observer's eye, it is customary to rely, not upon a single measurement, but upon the mean value of a fairly considerable number of photometric measurements taken by the same observer in rapid succession. Since the probable closeness to the truth of the mean of a set of measurements taken under the same contingencies increases as the square root of the number included in the set, nine measurements are collectively three times as good as one measurement in probable approximation to the unerroneous result.

It has long been recognized, however, that instead of trying to improve the approximation of the photometric measurements by accumulating the observations of one or more observers, it would be more satisfactory to substitute an artificial eye for the human eye and to develop the precision of the substituted device. This device would naturally be some form of radiant-energy detector. That this is no chimera is certified by the assertion of botanists that the "eyes," or light-responsive organs, of certain plants are much more sensitive to light than is the human eye. A certain degree of success has been obtained with photoelectric apparatus during the last few years, subject to the difficulty that the curve of sensibility with respect to wave length in the spectrum is quite different in the real and artificial eyes.

The article by James R. Randolph in our Digest this week gives some interesting quantitative comparisons between photometric tests using real and artificial eyes on one and the same electric lamp. It is to be hoped that a suitable and reliable technique can be elaborated for photometric work with an artificial eye of this kind. The real eye is, of course, the only final criterion of success in this undertaking.

Bad Illumination and Accidents

PROFESSOR CLEWELL'S discussion of the relation of industrial lighting to safety ought to be in the hands of every employer of labor. It now seems to have been well demonstrated that as illumination decreases accidents increase, regardless of whether the decrease is due to a change from natural to artificial light or to the ordinary variations of daylight resulting from the time of day or the weather. Manufacturing buildings, taking them as they run, are not well lighted either by day or by night, although some modern industrial plants are so designed as to get very satisfactory day illumination from windows. These very buildings are often poorly illuminated at night as regards either quantity or quality of light, and sometimes they suffer by reason of the ample window space through which interior light escapes as effectively as light enters.

A very large proportion of workshops do not have adequate window space as compared with the floor space, and the neighboring buildings often obstruct the entering light. In such places artificial light is practically a necessity all the time over a considerable part of the area. It is small wonder therefore that in the average factory insufficient or improper lighting soon makes itself felt through the occurrence of accidents. As Professor Clewell indicates, insufficient light, glare and shadows are the three commonest sources of trouble. The examples he gives ought to be thoroughly convincing, and almost any engineer can duplicate them from his own personal observation. At the present lamp efficiencies and low cost of energy there is absolutely no excuse for bad illumination. Glare and shadows can both be avoided by proper choice and spacing of the lighting units, of which a sufficient quantity can be easily supplied.

Just now the gas-filled lamp is productive of much bad practice in industrial illumination. It is invaluable when properly applied and intolerable otherwise. Luminous flux from this source is so cheaply obtainable that there is no possible excuse for misapplying it. In fact, bad results must be due to ignorance or parsimony —ignorance of what conditions ought to be and niggardly policy in changing to the new illuminant. Three very simple rules will avoid most of the trouble. Always keep the filament out of direct view; always screen it by some diffusing material, and keep the walls and ceiling light in color, even at some little expense of

cleaning and whitewashing. As to quantity, if the conditions just laid down are fulfilled there is no danger of overdoing illumination. On a cloudy day the maximum light furnished is likely to be considerably below daylight illumination even in a well-lighted shop. These are times when night work is of special importance, and for efficient working as well as for avoidance of accidents good illumination pays.

Looking Toward Daylight Saving

ALTHOUGH it is rather late to put through any legislation to effect daylight saving for this year, some discussion has been aroused by Senate Bill No. 1854, introduced by Senator Calder of New York. This makes the customary provisions for establishing standard legal time, duly shoved ahead one hour for daylight-saving purposes. The period of the change according to this bill would be from the last Sunday in April to the first Sunday in September, and the bill if passed will become legally effective at the beginning of the next calendar year. The more excitable advocates of daylight saving object violently to putting over a trial of the system until next season, but considering the time it has taken Congress even to struggle toward the final stages of vitally important bills like those relating to treasonable activities and food conservation, we judge that the chance of beginning daylight saving this season is very slim.

We have expressed ourselves several times on this subject, and have seen no reason to change our general opinion that the proposed plan is on the whole pleasant and harmless. It would be a boon to the enthusiastic amateur gardeners who are planting cabbageheads in hills and sowing carefully peeled potatoes. To the ordinary worker it would give a little more daylight time for recreation in the evening. But we quite fail to see where any of the enormous savings expected by the friends of the measure are going to materialize. The reputed results in England are quite impossible to verify owing to the many causes which have co-operated during the war to change the consumption of electrical energy for lighting purposes. If less coal has been burned, it may be due to any one of a number of factors, and we are very doubtful whether daylight saving had very much to do with it or would produce any large measure of economy here.

Repulsion and Inductance of Reactors

THE increasing use of reactors to limit the possible rush of current through accidental short circuits has led to improvements in the design and mounting of these devices in central stations and substations. By inadvertence, it is possible so to associate reactors in different parts of an alternating-current system that, in the event of a short circuit, the mechanical forces brought to bear upon the reactors may injure them. Moreover, if they are improperly mounted, they may mutually affect each other at all working times in such a manner as to induce mutually unbalancing emfs. The subject is dealt with effectively this week by H. B. Dwight in an article which discusses both the mechanical forces and the mutual inductances.

On first thought there does not seem to be any close connection between the mutual inductance of a set of reactors, expressed say in henrys, and the mechanical forces, or couples, which they will mutually exert on each other, expressed say in kilograms weight or in kilograms acting at a meter. Nevertheless, it is a well-known proposition that if one such reactor is, say, firmly fixed and the other is capable of making any small excursion or bodily movement, either of translation or of rotation, then the forces with which the two will pull each other magnetically in the excursion will be the product of the currents in the two reactors times the change in their mutual inductance per unit of displacement. The forces will therefore be large if the mutual inductance happens to change rapidly in the assumed displacement, while they would vanish if the mutual inductance made no change.

It is interesting to observe in the article that altering the scale of geometrical construction and arrangement, including a set of reactors, does not alter the total mechanical forces between them so long as the traversing currents remain constant. If, on the other hand, the current densities are kept constant, the forces will increase with the square of the linear dimensions.

The Coming Issues

WHILE very few lighting companies, especially east of the Rockies, face conditions in the domestic field bordering on saturation, there is a real desire to know how to increase the number of consumers per 100 population. Generally any efforts in this direction have been by forced means. In the next issue of the ELECTRICAL WORLD there will appear an article describing how through better salesmanship the number of domestic consumers is being increased in thirty-two towns in the Middle West. The national need for intensified conservation of resources is recognized universally; it can yield far-reaching economic results in the vital field of hydroelectric development. An article in the issue of June 23 will urge national encouragement to hydroelectric construction. This issue will also contain the fourth installment of C. E. Clewell's series on industrial illumination, the particular subject which will be discussed being legal requirements of factory lighting. In this article the author points out that many companies have lagged behind in bringing their lighting facilities up to requirements owing to their failure to realize the value of adequate lighting in plant production, or because they are ignorant of the advances in lighting. Attention is called to the need of expressing the legal requirements for lighting in simple terms that can be readily understood and enforced. The last issue of June, dated June 30, will be devoted principally to industrial applications.

Repulsion and Mutual Inductance of Reactors

Some Considerations That Have Been Found Necessary When Installing Coils with Parallel Axes—Curves Which May Be Used to Obviate the Use of Formulas

BY H. B. DWIGHT

OWING to the increasing use of reactors in many systems for confining disturbances to the sections in which they originate it is important to know the magnitude of their mutual inductance and the forces exerted between them. The value of the mutual inductance is useful in calculating and correcting any

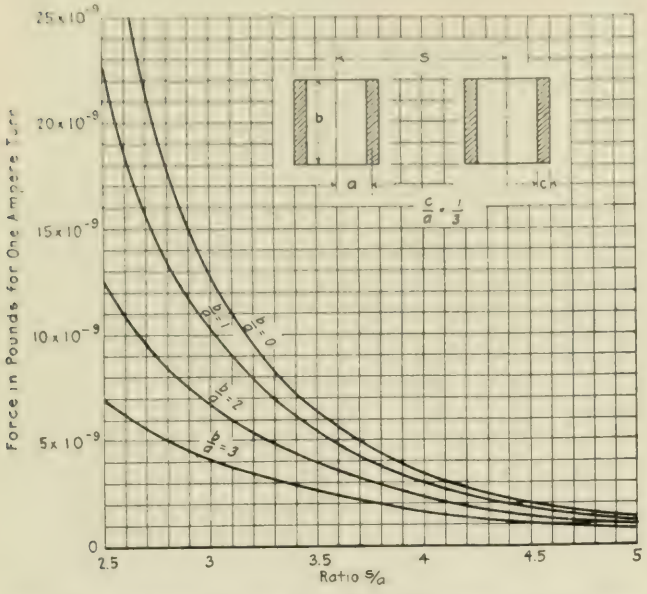


FIG. 1—MECHANICAL FORCE EXERTED BETWEEN COILS WITH PARALLEL AXES

unbalance of voltage which may be produced, while the attraction or repulsion which may exist between the coils is necessary in designing the supports and braces for the coils.

Since existing formulas which express the mutual action of cylindrical coils with air cores apply only to coils having the same axis, formulas will be derived here that will be applicable to similar coils placed side by side with their axes parallel. To obviate the necessity of using these formulas for calculations, however, curves based thereon will be presented. These curves and formulas will, it is believed, give results within a small percentage of accurate if the reactors are of the usual shape and at the usual distances apart.

Before deriving the formulas it may be pointed out that the mutual inductance of two thin solenoids A and B is the number of magnetic lines of force which interlink one coil when unit current flows in the other. This number will not be greatly changed if one of the coils be altered to have another shape of the same cross-sectional area, such as the approximately square shape shown in Fig. 5. The area of the section of the altered coil B is $m/\pi s \times 4\pi ms = 4m^2$. If this quantity is equal to the area of the round coil, πa^2, then $m = (a\sqrt{\pi}) \div 2$. Thus m is a constant which does not change when s varies.

The mutual inductance of coil A and a large concentric coil of radius $s - m$ and the same axial length b may be calculated by Searle and Airey's formula:*

$$M_1 = \frac{2\pi^2 a^2 N^2}{q}\left[1 + \left(\frac{3}{8}a^2 - \frac{1}{8}b^2\right)\frac{(s-m)^2}{q^4} + \left(\frac{15}{64}a^4 - \frac{15}{64}a^2b^2 + \frac{3}{128}b^4\right)\frac{(s-m)^4}{q^8} - \left(\frac{5}{64}a^4b^2 - \frac{5}{64}a^2b^4 + \frac{1}{128}b^6\right)\frac{(s-m)^2}{q^8} + \text{etc.}\right] \quad (1)$$

in which a is the mean radius, b the length, c the thickness of winding, s the spacing center to center, N the number of turns in each coil, $q = \sqrt{\frac{1}{4}b^2 + (s-m)^2}$ and $r = \sqrt{\frac{1}{4}b^2 + (s+m)^2}$. For the present the dimensions will be assumed to be in centimeters.

Similarly, the mutual inductance of coil A and a coil of radius $s + m$ is

$$M_2 = \frac{2\pi^2 a^2 N^2}{r}\left[1 + \left(\frac{3}{8}a^2 - \frac{1}{8}b^2\right)\frac{(s+m)^2}{r^4} + \left(\frac{15}{64}a^4 - \frac{15}{64}a^2b^2 + \frac{3}{128}b^4\right)\frac{(s+m)^4}{r^8} - \left(\frac{5}{64}a^4b^2 - \frac{5}{64}a^2b^4 + \frac{1}{128}b^6\right)\frac{(s+m)^2}{r^8} + \text{etc.}\right] \quad (2)$$

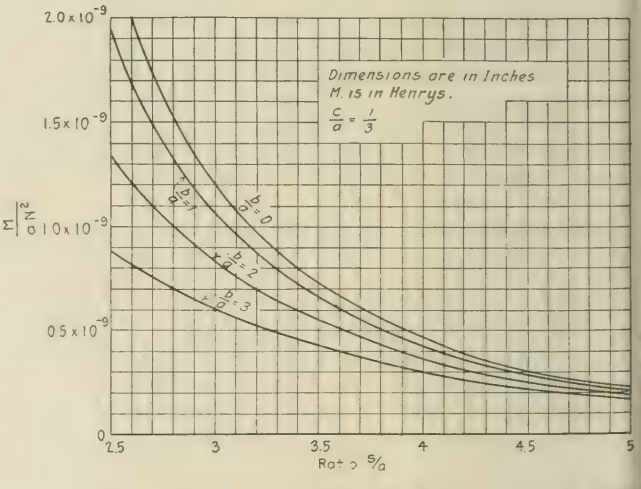


FIG. 2—MUTUAL INDUCTANCE OF COILS WITH PARALLEL AXES

The difference between M_1 and M_2 is the number of lines of force which pass through the circular belt of width $2m$ between the two large coils. Since the section of

*The *Electrician*, London, 1905, Vol. 56, page 318. *Bulletin* of the Bureau of Standards, Vol. 8, No. 1, equation 43, page 62.

the altered coil B is $m/\pi s$ times the area of this belt, the mutual inductance of coil A and the altered coil B is $m/\pi s\ (M_1 - M_2)$, in which M_1 and M_2 are given by equations (1) and (2). (3)

With coils of usual shape a small correction must be made on account of the thickness c of the winding, where the inside diameter of the coil is $2a - c$ and the outside diameter is $2a + c$. This correction may be made by means of the formula†

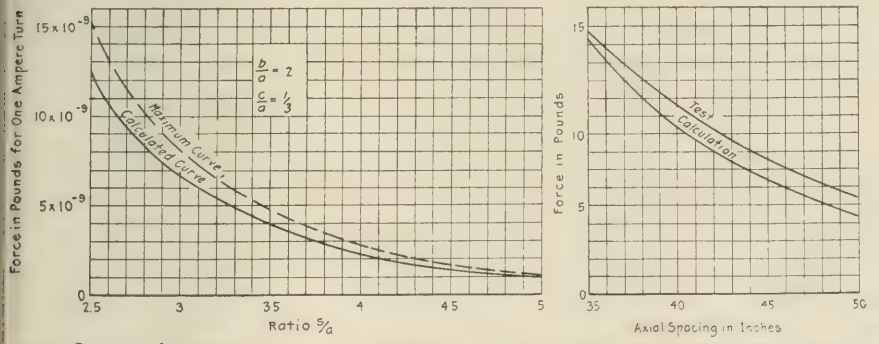
$$M = M_s + \frac{c^2}{24}\left(\frac{d^2M_s}{da^2} + \frac{d^2M_s}{ds^2}\right) \qquad (4)$$

where M is the mutual inductance of two thick coils of mean radii a and $s - m$ or $s + m$, and M_s is the mutual inductance of two thin solenoids of the above radii.

The corrected value of M_1, to a first approximation, is

$$M_1' = M_1 + \frac{\pi^2c^2N^2}{6q} = M_1 + \frac{2\pi^2a^2N^2}{q} \times \frac{c^2}{12a^2} \qquad (5)$$

Thus the first term in the series for M_1, equation (1), becomes $(1 + c^2/12a^2)$ instead of 1, and the same change is made in equation (2). It is evident that a coil with an unusually small orifice will require more correction terms in c than are given above. However, the above correction is sufficient for the usual current-limiting reactors, since the effect of the correction for thickness is only about 2 per cent in such cases.



FIGS. 3 AND 4—COMPARISONS OF FORMULA WITH MAXIMUM CURVE AND DATA OBTAINED BY TEST

When a coil is wound with large air spaces between the wires or cables, as is usual with current-limiting reactors, allowance must be made in calculating the self-inductance of the coil, but it may be neglected in approximate calculations of mutual inductance. However, in measuring the coil each dimension‡ should be taken as the number of wires or cables times the pitch, instead of the actual measured dimension over the copper, which is too small.

By including the terms in c and changing to units of inches and henrys, equation (3) becomes

$$M = \frac{2\pi a^2N^2m}{0.3937s \times 10^9}\left[\left(1 + \frac{c^2}{12a^2}\right)\left(\frac{1}{q} - \frac{1}{r}\right) - \left(\frac{1}{8}b^2 - \frac{3}{8}a^2\right)\left\{\frac{(s-m)^2}{q^5} - \frac{(s+m)^2}{r^5}\right\} + \text{etc.}\right] \qquad (6)$$

in which the dimensions are in inches. This equation contains enough terms for usual approximate work. If all the dimensions are in centimeters, the formula should be multiplied by 0.3937.

†See *Bulletin* of the Bureau of Standards, Vol. 8, No. 1, by Rosa and Grover, page 33. ‡See do., Vol. 8, No. 1, page 119.

Derivation of Force Formula

The force in dynes between two coils is exactly equal to the differential of the mutual inductance with respect to the distance between the coils when absolute units are used and when unit current is flowing. This relation may be shown by equating the mechanical and electrical work, when one coil moves a short distance ds in time dt. Thus $F\,ds/dt = -i_2e = -i_1i_2\,dM/dt$, since the voltage generated in the coil is equal to the rate of change of lines of force in it. Therefore, the force in dynes is $F = -i_1i_2\,dM/ds$, where i_1 and i_2 are the currents in the two coils. Equations (1) and (2) are in forms which are readily differentiated with respect to s, giving

$$F = \frac{2\pi a^2i_1i_2N^2m}{4.45 \times 10^7}\left[\left(1 + \frac{c^2}{12a^2}\right)\left(\frac{1}{qs^2} + \frac{s-m}{q^3s} - \frac{1}{rs^2} - \frac{s+m}{r^3s}\right) + \left(\frac{1}{8}b^2 - \frac{3}{8}a^2\right)\left\{\frac{(s-m)(s+m)}{q^5s^2} - \frac{5(s-m)^2}{q^5s} - \frac{(s-m)(s+m)}{r^5s^2} + \frac{5(s+m)^2}{r^5s}\right\} + \text{etc.}\right] \qquad (7)$$

As in the case of straight conductors, only ratios of the various dimensions are involved in the formula for mechanical force, so the dimensions may be either in inches or in centimeters, so long as they are all in the same units. The interesting condition results, therefore, that if all the dimensions, including spacing, of a group of coils be increased by a certain ratio, the mechanical force in pounds is not changed at all.

The value of force given by formula (7) is the average force due to alternating current and is the same in value as the force due to direct current. At the peak of the alternating-current wave in a single-phase circuit the force rises to double the value given by this formula. When the momentary current becomes zero the force becomes zero.

The results of formulas (6) and (7) are only approximate for two round coils, although they may be theoretically exact for coil A and the altered coil B (Fig. 5) if enough terms of the series are calculated. Probably the closeness of this approximation can be determined best by making laboratory tests and comparing the test measurements with the calculations. However, a rough estimate can first be made by considering another alteration of coil B (Fig. 6).

This alteration of coil B is such that part of the area of section of the round coil is moved nearer to A and thus into regions of stronger magnetic flux. Therefore the mutual inductance is increased, and as the effect is accentuated at small spacings of the coils, the rate of change of the mutual inductance, and consequently the mechanical force, are also increased. Thus the mutual inductance and the repulsion of coil A and the altered coil B (Fig. 6) are considerably greater than the true values for the two round coils, as shown by the following formulas.

The formulas giving maximum results for values of s a less than 5 are:

$$F \text{ (in pounds)} = \frac{2\pi^2 a^2 i_1 i_2 N^2 10^{-7}}{3.26 \times 4.45(s - 0.185a)}\left[\left(1 + \frac{c^2}{12a^2}\right)\left\{\frac{1}{q(s-0.185a)} + \frac{s-a}{q^3} - \frac{1}{r(s-0.185a)} - \frac{s+0.63a}{r^3}\right\} + \left(\frac{1}{8}b^2 - \frac{3}{8}a^2\right)\left\{\frac{2(s-a)}{q^3} - \frac{(s-a)^3}{q^5(s-0.185a)} - \frac{5(s-a)^3}{q^7} - \frac{2(s+0.63a)}{r^3} + \frac{(s+0.63a)^4}{r^5(s-0.185a)} + \frac{5(s+0.63a)^3}{r^7}\right\} + \text{etc.}\right] \quad (8)$$

$$M \text{ (in henrys)} = \frac{2\pi^2 a^2 N^2 \times 10^{-7}}{0.3937 \times 3.26(s-0.185a)}\left[\left(1 + \frac{c^2}{12a^2}\right)\left(\frac{1}{q} - \frac{1}{r}\right) - \left(\frac{1}{8}b^2 - \frac{3}{8}a^2\right)\left\{\frac{(s-a)^3}{q^5} - \frac{(s+0.63a)^3}{r^5}\right\} + \text{etc.}\right] \quad (9)$$

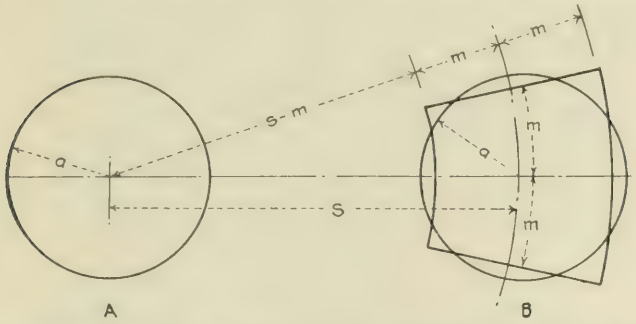
where the dimensions are in inches, and where

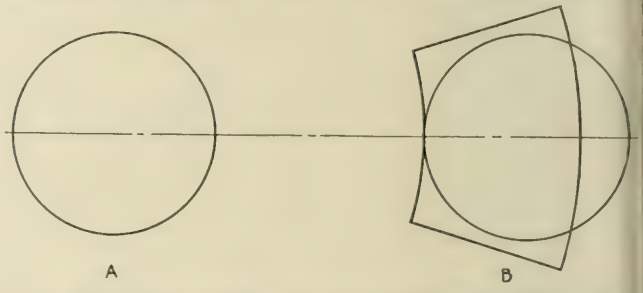
$$q = \sqrt{\frac{1}{4}b^2 + (s-a)^2}$$

and

$$r = \sqrt{\frac{1}{4}b^2 + (s+0.63a)^2}.$$

The changes in the inductance with the conditions in Fig. 6 are very much greater than with the conditions in Fig. 5, because in the latter some parts of the area





FIGS. 5 AND 6—SECTION OF TWO SOLENOIDS AND ALTERATION OF ONE COIL TO INCREASE INDUCTANCE AND REPULSION

are moved into regions of stronger flux and other parts into weaker, and so the changes balance each other to a large extent. By an examination of Fig. 5 it may be seen that the remainder is moved away from coil A into regions of weaker flux, so formulas (6) and (7) are slightly too small. Since the maximum curve of Fig. 3 is considerably too large and the curve calculated according to formula (6) is slightly too small, an inspection of Fig. 3 shows that formula (6) must be correct within a very small percentage. The values of mutual inductance given by formula (9) are larger than those of formula (7) in practically the same ratio as formula (8) is larger than formula (6). Consequently, formulas (6) and (7) have practically the same accuracy.

Formulas (6) and (7) may be useful when extended to include further terms of the convergent series of which they are a part.

Following are examples which are given to show the use of the formulas for repulsion and mutual inductance. In determining the average mechanical forces due to three-phase currents, the forces due to the products of the instantaneous values of two alternating currents which are 120 deg. out of phase are calculated in the same way as the watts due to the products of the instantaneous values of an alternating current and an alternating voltage which are out of phase.

Example I. Find the average mechanical force acting on each of two coils carrying single-phase current, the conditions being as follows:

Mean radius of coils (in.) $= a = 12.56$; length of coils (in.) $= b = 30.06$; thickness of winding (in.) $= c = 4.87$; number of turns $= N = 114$; current (amp.) $= i_1 = i_2 = 400$, and the coils are placed side by side with the parallel axes 45 in. apart.

From the above data, $m = 11.13$, $s = m = 33.87$, $s + m = 56.13$, $q = 37.1$, and $r = 58.1$. Therefore

Force (lb.) $= 516{,}000\,[1.0125 \times 10^{-8}(1.332 + 1.478 - 0.850 - 0.636) + 53.8 \times 10^{-8}(1.34 - 4.48 - 0.14 + 0.88)] = 6.25$ lb. (see Fig. 4).

Using Fig. 1 for approximate work instead of formula (6), $F = 3 \times 10^{-9} \times 114^2 \times 400^2 = 6$ lb.

Example II—Find the average mechanical force on each of three coils of the same size and spacing as those in Example I, placed side by side in a row and carrying three-phase current (400 amp. per phase).

Let the three coils in a row be called a, b and c. The currents in them are 120 deg. apart in phase. The average force on a caused by I_b is 6.25 cos 120 deg. $= 3.12$ lb., the calculation being similar to Example I.

To find the force on a caused by I_c, formula (7) is used, the axial spacing being 90 in. The average force on a caused by I_c is 0.50 cos 120 deg. $= 0.25$ lb. This quantity is to be added to the force caused by I_b, making a total average force on a of 3.37 lb., tending to move it toward the center coil. Coil c is also under an average attraction of 3.37 lb. Coil b is attracted by both a and c, and although there is a momentary force, first in one direction and then in the other, the average force on b is zero. Since the above forces increase as the square of the current, they attain large values at times of short circuit.

Example III.—Find the voltage drop due to mutual inductance in each coil of Example II, the frequency being 60 cycles.

Using formula (6), with a spacing of 45 in., $M_{ab} = 0.0081\,[1.0125(0.02698 - 0.01722) - 53.8(0.0000164 - 0.0000048)] = 7.5 \times 10^{-5}$ henrys. Also, from Fig. 2, $M_{ab} = 0.46 \times 10^{-9} \times 114^2 \times 12.56 = 7.5 \times 10^{-5}$ henrys.

Using a spacing of 90 in., $M_{ac} = 1.1 \times 10^{-5}$ henrys.

Let the currents in the three coils a, b and c be

$$I_a = 400 \text{ amp.}$$
$$I_b = -200 + j200\sqrt{3} \text{ amp.}$$
and $$I_c = -200 - j200\sqrt{3} \text{ amp.}$$

The drop in a due to mutual inductance is

$$2\pi \times 60j(I_b M_{ab} + I_c M_{ac}) = -8.4 - j6.5 \text{ volts.}$$

The drop in b due to mutual inductance is

$$2\pi \times 60j(I_a M_{ab} + I_c M_{bc}) = 9.8 + j5.7 \text{ volts.}$$

The drop in c due to mutual inductance is

$$2\pi \times 60j(I_a M_{ac} + I_b M_{bc}) = -9.8 - j4.0 \text{ volts.}$$

Power Rates Raised by Coal Cost

Alarming and Continuing Cost and Scarcity of Fuel Lead to Advances in Rates for Electrical Energy for Power—Action of the Rockford (Ill.) Electric Company Before Public Utilities Commission

AN ACUTE rate situation is raised for central stations and consumers by the alarming and continuing high cost and scarcity of fuel. Coal consumption is so great a factor in power production that the companies, large or small, cannot absorb the heavy increase in cost without either raising rates or suffering reduction in net income. On power business particularly the justice of a rate fluctuating with coal costs is receiving general recognition; the consumers affected are in business themselves; they understand readily what the companies face as a result of the abnormal coal situation. It is for this reason that so many companies are adding clauses to their power schedules as a protection against the serious conditions of last winter. In some cases this does not involve the necessity of application to the State Public Service Commission, in others the approval of that body is essential.

One of the interesting cases is that in which the Rockford Electric Company seeks the approval of a coal clause by the Illinois Public Utilities Commission. This company is controlled by the American Gas & Electric Company, of which M. F. Millikan is vice-president and general counsel.

Range of Coal Cost Affecting Rates

A supplement applicable to power rates, filed by the company with the commission, is in substance as follows:

> The rates set forth in the published schedule of the company, designated as power schedules H, I, J, K, L and M, will be the only basis of charge for power during such months as the average cost of coal f.o.b. cars on the power-plant switch track of the company in Rockford shall be not more than $2.25 per ton and not less than $1.75 per ton.
>
> For each 5 cents decrease in the average monthly cost of coal below $1.75 per ton f.o.b. cars on the power-plant switch track, there will be deducted each month from all net bills based upon power schedules to which this schedule is supplementary one-tenth of a mill per kilowatt-hour.
>
> For each 5 cents increase above $2.25 per ton there will be added one-tenth of a mill per kilowatt hour.

The total cost of coal to the company for January, February and March was:

	1916	1917	Increase	Per Cent Increase
January	$12,481	$21,822	$9,341	75
February	13,635	19,240	5,605	41
March	12,412	17,314	4,902	40
	$38,528	$58,376	$19,848	52

That increased costs are not due to increased consumption was shown by the company as follows:

	Tons Coal Burned		Average Cost per Ton		Per Cent
	1916	1917	1916	1917	Increase
January	6450	6326	$1.93	$3.45	79
February	6750	5873	2.02	3.28	62
March	5939	5550	2.09	3.12	49
	19,139	17,749			

Although uncertain how long the present situation in the coal market will last, the company says that "there seems to be no immediate prospect that the conditions will again become what has heretofore been considered normal."

Cost of coal represents practically 75 per cent of the cost of the production of electric energy, and if some provision is not made for taking care of the increase, it will mean that the company will be unable to finance the betterments, extensions and improvements which are required for the service of the public and that there can be no return to the persons who have invested in the securities of the company.

Methods of Recouping

Discussing the two methods by which increased cost might be overcome—a horizontal increase in the price of electric energy or an increase based upon increased cost coal—the company says:

"If a horizontal increase in rates be put in effect, pursuant to authority of the commission, it will be necessary in order to afford protection to the company to make the increase in rate sufficient to meet conditions of maximum cost of fuel as far as may be ascertained, based upon recent experience.

"Rates so fixed would, with reason, be maintained until basic conditions are permanently restored to a more normal condition. If so happens that there is a fluctuation from month to month the customers of the company would derive no advantage under this method.

"There is no assurance that the new schedules, however carefully established now, might not again fail to meet the situation as it may develop.

"It has seemed to the officers of the company that it would be more equitable and more satisfactory to meet the difficulty by such a supplement as has been filed rather than to ask for a straight increase in the price charged for electric energy. If a straight increase in the price charged for electric energy were asked and allowed, there is no assurance that the new schedules would not within a few months result in precisely the same situation which to-day confronts the company."

Increased Fuel Cost Alone Covered

The company has submitted evidence to show that application of the proposed supplement will return only the increased fuel cost. It is not the purpose to increase net revenue in this way.

With the method proposed power customers will derive whatever advantage may accrue through favorable fuel prices during any month and will be assessed for only the additional fuel cost actually incurred to supply them with the energy they use.

The following amounts per kilowatt-hour would have been added to power bills had this supplement been in effect:

		Mills
January	$3.45 — 2.25 = 1.20 = 24 points	= 2.4
February	3.28 — 2.25 = 1.03 = 21 points	= 2.1
March	3.12 — 2.25 = .87 = 17 points	= 1.7

The revenue of the company from commercial, residential and municipal lighting, it is pointed out, is ap-

proximately one third the total revenue, and it is proposed to absorb so long as may be possible increased operating costs on these classes of business.

The proposed increases are made applicable to power users because of the lower rates extended to them and also because of the fact that if operating individual plants (which many have done in the past) these customers would have to meet the same extraordinary increased expenses for fuel as the company; moreover, they in turn may meet a part of the increased power expense by a modification of the selling prices for their products.

Notice of the intention of the company to apply to the commission for the approval of the supplement was published for two successive weeks in newspapers of general circulation in Rockford. In addition the matter was given wide publicity among those affected by the weekly bulletin of the Merchants and Shippers' Association, practically all of whose members are power customers of the company. The secretary of that association appeared at the hearing before Commissioner Shaw and testified that not one objection had been taken to the proposed increase.

Individual Plants Similarly Affected

"Practically every power consumer of the utility," the company says, "is a potential competitor in so far as furnishing power to himself is concerned. If the power user operates his own plant, he cannot ascertain what the cost of such operation will be until long after the service has been rendered; he cannot know exactly what his fuel, labor or other elements of the cost of power will be until he has purchased the same. If his fuel contractor is unable to make deliveries, he must then have recourse to the open market and pay the prices demanded under such conditions precisely in the same manner that the utility must.

"Therefore the conditions under which he operates are essentially the same as the arrangement which we propose, although under the proposed arrangement he is still able more nearly to determine his costs because of the fact that the price of coal has been reasonably uniform for the past ten or fifteen years and up to the latter part of 1916. There has heretofore been but little or no occasion for such a supplement as is now proposed, although it has been a recognized principle in private business for a great many years that the price of the finished product should vary in accordance with the price of raw material and labor used in the manufacture of material. Industrial conditions since the outbreak of the world war have been such as to cause an enormous increase in the consumption of coal and to make it all the more difficult for public utilties to supply themselves with coal for conversion into electric energy at a price which will permit the continuance of rate schedules based upon past prevailing prices of coal.

"This company has done all that is possible to protect itself for the future. It has entered into contracts to cover its full requirements for the coming year with reputable and responsible people, but there is no assurance that these people will carry out their commitments.

"The company is increasing its storage capacity from 6000 tons to approximately 20,000 tons at a cost of abouf approximately $50,000 to enable it to store fuel bought under the best existing conditions to protect itself and its customers against shortage or interrupted supply. The capacity being provided will be sufficient under ordinary circumstances to supply all of the coal required by the company over a period of from two and one-half to three months.

"While it has been a fact in the past that an assurance of the stability of the cost of service has been not only desirable but necessary on the part of the utility, the existing conditions under which we now operate show the fallacy of the principle that the total resultant cost from the application of a schedule can be known in advance of the period during which service is rendered thereunder.

Application of Rate

H. C. Eddy, new-business manager American Gas & Electric Company, testified before Commissioner Shaw:

> The average cost of coal say during the month of January, 1917, was $3.45 per ton. The based price above which this schedule becomes operative is $2.25. Excess cost of coal then for January above the based price is $1.20 per ton. The kilowatt-hours generated for power supplied customers affected by this schedule during January was 1,318,093. The average efficiency of the generating plant for that month was 3.31 lb. per kilowatt-hour, which corresponds to a consumption of coal required to produce the power sold under the schedule affected by this supplement to 2181 tons; the excess cost being $1.20, it follows that the total excess cost of coal required to supply power to customers affected was $2,617.20. The additional income which the company would derive by the application of this coal clause would have been for January $2,750.80, returning thereby to the company $133.60 more than the cost of coal.
>
> The average cost of coal for February, 1917, was $3.28 per ton, representing an excess of $1.03 per ton above the based price named in the schedule. The output of kilowatt-hours required to supply customers affected by this schedule was 1,211,154. The efficiency during February was 3.51 lb. of coal per kilowatt-hour, which would correspond to a consumption of 2150 tons required to supply power customers affected; 2150 tons at $1.03 excess cost comes to $2214.50. The additional revenue returned to the company by the application of the supplementary schedule was $2211.94, leaving a deficiency of $2.56.
>
> Because of the slight variance in coal consumption per kilowatt-hour from month to month, it is out of the question from an accounting standpoint and also from a standpoint of a schedule to find a factor which shall, month in and month out, exactly return the excess cost of coal, and the figures I have submitted show that a proposed increase of one-tenth of one mill per kilowatt-hour for each 5-cent increase in the cost of coal based at $2.25 accomplishes this result with approximate accuracy.

The company mentions other similar provisions in contracts between other utilities and consumers, including that of the Commonwealth Edison Company and Chicago City Railway, the Cleveland Electric Illuminating Company and Cleveland Railway, the Atlantic City Electric Company, the New York Edison Company; the United Electric Light & Power Company, New York; the Duquesne Light Company, Pittsburgh, and the New Bedford (Mass.) Gas & Edison Light Company.

In conclusion the company urges early determination as it "is in urgent need of immediate relief from the very serious increases it has been compelled to bear in the cost of coal as well as all other materials used in the performance of its services, although it has asked no increase in its rates due to the increased cost of materials, labor and supplies other than coal."

Relation of Industrial Lighting to Safety

Varying Intensities of Illumination, Insufficient Quantities of Light, Shadows and Exposed Sources of Light Are Frequent Causes of Accidents — Examples of Accidents Caused by Improper Illumination

BY C. E. CLEWELL

Assistant Professor of Electrical Engineering, University of Pennsylvania

Adequate lighting is an important addition to the list of safety precautions for any factory, and particularly so where workmen's compensation laws are in force. The fact that the trend of casualty insurance companies is to offer reduced premium rates to well-lighted factories, or what amounts to the same thing, to penalize by higher rates the poorly lighted plant, is evidence that the well-lighted industries are beginning to be looked upon as preferred risks, other things being equal. Some typical cases where bad lighting has contributed to industrial accidents are described and illustrations are given to show wherein inadequate or poorly arranged lamps have caused such accidents. Were there no other incentive for the installation of the best available systems of illumination, the average factory could well afford to view the expenditure for lamps and wiring as a safeguard against just the class of accidents described. These features of the lighting problem, therefore, commend themselves to factory managements as of unusual and timely interest.

WIDESPREAD investigations in the past have shown that the industrial accident rate is greater where work is performed under artificial light than where it is done under natural lighting conditions. For example, Fig. 1 shows graphically the percentage of difference between accident rates under daylight and under artificial light for a given year.[1]

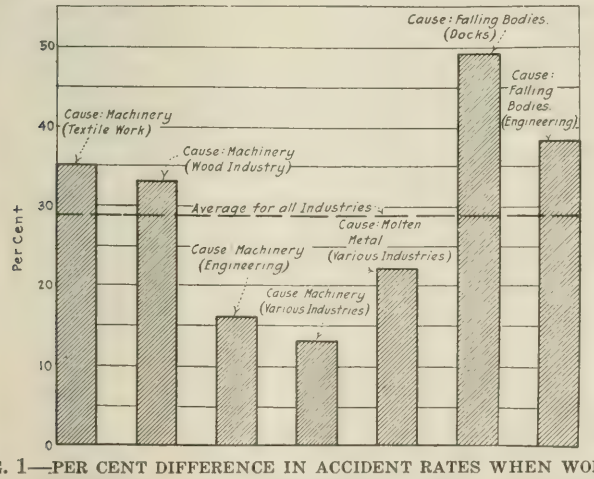


FIG. 1—PER CENT DIFFERENCE IN ACCIDENT RATES WHEN WORK IS PERFORMED UNDER DAYLIGHT AND ARTIFICIAL LIGHT

This fact in itself does not necessarily show that artificial light is the cause of the greater accident rate, but rather seems to point to poor lighting conditions as the probable cause.

The general facts indicated by Fig. 1 are further illustrated by the findings[2] of a prominent American casualty insurance company, based on a study of conditions in 1910, which show that of 91,000 accidents in and about industrial plants 23.8 per cent were due, directly or indirectly, to the lack of proper illumination. This particular company is able to give authoritative data on the subject because its specialists in accident-prevention work keep a record of every accident in and about factories and mills which carry insurance with the company. In the case of all important accidents the surrounding conditions at the time of the accident are investigated. The foregoing figures may therefore be taken as representative of the part played by poor lighting in the industrial accident rate in this country.

Variable Daylight as a Factor

The large differences in light intensities due to daylight within factory buildings are not always appreciated in relation to this problem. The curves[3] in Figs. 2 and 3 give some idea of the differences which may occur. Extreme variations of exterior daylight conditions like this obviously make corresponding changes in the interior illumination of industrial buildings Factories which depend on side windows only may have spaces where the ratio of interior to exterior light is as low as 0.2 of 1 per cent. In such a case a factory space, under the conditions of exterior daylight shown by Fig. 3, will have less than one foot-candle of natural illumination in the mornings up to 10 o'clock and in the afternoons after 2 o'clock on an average December day. These figures are selected because they are typical of extreme conditions.

Many circumstances may thus combine to render light a contributory cause for an accident. The enormous intensities of exterior illumination shown by the upper line in Fig. 2 give some idea of the stimulus to the eye when the line of vision is directed through a window to outside spaces or even upon interior surfaces which receive the direct light from the sun. A sudden decrease of natural light due to heavy clouds and the transition to the very much reduced intensities common with artificial illumination may readily be a cause for inaccuracies in visual judgment.

In a similar way the transition from natural to artificial light in the afternoons of winter days, with the necessity for accommodation of the eye to the different quality and quantity of the artificial lighting, as well as variations in the directions by which the artificial light reaches the machines, must all be taken into account. It appears, therefore, that at the times when artificial and natural light are both present in the late afternoon, with a fading condition of daylight, the influence of the resultant illumination on the accident rate may also be a material factor, in distinction to conditions governed solely by artificial light, as at night.

Artificial Light as an Influence

The extremely serious charge against artificial light evidenced above cannot justly be based on the light, but must be attributed rather to improper artificial illumination, prominent causes of which are inadequate light,

[1]Based on a study of conditions in 1913 as given in the British factory-lighting report of 1915, page 25.

[2]Reported by R. E. Simpson, *Transactions* Illuminating Engineering Society, Vol. X, No. 9, page 868.

[3]Figs. 2 and 3 are based on the British factory lighting report previously referred to, pages 64 and 65.

glare and shadows. The provision of sufficient quantities of light and the elimination of shadows are easier to bring about than is the elimination of glare.

The blinding effect of lamps has unfortunately greatly increased with the increasing use of the vacuum tungsten lamps, and particularly with that of the nitrogen

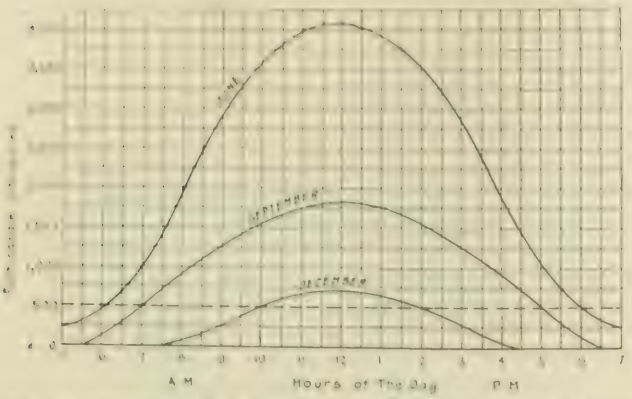


FIG. 2—APPROXIMATE VARIATIONS IN DAYLIGHT ILLUMINATION INTENSITIES UNDER OPEN SKY

filled tungsten units. In this connection, Mr. Simpson in a report (see footnote 2) goes so far as to say in effect that, while excellent results in the way of diffusion and distribution can be and have been obtained by the use of dome-type reflectors with the nitrogen-filled tungsten lamps, when viewed from the standpoint of safety, they should never be used together, unless the mounting height is sufficient to remove any possibility of the unprotected part of the lamp coming within the line of vision. Unless this policy is followed, it is inevitable that the eyesight of the workmen will be impaired, with a consequent increase in the likelihood of accidents.

While the necessity for good light in spaces used for manufacturing is great, it is very interesting to note the tendency for a large proportion of accidents to occur on stairways, in passageways and throughout infrequently used parts of factory buildings. For this reason it is perhaps advisable to emphasize the unusual importance of giving attention to the proper lighting of these spaces, which would ordinarily have a secondary place in the program of good lighting. Recent factory-lighting codes in this country emphasize this phase of the problem.

While general statements covering the relations of light to accidents are of value and interest, they have the disadvantage which is likely to follow when a problem like that of accident prevention is treated in the form of an abstract rather than a concrete discussion. For this reason several actual cases of accidents which have been due to poor light will now be introduced to illustrate some of the features mentioned above.

Actual Cases of Accidents Due to Poor Light

The first of these cases illustrates the evils of dense shadows and the need of fairly uniform illumination on the floors of passageways and aisles which are used for the transportation of materials on trucks. Fig. 4 represents a space[4] in a factory where poor lighting results from an unduly wide separation of the lamps. The lamp nearest the aisle is behind a column which casts a dense shadow on the passageway floor, thus making it practically impossible to see a flat 2-in. (5.08-cm.) iron bar which happens to be lying at an angle across the floor.

The truck which is shown was pulled along the passage by a workman who failed to see the iron bar. As a result, one of the front wheels struck the bar and thus threw the axle of the truck sharply to the right, jerking the handle out of the truckman's hand and causing it to strike the right foot of another employee who had stepped to one side to let the truck pass. This blow broke a small bone in his foot. Moreover, the sudden jar of the truck threw off one of the heavy pipes, which rolled along the truck handle and against the left leg of the same workman, breaking both bones below the knee. There is little doubt that with sufficient light at this point at least one of the two workmen would have seen the bar, and the workman normally would have removed the bar instead of trying to pull a heavily loaded truck over it.

A Crane Accident

Fig. 5 illustrates a case where incandescent lamps with steel reflectors were placed below a post crane. The post crane was struck by the load suspended from a traveling overhead crane, and the shock knocked a steel beam from the grab hooks of the post crane and caused injuries to employees who happened to be beneath. The overhead-crane operator asserted that he could not tell that the load was being carried near enough to the floor to strike the post crane.

From the illumination standpoint, two features are to be noted in this accident—first, the difficulty experienced in seeing the work on the shop floor because of the inadequacy of the general lighting system, and, second, the disadvantage in the use of lamps near the

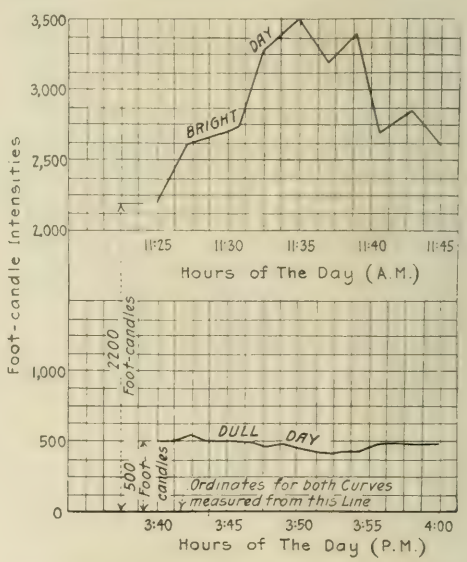


FIG. 3—VARIATIONS IN MEASURED ILLUMINATION INTENSITIES UNDER OPEN SKY IN MARCH

floor and under projections such as this post crane, because of the fact that the post-crane projection was by their use cut off from all upward light and was rendered invisible from overhead when viewed at sharp angles by the crane man in approaching this part of the shop from a distance.

As pointed out previously, one of the worst features

[4]The description of each of these cases, together with the arrangements for the sketches, is due to R. E. Simpson, engineer with the Travelers Insurance Company, Hartford, Conn. See also "Illumination and One Year's Accidents," *Transactions* I. E. S., Vol. X, No. 9, page 868.

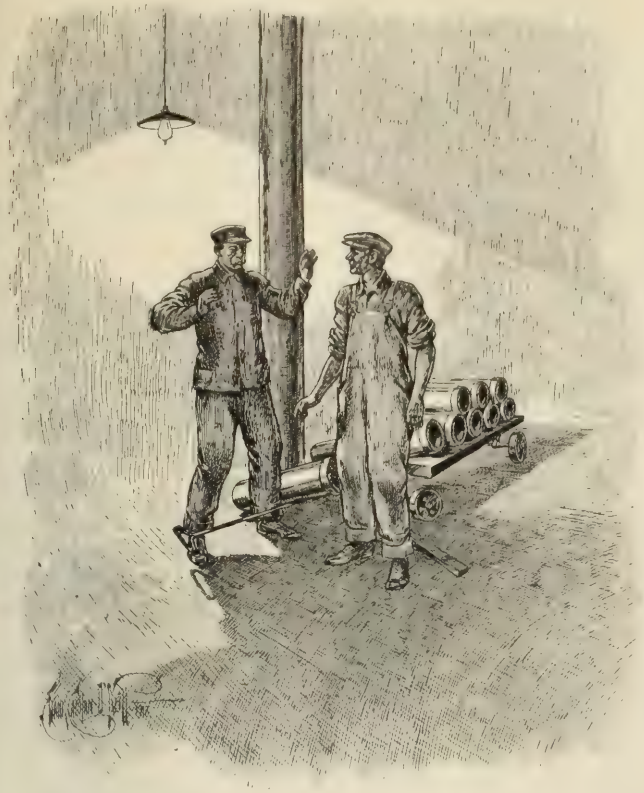


Fig. 4—Jar caused by truck striking bar concealed by shadow on floor knocked truck handle from workman's hand and dislodged pipe, thereby breaking other workman's leg.

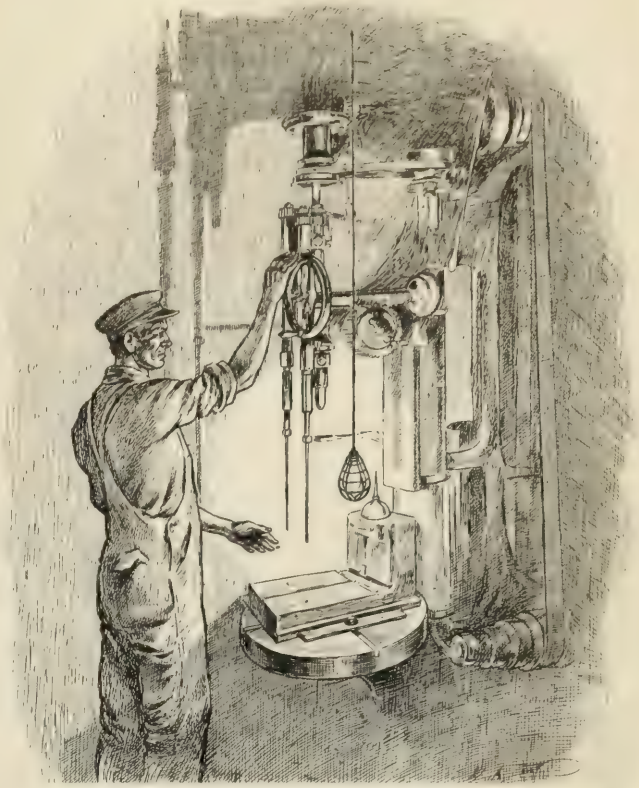


Fig. 6—Blinded by the glare of the bare lamp over the drill-press table, the operator stuck his fingers between gears while reaching for the drill-press feed control.

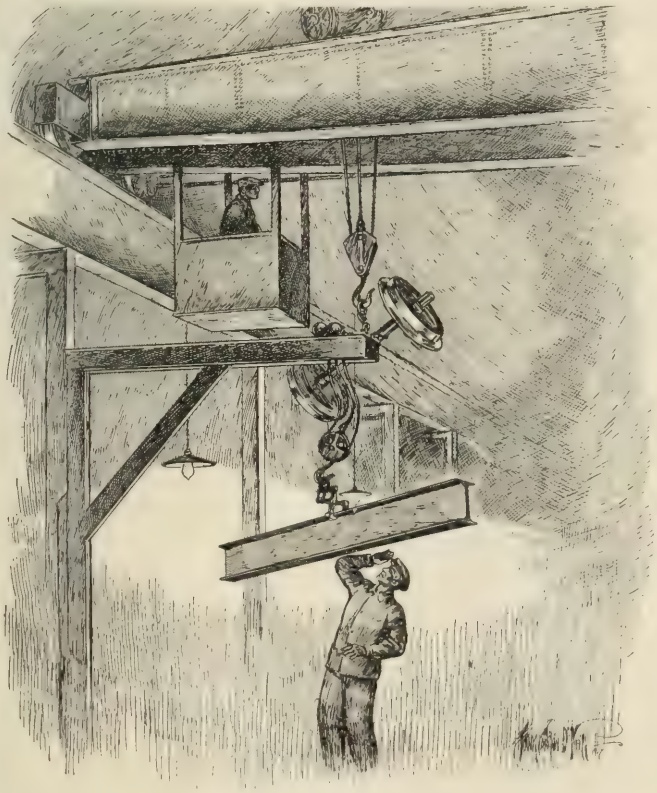


Fig. 5—Beam knocked from grip of post crane because poor lighting failed to disclose its presence to the operator of the overhead traveling crane carrying car wheels.



Fig. 7—Owing to inadequate lighting the man cleaning the stairs was struck in the back of the head by an iron bar carried by the man ascending the stairs behind him.

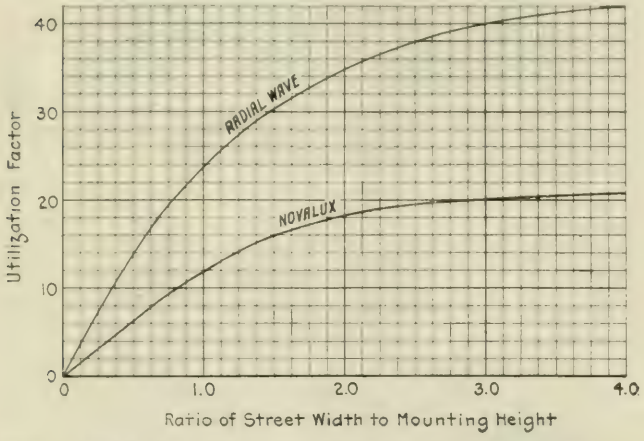
EXAMPLES OF HOW INADEQUATE LIGHTING CAUSES ACCIDENTS

of modern lamps when unshaded is the blinding or glare effect produced when a workman changes his line of vision from directly toward such a bright lamp to another space with less light. At the instant of making such a change in his line of vision he is temporarily blinded and is thus unable to see the less brightly lighted objects. In Fig. 6 the conditions surrounding an accident from such a cause are shown.

The workman had been operating a drilling machine, which was lighted by an unshaded lamp close to the work. In the normal operation of this drill he was forced to view the work with the bright lamp in front of his eyes. In attempting to adjust the drill by means of a wheel above his head he placed his hand in the gears, and thus received severe lacerations and bruises, because of the temporary blindness produced by the filament of the bright lamp. It is almost needless to remark here that the proper shading of such a lamp should be considered as of equal importance with the mechanical protection of the gears, if accidents of this kind are to be avoided.

A Case of Totally Inadequate Light

The three cases just described and illustrated refer, in general, to defects in poorly arranged lighting in the form of shadows, improperly arranged lamps and glare.



The case illustrated by Fig. 7 is one of totally inadequate light on a neglected stairway. A janitor was attempting to sweep the steps in virtual darkness. A second workman approached the stairway carrying a bar of iron on his shoulder and because of the darkness did not see the janitor in his pathway. As a result the iron bar struck the janitor on the back of the head, causing a severe scalp wound.

Cases of this kind may seem out of place for illustrating various phases of the accident problem, and yet they are typical of the kind of accidents which go to make up the enormous list that occurs year after year in this country. It is a striking fact that the inspectors of casualty companies, because of their distinct interest in accident prevention and their duty to recommend changes in conditions which appear to increase accident hazard, have many opportunities to suggest remedies in poorly lighted factory spaces.

Auxiliary Lighting for Safety

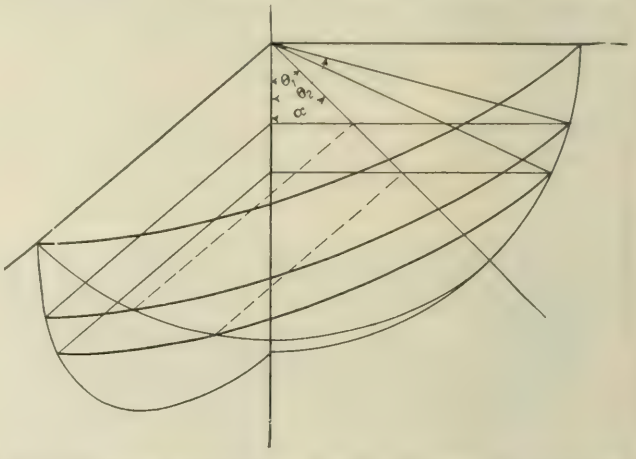
The failure of the regular lighting system when a large night force is at work can readily contribute to panic, with the attending dangers. The recently enacted Pennsylvania and New Jersey lighting codes, therefore, require that all factories shall be provided with an auxiliary system of lamps in some form which shall be thoroughly dependable at all times. In neither of these codes is there any specific outline as to just what shall constitute such an auxiliary system, and this, in fact, has been one of the points raised for settlement since the codes became effective in 1916. Up to this time there does not seem to have been any definite ruling on this question by any of the state departments.

UTILIZATION FACTORS FOR STREET-LIGHTING UNITS

Method of Calculating Flux Incident Upon Street Surfaces from the Zonal Candlepowers of the Lighting Units

BY EUGENE PETERSON

All methods in practical use to-day for determining the mean horizontal intensity of illumination along a street seem to be based upon the determination of the illumination at a number of points more or less representative of the street as a whole. Disadvantages in this method of procedure, at once apparent, make it advisable to seek other means for its solution, the most feasible of which is perhaps that involving the computation of the average intensity as the quotient of the incident flux divided by the surface area.



FIGS. 1 AND 2—UTILIZATION FACTORS FOR TWO TYPES OF LIGHTING UNITS; ZONES CONSIDERED IN DERIVING FORMULA AND CURVES

In a paper presented before the Illuminating Engineering Society in 1910 Preston S. Millar developed curves for what were then some of the most generally used illuminants, illustrating the variation of the percentage light flux effective upon the street as affected by varying the street dimensions. Unfortunately, the graphical method used in the construction of these curves does not lend itself very readily to specific application, so that the solution given below has been developed from the writer's work at the Electrical Testing Laboratories to meet that requirement.

First, it is considered that a light source is mounted at a height h directly over one side of a street of width w, as shown here. Under these conditions it may be seen that the flux directed toward the street is included within two planes passing through the two sides of the street and intersecting at the luminous center of the source. Consideration of the light in this manner involves two assumptions, (1) that there are no reflecting

surfaces to redirect flux toward the street, and (2) that the street is straight and infinitely long.

The first and obvious method of attack would be to integrate the flux over the area of the distribution surface of the unit cut off by the two intersecting planes, but the actual solution is not so simple. Perhaps it might be advisable to show just why distribution curves are not in general susceptible of direct mathematical treatment. In the great majority of cases the distribution (curve) is symmetrical about its vertical axis,

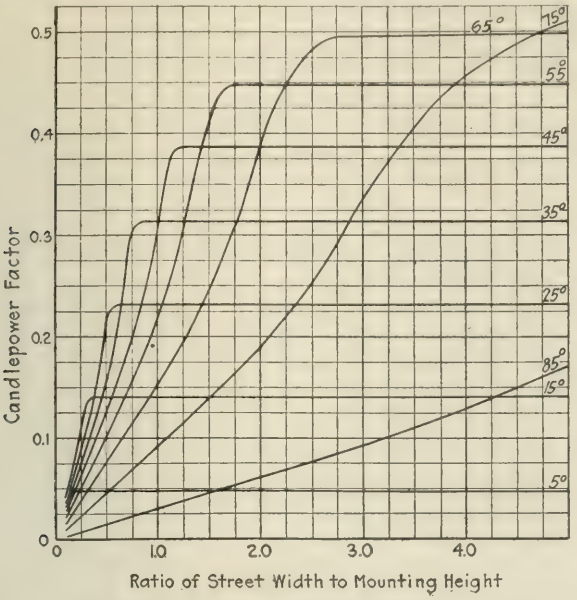


FIG. 3—EFFECT OF RATIO OF STREET WIDTH TO MOUNTING HEIGHT ON PER CENT ZONAL FLUX REACHING STREET

hence the distribution surface is a surface of revolution, formed by rotating the curve about this axis of symmetry. Because of the irregularity of such curves, probably no one equation could be made to fit an entire curve; therefore it is necessary to piece it out by equations for small components. Not only this operation but the integration for the surface, however simple the curve might be, leads to extremely complicated expressions. Therefore, since the above process would have to be carried through for every distribution curve and for every ratio of street width to mounting height, it is evident that the direct method is unsuitable.

It is almost unnecessary to state that with a source having a uniform distribution of 1 cp. (the total flux due to which is consequently 4π lumens) the flux issuing from any particular portion is equal numerically to the area of that particular portion, and if the candlepower is other than unity the flux is computed as the product of the candle-power and the area of that portion. This forms the basis for a solution which considers the effective flux from each zone; the total effective flux is then the summation of the effective zonal fluxes.

Since distribution curves are usually determined with sufficient accuracy by specifying the candle-power at 10 deg. intervals, the lower hemisphere can be divided similarly. For zones making small angles with the nadir, probably all the zonal flux falls upon the street, but as the angle increases the proportion of effective to total zonal flux becomes smaller and smaller until at 90 deg. and greater angles from the nadir none is effective. Thus it follows that the effective zonal flux is found from the zonal area included between the intersecting planes and the representative candle-power obtained from the distribution curve. It now remains to derive a general expression for the area of a zone with bounding angles θ_1 and θ_2 cut off by a plane making an angle $\alpha = \tan^{-1} w/h$ with the reference plane (see Fig. 2). This may be effected by ordinary calculus* as follows:

$$\frac{A}{2} = \int_{\cos\theta_1}^{\cos\theta_2}\int_{0}^{y\tan\alpha} \sec y\,dy\,dx = \int_{\cos\theta_1}^{\cos\theta_2}\int_{0}^{y\tan\alpha} \frac{dx\,dy}{\sqrt{1-x^2-y^2}}$$

$$= \int_{\cos\theta_1}^{\cos\theta_2} \sin^{-1}\frac{y\tan\alpha}{\sqrt{1-y^2}}\,dy$$

By parts:

$$= \left[y\sin^{-1}\frac{y\tan\alpha}{\sqrt{1-y^2}}\right]_{\cos\theta_1}^{\cos\theta_2} + \int_{\cos\theta_1}^{\cos\theta_2} \frac{y\tan\alpha\,dy}{(1-y^2)\sqrt{1-y^2\sec^2\alpha}}$$

According to Peirce's integral table No. 230:

$$\left[\tan^{-1}\sqrt{\frac{11}{\frac{1-y^2\sec^2\alpha}{\tan^2\alpha}}}\right]_{\cos\theta_1}^{\cos\theta_2}$$

Therefore

$$A = 2[\cos\theta_2\sin^{-1}(\cot\theta_2\tan\alpha) - \cos\theta_1\sin^{-1}(\cot\theta_1\tan\alpha) + \tan^{-1}\sqrt{\frac{1-\cos^2\theta_2\sec^2\alpha}{\tan^2\alpha}} - \tan^{-1}\sqrt{\frac{1-\cos^2\theta_1\sec^2\alpha}{\tan^2\alpha}}]$$

For any given zone, then, the effective flux varies with the ratio w/h. In the accompanying curves it has been plotted for 10 deg. zones from zero degrees to 90 deg. with the zone factors as ordinates and the ratios of w/h as abscissae. The zone factor A in the formula is that quantity by which the zonal candle-power is multiplied to give the effective flux. It is obtained from the derived equation.

To take a concrete example, suppose a radial wave unit is mounted 20 ft. over the center of a street measuring 80 ft. between building lines. Dividing the street surface by the reference plane which passes through the center of the unit and the center line of street, two surfaces equal in area and similarly placed are obtained. Hence the total incident flux is twice that on either surface.

Since the total flux is 843 lumens and the effective flux, 586.4, $= 293.2 \times 2$, then the ratio of the effective to the total flux—what might be called the *utilization factor*—is $586 \div 843$, or 69 per cent. The variation of the utilization factor with changes in the ratio w/h is shown in accompanying curves for two units of widely different distribution characteristics—one utilitarian, the other esthetic. The utilization factor depends not only upon the distribution characteristics of the unit, but also upon the street width and mounting height. If two units with different distribution characteristics are to be compared with respect to the amount of light they direct toward the street, the comparison should be made with the same value of w/h for both.

It should be emphasized that the calculations previously made refer only to the directly incident flux. Where buildings are present a considerable increase in illumination may be obtained by reflected light, for which no means of calculation has been made available. A fair approximation may be made, however, by applying to the flux incident upon the building fronts (as computed by the preceding method) coefficients deduced from experimental data.

*Byerly, W. E., "Integral Calculus," page 164.

Economical Spacing of Transformers

Relation Between Transformer Size and Spacing and Wire Size—How Allowances Must Be Made for Departure from Ideal Conditions—Allowing for Growth of Load

BY P. O. REYNEAU*
Distribution Engineer the Detroit Edison Company

ECONOMICAL arrangements of distribution transformers can be determined only by comparing the cost of secondary wire, cost of transformers, cost of installation, core and copper loss charges, inspection charges, etc. However, if two or more of these variables are fixed either by the conditions of load to be expected, where a new system is being laid out, or by the actual equipment installed, where improvements are being made on an existing system, very satisfactory analysis can be made with the help of the accompanying curves. For instance, with the size of wire and transformers fixed the curves show the spacing of transformers which will keep the voltage drop on continuous secondary mains within allowable limits and will not overload the transformers.

Three curves are shown for the three sizes of secondary wire commonly used. Each curve is plotted to show the load in kilowatts that can be transmitted for different distances on a three-wire secondary with a 3 per cent voltage drop at 224 delivered volts with the load uniformly distributed and the transformer at the center of the main. This is the same condition which obtains with continuous secondary mains and equal spacing of transformers.

Basis for Curves

The curves embody a combination of two formulas†: $A = (D \times W \times C) \div PE^2$ and $V = PB$, in which A = area of conductor in circular mils; D = distance one way from source to receiver in feet; W = load in watts; C = a constant depending on the power factor and the resistivity of the conductor = $(2\rho \times 100) \div \cos^2\theta = 2400$ for 95 per cent power factor and $\rho = 10.82$ ohms per mil foot, for stranded wire; P = per cent power loss of delivered power; V = per cent volts loss of delivered volts; E = receiver voltage, and B = a constant for any given size of wire, spacing, frequency and power factor which may be quite accurately determined for any assumed limits of current and length of line.

If $P = V \div B$ is substituted in the first formula it becomes $A = (D \times W \times C \times B) \div (V \times E^2)$, or $W = (A \times V \times E^2) \div (D \times C \times B)$.

If V, the per cent volts loss, is assumed, say at 3 per cent, and the receiver voltage is assumed to be held constant, say at 224 volts, for any given size of wire, A and B are fixed and the formula becomes W = a constant $\div D$.

This constant was determined for the various sizes of wire and the resulting formulas were plotted as shown. D in the above formula is the distance one way from the source with concentrated load. In this special case, where the distance between banked transformers is used, with uniformly distributed load, it may be considered the same as the case of a length of line with the transformer in the center and load uniformly distributed. Thus the total load on the transformer is divided by two, half each side, and the distance each way with uniformly distributed load may be considered the same as one-half that distance with concentrated load. Hence D = distance between transformers $\div$ 8. The curves give the relation between the total load on a transformer and the spacing of transformers for 3 per cent voltage drop.

For general conditions it can be assumed that the load on the secondary mains is uniformly distributed. This is especially true of residence districts where the houses are all of about the same class, and is also more or less true of business districts. Where the two classes of load are in the same secondary bank each must be considered separately. At certain points in a secondary bank there may be large loads caused by a theater, apartment house, large store or something of that nature. These can be taken care of usually by figuring proper size and spacing of transformers for the bank exclusive of these large loads and then placing transformers near enough to the service taps of these large loads to prevent excessive drop in the secondaries and making the transformer large enough to handle the extra load. In some cases it may even be preferable to handle these large loads on separate transformers.

In caring for loads which are more or less uniformly distributed along the secondary mains it becomes convenient to determine the "density of load" in kilowatts per 1000 ft. (304.8 m.) of three-wire secondary. This is done by dividing the load on any secondary main (obtained by test or other means of estimating) by the length of the main in thousands of feet. Since the accompanying curves are plotted for distance between transformers against kilowatts transmitted by each transformer, radial lines from the origin will be lines of constant load density. By the use of these lines in connection with the curves the best conditions of installation for each density of load may be readily determined. It is also convenient in the use of these curves to ink in the vertical lines representing the load capacity of the standard sizes of transformers used, as the spacing of transformers is limited by the load capacity of the transformers used as well as the voltage drop, and it is also important that the transformers should be working fairly well up to capacity.

How the Curves Are Used

Probably the best method of showing the use of the curves is by a practical example: For instance, in a given district having banked secondaries of No. 4 wire suppose the load tests on present transformers show an average load density of 5 kw. per 1000 ft. (304.8 m.). Finding the point where the line of 5-kw. density intersects the curve for No. 4 wire, it can be seen that this

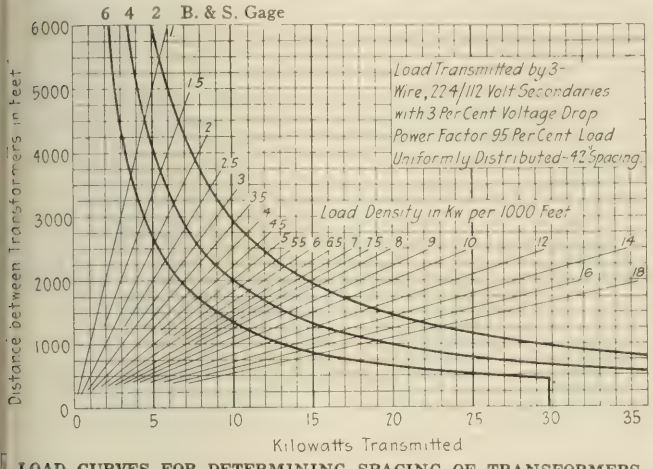
*The author wishes to express his indebtedness to Harold Cole for his valuable assistance in preparing the article.

†The use of these equations was suggested by an article by Harold Goodwin, Jr., published in the *General Electric Review*, December, 1914. The values of B in the second equation used here are not those found in the above article, but have been determined to suit the conditions of the system to which they were applied.

load could be carried by transformers spaced 2000 ft. (609.6 m.) apart with a 3 per cent voltage drop under the ideal conditions assumed. The load on each transformer would be 10 kw., therefore 10-kw. transformers would be necessary.

However, it would hardly be advisable to space transformers up to the limit permitted by the drop in this manner. Several conditions would interfere. In the first place, the load would not be exactly uniformly distributed and the drop would be greater than 3 per cent in some places. In the second place, the load tests would never represent the peak load throughout the season and there would be a greater voltage drop under peak-load conditions. In the third place, this method does not make any allowance for growth.

A safe method of taking care of such unknown conditions obviously would be to allow for a greater density of load than that shown by tests. The amount of this



LOAD CURVES FOR DETERMINING SPACING OF TRANSFORMERS

allowance would naturally depend upon the character of the district served. In a district which is entirely built up the increase in load from year to year will not be so great as in districts which contain a large number of vacant lots and are building up rapidly. Where the increase is expected to be fairly rapid it will usually be best to make the transformer spacing suitable for the higher densities and large transformers and then use smaller-size transformers until they become overloaded, at which time they can be replaced by the large size. In this way considerable saving is effected owing to the fact that the transformers are replaced in the same location and the expense of framing transformer poles is eliminated.

Allowing for Growth of Load

Assuming therefore in the present case a density twice as great as found from tests, say 10 kw. per 1000 ft. (304.8 m.), it will be found from the curves that with No. 4 wire transformers could be spaced 1400 ft. (426.5 m.) apart for a 3 per cent drop. The load on each transformer with this condition would be 14 kw., and it would be necessary to use a 15-kw. transformer when the load density came up to the assumed value. The transformer, however, could never be loaded up to capacity with this spacing without giving a greater voltage drop than that allowable. It would therefore be best to space the transformers so as to allow for full load on a 15-kw. transformer before the drop becomes excessive. This would mean a spacing of 1300 ft. (396.2 m.) or less.

With a spacing of 1300 ft. (396.2 m.), however, 10-kw. transformers could be used to carry a load density of 7.5 kw. per 1000 ft. (304.8 m.), which would in the case assumed probably be satisfactory for a year or two. Then as the transformers became overloaded they could be replaced by 15-kw. transformers, which would add sufficient capacity to last several years.

It may be of assistance in becoming familiar with the curves to note the significance of the location of any point with respect to the curves. In general, all points below the curve for any wire size indicate that the voltage drop will be less than 3 per cent; all points on the curve indicate that the drop will be 3 per cent, whereas all points above the curve indicate that the drop will be more than 3 per cent for that particular condition.

To take a simple example first, suppose a 10-kw. transformer has a load of 8 kw. on a secondary main of No. 6 wire, 2000 ft. (609.6 m.) long, with the transformer located at the center of the main. The intersection of the 8-kw. line with the 2000-ft. distance line is a point above the curve of No. 6 wire and shows that the drop at the end of the secondary main is very likely more than 3 per cent. The point of intersection, incidentally, is also on the line of 4-kw. density, which, however, might have been determined beforehand by dividing the load (8 kw.) by the length of the secondary main, 2000 ft. (609.6 m.).

An example of the more general application of the curves would be as follows: With No. 6 wire and 10-kw. transformers, for any load density up to 7.5 kw. per 1000 ft. (304.8 m.) the proper spacing of transformers is determined by the size of the wire and the transformer cannot be fully loaded without having more than 3 per cent drop. This can be seen by referring to the curve. With a load density of 4 kw. per 1000 ft. (304.8 m.) 10-kw. transformers would have to be put 2500 ft. (762 m.) apart to be fully loaded, as shown by the intersection of the 4-kw. density line and the 10-kw. transformer line. This point of intersection, however, is far above the curve for No. 6 wire and the drop would be much more than 3 per cent. It would be necessary to use No. 2 wire to keep the drop below 3 per cent, as the point falls below the curve for No. 2 wire.

On the other hand, with No. 6 wire and 10-kw. transformers, for any load density above 7.5 kw. per 1000 ft. (304.8 m.) the proper spacing of transformers is determined by the transformer capacity. For with a load density of 10 kw. per 1000 ft. the transformers would be fully loaded with a spacing of 1000 ft. (304.8 m.). The intersection of the 10-kw. density line and 10-kw. transformer line in this case falls below the curve for No. 6 wire and the voltage drop is therefore less than 3 per cent. The 7.5-kw. density line, the 10-kw. transformer line and the No. 6 wire curve all intersect at a point showing that 1250 ft. (381 m.) is the ideal spacing for 10-kw. transformers and No. 6 wire.

It should be evident from the foregoing discussion that these curves do not determine exactly the conditions which would obtain in any specific case, but that they must be used more as a basis for good judgment. Practical differences between the ideal conditions assumed and the actual conditions encountered must be handled by making suitable allowances in spacing of transformers, by judicious location of transformers near the heavier loads, and by proper allowance for growth and inaccuracy in testing or estimating loads.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

IMPROVING COAL ECONOMY

Mixture of Screenings and Bituminous Coal Found Economical by Massachusetts Company

Tests have been conducted with Pennsylvania coal and New River coal by the Concord (Mass.), Maynard & Hudson Street Railway, and although the former costs less per ton, it has been found that a lower cost per kilowatt-hour is obtained with the New River because the amount of ash produced is less than with the Pennsylvania coal. The latter is difficult to use under the conditions obtaining in the railway company's plant as it clogs the grates, necessitating the employment of more men in the boiler room than with New River coal.

By mixing bird's-eye hard-coal screenings with bituminous coal of the "carbon four" grade, in the proportion of one to one, the Concord (Mass.) electric plant finds it can produce energy at lower cost than with Pennsylvania coal alone. Without a test it is difficult to tell whether the cost of production can be lowered by using New River coal, but the mixture of screenings and Pennsylvania coal gives entirely satisfactory results, according to A. W. Lee, manager of the plant.

ADJUSTABLE METER RACK

Made of Simple Materials and Designed to Support Meters of Any Size in Convenient Positions

The meter rack shown in the accompanying illustrations is made of 1.5-in. by 0.25-in. (3.8-cm. by 6.4-mm.) strap, channel and T-iron. All uprights except the end pieces are made of two pieces of channel iron



FIGS. 1 AND 2—RACK SUPPORTING DIFFERENT TYPES OF METERS AND DETAIL OF RACK

riveted with the open sides of the channel face to face. The end uprights are T-iron. In the vertical channel-iron members between the intersections with the horizontal pieces of strap iron are punched slots resembling keyholes. Special plugs are made to fit these holes. One of the plugs may be seen on the strap iron in Fig. 2.

The use of the two channel irons makes it possible to hang meters on both sides of the rack. The plugs or pegs, being easily removable, can be taken out when they are not supporting meters and hence are not likely to catch the clothes of workmen or otherwise to act as obstacles. Edgar A. Felsenkeller of Milwaukee, who designed this rack, stated that in building another he would use similar pegs instead of rivets to make the joints between the channel iron and the horizontal strap-iron pieces. This change would permit the horizontal pieces to be moved to closer or wider spacings at will for the most convenient hanging of meters of different sizes.

HINTS ABOUT TESTING OIL

Importance of Determining Minimum Breakdown Voltage and Other Considerations

BY ALBERT MARTINEAU

Three breakdown tests will usually give a typical indication of the dielectric strength. However, it is well to remember that it is the minimum not the maximum voltage that is the criterion as to insulating properties. One extremely low-puncture voltage with two high ones indicates the presence of foreign particles between electrodes, and a fourth test should be made. Three low values usually indicate truthfully the presence of moisture. If the breakdown voltages become lower and lower as successive tests are made, it is probable that carbonized particles of oil are floating within the electrostatic field.

When using so small a quantity of oil as 1 pint (0.47 l.), it is important for accurate results to agitate the oil violently after each puncture, aiming to wash out from between the electrodes burnt oil and other foreign particles the presence of which lowers the puncture voltage. Not only is it advisable to swish the oil around to wash out horizontally between electrodes, but the movement of the top electrode up and down vertically assists the removal of air bubbles upon the top electrode.

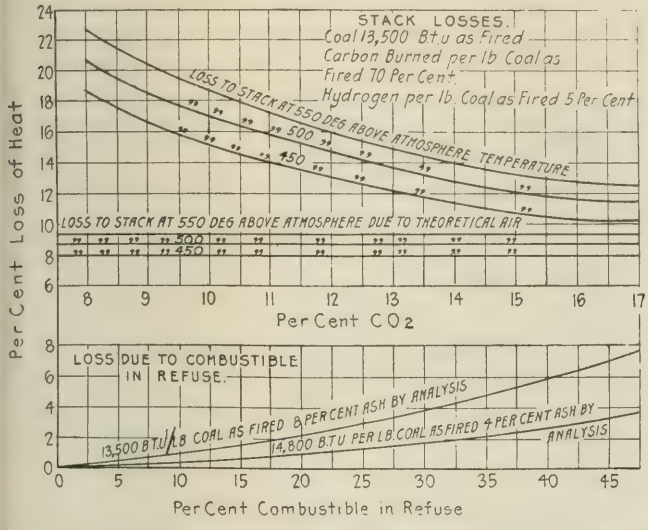
It is highly desirable to standardize the shape and dimensions of the electrodes and the air gap used. The puncture voltage for a given oil will vary with the shape, dimensions and spacing of the electrodes, whether expressed as the puncture voltage for a definite spacing or in volts per mil. Moreover, when testing oil and making a comparison with the manufacturer it simplifies matters where both interests are able to make a direct comparison of results, which is not possible if the electrodes are not the same size and shape and have not the same spacing. Some engineers prefer the disk, others the sphere. The disk is the more easily made, but possesses disadvantages in use. The spherical electrode is less liable to damage from puncture,

the adhesion of foreign particles and air bubbles has less effect and these are less liable to occur. If they do occur they can be more readily removed. The spherical electrode also requires a lower puncture voltage.

BOILER ROOM LOSSES

Effect of Excess Air and Combustible in Refuse on the Economy Obtained in Steam Plants

There are only a few sources of heat loss in a generating plant which can be controlled to any extent, the most important of these being the loss due to excess air. The percentage of heat or percentage of coal which is lost through the stack for different tempera-



FIGS. 1 AND 2—HOW STACK LOSSES VARY WITH CO_2 AND LOSSES DUE TO COMBUSTIBLE IN ASH

tures of excess gases and percentages of CO_2 is shown in Fig. 1. The straight lines labeled "Loss to stack at 450 deg., 500 deg. and 600 deg. above atmosphere due to theoretical air" show the percentage of coal required for heating the furnace gases from atmospheric temperature up to the stack temperature. With no excess air and perfect combustion these lines represent the heat lost through the stack for various temperatures. With different amounts of excess air indicated by various percentages of CO_2 the total heat loss through the stack is as shown by the upper curves. The differences between the lower curves and the upper curves is the excess air loss.

When interpreting these curves it should be remembered that 16 per cent CO_2 represents 12.4 per cent excess air, 14 per cent CO_2 represents 39 per cent excess air, 10 per cent CO_2 represents 87 per cent excess air, and 8 per cent CO_2 represents 123 per cent excess air. When the CO_2 is reduced from 16 per cent to 10 per cent, the heat loss is increased by approximately 6 per cent of the coal burned, provided, of course, that the exit temperature remains the same. The volume of gases is much greater with 10 per cent CO_2 than with 16 per cent, owing to the greater amount of excess air, and the temperature of combustion is lower; therefore the heat absorbed by the boiler is less, so that the final temperature is higher and the heat loss due to excess air is greater than is really shown by the curves. A difference of 100 deg. in the exit temperature represents a loss of about 2½ per cent.

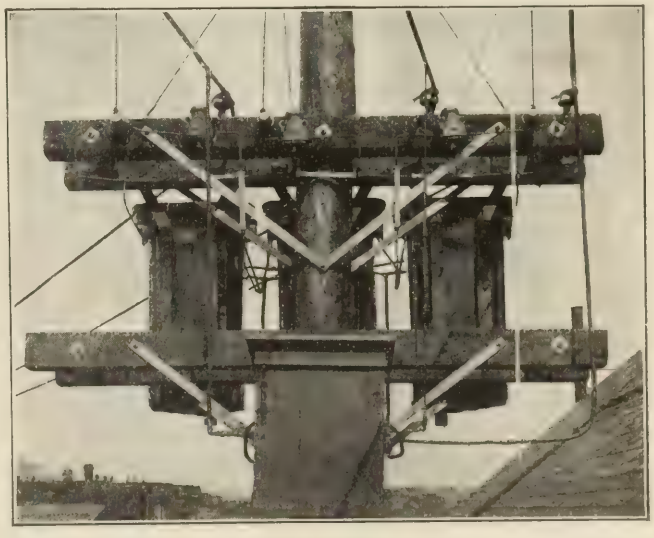
The losses due to combustible in the refuse are shown in Fig. 2. The loss due to the combustible in the refuse in the coal containing 4 per cent ash is approximately only one-half the loss due to combustible in the refuse of the coal burning 8 per cent ash. The curves show it is more important to burn out the carbon in a high-ash coal than a low-ash coal. While this is simple, there is a point beyond which it is not advisable to burn the combustible in the refuse, as large volumes of air are required to burn out the coke to a minimum, and the loss due to excess air greatly exceeds that which would have occurred had the combustible been dumped with the ash. The best plan of operation is to find this point by test or gas analysis and then operate accordingly. These points were brought out by H. F. Lawrence, test engineer of the American Engineering Company, at a recent meeting of the station operation committee of the Ohio Electric Light Association.

IMPROVING LINE WORK

Linemen Criticise One Another's Work by Aid of Photographs of Completed Job

Most of the work carried out by linemen is made in locations which are not readily accessible for inspection, so that careless work cannot readily be detected, especially if reliance is placed upon binoculars alone. On the lines of the Georgia Railway & Power Company, however, the linemen are so interested in their work that they request that photographs be taken of any job of which they are particularly proud. These jobs, naturally, are the more complicated ones and the very kind that ought to be done perfectly. After the photographs are taken they are framed and hung in the trouble stations. Here they are studied by the various linemen, and it is a remarkably good job that gets by unscathed.

In the accompanying illustration is shown a pole-transformer job in which it was found that one lead was



WIRING OF TRANSFORMERS CRITICISED BECAUSE THE LEAD ON THE RIGHT WAS TOO LONG

too long to get a straight wire. T. F. Johnson, superintendent of transmission, finds that self-criticism is more effective than scoldings. The men have simply learned to take such pride in their work that they do everything possible to earn praise instead of blame.

COST OF MANHOLES

Data Based on Analysis of Records from Boston Company Applying to Standard Construction

From an analysis of the cost of distribution equipment on the Boston Edison company's system are taken the accompanying data showing the cost of standard manholes constructed under average conditions during regular working hours without traffic interference or frost. Sewer connections of 15-ft. (4.5 m.) length were provided in all cases.

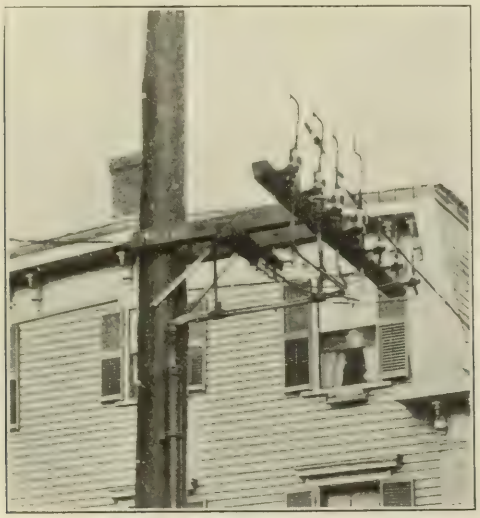
COST OF CONSTRUCTING STANDARD MANHOLES

Approximate Size	Surface Duct	With Sewer Connection	Surface Macadam, Ordinary Pavement Without Concrete Base	With Sewer Connection	Surface Asphalt, Bitulithic, Wood Block, Granite Block, All with Concrete Base	With Sewer Connection
Below 3 ft. x 4 ft. x 3 ft.	$30	$50	$30	$50	$40	$65
3 ft. x 4 ft. x 4 ft.	30	50	50	70	70	95
3 ft. x 5 ft. x 5 ft. or 4 ft. x 4 ft. x 4 ft.	70	90	90	110	110	135
4 ft. x 5 ft. x 6 ft.	80	100	100	120	120	145
5 ft. x 7 ft. x 7 ft. or 5 ft. x 8 ft. x 7 ft. or 6 ft. x 6 ft. x 6 ft. or 7 ft.	125	145	180	200	205	230
6 ft. x 7 ft. x 8 ft.	150	175	200	220	230	255
6 ft. x 10 ft. x 8 ft.			250	270	285	310

INEXPENSIVE CONSTRUCTION THAT PROTECTS LINEMEN

Method of Supporting Junctions Between Overhead and Underground Lines Where Openwork Wire Extends Part Way Down Pole

The results of an effort to safeguard linemen at junctions between overhead and underground circuits is shown in the accompanying photograph of a type of construction used by an Eastern company. The underground cables are carried from the ducts vertically along the pole to a height of 15 ft. (4.6 m.). The conductors are given a right-angled turn and carried outward about 2 ft. (0.61 m.) below a platform frame to a branching point below an extended cross-arm, the horizontal leads being supported by appropriate insulating hangers. The cross-arm is placed far enough out from the pole to give ample clearance space for a lineman between the wires and the pole itself. From the branching point beneath the cross-arm the various leads are run into small pot-heads, from which taps are made to the overhead lines. All the way up the pole the lineman obtains a clearance of about 18 in. to 24 in. (0.46 m. to 0.61 m.).

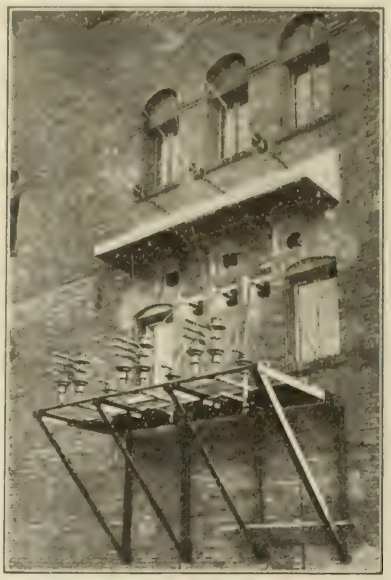


A SPECIAL PLATFORM FRAME USED FOR CONNECTING CABLES TO OVERHEAD LINES

SUBSTATION LINE ENTRANCE

Structure Carrying Lightning-Arrester Horn Gaps Operated from Within Station

In providing for incoming 33,000-volt service the People's Gas & Electric Company of Oswego, N. Y., makes use of the simple but effective structure illustrated herewith. The phase wires are dead-ended on strain insulators fastened to the wall of the building. Taps are carried downward to insulators mounted on a horizontal pipe rod carried beneath a reinforced concrete hood, and thence the wires lead through insulating bushings in the wall to the substation interior. The bushings are surrounded by concrete panels and the inside of the openings in the brickwork is cemented over. The lightning-arrester connections are taken off the taps to the horn gaps and run through bushings to the arresters in the building. The horn gaps are opened and closed mechanically for arrester charging by a rod extending through the substation wall into the interior. This line entrance was built at moderate cost in comparison with the elaborate structures often employed in connection with lines operating at this voltage.



FRAMEWORK SUPPORTING LINE-ENTRANCE ACCESSORIES

Dynamiting Foundations Inside the Station

To make room for the foundation of a 20,000-kw. turbo-generator to be installed shortly in the State Street station of the United Electric Light Company, Springfield, Mass., it has been found necessary to dynamite a foundation of solid concrete already in place for a smaller machine. This work is being successfully done in the turbine-room basement without interrupting service. Blocks of concrete weighing from 1 ton to 3 tons (0.9 t. to 2.7 t.) each are being dislodged by the use of sticks of dynamite 1 in. (2.54 cm.) long, placed in nine or ten holes per block at a depth of about 2 ft. (0.61 m.). The broken-off pieces are removed easily by a Niles electric crane.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

CELEBRATION OF JULY FOURTH

Central Station Can Be of Assistance to Local Authorities Through Many Lighting Effects

In a little more than two weeks this country will celebrate the Fourth of July, the national birthday. This year unusual significance attaches to this day. That the United States of America, which almost a century and a half ago, July 4, 1776, declared its independence and the right of the individual to life, liberty and the pursuit of happiness, should again be waging war for the same rights of the individual makes Independence Day this year doubly dear to the American people.

For that reason an effort greater than usual will probably be made to stimulate patriotism. Bands, parades, decorations, etc., will undoubtedly be used quite extensively. As their share the electric lighting companies can be of great assistance to the local authorities by doing what they can to make the night illumination spectacular. Red, white and blue streamers, floodlighting of statues, searchlights sweeping the skies with color effects, patriotic emblems, electric flags, are some of the ways in which electricity can do its bit.

WOMEN RAISE STANDARDS OF METER DEPARTMENT

Their Presence Is Considered Desirable on Account of Its Effect on the General Deportment of Meter Men and Repair Men

In one of the medium-sized cities of the Middle West the lighting company has built, apart from its other offices, a serviceable and well-arranged building for its meter and distribution departments and has found it advantageous to place a few girls in the clerical division of the force. Both departments were formerly operated wholly by men, with the result that little restraint was exercised by some members of the organization as regarded decency of speech. Time was wasted in story-telling, and the use of lewd language sometimes proved embarrassing to department heads if a customer was visiting the department.

When a vacancy occurred in the clerical force it was decided to fill the place with a girl. A young woman who seemed to possess more than average common sense was selected for the place and was told of the situation as it existed. It was further explained to her that part of the purpose in selecting her for the job was to "quiet down the gang."

The scheme has worked so successfully that the formerly rather rough crew is now a model of deportment. It has been deemed advisable to add still other female employees to the department. One of these, it is expected, will be used in light appliance repair work, which is done on the customers' premises. Incidentally the men now take more pride in their personal appearance as well as in the appearance of the department quarters. The efficiency of both departments has increased perceptibly since the addition of women to the force.

SHALL DEPARTMENT STORES CARRY ELECTRIC RANGES?

Margin of Profit Not Yet Sufficient, but After Pioneer Work Has Been Done These Channels of Distribution Will Be Opened to the Range

A commercial company in a Western state which operates a chain of household-furnishing stores last year did a business in socket appliances amounting to over $200,000. Electric ranges, however, are not sold in any of the stores operated by this company, the reason given being that the margin of profit in the range business is not sufficient to make it profitable as a merchandising venture. The central stations, on the other hand, have largely withdrawn from the socket appliance business, leaving this to the department stores and the electrical dealers. The central station is still selling ranges in the belief that during the pioneer years of the "Cook by wire" idea other agencies cannot do this in a way that will make the ranges "stay sold."

Cause and effect may be interwoven in this situation, because so long as the central station continues to sell ranges without profit on the sale itself other agencies cannot compete. On the other hand, if the department store could sell electric ranges to prospective gas or coal range customers as effectively as it sells socket appliances, the total number of ranges put in service each year would be greatly increased. The department store finds, for example, that many customers come in to look at percolators for use on stoves and go out with electric percolators which were on display among the others, their superior advantages making the sale easy, even at a higher price than the customer expected to pay. A very considerable percentage of the volume of electric appliance business, household-furnishing stores assert, comes from customers who thus compare the electric device with the older type displayed by its side.

VIEW OF THE DEPARTMENT STORE MANAGER

The department store manager is not partial to either type, because he figures a certain percentage of profit on all stock and the customer's choice is immaterial to him. There is this difference, however, that the electric device, being a superior and more elaborate article, usually commands a higher price. Therefore, the total value of goods sold and the total net profit are greater if the percentage of electric appliances sales is high. On this basis the household-furnishing stores can be interested in any new socket appliance that promises to be useful in the home.

The household-furnishing stores handle gas ranges,

and with properly trained salesmen a certain percentage of gas-range "prospects" might well become interested in electric ranges. This becomes the more evident when it develops that a great many gas ranges bring a higher price than the average electric range. Gas ranges costing over $200 are not unusual sales in the larger stores.

Comparing the large household-furnishing stores with the central station as agencies for the sale of electric appliances, other things being equal, it is apparent that the central station desiring to increase this class of load to the utmost will do well to consider a co-operative agreement with the household-furnishing store. The difficulty in effecting such an agreement is the chief obstacle to getting the larger stores in line with other electric range boosters. This, however, should not be insurmountable. It is generally admitted that in time electric ranges will be regularly stocked by household-furnishing stores. Perhaps by further study of the problem this time may be hastened. Manifestly, the central station must undertake to follow up each sale with a demonstrator, guarantee prompt repairs and replacements, etc. The department store, on the other hand, cannot afford to enter into such an agreement unless it has a volume of business that warrants the employment of high-grade electric range salesmen, and these men must keep in close touch with the power companies and understand their problems as well as those of the sales work in which they are engaged.

EFFECT OF INCREASING THE INDUSTRIAL LOAD

Usual Spring Decrease in Output Gives Way to Increase, While Evening Peak Has Practically Disappeared

That the increase in power load has been very great in the last few months and has left an unmistakable impression on the business of central stations is now evident. This condition is briefly commented on, in part as follows, by the Consolidated Gas, Electric Light & Power Company of Baltimore, Md., in a booklet recently issued entitled "A Ten-Year Review, Present Status and Prospects":

"The conditions are now more favorable than ever before to central station service, owing to increased demand for power and the high cost of coal, supplies, labor and all equipment for isolated power plants. Manufacturers in general have been turning to the electric public service companies to supply their permanent power requirements rather than submit to the delays, uncertainties and unnecessary investment in providing individual power plants, realizing also that both for low cost of power and for reliability central station service is most advantageous.

"Comparing the four months of January, February, March and April, 1917, with the corresponding months of 1916, the average increase in all electric service has amounted to 42.7 per cent, while the average increase in the large industrial service amounts to 65.2 per cent. These four months of 1917 are interesting since they show the continued improvement in the amount and character of electric output. Instead of the usual decrease in output with the spring months, there has been a steady increase from month to month, and evidence of the increasing industrial load is given by the practical disappearance of the evening peak load. The daily output is breaking all previous records even as compared with winter months despite the longer hours of daylight."

MODEL EQUIPMENT FOR COMMERCIAL DEPARTMENTS

All Subsidiary Companies of United Gas & Electric Are Now Equipped with Standard Furnishings and Systems

All of the subsidiary properties of the United Gas & Electric Engineering Corporation now are equipped with standard furnishings and systems for the commercial department. An illustration of such a model department is printed here. On one wall is a sale



MODEL COMMERCIAL DEPARTMENT EQUIPMENT

chart showing the individual records of the salesmen daily during the current month and also the monthly sales for the current year. On the opposite wall are two charts, one showing gas sales and the other the horsepower in motors connected.

TO DEVOTE ADDITIONAL ATTENTION TO APPLIANCES

Byllesby Properties to Campaign Indefinitely Under Belief that Conditions Will Create Big Domestic Demand

Starting immediately and continuing indefinitely Byllesby electric utility properties will devote additional attention to the placing of electrical appliances in homes. A circular letter to all managers on this subject by Vice-president Arthur S. Huey is quoted:

"High prices for commodities and labor and the drafting of men into the army and primarily essential war occupations are rapidly causing a situation in American households favoring the vastly increased use of electric service for domestic purposes. Practically every electric household device is bound to be in greater demand from now on indefinitely. Scarcity of servants and their dismissal from necessity or economy will cause women of the well-to-do class to turn to mechanical helps to assist them in performing housework. The non-fluctuating character of electric rates will be a factor in causing many people who formerly regarded electric household appliances as luxuries to demand

them as necessities. The cost of service will seem small compared with other increased expense.

"We believe that if proper advantage is taken of the situation a large quantity of electric household appliances can be placed at our properties during the remainder of the year, thus building up the earnings of existing customers and producing additional revenue without increased investment.

"We would suggest that you give the subject of selling electric appliances your very best consideration and call upon the ingenuity and sales ability of your force to promote successful endeavor along this line."

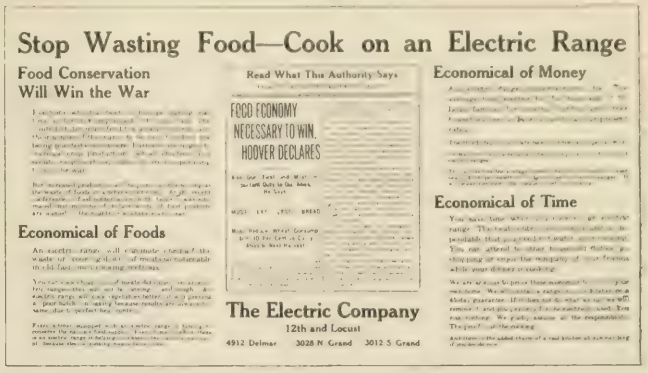
HIGH COST OF LIVING AS ELECTRIC RANGE ARGUMENT

Should Not Be Difficult to Show, Especially in the Case of Large Families, that Saving in Food Will Pay First Cost in One Year

To-day the two things that are most talked of and most thought of are the war and the high cost of living. Every wage earner who has a family to support and every mother who has a family to feed know full well the way in which the buying power of the dollar has decreased. Economy has become a household motto. The problem of the family now is not how little it can get along with, but how that little which the family now has can be stretched out and conserved.

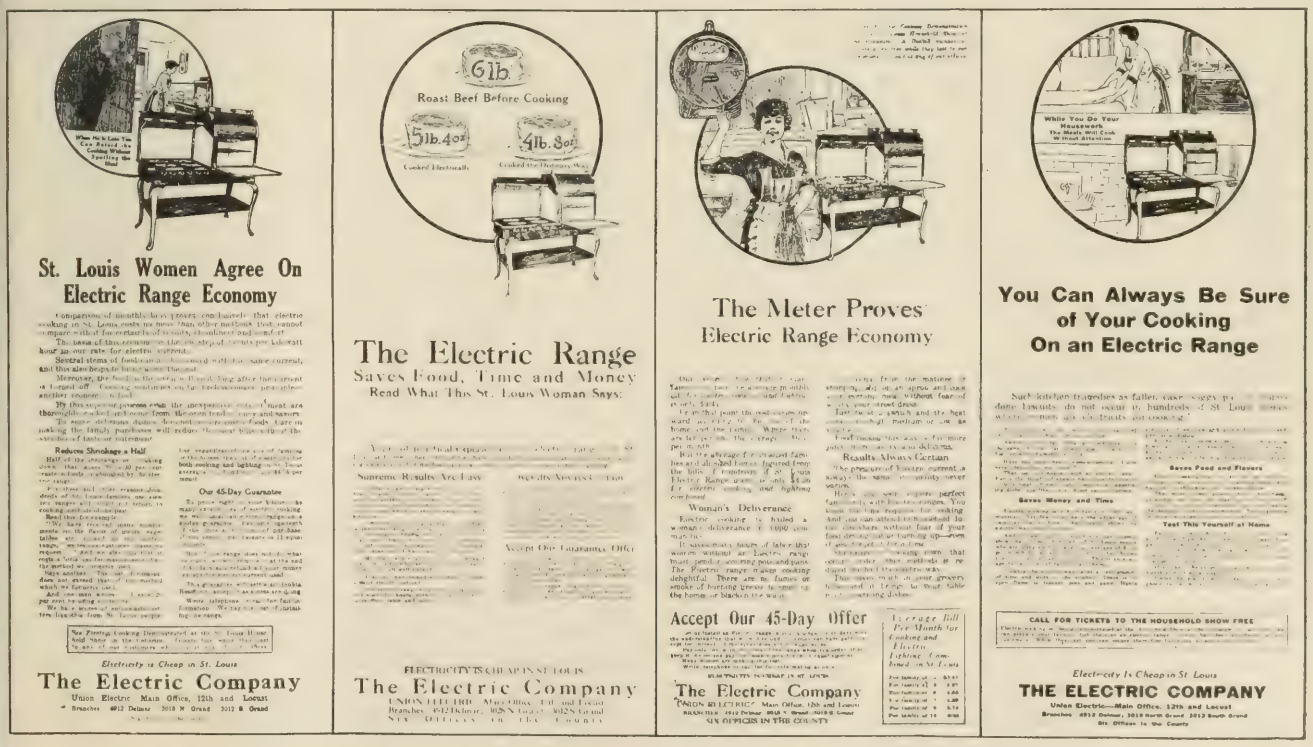
Now is the time when economy will be a greater sales force than ever before; and there seems every reason to believe that the sale of electric ranges will be increased proportionately to the extent that the economy of the range is advertised and used as the selling force behind the advertising.

In St. Louis, where an electric range campaign has now been going on for some months, the Union Electric Light & Power Company has used a series of advertisements in local papers in which emphasis is placed entirely on the economy of the range—economy of food, economy of time and economy of money. The St. Louis company is selling ranges, and selling many of them, and apparently is very successful in its campaign. Some of the advertisements which have been running in the St. Louis papers are reproduced here, and attention is called particularly to the one entitled "Stop Wasting Food—Cook on an Electric Range." Food conservation and electric range economy are clearly shown to be synonymous.



THE TIMELINESS OF THE ECONOMY ARGUMENT IS APPARENT

It is well known that roasts cooked in an electric range show little loss of weight compared with other forms of cooking. In the present food crisis this is undoubtedly a very strong argument. When a housewife is shown that a 6-lb. roast of beef costing 35 cents a pound will lose only a few ounces during roasting by electricity but over a pound when roasted by other means, a strong appeal is made. It should not be difficult, especially where there are large families, to show that the saving in food at prevailing prices will pay the first cost of the electric range in twelve months' time.



PART OF SERIES OF ADVERTISEMENTS DEVELOPING IDEA OF ECONOMY OF ELECTRIC COOKING

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

USING THE PHOTOELECTRIC CELL AS A PHOTOMETER

Description of a Rapid and Accurate Method Used for Determining Illumination Intensity and Light Distribution

BY JAMES R. RANDOLPH

THE photoelectric cells developed by Dr. Kunz of the physics department of the University of Illinois have been in use for some time for measuring the light of stars, in which service they have given very satisfactory results. It has been suggested that for certain kinds of photometry they would offer advantages over methods now in general use. With a view to determining the suitability of the cells for this kind of work the writer performed the following series of tests in the department of physics, University of Illinois.



FIG. 1—40-VOLT TEST LAMP

Fundamentally, the photoelectric cell consists of a wire grid and a thin film of some metal such as potassium inclosed in a glass bulb containing argon under low pressure. The film is connected to the negative side of the circuit and the grid to the positive side. When light shines on the film it gives off ions which convey small charges of negative electricity to the grid, thus causing a current of sufficient strength to be detected by a sensitive galvanometer or electrometer. The strength of this current has been shown to be directly proportional to the intensity of light reaching the cell for a given quality of light, *i.e.*, inversely proportional to the square of the distance between the source and the cell. This greatly simplifies the calculations and would thus permit the use of the photoelectric cell in photometry where a large number of readings had to be taken, as in determining the distribution of light from lamps, shades, etc., or for determining the distribution of light in a room.

For the test two lamps were used. The first was a 40-volt tungsten lamp (Fig. 1) having a filament made of four coils set in a row so that the light in the direction of the row is much less than that emitted at 90 deg. therefrom. The second lamp was an ordinary 120-watt carbon-filament unit. Distribution curves were made for each of these lamps to show the variation of candlepower around the lamp in a plane perpendicular to its major axis. One curve for each lamp was made with the photoelectric cell and one with a photometer.

The lamp to be tested was placed in the socket *A*, Fig. 2, which was mounted on a graduated revolvable circle sliding on the photometer bench. Near the end of this photometer bench was a box *B*, containing a photometric cell *C* and having a small opening with a shutter in the side toward the lamp through which the light could reach the cell.

The circuit containing the photoelectric cell consists of a battery *D*, whose negative terminal is grounded as shown, while the positive terminal is connected through a 10,000-ohm resistance *F* to the grid, or positive terminal, of the photoelectric cell. The negative terminal of the cell is connected to ground through the graphite resistance *G*, across whose terminals the electrometer *E* is connected. In the circuit supplying the lamp are an ammeter and an adjustable resistance so that the current may be kept constant during a test. For the photometer tests a 16-cp. standard carbon lamp and a Lummer-Brodhun photometer were used.

In starting a test the lamp was lighted and allowed to burn until current through it became constant. Then the lamp was turned until the pointer on the graduated circle stood at zero degrees, when the shutter was opened. After the electrometer deflection was read the shutter was closed until the electrometer indicator rested on zero, when the shutter was opened again and another reading taken. The average of the two readings was used. The shutter was closed, the lamp turned to a new angle, and the process repeated. In this way a series of readings was obtained for different positions of the lamp. To save taking a large number of readings the lamp could be turned by the observer while watching the electrometer. In this way

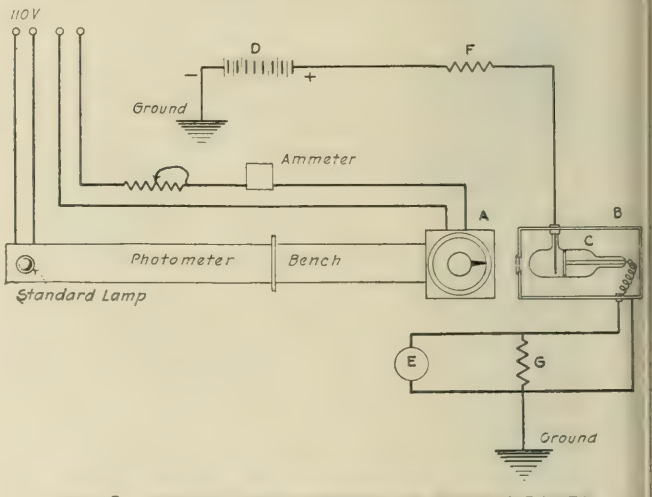


FIG. 2—CIRCUIT ARRANGEMENT FOR TESTING LAMPS

all regions of marked variation can be known in advance and more readings be taken there than in regions known to be uniform. A corresponding set of readings was taken with the photometer, using the same angles as before.

The results of one of these experiments are given in the accompanying curves. By moving the lamp on the

photometer bench light intensities of 4 to 400 candle meters* were secured. The ratios between intensity of illumination and corrected deflection are absolutely constant except for two points at the lower end of the series, and these are not very different. When, therefore, this ratio is known, candlepower can be obtained from deflection by simple multiplication. (The deflection of an electrometer is not exactly proportional to the current, but within the limits of this experiment the error is inappreciable.) To find the ratio for any lamp a number of simultaneous readings of deflection and candlepower are obtained and the average ratio is taken. Since in these experiments photometer readings were taken at all points where cell readings were taken, the average readings could be compared. The curves plainly show the necessity of taking for this purpose several photometer readings at widely separated points in order to get an accurate average. The average values of the light given out in a horizontal plane are identical, no matter whether the photoelectric cell is used or the photometer.

In the curve of the carbon lamp (Fig. 3) there is a hump at 60 deg. for which no reason is apparent. It is probably due to a spot on the lamp bulb where there is less carbon deposit than elsewhere.

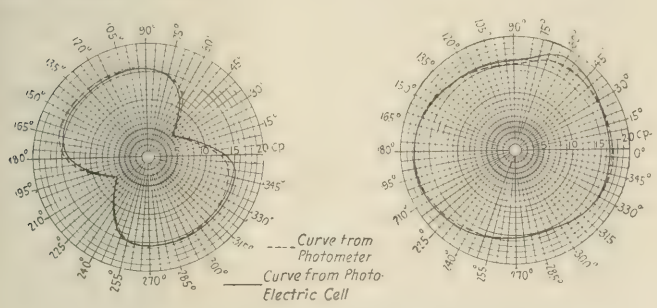


FIG. 3—DISTRIBUTION CURVES OF TUNGSTEN AND CARBON-FILAMENT LAMPS OBTAINED BY PHOTOMETER AND PHOTOELECTRIC CELL

According to these tests it appears that the photoelectric cell in its present state of development can be used as a photometer provided the ratio between candlepower and electrometer deflection is known for the lamp to be tested. It will be especially valuable for cases where a curve must be drawn showing the variation of intensity from point to point, as the readings may be reduced to candlepower by a simple multiplication, and by watching the galvanometer while the cell or the source of light is moved the important points in the curve can be located and the number of readings thus reduced. When large units—for instance, reflectors of high intensity—have to be measured in different directions the space required for an ordinary photometer is very large. The method employing a photoelectric cell and a galvanometer would require only about one-tenth of this space or less.

*J. Kunz, *Astrophysical Journal*, March, 1917.

Generators, Motors and Transformers

Intermittent Rating of Motors of Large Output.—H. H. BROUGHTON.—When the effects of the accelerating, retarding and stopping periods of intermittently loaded motors are considered the three methods commonly used for determining the ratings lead to considerably different results. In view of this condition the author believes that standards committees should specify which method of rating should be adopted.—*London Electrician*, May 4, 1917.

Field Distortion in Direct-Current Machines.—R. W. OWENS.—Relation of compensating windings to commutating poles and consideration of problems of commutation.—*Electric Journal*, May, 1917.

Traction

Operating Results on Electrified Division of Chicago, Milwaukee & St. Paul Railway.—A. BEEUWKES.—Data comparing three months' operation with steam and electric locomotives. Although the figures for electric operation are very favorable they can hardly be considered final, because more experience has been obtained with steam locomotives than with electric. In the period covered about the same number of train-miles were covered with electric locomotives as with steam. The schedule of the through trains under electric operation was reduced forty minutes below that with steam operation. Under these conditions the following results were obtained with steam and electric passenger trains respectively: Excess time in switching cars, 240 and 118; hot bearings (engines), 79 and 641; total minutes delayed, 7198 and 6802; total number of trains delayed, 157 and 81; total number of trains making schedule time, 300 and 307; minutes delayed per 100 train-miles, 6.03 and 5.70; passenger train-miles, 119,330 and 119,-237; coal per train-mile (steam), 188 lb.; kilowatt-hour per train-mile (electric), 29.1. With steam and electric freight trains the results were as follows: Thousand ton-miles per engine, 6745 and 24,260; kilowatt-hours per 1000 ton-miles (electric), 39.4; pounds coal per 1000 ton-miles (steam), 276.—*General Electric Review*, May, 1917.

Electrification of Western End of Chicago, Milwaukee & St. Paul Railway.—K. R. HARE.—Describes the extent of electrification proposed on Chicago, Milwaukee & St. Paul Railway west of Othello, Wash. A description of the system to be used and the method of supplying power is also given.—*General Electric Review*, May, 1917.

Installations, Systems and Appliances

Bombay Hydroelectric Power Scheme.—Descriptive information which supplements that presented by the *Engineer* in its April 16, 1915, issue. The dams which have been built, the article points out, are remarkable for their length, one being 100 ft. (30.5 m.) high and more than 1½ miles (2.4 km.) long. The design features of the dams, aqueduct, headgate, forebay, pipe line, etc., are described and information is given regarding the methods used to overcome construction difficulties.—*London Engineer*, May 18, 1917.

Electrophysics and Magnetism

Electrical Properties of Gases.—J. J. THOMSON.—By experiments it was pointed out that the process of making gases conductive consists of ejecting negative particles from the molecules. This can be done by exposing the gas to the action of radioactive bodies, Roentgen rays, and some other forms of light. The wave length of the light must be less than a certain definite value which depends on the gas used.—*London Engineering*, May 11, 1917.

Electrical Precipitation in Chemical Industries.—A. F. MESTON.—Article calls attention to manner in which

a physicist and electrical engineer can overcome difficulties and improve conditions in chemical industries with electrical precipitation. Applications of this process are referred to in connection with collection of acids driven off during concentration, reclaiming chlorine gas, sulphur and fluorine, precipitation of cement dust, etc.—*The Electric Journal*, June, 1917.

Electrochemistry and Batteries

Characteristics of Electrolyte for Lightning Arresters.—G. C. DILL.—For satisfactory operation of an electrolytic cell, purity of the aluminum and the electrolyte and cleanliness in handling these materials, as well as cleanliness of the container, are very essential, as they affect the characteristics and useful life of the cell. It is believed that a large part of all the troubles which occasionally occur in the operation of electrolytic arresters is due to neglect of one or more of these precautions. Several years ago one of the leading manufacturers furnished the electrolyte in dry form, allowing the customer to mix it with pure water in certain proportions. They were soon obliged to discontinue this procedure, however, on account of the

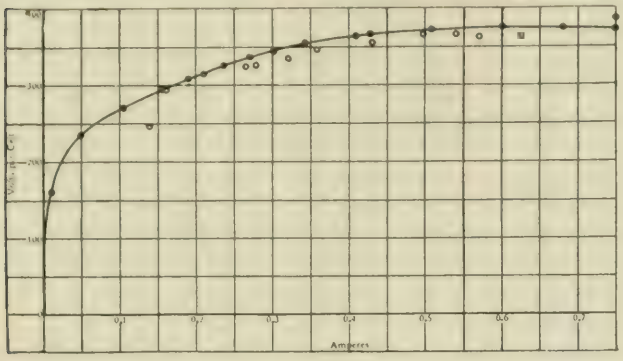


FIG. 4—TYPICAL CHARACTERISTIC CURVE OF ALUMINUM-CELL LIGHTNING ARRESTER WITH IMPURE ELECTROLYTE

unsatisfactory results obtained, because very little reliance could be placed upon the purity of the water used. A remarkable feature of some cells is that the film will build up in less than one-half of a cycle after the cell has stood several days without being charged. Others require a heavy charging current and a long time to build up the film because of poor or an impure electrolyte. The number of cells required for an arrester for operation at a given voltage is dependent upon the critical voltage of the electrolyte which is to be used. Therefore, in arresters of different makes and of different stages of development, electrolytes should not be used interchangeably unless the properties and characteristics of the electrolytes are definitely known. In some cases operators lose sight of the fact that an electrolytic arrester will have a different charging current on 60 cycles from what it will have on 25 cycles. This difference in charging current is due to the capacity effect of the arrester. A large charging current indicates greater electrostatic capacity, which in turn indicates a greater discharge capacity. All electrolytes do not work equally well under the influence of heat. The earlier electrolytes for electrolytic arresters had a maximum safe temperature of approximately 100 deg. The reason for this was that the action of the heat produced certain chemical changes in the electrolyte, which increased the dissolution of the film. Some of the newer electrolytes, however, are comparatively stable under the influence of heat and may be worked up to 135 deg., a temperature which is very seldom exceeded in operating conditions except for very short periods. The chemical constituents of an electrolyte reduce the freezing temperature below that of water, but will not prevent its freezing. Electrolyte for electrolytic arresters freezes between 18 and 25 deg. Fahr., but in the case of lightning arresters it takes a considerable time for the cold to penetrate the surrounding jacket. New developments may bring forth a new electrolyte which will freeze at a still lower temperature. Electrolyte may be subjected to freezing for long intervals without being injured. When frozen its conductivity is reduced, and the freedom of discharge of the arrester is correspondingly reduced. However, the conductivity returns when the electrolyte thaws.—*The Electric Journal*, June, 1917.

Theoretical Aspects of Electrical Precipitation.—W. W. STRONG.—The electrical precipitation process from the theoretical point of view can be divided into (a) the formation of ions, (b) the charging of the fume particles by the ions, (c) the driving of the fume ions to the passive electrode, and (d) the collection of the fume at this electrode. If no ions were formed, if the ions could not be made to stick to the fume particles, or if the fume ions could not be driven to the collecting electrode by the electric field, electrical precipitation of fumes would be impossible. In this paper it is shown how important it is to keep the fumes to be precipitated within the "region of passive electrodes precipitation." The fact that space charges do not interfere with electrical precipitation shows that any choking of corona currents by space charges must be due to the large ions. Through the action of eddies fume particles may be carried within the ion-forming layer. The deposit of a layer of insulating material about the active electrode may result in the piling up of space charges in this region and then sparking. The greater the space charge in a treater the less the voltage that can be impressed upon the treater. An indication is given as to how the charging of fumes can be made more efficient. The great advances in fume precipitation, it was pointed out, will be made by (a) the more efficient charging of the particles, (b) the maintenance of the corona more continuously and uniformly at its maximum value, and (c) the useful applications of the chemical power of the corona as well as its precipitating power.—*Met. and Chem. Engineering*, June 1, 1917.

Telegraphy, Telephony and Signals

New Radio Installation of French Postal and Telegraph Department.—LEON BOUTHILLON.—This paper has for its object an explanation of the considerations which have led the radio service of the French Postal and Telegraph Department to a system wherein a direct-current source charges condensers which are in turn discharged by means of rotary gaps. The investigation shows (1) the theory of the use of direct current in charging radio-telegraphic condenser; (2) the possibility of using such direct-current machines, and (3) the conditions under which such machines can be used and the useful formulas in connection therewith. This work calls attention to high-tension dynamos. It is now possible to build these up to 25,000 volts per machine and even further.—*Proceedings of Amer. Inst. of Radio Eng.*, June, 1917.

Scientific and Industrial Research

A Department Devoted to Interchange of Ideas, Investigations Contemplated, Research Facilities Available, and Suggestions for Co-operative Work.

Conducted by PROF. VLADIMIR KARAPETOFF
Cornell University

NATION-WIDE CENSUS OF RESEARCH FACILITIES

National Research Council Is Collecting Information to Stimulate Investigational Activity and Co-operation Along Technical Lines

The National Research Council, formed by the National Academy of Sciences at the request of the President of the United States, is collecting information concerning research men and facilities available in this country. Such information will be used to stimulate investigational activity and co-operation along technical lines and to aid in the solution of the scientific and technical problems of the government. While under normal conditions the Research Council will direct its efforts toward the development of research in all its aspects, present conditions demand that special attention be given to the problems of national defense.

An important preliminary step in the work of the Research Council is the preparation of a national census of research, showing the research men and facilities in co-operating government bureaus, educational institutions, research foundations and industrial research laboratories. To secure information for this census in such form that it can be readily tabulated special blanks have been distributed.

Three kinds of blanks have been sent out: (a) for educational institutions, (b) for industrial laboratories, and (c) for institutions other than educational and industrial.

In the blanks sent to educational institutions it is suggested that a research committee be formed in each institution consisting of faculty members, trustees and alumni. Information is asked regarding the available research funds and scholarships, their purpose and limitations as to use. The council also desires a detailed statement as to the ways and the extent to which the personnel and the facilities of the institution might be available for problems relating to national defense. Questions are also asked regarding the extent to which the members are co-operating with each other or with outside investigators, institutions or manufacturers.

Each department is also encouraged to state problems upon which co-operation is desired and the greatest research needs of the staff, such as time for research, funds for special apparatus or materials, library facilities, contact with other investigators, financial aid for attending scientific meetings, leaves of absence to pursue research, etc.

The blanks which were sent to industrial establishments ask for the names and titles of persons who direct research work, the organization of laboratory staff and problems which they are especially fitted to undertake by reason of unusual equipment and trained personnel. In addition, the council asks to what extent the particular laboratory is co-operating with other establishments, and whether or not the council may be of service to it in connection with military problems. As a measure of preparedness, the council desires to know to what extent the facilities of the laboratory may be available for research relating to national defense and how much these facilities could be expanded if necessary.

SCIENTIFIC PROBLEMS ON WHICH RESEARCH COUNCIL IS WORKING

Among subjects that the council is investigating and on which it desires information are the following:

Physics (Dr. R. A. Millikan, chairman).—Exhaustive study of devices for detecting completely submerged submarines and mines; range finders of various types; devices for detecting invisible aircraft and sapping parties; improvements in wireless apparatus and other instruments used with aircraft; military photography.

Chemistry (Dr. Marston T. Bogert, chairman).—Generation, detection and absorption of hydrogen, and problems incidental thereto; absorption of other gases, particularly noxious ones; fire extinguishers; prevention of corrosion and electrolytic action on the hulls of vessels; non-corrosive metals and alloys for a great variety of uses; balloon fabrics; new explosives; new sources of important products; utilization of wastes and by-products.

Engineering (Gano Dunn, chairman).—This committee, which will organize research in the various branches of engineering, has just been formed with the co-operation of the national engineering societies.

Nitrate Supply (Dr. Arthur A. Noyes, chairman).—This committee, which was appointed at the request of the Secretary of War to consider the process to be used by the government in its plant for producing nitrates for explosives and fertilizers, has submitted a full report.

WHAT CANADA IS DOING TO MEET WAR CONDITIONS

Elimination of Waste, Utilization of By-Products and Adoption of New Processes Being Studied in the Dominion

Research has been spurred on in Canada by war necessities, by consideration of Germany's industrial strength and by recognition of the need of co-operation between science and industry. The movement, which is chiefly toward the elimination of waste, utilization of by-products and adoption of new processes, is being directed by the Honorary Advisory Council for Scientific and Industrial Research of the Department of Trade and Commerce.

Closer relations than have existed heretofore are being effected between the educational institutions and manufacturing establishments, so that Canadian college graduates may continue their training in the Dominion under actual commercial practice.

The opportunity for scientific research is to be brought within reach of even the small manufacturing establishment. With this end in view the council has recommended that bureaus be organized in the principal centers of Canada, with technical staffs and properly equipped laboratories.

The advisory council has also grappled with the prob-

lem of providing a cheap fuel for western Canada, more especially for Manitoba and Saskatchewan. Experiments have been conducted with lignite. The council is convinced that from this material two grades of high-class briquetted fuel can be produced, one similar to anthracite and the other to bituminous coal in general character.

Experiments have also been made by officers of the Canadian Geological Survey with oil-laden shale from Lambton County, Ont., with a view to testing its possible value as a fuel. Utilization, too, as a substitute for coal, of peat from the great deposits in northern Ontario and elsewhere in the Dominion has been considered. Exploitation of these potential resources may become an important factor in solving the fuel difficulties of Ontario and Quebec.

N. E. L. A. COMMITTEE SUGGESTS TOPICS FOR RESEARCH WORK

Necessity of Research Along Electrical Lines to Prevent Crippling Industrial Development Is Recognized

Scientific and industrial research has acquired a very great stimulus since the opening of the war. Recognizing this fact, the sub-committee on research of the National Electric Light Association has made an investigation of the possibilities of co-operative research between utilities and institutions having research facilities. As a result of correspondence and conference a large number of problems were suggested the solution of which is of utmost importance to the country at large as on it depends the reliability of electric service furnished industrial plants engaged in the manufacture of the nation's domestic and war-time needs.

A few of the more important subjects are as follows: (1) Fuel economics; (2) characteristics of steel conductors; (3) increasing of load factors by nitrate plants; (4) determination of all combinations of transformer loading, and publication of tables showing their effect on apparatus, both transformer and motor (this will include all emergency conditions, such as conversion of transformer banks from Y to delta and reverse and the effects of lower than normal voltage and also of unbalanced voltages on the operation of motors, and the results of the investigation should be published in tables sufficiently non-technical to be intelligible to power customers as well as of material assistance to central stations in helping their power customers through emergencies); (5) incipient faults in insulators; (6) sludging of transformer oils and determination of their relative values; (7) causes and suppression of surges on long lightly loaded lines; (8) overhead-line and underground-cable insulation for high voltages; (9) protection of lines and equipment against high-voltage, high-frequency, and high-power, low-frequency disturbances; (10) perfection of high-voltage insulators; (11) depths and bearing surfaces of guy anchors in various soils, and (12) inductive interference.

Owing to the postponement of the activities of this sub-committee on account of war activities, educational and industrial institutions which have investigators and laboratory equipment available can do considerable good, this committee points out, if they will undertake the further study of some of these problems.

Summary of Investigations, Available Apparatus and Research Suggestions

Subjects Being Investigated (Research Work Reported Since May 19)*

COMMUTATION
A critical review of the work already done, including a repetition of the experimental work of Mandull, and experimental work to explain the apparently contradictory results found by various writers.—*Cornell University, A. Gray.*

CONDENSERS
Effects of frequencies up to 3000 cycles per second on condensers.—*Ohio State University, A. E. Flowers.*

CORE LOSSES
Analysis of core losses in rotating electrical machinery.—*Massachusetts Institute of Technology, O. R. Schurig.*

DIELECTRICS
Study of the laws underlying the dielectric strength of insulating materials.—*Massachusetts Institute of Technology.*

ELECTROMAGNETS.
An experimental study leading to a method of predetermination of characteristics.—*Cornell University, H. W. Brown.*

HEATING OF ELECTRICAL MACHINERY.
A critical review of the work already done, and further experimental work to confirm and to extend the data at present available.—*Cornell University, A. Gray.*

MOTORS, POLYPHASE COMMUTATOR.
Construction of kinematic devices which imitate quantitatively the vectorial relations and give performance characteristics of such motors.—*Cornell University, V. Karapetoff.*

PHOTOMETERS.
Study of integrating photometers.—*Massachusetts Institute of Technology, O. R. Schurig.*

PORCELAIN.
Electrical characteristics of various mixtures and firing temperatures of unglazed porcelain.—*Ohio State University, A. E. Flowers.*

RAILWAYS, ELECTRIC.
Traffic research.—*Massachusetts Institute of Technology, O. R. Schurig.*

RECTIFIERS, ELECTROLYTIC.
An experimental study with the oscillograph to try to improve the efficiency of such apparatus.—*Cornell University, J. F. Putnam.*

SKIN EFFECT.
Researches in connection with conductors at frequencies ranging from 100 to 5000 and from 10,000 to 100,000 cycles per second.—*Massachusetts Institute of Technology, O. R. Schurig.*

TELEPHONES.
Investigation of behavior of telephonic diaphragms.—*Massachusetts Institute of Technology, O. R. Schurig.*

TRANSIENT PHENOMENA.
Mathematical investigation of traveling waves along wires, with the view to introducing trigonometric expressions which simplify the integration of the differential equations and the determination of the terminal conditions. Design of mechanical models to imitate the propagation of impulses along electrical conductors.—*Cornell University, V. Karapetoff.*

TRANSMISSION.
Study of artificial transmission lines; physical qualities of transmission lines.—*Massachusetts Institute of Technology, O. R. Schurig.*

Apparatus Available for Research Purposes

OHIO STATE UNIVERSITY.
(1) Facilities for testing ceramic products; (2) apparatus for investigating high-voltage phenomena using potentials up to 200,000 volts; (3) facilities for tests at telephonic frequencies; (4) two radio sets and two overhead antennae, the larger supplied by a 5-kw. sending outfit.—*A. E. Flowers.*

Suggestions for Research

DIELECTRIC STRENGTH AT TRANSIENT VOLTAGES.
For common dielectrics what are the piercing voltages as functions of time, especially for the short duration of one second to one-thousandth of a second? This information may make clear some obscure points in the operation of lightning arresters, devices for limiting over-voltages, spark protectors, etc.—*Ch. David, Revue Générale de l'Electricité, Vol. I, page 562 (1917).*

INSULATORS.
Improvements in porcelain insulators to increase their life and to reduce cracking; study of substitutes for porcelain; rational theoretical design for dielectric stresses.—*V. Karapetoff, Cornell University.*

REACTANCE FOR ELECTRIC FURNACES.
Investigation of the effect of amount and location of reactance in the circuits for electric furnaces, more particularly in the production of steel.—*T. H. Schoepf, Westinghouse Electric & Manufacturing Company.*

SELF-INDUCTION, EFFECT OF FREQUENCY.
Variation of self-induction with frequency, at radio frequencies. Investigation of this subject was planned by the Ohio State University, but the work has been postponed.—*A. E. Flowers, Ohio State University.*

*The names of individuals given after each institution reporting investigations are those of persons with whom others interested should communicate. All institutions reporting research work should give such names.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

ELECTRIC RATES INCREASED BY THE COLUMBUS COMPANY

Average Advance of 25 Per Cent in Schedules for Both Business Lighting and Power—Residence Rate Unaffected

Electric rates of the Columbus (Ohio) Railway Power & Light Company have been increased to an extent which will average 25 per cent. This change is due to higher costs of operation. No advance was made by the company in the rate for residence lighting; that was already at the maximum figure provided by the city ordinance.

CALIFORNIA TO INTERCONNECT THE TRANSMISSION SYSTEMS

Railroad Commission and Power Companies Discussing Large Plan to Safeguard Service and Facilitate Exchange of Energy

The Railroad Commission of California is discussing with the power companies a plan for interconnecting transmission systems to safeguard service and facilitate an exchange of energy, thereby reducing costly fuel-oil consumption in standby stations. In working out the details of the scheme the engineering committee of the Pacific Coast Section of the National Electric Light Association is assisting with information both as to quantity developed and undeveloped water power available and in the consideration of the problems involved in interconnections.

The Railroad Commission suggests that present action conform to the idea of ultimately having a through bus line from Redding to Fresno, about 300 miles. This would directly connect the large Pit River development now under way with the group of systems in central California and would have sufficient capacity to transfer considerable blocks of energy to or from the Pacific Light & Power Company's Big Creek plant and thus to the southern California group of companies.

Whether or not the State bus plan is carried out it has been shown that meantime the three large systems entering San Francisco can be interconnected so that energy could be interchanged much more effectively than at present. For example, what would constitute a central State bus line could be established by a tie at the junction of the Pacific Gas & Electric Company with the Great Western Power Company midway between Marysville and Sacramento and the construction of 25 miles of line between the Sierra & San Francisco Power Company station at Manteca and the Great Western Company station at Isleton.

This would not only accomplish the ends sought for at present, but would be the logical first move toward the more elaborate interconnection plan if this is adopted later. The high-tension line of the Sierra & San Francisco system passes around the lower end of San Francisco Bay in a loop which would be the logical starting point for connecting the central and southern groups by means of a second or parallel bus passing through and connecting the several companies serving coast cities between San Francisco and Los Angeles.

The commission's proposition had not been formally presented to the companies on June 13, when this information was telegraphed to the ELECTRICAL WORLD, but was already being considered informally and more definite action is expected shortly.

MORE SUBSCRIPTIONS TO THE LIBERTY LOAN

Reports from Various Companies in the Electrical Industries of Investment in the Premier Government Security

As this issue of the ELECTRICAL WORLD goes to press many additional notices of subscriptions to the Liberty Loan from the electrical industries are reported. Among them are:

Consolidated Gas, Electric Light & Power Company, Baltimore, $100,000 for employees in addition to the $100,000 for account of the company itself.

McGraw-Hill Publishing Company, Inc., publisher of ELECTRICAL WORLD, $50,000, representing approximately subscriptions of employees. This is in addition to $100,000 previously reported for the company itself.

OTHER SUBSCRIPTIONS REPORTED

Manhattan Electrical Supply Company, $250,000.

Mackay Companies, $1,000,000.

Crocker-Wheeler Company, $100,000; in addition, $49,800 reported for employees.

Consolidated Gas Company, New York, and affiliated electric and gas companies, $5,000,000; in addition, $700,000 for employees.

Electric Bond & Share Company, $200,000.

American Brass Company, $1,000,000.

Simplex Wire & Cable Company, $100,000.

Westinghouse Lamp Company, Bloomfield, N. J., employees, $30,000.

GENERAL ELECTRIC EMPLOYEES

"Liberty Loan day" at the various plants of the General Electric Company resulted in the sale of $2,955,550 of Liberty bonds. The Schenectady works, with 22,000 employees, the largest plant and the company's main office, led with the total of $1,055,700. Six hundred bond salesmen visited each of the 22,000 employees at Schenectady, and when the last man had subscribed the million-dollar mark was passed. In a number of departments every employee subscribed.

WAR'S INFLUENCE ON CANADIAN CENTRAL STATION DEVELOPMENT

In the First Convention in Three Years Canadian Electrical Association Reflects General Prosperity of Electrical Properties in the Dominion

The twenty seventh annual meeting of the Canadian Electrical Association, the first convention of this kind since the European war began, was held at the Ritz-Carlton Hotel, Montreal, June 7 and 8. It was very well attended, particularly by engineers and executives of systems in the Eastern Provinces of Canada, and was most encouraging in retrospect and prospect. Mr. D. H. McDougall of the Toronto Power Company, who was recently elected vice-president of the National Electric Light Association, was re-elected president of the association. J. S. Norris, secretary, treasurer and general manager of the Civic Investment & Industrial Company, Montreal, was elected first vice-president; E. A. Dunlop, president of the Pembroke (Ont.) Electric Light Company, was elected second vice-president, and A. Monro Grier of Toronto, vice-president and secretary of the Canadian Niagara Power Company, third vice-president. Alan Sullivan of Toronto was continued as secretary.

Canadian Properties and the War

In his address President McDougall outlined the difficulties imposed on the Canadian companies by the war and said the industry had passed through perhaps the most eventful year since the founding of the first central station company in 1884. The demands for energy have in most cases been abnormal owing to munition manufacture and to the fact that Canada herself is prosperous, but all the conditions have been met by the companies for the most part in spite of the inroads on operating and commercial staffs, difficulties of financing and of securing fuel. Many companies have had to forego any extensive financing and have had to limit their capital requirements to items of a most imperative nature and which could be financed among shareholders. He showed the extraordinary response to the colors manifested by the entire electrical industry in Canada, stating that both in Montreal and in Toronto about 35 per cent of the normal number of men employed have enlisted.

Mr. George Muldaur, traveling secretary of the National Electric Light Association, brought greetings from the parent body to the Canadian association and showed to what extent the national body has been instrumental in forming an increasing number of company sections.

Reports and Papers

Reports were made by Wills MacLachlan of Toronto, chairman of the accident prevention committee; E. N. Hyde, Canadian representative of the Lighting Sales Bureau; M. C. Gilman, Toronto, chairman of the committee on commercial light and power sales; W. H. McIntyre, Ottawa, and L. C. Haskell, Montreal, of the committee on education of salesmen, and P. T. Davies of the Civic Investment & Industrial Company, Montreal, chairman of the rate research committee. In addition, addresses were made by H. E. Howe of Arthur D. Little, Inc., on "Electrochemical Products"; Ward Harrison of the National Lamp Works, Cleveland, on "Illumination"; Julian C. Smith, chief engineer and vice-president of the Shawinigan Water & Power Company, Montreal, on "Energy Distribution, Present and Prospective," and P. Ackerman of the Toronto Power Company on "Selective Relay Protection of Alternating-Current Main Transmission Lines and Distribution Systems." The Montreal companies section of the National Electric Light Association entertained the delegates in the Ritz-Carlton on the evening of June 7.

Energy Distribution

In his paper Julian C. Smith showed the enormous use made of electricity since 1870. As indicative of electrical development in the Dominion of Canada, Mr. Smith presented the following list showing the kilowatt-hours used per capita as supplied by the electric service companies in the United States and Canada for all purposes except railways:

	Kw.-Hr. per Capita		Kw.-Hr. per Capita
Shawinigan Falls, Que.	41,000	Minneapolis	450
Niagara Falls, N. Y.	33,000	Cleveland	400
Three Rivers, Quebec	3,400	Boston	350
Montreal	700	Philadelphia	250
Toronto	700	New York	225
Buffalo	585	Quebec	200
Pittsburgh	500	Newark	180
Rochester	450		

Mr. Smith intimated that to-day in the United States and Canada, in those places where normal industrial life exists, the kilowatt-hours used per annum per capita amount to about 500, of which 400 kw.-hr. are used for factory purposes and 100 kw.-hr. for household uses. With the increased use of small accessories and development of electric cooking Mr. Smith predicted that the use of electricity in the household will increase 300 per cent within the next five or six years. At the same time the industrial use is bound to increase so that there is every probability that in ten years from to-day the use of electrical energy will be twice what it is at the present time.

While the development of power by means of water-power stations has reached such a high point of efficiency that very little improvement can be hoped for in this direction, Mr. Smith said that the efforts of engineers and designers must be devoted to a reduction of costs and that the financing of such enterprises must also be improved. The government authorities can assist in this matter by preventing duplication of lines and systems and by a proper control of construction work as well as the proper control of rates.

Selective Relay Protection

Mr. Ackerman outlined a system of protection on the 60,000-volt lines of the Toronto Power Company between Niagara Falls and Toronto where parallel feeder protection has been in service since January, 1916, and a double-line protection since April, 1917. Both protective schemes have cleared thirty-four line short circuits without a single failure. Ten of the short circuits were due to lightning, four to sleet and wind, fifteen to old insulators, four to line tests made to prove the effectiveness of the relays, and one to some unknown cause. In twenty-six of the cases no load was lost, in five cases less than 20 per cent of the synchronous load was lost, and in three cases the load lost varied from 20 to 50 per cent. The instantaneous selective system used is based in principle on the fact that the currents of the same phase of parallel lines are balanced normally but unbalanced in case of a short circuit within any one of the parallel lines.

ELECTRIC POWER CLUB HOLDS WAR CONVENTION

Eighth Annual Meeting at Washington This Week Divided Between Regular Business and Questions Affecting Service to the Nation

The eighth annual meeting of the Electric Power Club was held at the New Willard Hotel, Washington, D. C., on Monday and Tuesday of this week. The first day's session was given over to the reports of various committees, including standardization, general engineering recommendations, fractional horsepower motors, large power motor, direct-current generator, transformer section and industrial control section. Most of the reports merely outlined the progress made by the committees since the last meeting.

In order to meet government and other similar requirements regarding name-plate markings, the general engineering recommendations committee has suggested that where the name-plate clearly indicates the specifications to which the apparatus conforms it is not necessary to give the detailed information specified in the rules of the club. The fractional horsepower committee recommended that the following name-plate markings be adopted as standard for fractional horsepower motors: For direct-current motors, (a) manufacturers' type and frame designation, (b) horsepower output, (c) time rating, (d) temperature rise, (e) r.p.m. at full load, (f) voltage, (g) full-load amperes, (h) winding, shunt, compound or series; for alternating-current motors, (a) manufacturers' type and frame designation, (b) horsepower output, (c) time rating, (d) temperature rise, (e) r.p.m. at full load, (f) frequency, (g) number of phases, (h) voltage, (i) full-load amperes.

On Tuesday morning the club listened to addresses by members of the Council of National Defense and by representatives of the government on the needs of its electrical division and correlative matters of specifications and tests. In the absence of Howard E. Coffin, W. S. Gifford outlined the work of the Council of National Defense and Paymaster John M. Hancock, officer in charge of purchase division of the Bureau of Supplies and Accounts, Lieut. Alexander Sharp of the electrical division of the Bureau of Steam Engineering and Mr. Dean, electrical expert of the Bureau of Construction and Repair, spoke of the methods of these various navy departments in filling their electrical needs.

STANDARDIZED COST SYSTEM

The chief topic of discussion of the whole meeting centered around the address of C. E. Patterson of the General Electric Company on uniform accounting. The accounting and cost system which is recommended for adoption by electrical manufacturers has the indorsement of the Electrical Manufacturers' Club, the Electric Power Club and the Associated Manufacturers of Electrical Supplies. It moreover bears the indorsement of the Federal Trade Commission. This system has been so planned that it not only conforms to the requirements of scientific accounting and an adequate cost system but is sufficiently flexible to be used to advantage by both large and small manufacturers.

The discussion was led by J. Lee Nicholson, a leader in the specialized branch of cost accounting, who has recently joined the Bureau of Foreign and Domestic Commerce to take charge of this branch of its work. It will be remembered that the Bureau of Foreign and Domestic Commerce has taken over from the Federal Trade Commission all matters relating to uniform cost accounting. It was recommended that all members of the Electric Power Club place the accounting and cost system into effect at once and give the committee as a result of its application to standard practice such suggestions for modification in minor details as would improve it. In view of the various measures adopted by the government for taxing manufacturers it was very generally recognized that an accurate knowledge of costs, depreciation, etc., was highly essential.

The government being prepared to let contracts on a cost plus percentage basis, it is now at work determining the elements constituting cost. Mr. Patterson was appointed to represent the club to aid the government in arriving at a just basis of cost.

At the Tuesday afternoon's session a very instructive paper was read on "Analysis of Increased Cost in Manufacturing Conditions" during the past three years. This showed the upward trend of prices of all material used in the manufacture of motors. There was also an interesting discussion on national economy. It was recognized that funds to meet the requirements of present and future government war loans must be derived as far as possible from savings from decreased expenses, and a paper was read outlining how manufacturers of electrical apparatus might further national economy during the war by limiting advertising, exhibition and entertainment expense where results are dubious. It was recommended that advertising be limited to journals with a high editorial standard.

E. R. Harding, the president of the club, owing to the condition of his health tendered his resignation as president and C. L. Collens, 2d, the vice-president, was elected in his stead. F. S. Hunting of Fort Wayne, Ind., was elected vice-president and T. E. Barnum of Milwaukee was elected to the board of governors. C. H. Roth of Chicago continues as secretary and treasurer. There were no other changes in the board of governors, which now consists of the president, vice-president, secretary and treasurer in addition to the following: James Burke, Burke Electric Company, Erie, Pa.; J. C. Hobart, Triumph Electric Company, Cincinnati, Ohio; J. R. Jeffrey, Allis-Chalmers Manufacturing Company, Milwaukee, Wis.; T. E. Barnum, Cutler-Hammer Manufacturing Company, Milwaukee, Wis.; W. A. Layman, Wagner Electric Manufacturing Company, St. Louis, Mo.; S. L. Nicholson, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.; H. C. Petty, Crocker-Wheeler Company, Ampere, N. J., and R. J. Russell, Century Electric Company, St. Louis, Mo.

C. L. Collens, 2d, who has been elected president of the club is a graduate of the Sheffield Scientific School of Yale University and of the School of Mines, Columbia University, having received a degree of electrical engineer from the latter in 1897. Following his graduation he spent a number of years at Niagara Falls as general manager of the International Acheson Graphite Company and later as superintendent of the plant of the Canadian Niagara Falls Power Company. For the last nine years Mr. Collens has been president of the Reliance Electric & Engineering Company of Cleveland, Ohio.

MOBILIZATION OF THE ELECTRIC AND GAS SERVICE

National Committee, of Which John W. Lieb Is Chairman, Issues Statement of Organization—Ready to Serve the Nation

The following statement has been issued by the National Committee on Gas and Electric Service, of which John W. Lieb is chairman:

Some months ago the committee of the American Gas Institute to co-operate with the government in regard to the military needs of the nation and the committee of the National Electric Light Association on war conditions, at a joint conference held in New York City, decided to organize a national committee which would secure to the United States government the most effective co-operation in the conduct of the war from the gas and electric light and power industries. The National Committee on Gas and Electric Service was thereupon organized with a membership of representative men from these two industries and the related natural-gas industry. The committee, as constituted, is as follows: Walter R. Addicks, vice-president Consolidated Gas Company, New York; Philip P. Barton, vice-president Niagara Falls Power Company; John A. Britton, vice-president Pacific Gas & Electric Company; Alex Dow, president Detroit Edison Company; Charles L. Edgar, president Edison Electric Illuminating Company, Boston; A. E. Forstall, president American Gas Institute; Joseph F. Guffey, president Natural Gas Association of America; Samuel Insull, president Commonwealth Edison Company; Chicago; D. C. Jackson, professor of electrical engineering, Massachusetts Institute of Technology; Joseph B. McCall, president Philadelphia Electric Company; Capt. William E. McKay, vice-president New England Gas & Coke Company, Boston; Herbert A. Wagner, president Consolidated Gas, Electric Light & Power Company, Baltimore; S. S. Wyer, consulting engineer, natural gas industry, Columbus; John W. Lieb, vice-president New York Edison Company (chairman of committee); William H. Gartley, vice-president Equitable Illuminating Gas Light Company, Philadelphia (vice-chairman of committee); George W. Elliott (secretary of committee), Washington.

Recognized as Advisory Committee

The committee is recognized by the advisory commission of the Council of National Defense as one of its advisory committees, and it has established an official headquarters in the Munsey Building, Washington, D. C., where it has placed itself at the service of the government for any assistance it may be able to render in behalf of the public utility industries it represents.

It is prepared to act as a vehicle of communication in all matters relating to the national defense between the various instrumentalities organized by the governmen for the conduct of the war and the gas companies producing and distributing artificial and natural gas and the electric light and power companies furnishing electric service. It proposes to place promptly at the disposal of the government any data or information which it may require as to the facilities in men or service which the companies may have available, to insure the continuous operation of plants so as to enable the munition plants, navy yards and manufacturing establishments, through continuous and uninterrupted service, to maintain their maximum output, and it will endeavor to provide the government with the necessary quantity of the essential by-products that can be made available for the production of high explosives and ammunition.

One of the most essential requirements in the co-ordination of the industrial resources of the country for the successful conduct of the war is to provide a regular and adequate supply of fuel to the important utilities engaged in enterprises through which they render service to the government and to the public. To facilitate solving the many problems affecting the continuous supply of fuel to operate their plants, the National Coal Board has been pleased to appoint George W. Elliott, secretary of the committee, to membership on the coal committee.

A questionnaire is now being prepared which will within the next few days be forwarded to every gas and electric light and power company in the country, asking them to send a statement of the various kinds and quantities of fuel each uses per annum for its various purposes, the water or rail connections over which they are received, together with a monthly statement of fuel contracted for, received and consumed. This will enable the committee to give prompt information to the authorities of fuel shortage in any particular locality, with the transportation lines involved, loading and unloading delays, car shortages, routing and transshipment difficulties, etc.

Opportunities for Co-operation

The committee has been in consultation with the authorities on matters affecting the service which the employees of the companies may render to the government and in regard to various questions connected with selective registration, conscription exemptions and provision for the dependents of employees who may be called upon to render military service. The furnishing of heat, light and power service to the troop cantonments for the mobilization of the military forces located in different parts of the country is now being considered, and information is being collected as to how these agencies may be made available to the camps in the shortest possible time from the nearest points of supply.

It is believed that this National Committee on Gas and Electric Service can be of great assistance to the government in these several directions and that it will cover a broad field of useful and patriotic service, bringing to bear on the successful conduct of the war, from the standpoint of efficient industrial mobilization, the vast resources of men and facilities which the utility companies of the country have at their command and through which they are now efficiently serving the public and which they desire to make available to the nation to the greatest practicable extent.

NEW YORK EDISON ASKS RELIEF FROM RATE CUTS

Tentative Promise of Further Decrease on July 1 Was Subject to Business Conditions—Increased Costs Heavy

The New York Edison Company has asked the Public Service Commission, First District, not to enforce against it a tentative promise which it made last November to reduce rates on July 1. The request was made by J. W. Lieb, vice-president and general manager.

The company at this time does not, according to Mr. Lieb, intend to go back to the old rate of 8 cents, but it desires in the face of cost increases already encountered and others expected in the near future to retain the 7½-cent rate for the present.

Mr. Lieb was requested by the commission to furnish detailed information as to the net increases in income in new business acquired and as to the added and expected increases in cost of production and distribution. Not having these figures at hand, Mr. Lieb requested an adjournment, which was taken until June 20.

Mr. Lieb said that the increase in the cost of coal alone is 50 per cent more than was contemplated at the time reductions were proposed. He added that the increased costs of the last four months represented a minimum of the increased costs expected. One new cost not contemplated is the 340 men who have been specially hired as uniformed guards to watch the plants of the company at a cost of about $400,000 per year.

"NORMAL PROFITS OF BUSINESS SHOULD BE MAINTAINED"

E. N. Hurley Says that Without Fair Margin of Return on Capital and Labor Necessary Incentive Will Be Lacking

Edward N. Hurley, former chairman of the Federal Trade Commission, in an address before the World Salesmanship Congress, Detroit, on "The War and Business," said in part:

"Shortly there will be created in Washington a central purchasing commission for the United States government and its allies. If this agency provides a uniform system for purchases, such as the cost of production plus a reasonable profit, the basis will be established for sound business conditions throughout the nation.

"It is idle to talk about cutting the profit out of war. There should be no abnormal profits, but the normal profits of business should be maintained, because without such a fair margin of return on capital and labor there will be none of the incentive necessary for increased productive energy.

"We should be able to meet the war bills out of our surplus energy. This is the best contribution that business men can make. There is no need for disturbing any wage or hour standard. If a man works eight hours a day, let him put a little more heart into his task and he will find that his productive energy will increase materially. Let the business man conduct his business a little more vigorously; let him work out his cost sheets and get his prices where they ought to be, and he will find that he is making enough extra money to pay for taxes and Liberty bonds. That should be his share in the war."

CITY OF CLEVELAND REPORT ADVISES BUYING COAL LAND

Commissioner Davis Also Suggests Direct Purchase of Fuel and Cars and Arrangement for Generating at Mouth of Pit

W. E. Davis, Commissioner of Light and Heat of Cleveland, recommends to the Director of Public Utilities an investigation of the possibilities of acquiring a comprehensive area of coal-bearing land. He recommends that for immediate requirements coal be purchased at coal mines through reputable agents at prices based upon miners' scale of wages and the heating value of the coal, with a reasonable profit for the producer. He also suggests purchase of a number of modern coal cars to transport fuel, installation of a submerged storage pit to hold at least 20,000 tons, and that every possible encouragement be given to some concern or corporation to establish a generating plant at a coal mine to transmit energy to the city.

The report takes up the possibility of combination of a number of cities to build a generating plant and buy a coal mine. Cleveland is faced with coal problems which make necessary the expenditure annually of upward of $438,000 in excess coal prices. The commissioner expresses the belief that the new Windsor plant of the American Gas & Electric Company will be able to produce energy at the switchboard for 1.5 mills per kilowatt-hour if not less. Application was made to the American Gas & Electric Company for a block of this power for Cleveland, but the commissioner was informed that the entire output had been sold. Construction of a power plant at a mine by the city itself, the commissioner says, is not practicable at present on account of the abnormal and unreasonable prices. However, it must be seriously considered, he said, in the near future.

LARGE-SCALE PRODUCTION NOW DESIRED IN ENGLAND

Board of Trade Committee Reports that Comprehensive Generating System Should Be Established as Soon as Possible

A memorandum has been issued by the electric power supply committee which was appointed by the Board of Trade of London, England, to "consider and report what steps should be taken, whether by legislation or otherwise, to insure that there shall be an adequate and economical supply of electric power for all classes of consumers in the United Kingdom, particularly industries which depend upon a cheap supply of power for their development."

The committee has unanimously concluded:

1. That when British industry is subjected to the test of keen international competition, after the war, its success will depend upon the adoption of the most efficient methods and machinery so as to reduce manufacturing costs as much as possible.
2. That a highly important element in reducing manufacturing costs will be the general extension of the use of electric power supplied at the lowest possible price, and it is by largely increasing the amount of power used in industry that the average output per head, and as a consequence the wages of the worker, can be raised.
3. That the present system under which a supply of electricity is provided in a large number of small areas by separate authorities is the result of a policy adopted at a time when the applied science of electrical engineering was in its infancy, and is incompatible with anything that can now be accepted as a technically sound system.
4. That the interconnection of existing electric supply stations recommended by the Board of Trade in its letter of May 25, 1916, however desirable in itself, cannot alone meet the requirements of the situation.
5. That a comprehensive system for the generation of electricity, and where necessary reorganizing its supply, should be established as soon as possible.

Representative associations will be invited to give evidence as to the best methods of giving effect to the conclusions.

NEW YORK OFFICE MOVED BY GENERAL ELECTRIC COMPANY

Change of Location from 30 Church Street to New Equitable Building Made on Twenty-fifth Anniversary

The New York City offices of the General Electric Company will be moved on June 16, the twenty-fifth anniversary of the company, from 30 Church Street to the Equitable Building, 120 Broadway. The entire twentieth floor has been arranged and furnished for the company. For nine years the offices have been at 30 Church Street, where the company located its New York headquarters when it outgrew the "Edison Building," at 44 Broad Street. This building was originally built for the Edison General Electric Company.

N. E. L. A. PUBLIC POLICY COMMITTEE MEETING HELD

Report Presented by Chairman Lieb of the Committee on War Conditions—Service for Cantonment Camps

A meeting of the public policy committee of the National Electric Light Association was held at the headquarters in New York on June 8.

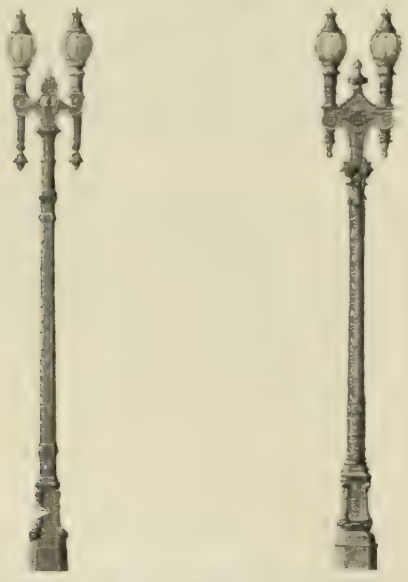
A number of matters were discussed. John W. Lieb, chairman of the committee on war conditions, presented a report outlining the work done by the National Committee on Gas and Electric Service. A similar report of the national committee, of which Mr. Lieb is also chairman, is published elsewhere in this issue.

It was also reported by Mr. Lieb that the government had asked for information as to the possibilities of furnishing electric service for the army cantonment camps. Information obtained from the various companies has been forwarded to Washington. Similar information regarding gas service was also furnished.

ORNAMENTAL LIGHTING FOR LOS ANGELES, CAL.

Careful Consideration Given to Standards for Broadway District in Order to Enhance Daylight Appearance of Street

A new ornamental lighting system is proposed for the district on Broadway, Los Angeles, between the Broadway tunnel and Tenth Street. The work is being undertaken by the Broadway Improvement Association. Total installation cost will be about $85,000, of



TYPES OF STREET-LIGHTING STANDARD FAVORED IN LOS ANGELES

which one-half or more will be paid by property owners and the remainder by the company supplying the service. The system was designed by W. D'Arcy Ryan, General Electric Company.

A resolution giving special commendation to the members of the Improvement association for their energy and the results accomplished, despite the cry of "retrenchment" on account of the war, was passed by the City Council of Los Angeles.

In general the scheme is to replace the present incandescent clusters with more ornamental and higher standards each carrying two luminous arc lamps of high candlepower, thus increasing the light flux in the street six or seven times, with an increase of less than two and one-third times the operating cost. Careful consideration has been given to the design of the standard in order that the daylight appearance of the street may be greatly enhanced and the row of standards may be a unifying factor of the street.

WESTINGHOUSE CHANGES AFFECT ELECTRICAL MARKETS OF WORLD

British Company Control Shifted to England, but American Company Retains Minority Interest—Alliance to Rival German Interests

Publication in the London newspapers of news of the sale of holdings of the Westinghouse Electric & Manufacturing Company in the British Westinghouse Electric & Manufacturing Company, Ltd., and an interview given out subsequently by Chairman Guy E. Tripp in New York confirm the rumors that final steps have been taken in the organization of a great aggregation of Westinghouse electric interests. A powerful financial group in London, through the control of the British Westinghouse Company, the French Westinghouse Company and the Italian Westinghouse Company, are said to have further plans which will rival the great German company, the Allgemeine Electricitäts Gesellschaft.

It is significant that the American Westinghouse company not only retains a financial interest in this combination, but that the sale of its shares is based upon and made in connection with an agreement of alliance with the London group under which the American company trades in the Western Hemisphere and the Far East, including Asiatic Russia, and the British company in Europe, Africa and Australia, each company representing the other as sole agent in its respective territory for business that naturally gravitates toward the other.

This is especially interesting as it is the first great Allied business combination that has been announced since the beginning of the war and marks another important development in the affairs of the Westinghouse company.

In his statement confirming the London report of a change in the relations of the American and British companies, Mr. Tripp said:

"The whole transaction is based upon an agreement under which the interests of the British company and the American company become closely allied to the end that the engineering skill and organization of both companies shall be most effectively put to use in the markets of the world."

In a letter to shareholders the directors of the British company say that "in view of the sentiment produced in this country by the war and of the possible changes which may result in international economic relations," they have desired for some time that the control should be transferred to Great Britain. They are of the opinion "that it is for the advantage of your company that our American friends should retain such an interest in its profits as will make it worth their while to continue in the future to assist in its development."

WORK OF N. E. L. A. SECTIONS MODIFIED IN THE WAR YEAR

Chairmen McClelland, Mansfield and Edkins Show that the Sections Are Meeting the Exigencies of War

While the work of sections of the National Electric Light Association cannot be forecast definitely because of the uncertainty of the war, the chairmen are following the policies formulated by the annual meeting on May 9 and 10.

TECHNICAL AND HYDROELECTRIC SECTION

R. J. McClelland, chairman Technical and Hydroelectric Section, writes to the ELECTRICAL WORLD:

"The Technical and Hydroelectric Section does not contemplate any considerable modification either in the character or in the extent of its activities.

"It was the opinion of the annual meeting that all important committee work should be continued with no more curtailment than would inevitably be necessitated by the increased individual responsibilities of the committee members. The member companies of the association are to be urged to make available as heretofore, in so far as they are able, the needed time of the members of their organizations.

"The technical committees have done some exceptionally valuable work during the last year, in spite of the severe handicap imposed by the unusual individual demands upon the men who have been carrying it on. It is most important that this work continue. If it possesses value in time of peace, its value should be greater now. The adjustments to changed conditions, the improvements in general efficiency which we will be called upon to make, will be much aided by the opportunities which this committee work affords for making generally available the results of individual experience."

ELECTRIC VEHICLE SECTION

E. S. Mansfield, chairman of the Electric Vehicle Section, writes to the ELECTRICAL WORLD:

"The Electric Vehicle Section has followed certain lines of specific endeavor during the past year rather than spending its time in general work and has exerted a great deal of influence and accomplished a good deal through its various committees in pushing along the business, which has been very successful and very gratifying.

"During the coming year, although the activities may be somewhat modified, it will be the intention of those directing the section to continue all activities to as great a degree as possible consistent with the necessary curtailment on account of the national conditions, and conforming to the general policy which may be defined for carrying out the work by the N. E. L. A."

COMMERCIAL SECTION

E. A. Edkins, chairman of the Commercial Section of the National Electric Light Association, has made the following statement in regard to the activities of the section during the coming year:

"To summarize adequately the vast amount of practical and valuable work accomplished by the Commercial Section during the last administrative year would require more space than is now available. The work of the Commercial Section as at present conducted enters minutely and exhaustively into every detail connected with the commercial side of our industry and, by cross-membership with other sections, into all related activities in which commercial work is at all concerned with the technical and accounting side of the business. This work is performed cheerfully and gratuitously by busy men occupying responsible positions in their respective companies, whose services in this work are given at a considerable personal sacrifice.

"Under the new and changed conditions this work will be continued, even though the necessary personal sacrifices may be greater than ever before. In general, the policy of the Commercial Section, at least for the immediate future, will be to watch with greater care than ever the developments in commercial work in all sections of the country, to study the best methods for developing intensive business to go on existing lines, to be on the alert for any and all opportunities which may present themselves for effective co-operation with the association staff at headquarters and with other association committees, and to hold ourselves in readiness to assume any new burdens or duties which may be assigned to us by the incoming administration."

SUBSTANTIAL IMPROVEMENT IN NORTH AMERICAN REPORT

President Mortimer, in Twenty-seventh Annual Statement of Holding Company, Shows Conditions in the Wisconsin and Missouri Subsidiaries

President James D. Mortimer of the North American Company, in the twenty-seventh annual report to stockholders, said that business conditions in the territories in which the company is interested showed substantial improvement over those prevailing during the greater part of 1915. This is readily apparent in the increased earnings of the Wisconsin subsidiaries. Some improvement in industrial activities in the Missouri territory is reflected in increased operating revenues, though offset in large measure, Mr. Mortimer adds, by increased operating expenses, due to higher costs of material, fuel, labor and taxes.

Total income of the company was $2,304,329, as compared with $1,952,503 in 1915. Dividends aggregating 5 per cent were paid on the stock.

A committee of the directors revalued the securities. The report states that conservative valuations were placed on all the securities; the amount at which 184,000 shares of United Railways Company of St. Louis common stock was carried was reduced to $1. The net decrease in book values was $2,600,000, which was charged to "contingent security depreciation reserve," created in 1914, leaving a balance in that reserve of $50,000.

Worcester Company's Steam-Heating Rates

The ELECTRICAL WORLD is requested to state, in correction of a misquotation in a former issue, that the following are the correct steam-heating rates of the Worcester (Mass.) Electric Light Company: First 10,000 lb., 95 cents per 1000 lb.; next 10,000 lb., 85 cents; next 30,000 lb., 75 cents; next 60,000 lb., 65 cents; next 120,000 lb., 55 cents.; all over 230,000 lb., 45 cents. The average rate received by the company is about 50 cents per 1000 lb.

RATE INCREASE BY A MUNICIPAL PLANT

Lighting System of Taunton, Mass., Raises Rates to Consumers to Keep Step with Advances in Cost of Coal

The municipal lighting plant at Taunton, Mass., has increased rates on account of higher coal cost.

Beginning July 1, the power schedule will be increased 5 per cent and the commercial lighting schedule 2½ per cent, these applying in both classes for each advance of $1 in the price of coal above $5 per gross ton.

OHIO COMMISSION AUTHORIZES INCREASE IN POWER RATES

Northwestern Ohio Railway & Power Company Raises Wholesale and Retail Power Schedule Practically 33 1/3 Per Cent

The Ohio Public Utilities Commission of Ohio has granted authority to the Northwestern Ohio Railway & Power Company to increase wholesale and retail power rates practically 33 1-3 per cent. The rates are to be covered by a tariff and approved by the commission on the usual thirty-day statutory notice. This will make the new rates effective on Aug. 1.

The company is controlled by the General Gas & Electric Company. It sells energy to the Port Clinton Electric Light & Power Company, also controlled by the General company. It also lights Genoa, Lakeside, Curtice, Clay Center and Gypsum.

RECOMMEND CHANGES IN NIAGARA SITUATION

Pending Legislation Under Discussion at the National and New York State Capitals Affecting the Production of Power

Electrochemical industries along the American-Niagara frontier are vitally interested in the bill advocated by Secretary of War Baker which seeks unusual rights regarding the extension of water-power diversion permits at Niagara Falls, N. Y. Explaining the measure before the House foreign affairs committee, Secretary Baker declared that he would not only designate who should enjoy the use of the extra diversion of water from the Niagara River but would regulate the price of the products that are manufactured with that power.

Gen. William M. Black, chief of engineers, mentioned that a survey is being made for a canal around Niagara Falls which might be used as a power project as well as for navigation. For several months federal engineers have been investigating the Niagara power situation as applied to the electrochemical industries, whose products are in great demand for the government. The shortage of power has handicapped many large and important industries.

Representatives of the large electric generating and electrochemical industries of Niagara Falls, N. Y., appeared recently before the New York State Conservation Commission at Albany in reference to the Niagara power situation. The generating companies explained the urgent necessity for legislation which would tend to increase the efficiency of existing power companies on the American side of the river and the increasing demands for additional electric power. It was pointed out that of the two companies on the American side of the river one diverts 6500 cu. ft. (182 cu. m.) of water per second and the other 8600 cu. ft. (241 cu. m.). One drops the water 138 ft. (42.06 m.) and develops 11 hp., and the other drops it 214 ft. (65.2 m.) and develops 22 hp. It is the object of the two companies to run the water through a single tunnel, thus gaining increased efficiency and developing greater horsepower.

Among those at the conference, which was held in the office of George D. Pratt, conservation commissioner, were Frederick D. Corey, president of the Niagara, Lockport & Ontario Power Company; Morris Cohn, Jr., of the Hydraulic Power Company, and former Senator Clinton T. Horton, attorney for Mr. Corey.

NEW HAMPSHIRE COSTS LEAD TO HIGHER RATES

Concord Company, Receiving Authority to Acquire Another Property, Shows Increased Costs from 21 Per Cent to 285 Per Cent

Higher local rates and improved service resulting from a proposed consolidation were under consideration by the New Hampshire Public Service Commission, following the petition of the Concord Electric Company for authority to purchase the Penacook Electric Company. On behalf of the Concord company Levin J. Chase, local manager for Charles H. Tenney & Company of Boston, general managers of the system, testified on costs.

Evidence showed that the application of the Concord rates to the Penacook customers would increase bills of the latter about 18 per cent, but that service would be greatly improved.

Mr. Chase presented the following, showing increases in cost since 1914:

	Old Cost	Present Cost	Per Cent Increase
Cross-arms, four-pin	0.579	0.70	21
Arresters, lightning, "F"	3.075	5.85	90
Lamp coloring (quarts)	0.943	2.06	118
Eye bolts, 15-in.	0.0575	0.1608	179
Manila rope, ⅜-in.	0.15	0.22	47
Guy wire, ⅜-in.	0.00768	0.0225	193
Insulators, glass, No. 3	0.0143	0.0237	66
Washers, round, ½-in	0.00165	0.00392	137
Screws, fetter drive, 4-in.	0.01274	0.0239	87
Machine bolts, 16-in.	0.055	0.0985	78
Guy wire, ¼-in.	0.005	0.0112	124
Wire, triple-braid, W. P. No. 6	0.1254	0.35	179
Machine bolts, 13-in.	0.0473	0.0855	80
Braces, cross-arm	0.1185	0.20	68
Washers, square, 2¼-in.	0.00922	0.0225	144
Mohair lamp cord	0.0122	0.047	285
Gasoline	0.12	0.25	108
Engine oil	0.19	0.2574	35
Poles	.....	.....	33
Average above items	.....	.....	109

The commission granted authority to the Concord company to purchase the Penacook company for $60,000, of which $55,000 may be capitalized. It decided that whether or not a consolidation took place an increase of the Penacook rates to the level of the Concord rates was not unreasonable and should be allowed. The Penacook company has reached its limits so far as water power is concerned and could not take new consumers without running its steam plant.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Franchise Time Limit.—A village resolution giving an electric lighting company certain privileges and providing that it should apply only to a section of a former agreement, which section was limited in time, is itself limited to the same period as the original agreement, according to the Court of Appeals of New York in Weedsport Electric Light Company versus village of Weedsport (115 N. E. 986). The consent by a village to an electric lighting company using its streets, etc., may be lawfully restricted by conditions which do not violate the constitution, statutes or established principles of municipal law.

Regulation of Power Dams.—Law intended as a complete scheme for control of power dams and modifying franchises previously granted, but failing to give some of parties affected right of appeal and review, was unconstitutional for taking private property without compensation and without due process of law and for failing to accord equal protection of laws; the Railway Commission's order under such act requiring defendant to maintain a power dam between maximum level of 6 ft. and minimum level of 5 ft., this being practically an impossibility and less than the usual variation of inland lakes, and the effect of the order being to destroy the value of the plant, but providing a heavy penalty for violation, was invalid, it was held by the Supreme Court of Wisconsin in the State versus Wisconsin-Minnesota Light & Power Company (162 N. W. 433).

Condemnation of Water Power.—The condemnation of certain water rights by a street and interurban railway company, conformably to the local law, cannot be said to be for a private use, and hence wanting in due process of law, on the ground that the contemplated works will produce much more power than will be needed for the railway, and that the company's charter empowers it to sell the surplus power, where the taking, according to the findings of the state courts, was with intent in good faith to carry on the public business authorized by the charter, i.e., to build and operate a railway between points named, and it was further found that it was necessary to generate electric power from the stream in order to operate the railway, that the proceeding was for a public use, and that, in order fully to develop the company's water power for such purpose it was necessary to condemn the rights in question, the Supreme Court held in Hendersonville Light & Power Company versus Saluda-Hendersonville Interurban Railway Company (37 Sup. 440).

Depreciation of Property Due to Tree Cutting by Linemen.—Where linemen in caring for the line went upon plaintiff's property and cut trees therefrom, their acts, though wrongful or negligent, are to be treated as the act of the defendant company, being in furtherance of its business, since it is only when the employee abandons his duty and willfully becomes a wrongdoer that the employer is exempt from all responsibility for the wrongful act, it was held by the Court of Appeals of Maryland (99 A. 991). In action for injuries to realty by cutting trees therefrom in construction of telegraph line, the owner was entitled to show depreciation of the value of the property resulting from the trespass by showing its value before the trespass and its value thereafter.

Negligence of Fellow Employees.—Where a power company did not have any rule that an employee taking an order relative to the cutting of current from a line should report to the person giving the order what had been done, a lineman's mere knowledge of the absence of such a rule did not charge him with assumption of the risk which he encountered in going near a line of the company that his superintendent had ordered cut out, nor would such mere knowledge be inconsistent with a finding that he did not assume the risk, the Supreme Court of Vermont held in Summerskill versus Vermont Power Manufacturing Company (99 A. 1017). A lineman did not therefore assume the risk of injury in approaching a line because he had been near a substation while his superintendent was inside telephoning and waiting to have the current cut off from that line. An employee does not assume extraordinary risks which he understands, and has a right to understand, do not exist. Where the work a power company's lineman was engaged in was that of construction or reconstruction, not of mere operation of the company's system, consisting of the removal of high-tension lines from one side of a highway to the other, the safe-place doctrine applied, and in entering upon the work of attempting to cut out the current from a line other employees of the power company were not fellow employees of the lineman in such sense as to make the fellow-employee doctrine applicable, but stood in the place of the employer in performing a non-delegable duty. Where the fellow-employee doctrine does not apply, the maxim that the principal must respond is applicable. The lineman of a power company who recovered verdict for $7,500 for an electric shock received from a high-tension wire was a high school graduate and had graduated from the department of applied sciences of a university, where he had studied electrical engineering. When injured he was a healthy and intelligent young man, twenty-three years of age, and the shock not only initiated a condition of traumatic neurasthenia, but gave rise to an uncontrollable dread on his part when in the presence of high-tension wires that was likely to impair his capacity in doing electrical work. Verdict held not to be excessive.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Indiana Commission Cases.—The new Public Service Commission of Indiana has issued a résumé of pending cases with a brief classification. The commission, under its first four years, from May 1, 1913, handled many rate cases of electrical utilities and numerous merger cases. The new commission finds that many such cases, however, remain. The summary shows fifty-seven pending cases of different character, which alone probably will require more than a year's time of the commission and its staff. In public utilities the docket shows that there are pending fifteen cases involving physical connection of telephones, thirty-eight telephone rate cases, twenty-one water rate cases, five water service cases, fifty-two electric light and power rate cases, eight electric service cases and five gas rate cases. Eleven applications for authority to issue stocks and bonds were pending on May 1, 1917, besides fourteen applications to surrender franchises and four petitions for purchase and sale of public utilities properties.

Oklahoma Valuation Deferred.—Commissioner Russell of the Corporation Commission of Oklahoma announces that no immediate valuation will be made of the Oklahoma Gas & Electric Company property. A statement by him is in part as follows: "The constitutional duty with which the commission is charged of valuing this plant is in nowise met or changed by the rate concessions or other matters, but in view of the fact that months, or possibly years, will be required to make valuations of all public utilities, the commission feels it can best serve the public interest as a whole by proceeding first with the valuation of the property of such companies as have been unable to make rates satisfactory to their customers. Labor, fuel and machinery are costing from 25 per cent to 100 per cent more now than in the very recent past. The taxes of this company for the coming year will be higher, its assessment having been raised $325,000 above that of the current year, or approximately 13 per cent. The agreement which the company has signed for a 10 per cent reduction in price of electricity (now effective) and an additional 10 per cent, effective in January next, is a very substantial reduction indeed, in the face of the advancing prices everywhere. With these two reductions in effect, the maximum domestic rate will be 7.2 cents per kilowatt-hour (net) and the minimum rate will be 67½ cents per 100 kw.-hr. To encourage the hope that these rates can be cut in two by valuation, or any other process, must lead to inevitable disappointment."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Increase in Stock of Hartford Electric Light Company.—Capital stock of the Hartford (Conn.) Electric Light Company will be increased from $4,500,000 to $6,000,000.

"More than 3000 Uses for Electricity."—The Society for Electrical Development has issued a booklet listing more than 3000 applications of electrical energy in 109 trades and industries. The booklet is one of a series to be issued in connection with the society's "Keep Business Going" campaign.

Lighting Contract in Dayton, Ohio.—W. J. Hagenah of Chicago has been conferring with representatives of the city of Dayton and the Dayton Power & Light Company. He has been employed by the city to make a physical inspection of the lighting company property before execution of a contract for street lighting.

"Business Must Go On."—Under this slogan the Citizens' Electric Company and other utilities of Hot Springs, Ark., tell their community in full-page advertisements in the daily newspapers that never in the history of the world was a nation called upon to perform so gigantic a task. The advertisements show the great demands which will be made upon all classes to participate in world-wide duties, and say that it is the height of folly even to think of hard times in this era of great prosperity.

Plan Permanent Exposition in New York.—The Bronx International Exposition, commemorating the tercentenary of the settlement of the Bronx Borough of New York City, will be opened, it is announced, on May 30, 1918. It will be at the East 177th Street subway station and the Bronx River, New York City, on a tract of twenty-five acres. New effects in the science of illumination will be introduced, and it is expected that W. D'A. Ryan will have charge of the development of this feature. The exposition will be permanent. Over 100 buildings are planned. The general style of architecture will be Spanish colonial.

Water Power in Sweden.—United States Consul General H. W. Harris writes from Stockholm, Sweden, that of the available water power in Sweden, estimated at 6,000,000 hp., about 15 per cent is in use. The number of plants in operation or in process of construction in 1915 was 453. Water power is employed to produce approximately one-half the total annual value of Swedish manufacture. Among the industries using it in 1915 were the following: Timber and pulp, 260,000 hp.; iron, 235,000; electrochemical, 90,000, and textile, 40,000. The total power developed from coal and oil for industrial purposes is about 400,000 hp. Of the installed water and steam power, about 60 per cent becomes electric power.

Franchise Tax for Distribution Outside of City Limits of Wilmington, Del.—On advice of counsel the city of Wilmington, Del., is arranging to collect a franchise tax from the Wilmington & Philadelphia Traction Company for electric light and power generated at the company's local station and sold outside of the city limits. The legal department holds that such electric energy is taxable, inasmuch as the contract for sale is made at the local office and it is immaterial whether the energy generated is disposed of in or out of the city. The company, on the other hand, has disputed the assessment with the contention that the phrase "within the city of Wilmington," as used in the contract between the company and the city, signifies distinctly within the city boundaries.

Unusual Accident.—At Logan, W. Va., an automobile crashed into a telephone pole carrying a heavy load. The car struck the pole with such force that a 20-ft. (6-m.) section was broken out of the pole just above the ground line. This part of the pole fell across the top of the car and remained securely balanced there, as the illustration shows. The upper 10-ft. (3-m.) section of the pole, relieved of its former support, dropped down and alighted squarely upon a messenger wire which was strung above the street at a less height. There the piece of pole remained in an upright position. The photograph was supplied by C. W. De Forest, Union Gas & Electric Company of Cincinnati.



Commissions Should Decide, Governor Whitman Holds.—Governor Whitman of New York State has vetoed the Baxter bill providing that in rate-making for telephone and telegraph corporations the Public Service Commission, Second District, should "take into consideration a reasonable average return upon the value of all the property actually used in the public service within the State." The Governor said: "It seems to me that this is a question which the Legislature should leave to the sound discretion of the Public Service Commission. A corporation is protected by the provisions of the Constitution of the United States, in that its rates cannot be so reduced that it fails to receive a reasonable return on the value of its property, and, as I have said, the question of the rule to be applied should be left to the commission and the courts, not prescribed by law."

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

Pittsburgh Section, I. E. S.—On June 8 the Pittsburgh Section of the Illuminating Engineering Society held its June meeting. Robert Garland spoke on the subject of "Daylight Saving."

Dallas Electric Club and Jovian League.—J. G. Barrett, illuminating engineer of the Texas Power & Light Company, addressed the Dallas Electric Club and Jovian League on the subject of illumination on June 4.

Los Angeles Section, A. I. E. E.—"Insulators and Insulator Design," by C. P. Leibold, engineer of the Ohio Brass Company, was the subject of the recent meeting of the Los Angeles Section of the American Institute of Electrical Engineers.

San Francisco Electrical Development and Jovian League.—At the June 6 meeting of this league Dr. Thomas Addison, Pacific Coast manager of the General Electric Company, delivered an address on "The War's Effect on the Electrical Business."

Illinois Contractors' Midsummer Meeting.—The Illinois Electrical Contractors' Association will hold its mid-summer meeting at Peoria, June 22 and 23. Col. Robley Stearnes, of New Orleans, president of the National Electrical Contractors' Association, will attend.

The Radio Club of America.—A meeting of the club was held on June 15 in the Engineering Building, Columbia University, New York City. Arthur A. Hebert, general manager of the American Radio Relay League, presented a paper on "Past and Future of the American Radio Amateur."

Pittsburgh Section, A. I. E. E.—The final meeting of the season of the Pittsburgh Section of the American Institute of Electrical Engineers was held June 12. One of the speakers was L. M. Johnston, general manager A. M. Byers Company, who talked on "Selective Conscription and What It Means." Capt. Walter Krueger, Third Infantry, United States Army, spoke on the subject of "Our Task."

Association of Iron and Steel Electrical Engineers.—The regular monthly meeting of this association will be held at Pittsburgh, Pa., to-day, June 16. The paper to be presented at this meeting will be "By-product Coke Ovens in the Steel Industry," by James Farrington. Count Kosloff, lieutenant-colonel in the Russian army, will speak during the dinner on "New Russia." The meetings of the Philadelphia Section have been discontinued until after the annual convention, which will be held in Philadelphia on Sept. 10 to 14, inclusive.

W. O. Custer, power specialist of the Mansfield Electric & Power Company, has been appointed manager of the Massillon Electric & Gas Company, succeeding T. O. Kennedy.

H. Gordon Gilpin, formerly assistant general manager of the Ohio Electric Railway Company, has been promoted to the position of general manager, with offices at Lima and Springfield, Ohio.

John B. Miller, president of the Southern California Edison Company, Los Angeles, Cal., has been called to Washington as one of the executive committee of five to finance the American Red Cross.

C. A. Bergen, formerly with the Emmanuel properties in Texas, has joined the Commonwealth Light & Power organization as manager of the Stearns Lighting & Power Company at Ludington, Mich.

P. B. Rice has resigned as electrical engineer of the United Gas & Electric Engineering Corporation to accept the position of mechanical and electrical engineer of the International Railway Company at Buffalo.

F. C. Pratt, assistant electrical engineer of the New York office of the Doherty Operating Company, has been appointed manager of the Alliance Gas & Power Company, succeeding W. J. Rose, who resigned to enter the steel business.

J. G. Menut, general manager of the Claremont Power Company, Claremont, N. H., has been made vice-president of the Colonial Power & Light Company, of which the Claremont concern is a branch, and also vice-president and a member of the board of trustees of the Claremont company.

Charles F. Lacombe, who has for the last few years been a consulting engineer at 45 Broadway, New York City, and who was formerly chief engineer of the Department of Water Supply, Gas and Electricity, New York, is now serving in the Second Provisional Regiment, Fifteenth Company, at Plattsburg, N. Y. He has qualified as a captain of engineers and expects within a few days to take up his military duties at Belvoir, Va. Mr. Lacombe's experience in construction and operation of light and power installations, together with his service in the city of New York, should be of value in his new work in governmental service.

W. R. McCann, valuation engineer of the State Public Utilities Commission of Illinois, has been appointed electrical engineer of the Emergency Fleet Corporation of the United States Shipping Board. He reported for duty to General Goethals this week. Mr. McCann prior to his connection with the Illinois commission was supervisor in the former division of erection of the Isthmian Canal Commission, where under the direction of the electrical and mechanical engineer of the commission he designed the electrical transmission system of the Panama Canal. Before going to the Isthmus he was connected with the Commonwealth Edison Company of Chicago.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

A. F. Traver, superintendent of the Denver Gas & Electric Light Company, has been appointed manager of the Spokane Gas & Fuel Company.

Ainslie A. Gray, formerly managing editor of the *Electrical Review and Western Electrician*, has formed a partnership with Charles Benjamin, with offices at 608 South Dearborn Street, Chicago, to handle technical and trade advertising. Mr. Gray is well known in technical and publication circles. Besides being a member of various electrical societies and past-president of the Electric Club of Chicago, he is president of the Associated Business Papers, Inc.

T. O. Kennedy, manager of the Massillon Electric & Gas Company, has been appointed superintendent of the Denver Gas Electric Company, succeeding A. F. Traver. Mr. Kennedy was graduated from the University of Missouri in 1907, when he entered the Doherty cadet school at Denver. The following year he went with the Montgomery (Ala.) Light & Water Works Company in the gas works as foreman, from which position he rose to assistant general superintendent. In 1910 he was appointed general superintendent of the Lincoln (Neb.) Gas & Electric Company. During January, 1912, he was sent by the Doherty organization to Forsyth, Mo., as engineer in charge of the Ozark Power & Water Company's development on the White River, where he remained until the fall of 1913, when he was called to New York. The following August found him as general manager of the Massillon property.

William J. Rose has resigned as treasurer and general manager of the Alliance Gas & Power Company to enter business for himself. He has been very prominently connected in all work in the electrical and gas industry and in both national and state associations. He was president of the Ohio Electric Light Association in 1915-1916 and is now chairman of the executive committee of this association. Mr. Rose took a very active interest in the civic development of Alliance as well as being financially interested in a number of its industries. He is at present president of the Rotary Club, director of the Country Club, director of the Merchants and Manufacturers' Club and past-president of the Chamber of Commerce. The employees of the Alliance Gas & Power Company, at a farewell banquet, presented Mr. Rose with a massive table lamp as a token of their appreciation of his work with them. Mr. Rose went to Alliance in 1908 as superintendent and was soon thereafter made manager.

Frank L. Perry, Baltimore, Md., who for a number of years was business manager for the *Western Electrician* of Chicago, has been made a merit member of the Electric Club-Jovian League of Chicago.

N. C. Draper, manager of the Sioux Falls (S. D.) division of the Northern States Power Company, has been elected president of the South Dakota Electrical Association. Mr. Draper became connected with Sioux Falls lighting interests in 1911, when he was appointed manager of the Sioux Falls Light & Power Company, the predecessor of the Northern States Power Company. For a time he was master mechanic of the Central Railway Company of Peoria, Ill., from which he rose to be superintendent of the Peoria & Pekin Terminal Railway Company. He was later vice-president and general manager of the Eastern Wisconsin Railway & Light Company of Fond du Lac, Wis. He was next connected with the Zanesville (Ohio) division of the Columbus, Newark & Zanesville Electric Railway, which supplies Zanesville with lighting, and from there he went to Sioux Falls.

Obituary

Arthur Gunn, who met his death on May 24 by the overturning of his automobile, was one of the founders and



ARTHUR GUNN

first president of the Northwest Electric Light & Power Association. Mr. Gunn was born in Maysville, Ky., March 21, 1866. In 1888 he was graduated from Park College, in Kansas City, Mo., after which he went to the State of Washington, where he started the Kelso *Courier*. From 1892 to 1894 he was engaged in banking in Wenatchee and in 1896 organized in that place what was known as the Pioneer Ditch Company. About twelve years ago he formed the Wenatchee Electric Company, which was later incorporated as the Wenatchee Valley Gas & Electric Company, of which he was president at the time of his death. Mr. Gunn took more than usual interest in civic affairs and was to be found on the governing boards of most of the local civic institutions.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

WAR DEMAND OF GOVERNMENT WILL UNDOUBTEDLY BE LARGE

Military and Naval Appropriation Bill Before House of Representatives Includes an Item of $5,900,000 for Searchlamps

Government orders for electrical goods for war purposes will undoubtedly reach a very large total aside from the demand otherwise created by the war. While no figures are available showing how much the government intends to expend on electrical equipment, the figure of $5,900,000 for searchlamps, included in the House military and naval expense bill, is significant.

In view of the available capacity for searchlamp production this figure is considerable. It is not known whether the appropriation includes the necessary auxiliary electrical equipment. Field lamps of the nature used abroad and also used by American forces in the Mexican punitive expedition are supplied with energy from gasoline-driven generators.

SCARCITY OF STEEL MAY AFFECT 1918 FAN DESIGN

Cast-Iron Product Seems Likely to Supersede the Pressed Steel Which Is Now Turned Out by Most Manufacturers

Scarcity of raw materials is liable to have a much more than temporary effect in the electrical market. Particular reference is had at this time to electric fans. Most manufacturers are turning out at present a pressed-steel fan. There has been great difficulty in getting steel this year, but the anticipated action of the government in commandeering a very substantial part, perhaps 50 per cent, of the steel output of the country may seriously embarrass manufacturers should they continue the manufacture of the same types.

It seems quite likely, therefore, that the 1918 design of electric fans will show a predominating use of cast iron. Some manufacturers are now using cast iron, and there is no doubt that this number will be materially increased before another season rolls by.

The use of cast iron in place of pressed steel will, of course, reduce the cost of manufacture somewhat and will consequently help materially to prevent the price of fans from advancing very much.

DEMAND FOR PASSENGER ELECTRICS MAINTAINED

Business Stimulated in Spite of Increase in Price—High Cost of Labor and Materials Will Force Another Advance Soon

Contrary to the general rapid decline in the gasoline pleasure-car business, the demand for electric pleasure cars has kept up remarkably well, and while in comparison with last year there is probably no appreciable increase, it must be remembered that during the first quarter of the current year the demand for these cars was decidedly below that of last year. Since then, however, business has picked up, and during last month it was particularly good, although some of the more prominent manufacturers had put into effect a price advance about the first of May.

Distributers and manufacturers of electric vehicles are optimistic over the existing situation. Higher prices for gasoline cars are foreseen, and this is expected to act in favor of the electric. Furthermore, there is a fear among gasoline car men that the government may follow the lead of England and France in commandeering gasoline vehicles for military purposes. In this event, of course, the sale of electrics would be greatly increased for local use.

Already some of the cars have been advanced around $200, and within a few days another advance, probably in the neighborhood of $100, is expected. Manufacturers have made every effort to keep the price down, feeling that a popular-priced car would appeal more to the general public. However, it has not been possible to withhold an advance any longer without sacrificing quality. Labor and materials have advanced to such an extent that a price increase became necessary.

JOBBERS' INVESTMENT IN STOCK MORE THAN DOUBLED

Average Advance in Supplies, Volume for Volume, Around 50 per Cent in the East, While Stocks Increase in Amount 40 per Cent

Not only have jobbers been required to carry a stock of late greatly in excess of normal—in fact, an excess on the average of 40 per cent in the East was shown in the ELECTRICAL WORLD for last week—but they have been required to carry this stock when prices have been rising

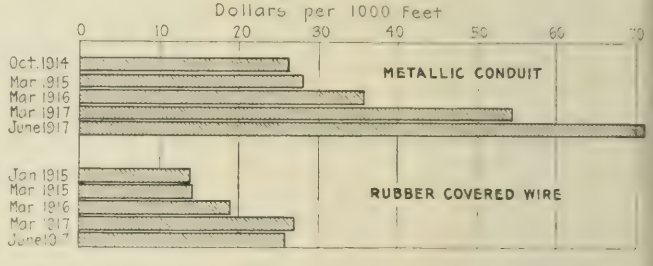


CHART SHOWING RAPID ADVANCE IN COST OF TWO MAJOR ITEMS IN JOBBERS' STOCKS

(Conduit has advanced 171 per cent in thirty-two months; wire, though lower now, did increase 93 per cent)

until they are considerably greater than they were two years ago. A further canvass of Eastern jobbers shows, as with stock, a great discrepancy in the figures. On the average, however, electrical supplies have advanced in the last two years in the neighborhood of 50 per cent. In other words, a jobber with the same volume of stock now that he had two years ago would probably find that he had 50 per cent more capital tied up in stock than he did in the late spring of 1915.

Since, however, the average condition revealed was a surplus stock of 40 per cent, then it becomes evident that the jobbers' additional investment in stock on which there is no return is not 50 per cent on the average, but 110 per cent.

The figures, of course, are based entirely on the results of the canvass of the Eastern supply men, but, as was pointed out in the ELECTRICAL WORLD last week, it is doubtful if conditions, except in isolated cases, are any better in any section of the country. In fact, on the Pacific Coast there are good reasons to believe that the jobbers' additional investment in stock is much more than 110 per cent because they have had to stock up more heavily than houses nearer the source of supply.

Prices of electrical supplies began to advance along in 1915 and since that time have continued to show increases. Prices for two of the major items, rubber-covered wire and

metallic conduit, covering the period of price increase up to the present, are shown graphically in the accompanying diagram. All supplies, of course, have not advanced so rapidly or as much as have these two, but with the exception perhaps of incandescent lamps there is hardly a line of general electrical supplies that has not increased in price once or more in the past two years.

Naturally this has had its effect on the jobbing trade. It has meant that a considerably greater volume of business has been done on credit. It has also caused jobbers generally to be much more cautious than formerly. Practically to double the investment in stock when it is well understood that 50 per cent is represented entirely by an increased value that will vanish as conditions approach normal has placed the trade in a peculiar position.

NEED OF STANDARDIZATION IN FOREIGN TRADE COMPETITION

English Manufacturers of Engineering Products Foresee the Necessity for Standard Specifications

To-day the foreign trade of the world belongs to that nation that can supply and will supply the goods. After the war a different condition will exist. Then there will be more manufacturing facilities available. Then there will be competition to obtain foreign trade to keep the factories at home running. So great will be the competition that everything will be done to lower the cost of production.

Quantity production will be one way to lower cost, and perhaps the greatest. This demands two things: (1) quantity sales, and (2) standardization. This is true whether it be for an individual manufacturer or for a group of manufacturers. It must therefore be easy to sell the goods. The proposition must be cut and dried so that time will not be lost in specialty sales. In the foreign markets, therefore, standardization of goods will be a very important factor. It will be necessary, furthermore, for the manufacturers of every nation to stick together. When the attention that England and Germany and France are giving to the after-war trade in foreign markets is noticed and studied, it will be seen that when the war is over it will not be the individual manufacturer's motor or switch, etc., that is sold, but an English motor, a German transformer, etc.

The Germans have their unions for promoting sales. England has caught the spirit, and through the British Engineering Standards Committee has standardized on British equipment, and realization of this as a factor in the foreign market has not been lost. Believing that urgent steps are needed to assist British engineering manufacturers in competing successfully in foreign markets, this committee has made the following recommendations:

"(a) That the specifications of the British Engineering Standards Committee, or at least the more important of them, should be at once translated into French, Spanish and Russian, with metrical equivalents for the British measurements and formulas.

"(b) That local committees of engineers and traders in close touch with the main committee in London should be formed at about twelve important trading centers—for example, in the Argentine, Brazil, Canada, Chile, China, India, Peru, Portugal, Russia, South Africa, Spain, Uruguay.

"(c) That the price of all our publications, whether in English or the other languages, should be largely reduced, viz., to about 1 shilling (24 cents) a copy or its equivalent in foreign moneys.

"(d) That the local committee should have as chairman the British consul or other government representative."

The British government has decided to give its assistance in carrying these investigations into effect. The British Foreign Office and the Board of Trade have decided to support the new venture through their officials, and the British treasury has given valuable financial assistance.

Already a start has been made on these recommendations by British manufacturers. The British Electrical and Allied Manufacturers' Association, beginning with the March issue, is translating *Beama*, the official monthly publication of the organization, into Russian and Spanish and distributing copies in Russia and in Spanish-speaking countries. This is in line with recommendation (a).

Very little so far has been done in the United States to prepare for the competition in the world's foreign trade that is to follow the war. Little strong co-operative effort is being made to place American goods as such on the markets of the world.

COPPER AND INSULATED WIRE MARKET CONDITIONS

Low-Priced Stocks in Hands of Jobbers Pretty Well Disposed of, so that Present Sales Are Based on Current Market Prices

BY M. A. OBERLANDER

Supply Sales Manager Western Electric Company, Inc

The copper market seems to be more active, bar copper being quoted at 32 cents and 32½ cents a pound. With the demand keeping up, there is every indication that we shall have a stable market, though of course at times there may be some slight fluctuations. Taking all conditions into consideration, it would appear that prices on copper will remain firm for some time to come.

From all indications the low-priced stocks of insulated wire in the hands of the jobbers have been pretty well disposed of, and it would seem that most of the sales now made by jobbers are based on wire bought at approximately present market prices.

It appears from investigations that have been made of the prices now quoted to consumers that they are more in line than those quoted some six months ago, when the cost of the material in the hands of the jobbers varied considerably. Taking into consideration the likelihood of the continued demand for insulated wires of the various grades, it would seem foolhardy for any one to sacrifice any stock that he may have on hand which was purchased at a lower price than the present market. Rubber-covered wire is being quoted in large quantities on the 38-cent base.

GENERAL CONDITIONS IN METALS MARKET

Lead Has Advanced, While Tin Has Receded Somewhat—Copper Quotations Higher on Future Deliveries

Generally speaking, there was little activity in the several metals markets as the week opened. Lead is higher than during the previous week, while tin is somewhat lower. Copper is firm, with slightly higher prices prevailing for future deliveries.

Reports from Washington have indicated a desire on the part of the government to purchase copper on the basis of cost plus a reasonable profit.

Nominal quotations were made on Monday for electrolytic copper as follows: June, 32.75 cents; July, 31.75 cents; third quarter, 31 cents, and fourth quarter, 29.50 cents.

NEW YORK METAL MARKET PRICES

	June 4 Selling Prices Bid	Asked	June 11 Selling Prices Bid	Asked
Copper:	£ s d		£ s d	
London, standard spot	130 0 0		130 0 0	
Prime Lake	31.00 to 32.00†		31.00 to 32.00†	
Electrolytic	32.50 to 33.00†		32.50 to 33.00†	
Casting	30.50 to 31.00†		30.00 to 31.00/	
Copper wire base	37.00 to 38.00/		37.00 to 38.00†	
Lead	10.00		11.00	
Nickel	50.00		50.00	
Sheet zinc, f.o.b. smelter	19.00		19.00	
Spelter, spot	9.55 to 9.67½		9.55 to 9.67½	
Tin, Straits	61.50†		60.75†	
Aluminum, 98 to 99 per cent	56.00 to 58.00†		56.00 to 58.00	

OLD METALS

Heavy copper and wire	28.00 to 28.50	28.00 to 28.50
Brass, heavy	17.50 to 18.00	17.50 to 18.00
Brass, light	14.25 to 14.75	14.50 to 14.75
Lead, heavy	9.25 to 9.75	10.00 to 10.25
Zinc, scrap	7.25 to 7.50	7.25 to 7.50

†Nominal.

Current Prices of Electrical Supplies

NEW YORK AND CHICAGO QUOTATIONS

The prices quoted are those prevailing in standard package or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists to contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

The variation in prices may be due to the difference in grade of products made by different manufacturers, to local conditions or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor

B. & S.	Size	List, per 1000 Ft.
No. 14	solid	$61.00
No. 12	solid	71.00
No. 10	solid	90.00
No. 8	solid	106.00
No. 6	solid	145.00
No. 10	stranded	95.00
No. 8	stranded	115.00
No. 6	stranded	160.00
No. 4	stranded	205.00
No. 2	stranded	266.00
No. 1	stranded	315.00

Twin-Conductor

No. 14	solid	104.00
No. 12	solid	135.00
No. 10	solid	185.00
No. 8	stranded	235.00
No. 6	stranded	370.00
No. 4	stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

No. 14 solid:	
Less than coil	+10% to $54.90 Net
Coil to 1000 ft.	3% to 48.80 Net
No. 12 solid:	
Less than coil	+10% to 63.90 Net
Coil to 1000 ft.	3% to 56.80 Net

Twin-Conductor

No. 14 solid:	
Less than coil	+10% to $78.00 Net
Coil to 1000 ft.	3% to 75.00 Net
No. 12 solid:	
Less. than coil	+10% to 121.00 Net
Coil to 1000 ft.	3% to 108.00 Net

DISCOUNT—CHICAGO

Single-Conductor

No. 14 solid:	
Less than coil	+10%
Coil to 1000 ft.	10%
No. 12 solid:	
Less than coil	+10%
Coil to 1000 ft.	10%

Twin-Conductor

No. 14 solid:	
Less than coil	+10%
Coil to 1000 ft.	10%
No. 12 solid:	
Less than coil	+10%
Coil to 1000 ft.	10%

ATTACHMENT PLUGS

List ranges from $0.22 to $0 30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	+20% to 12%
1/5 to std. pkg.	10% to 20%
Std. pkg.	24% to 34%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+10% to 12%
1/5 to std. pkg.	10% to 12%
Std. pkg.	34% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.35	$0.35
12 to 50	.30	.30
50 to barrel	.28	.28 to .29
Barrel lots	.24	25

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.35	$0.35
12 to 30	.30	.30
50 to barrel	.255 to .28	.285 to .29
Barrel lots	.24 to .24¾	.25 to .25¾

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
5/16	250	$5.00
⅜	250	7.50
½	100	10.00
¾	50	13.00
1	50	21.00
1¼	50	26.00
1½	25-50	35.00
2	25-50	45.00
2½	25-50	52.00

DISCOUNT—NEW YORK

	Less than Coil	Coil to 1000 Ft.
¾-in. single strip		
⅜-in. double strip		
½-in. single strip	Net to 10%	7% to 20%
½-in double strip	Net to 5%	4% to 15%

NET PER 1000 FT.—CHICAGO

	Less than Coil	Coil to 1000 Ft.
⅜-in. single strip	$71.25 to $75.00	$60.00 to $63.75
⅜-in. double strip	75.00 to 78.75	67.50 to 71.25
½-in. single strip	95.00 to 100.00	80.00 to 85.00
½-in. double strip	100.00 to 105.00	90.00 to 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, in.	List, per Foot	Size., in	List, per Foot
7/32	$0.05½	1	$0.25
¼	.06	1¼	.33
⅜	.09	1½	.40
½	.12	1¾	.47
⅝	.15	2	.55
¾	.18	2¼	.65

DISCOUNT—NEW YORK

Less Than $15 List	$15 to $60 List	$60 to $150 List
Net to 33⅓%	45% to 50%	53% to 55%

NET PER 1000 FT.—CHICAGO

Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in. $36.67 to $55.00	$27.50	$23.10 to $24.75
¼-in. 40.00 to 60.00	30.00	25.20 to 27.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 38

Size, In.	Conduit, List per Foot
¼	$0.08½
⅜	.08½
½	.08½
¾	.11½
1	.17
1¼	.23
1½	27½
2	.37
2½	.58½
3	.76½

	Couplings, List	Elbows, List
¼	$0.05	$0.19
⅜	.06	.19
½	.07	.19
¾	.10	.25
1	.13	.37
1¼	.17	.45
1½	.21	.60
2	.28	1.10
2½	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	¼ In. to ½ In.	¾ In. to 3 In.
Less than 2500 lb.	6% to 8%	8% to 10%
2500 to 5000 lb.	9% to 11%	11% to 13%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ In. to ½ In.	¾ In. to 3 In.
Less than 2500 lb.	3.8% to 5.8%	5.8% to 7.8%
2500 to 5000 lb.	6.8% to 8.8%	8.8% to 10.8%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

Net	$3.15 to $3.50

CHICAGO

Net	$3.10 to $3.85

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	28%
1/5 to std. pkg.	38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	28%
1/5 to std. pkg.	38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	$5.75 to $6.30
1/5 to std. pkg.	4.50 to 5.25

Standard package, 500. List, $0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	$6.25
1/5 to std. pkg.	5.25

Standard package, 500. List, $0.07.

LAMPS, MAZDA

105 to 125 Volts

Regular, clear:	Std Pkg.	List, Each
10 to 40-watt—B	100	$0.27
60-watt—B	100	.36
100-watt—B	24	.65
75-watt—C	50	.65
100-watt—C	24	1.00
200-watt—C	24	2.00
300-watt—C	24	3.00
Round bulbs, 3½ in., frosted:		
15-watt—G 25	50	.50
25-watt—G 25	50	.50
40-watt—G 25	50	.50
Round bulbs, 3¾ in., frosted:		
60-watt—G 30	24	.72
Round bulbs, 4⅜ in., frosted:		
100-watt—G 35	24	1.05

105 to 125 Volts

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net list
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$30.00 to $35.17
Coil to 1000 ft.	21.00 to 26.73

CHICAGO

	Per 1000 Ft. Net
less than coil (250 ft.)	$37.20 to $38.16
Coil to 1000 ft.	27.90 to 28.62

LAMP GUARDS, WIRE

Standard packages from 50 to 150.

NEW YORK

Net per 100	$18.00 to $29.00

CHICAGO

Net per 100	$12.50 to $28.35

OUTLET BOXES

Nos.	List, per 100
101—A, A1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200 S.E., 300, A.X. 1½, 4 S.	30.00
103—C.A., 9, 4 R., B 1½	25.00
106—F.A., 7, C.S. 1½, 3 R.	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	List to 33%	List to 27%
$10.00 to $50.00 list	42%	18% to 37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	40%	35%
$10.00 to $50.00 list	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	$14.00 to $20.00
1/5 to std. pkg.	13.00 to 15.80

Standard package, 2200. List per 1000, $20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	$14.00 to $18.00
1/5 to std. pkg.	13.00

Standard package, 2200. List per 1000, $20.

PORCELAIN KNOBS

NEW YORK

Per 1000 Net	5½ N.C.—Solid Std. Pkg. 3500	Nail-it—N.C. Std. Pkg. 4000
Less than 1/5 std. pkg.	$10.50 to $24.30	$21.10
1/5 to std. pkg.	9.75 to 12.15	28.00

CHICAGO

Per 1000 Net	5½ N.C.—Solid Std. Pkg. 3500	Nail-it—N.C. Std. Pkg. 4000
Less than 1/5 std. pkg.	$8.40 to $18.00	$20.75 to $28.00
1/5 to std. pkg.	7.80 to 9.00	16.30 to 21.50

SOCKETS AND RECEPTACLES

	Std. Pk.	List
⅛-in. cap key and push sockets	500	$0.33
⅛-in. cap keyless socket	500	.30
⅛-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15% to 20%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

Perkins or Trumbull Type A:	List
30-amp. S. P. S. T.	$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30 amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Perkins Type B or Trumbull Type C:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

Less than $10 list	...
$10 to $25 list	11% to 16%
$25 to $50 list	14% to 24%

DISCOUNT—CHICAGO

Less than $10 list	+ 5% to 5%
$10 to $25 list	11% to 16%
$25 to $50 list	14% to 24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single pole	250	$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp., three-point	100	.56
10-amp., three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	16%
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+ 20% to Net
1/5 to std. pkg.	Net list to 15%
Std. pkg.	30%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar	List, Each
No. 155	$0.34
No. 160	0.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	Net to 23%	Net to 18%
$2.00 to $10.00 list	23% to 50%	18% to 40%
$10.00 to $50.00 list	23% to 60%	18% to 52%

DISCOUNT—CHICAGO

	Black.	Galvanized.
Less than $2.00 list	....	....
$2.00 to $10.00 list	25% to 50%	15% to 40%
$10.00 to $50.00 list	35% to 64%	25% to 52%

TOASTERS, UPRIGHT

NEW YORK

Net price	$3.15 to $3.50

CHICAGO

Net price	$2.80 to $3.50

WIRE, ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.52 to $0.62
No. 18, full spools	0.48 to 0.53

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.65 to $0.6885
No. 18, full spools	0.5285 to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$15.00-18.00	12.00-14.50	11.50-12.50
12	21.66-27.05	18.96-22.85	18.01-20.95
10	29.60-39.27	26.64-33.66	24.68-25.31
8	42.40-51.44	38.16-48.42	33.51-36.25
6	72.19-89.57	64.98-76.80	56.63-61.73

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$18.00	$16.00	$14.00
12	27.05-29.89	22.05-25.62	20.95-23.48
10	38.20-42.28	32.00-36.64	29.60-33.22
8	46.54-60.13	42.35-51.54	37.70-42.95
6	72.70-82.20	66.65-75.35	59.40-68.50

WIRE, WEATHER-PROOF

Solid-Conductor, Triple-Braid, Sizes 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	$40.25 to $45.00
25 to 50 lb.	39.25 to 42.00
50 to 100 lb.	38.00 to 38.25

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.	$44.85 to $45.35
25 to 50 lb.	43.85 to 44.35
50 to 100 lb.	42.85 to 43.35

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Hot Plates

The hot plate shown in the accompanying illustration is a product of the Standard Electric Stove Company of Toledo, Ohio. The resistor ribbon is cut to give exactly the number of watts desired by measuring each element with

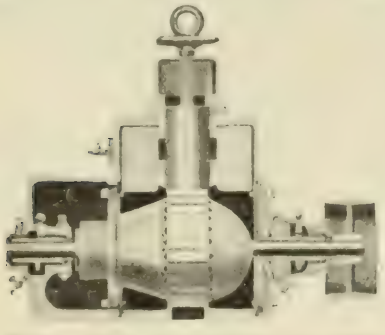


PORTABLE HOT PLATE

a wattmeter. The nichrome resistance ribbon which is used in the heating element is coiled and laid into a clay product, which has high heat conductivity and yet is a non-conductor of electricity. The clay is baked at a temperature of 1500 deg. to secure a glass finish. To prevent radiation of heat below the element, a rock mineral-wool pad is held in place by a rimmed metal bowl and porcelain terminal block, to which leads are attached. There are no channels or recesses to accumulate dirt. These heaters are made for 110 volts unless otherwise specified. The total demand is 1000 watts.

Multi-Speed Motor

The improved type of multi-speed motor shown in the accompanying illustration is manufactured by the Stow Manufacturing Company, Binghamton, N. Y. It is said to have a speed range similar to that of direct-current motors. Maximum efficiency is secured over the speed range provided without the expense and complication of auxiliary machines, controllers or rheostats, the speed being varied by turning a hand-

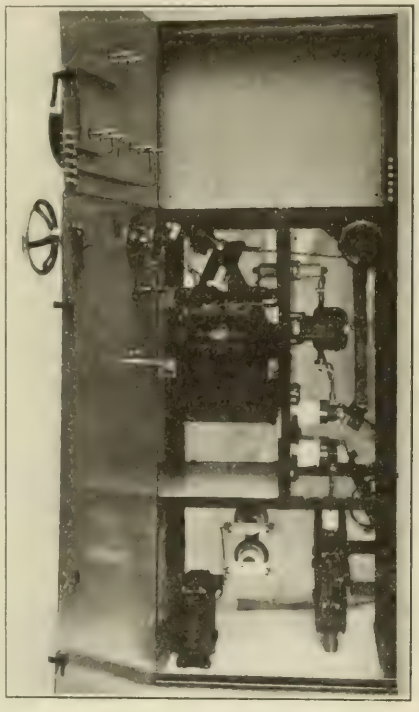


MOTOR WITH WIDE RANGE OF SPEED

wheel which changes the reluctance of the field magnetic circuit. The motor is furnished in two types—bipolar and four-pole. Both are iron-clad and particularly adapted to steel-mill service and for driving heavy machinery as well as printing presses, pumps, etc. The pole pieces and plungers used to vary the magnetic reluctance are designed so that as the volume of effective magnetism is diminished by the outward movement of the plunger the remaining magnetic flux is forced toward the direction of the pole tips, thus furnishing a magnetic field which, it is said, will insure sparkless commutation.

Switching Compartment Unit

Compartment units primarily intended for substation use, any number of which can be assembled together to form a complete switchboard, have been



SWITCHING COMPARTMENT UNITS THAT INTERLOCK

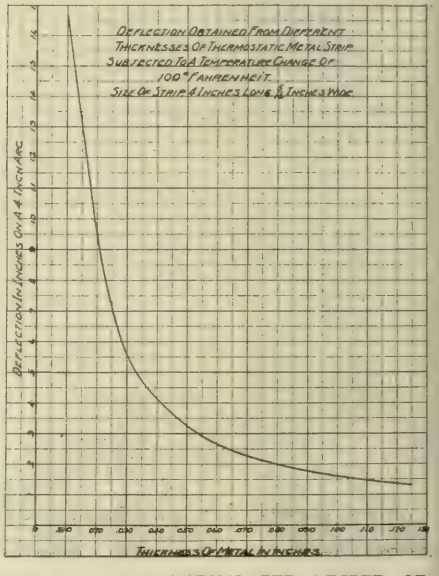
developed by Ferranti Limited, Hollinwood, Lancashire, England. These units are provided with a mechanical interlock which, it is claimed, insures that (a) access cannot be obtained to high-tension apparatus until it has been de-energized, (b) knife switches cannot be opened until the oil switch has been opened, (c) oil switch cannot be closed unless the knife switches are completely open or completely closed, (d) the ground switch, when fitted, cannot be closed until the isolating switches are completely open, and (e) the lower door cannot be opened until the ground switch is closed.

All of the apparatus inside of the unit is accessible from the front, so the units can be installed close to a wall or in a recess. A wide range of equipment is provided to suit the needs of the user.

The unit is built of strong steel plates and angle iron and is divided into compartments by horizontal and vertical division plates. The front plates form two hinged doors, the upper one serving to carry any instruments required. When the door is opened the connections to the instruments are completely exposed. A steel plate shields these connections from adjacent high-tension apparatus. The lower door carries the operating apparatus for the switches, and also provides additional space for instruments, relays, etc.

Thermostatic Metal

The General Electric Company of Schenectady, N. Y., has perfected a product to be known as "thermostatic metal," which bends or regains its original straightness in accordance with well-defined laws as the temperature rises or falls. As a result of this responsiveness to temperature change and the mechanical force developed, this metal is used to actuate various mechanisms which tend to neutralize either the temperature change or its effect upon devices.



CURVE OF DEFLECTION PER DEGREE OF TEMPERATURE CHANGE

This metal consists of two strong non-corrosive metals possessing widely different coefficients of expansion, the widest difference possible, it is said, for any known stable combination of metals. These two metals are firmly

attached to each other throughout their entire length so that there is absolutely no slippage of one metal on the other. The metal can be cut, stamped or pressed into practically any desired shape, and when annealed will have all its original inherent qualities. Moreover, it will not deteriorate nor take permanent "set" under applications of heat or force within definite practical limits. The metal is manufactured in various standard thicknesses ranging from 0.25 in. to 0.015 in. (6.4 mm. to 0.39 mm.), maximum width of 4 in. (10.16 cm.) and maximum length of 36 in. (0.91 m.).

As an indicator this metal is remarkable in that it can be used for temperatures as high as 500 deg. Fahr. (260 deg. C.). The deflection per degree of temperature change, besides being quite considerable as shown in the accompanying curve, is a constant for any definite piece of the metal. Since a definite and considerable opposing force is necessary to cause the metal to take permanent set, the metal can be depended upon when used in devices where extreme accuracy is required, it is claimed.

If the curving of this thermostatic metal on heating or cooling is opposed, the metal will produce a mechanical force, which is limited only by the force required to produce permanent set.

Ice Scraper

The electrically driven ice scraper, shown herewith, which is intended for rinks, has been developed by Dudley H. Scott of Cleveland, Ohio. The scraper was made by mounting a 10-hp. Lincoln slip-ring induction motor on a small automobile chassis, connection being made to the transmission shaft of the chassis by a chain. The reason for running the outfit with this type of motor was to secure a very slow and variable speed. The tractor draws a trailer which carries a planing blade adjustable as to the depth of the cut. Power for the planer is secured through the cable suspended from the center of the roof. The cable is attached at both ends, so it will not twist when the tractor is driven around the rink. The cable drags on the ice, but with no interference with the management of the planer, except in the



ELECTRICALLY DRIVEN ICE SCRAPER

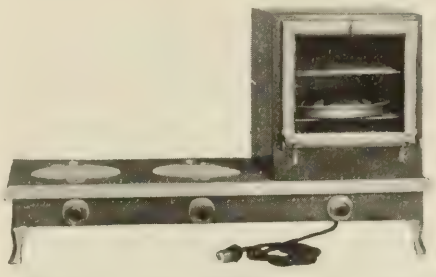
last two or three trips up and down the center of the rink. An Allen-Bradley controller is used to vary the speed of the motor. By use of this particular type of controller a very fine graduation of speed may be obtained.

Waste Heat Gage

The Precision Instrument Company of Detroit, Mich., has developed a combination of two gages in one case that can be used with natural-draft boilers, boilers utilizing the gases from a heating furnace, economizers, or in connection with any waste-heat service. The gages are inclosed in substantial dust-proof black-enamel cases. A door makes the interior of the gage accessible. The dials have a dull aluminum finish, with distinct black numbers. Provisions are made to permit checking the U-gage and adjusting the setting to zero. Recording gages in the same type of case and having the same range can also be supplied.

Kitchenette Range

The Allmur Manufacturing Company of Marion, Ind., has developed the kitchenette range shown in the accompanying illustration. The oven is 12 in. (30.48 cm.) long by 12 in. (30.48 cm.) wide by 16 in. (40.6 cm.) high, and is equipped with a glass door. The heating units are of the patented type made by this company, that can be easily removed, being held in place by wing units. The elements are wound



HEATING UNITS REMOVABLE ON THIS RANGE

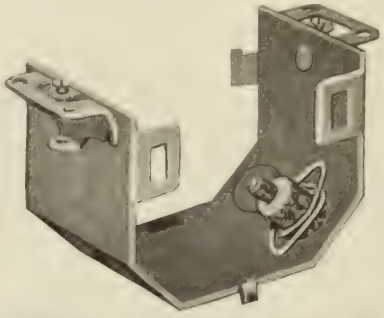
for a demand of 600 watts each. The range is 33 in. (83.8 cm.) long, and 20 in. (50.8 cm.) high.

Wood Preserver

Prior to the war, practically all of the so-called carbolineum or anthracene wood-preserving oils were imported from Germany. Since imports have been cut off, the Kettle River Company, Minneapolis, Minn., has placed on the market a product known as K-R wood preserver, which, it is said, is superior to the formerly imported German product. This wood preserver is a straight distillate of bituminous coal tar, free from any adulteration. The specifications for quality and purity are very stringent. When analyzed by the methods described by the United States Signal Service of the United States Navy, the oil has passed the following specifications before being placed in steel tanks, from which it is drawn into steel drums for the trade: Specific gravity at 39 deg. C., 1.11 to 1.13; flashing point, above 120 deg. C.; burning point, above 165 deg. C.; distillate below 235 deg. C., not exceeding 2 per cent.; distillate between 235 deg. C. and 300 deg. C., not exceeding 10 per cent; pure liquid coal-tar oil residue at and above 300 deg. C., over 90 per cent; tar acids, less than 2 per cent; sulphonation residue, less than 0.25 cc. (or 0.25 per cent); constituents insoluble in benzol, less than 0.25 per cent; condition at 38 deg. C., liquid; ash left on ignition, not exceeding 1 per cent.

Switch Box

Sectional screwless switch boxes similar to the one shown herewith that may be fastened together with screws

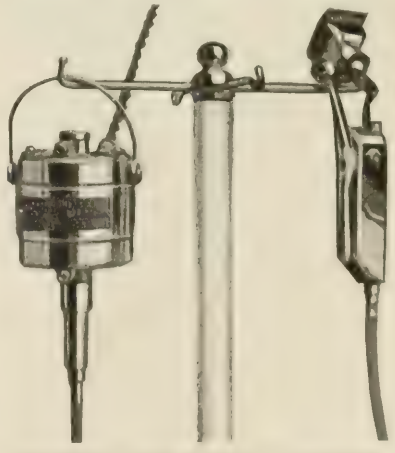


SECTIONAL SCREWLESS SWITCH BOX

are made by the A. B. Wilson Company, Leader-News Building, Cleveland, Ohio. The dimensions of these boxes are 2.25 in. (5.72 cm.) deep by 2 in. (5.08 cm.) wide by 3 in. (7.6 cm.) long, leaving plenty of room inside the box. The ears of this type of box are reversible, so it may be made to fit any wall device.

Electric Hair Cutter

An electric hair cutter designed to perform its function in a short time and with small discomfort to customers has been placed on the market by the Moore Electric Corporation of Chicago. A Racine motor, rated at 0.05 hp. and operating on 110-130 volts, alternating or direct current, drives a worm in the hair cutter by means of a flexible shaft. A crank attached to this gear operates the clipper with a sliding motion. With



ELECTRIC HAIR-CUTTING MACHINE

this device hair can be cut easily in five minutes and records of three-minute hair cuts have been made. A vibrator is also made to operate from the motor and can be interchanged with the hair cutter in a few seconds.

Trade Notes

HICKEY & SCHNEIDER have taken larger offices in the same building at No. 1 Broadway, New York City.

ROBERT H. TAYLOR has resigned as secretary of the National Equipment Corporation to become affiliated with W. B. Ogden & Company. He is succeeded by O. K. Davis.

THE WESTINGHOUSE LAMP COMPANY announces the removal of its New York district sales office from 100 Fifth Avenue to rooms 1211-1212, 165 Broadway, New York city.

THE SMITH FLURRY ELECTRIC COMPANY, Dallas, Tex., will in the future act as distributor throughout Texas and Oklahoma for electric ranges and heating devices manufactured by the Crabe Stove & Range Company of Kokomo, Ind.

D. H. THOMSON has been elected president and treasurer of the Terry Steam Turbine Company of Hartford, Conn., filling the vacancy caused by the death of James Terry. N. L. Snow, sales manager of the company, has been elected vice-president.

ERNEST F. LEARNED, formerly with the engineering department of Stone & Webster, has joined the staff of the Day Baker Motor Truck Company, Boston, Mass., as head of the industrial electric truck department. He will handle the C. W. Hunt Company's electric trucks and tower plant coal-handling equipment.

THE ROYAL BANK OF CANADA, with offices at William and Cedar Streets, New York City, announces that it has opened four branches in Venezuela, at Caracas, Maracaibo, Ciudad Bolivar and Puerto Cabello. These are in addition to fifty-one branches in the West Indies, South and Central America. The bank is prepared to transact a general banking business at these points.

ROBERT ABBOTT, who for the last eight years has been connected with the sales organization of the Bryant Electric Company, and has managed its New York office since it was opened in 1913, has volunteered for service in the Roosevelt base hospital unit, and sailed for France last week. No announcement has been made by the company with reference to his successor in the New York office.

C. S. BUTLER, who has been associated with the Hess-Bright Manufacturing Company for about seven years, has been appointed sales manager of the Carlson-Wenstrom Company, Richmond Street and Erie Avenue, Philadelphia, Pa. It is the intention of the Carlson-Wenstrom Company to introduce and manufacture a new design for high-grade double-row ball bearings, as well as to market a complete line of thrust ball bearings.

C. W. CHESTNUT, who for the past two and a half years has been sales manager of the Western Electric Company at Omaha, Neb., was recently transferred to the Seattle offices of the company. He will hold the same position in Seattle and will have supervision of both the Portland and Seattle branches. The position of sales manager in Seattle heretofore has been held by J. I. Colwell in connection with his duties as manager. Mr. Colwell will continue as manager of the Seattle office.

THE TRUMP MANUFACTURING COMPANY, Springfield, Ohio, manufacturer of water-power machinery, states that the receivership under which it has been operated for the past seven years has been lifted and the company is doing business as a going concern. The engineering department and the management remain unchanged. The company reports having on its books a larger volume of business than ever before in its history and that the prospects for the future are more than encouraging.

THE SANGAMO ELECTRIC COMPANY of Springfield, Ill., announces the opening of a San Francisco office at 37 Stevenson Street, in charge of L. A. Nott, district manager. This office will represent the Sangamo company in northern California and that part of southern California not handled by the Sangamo company's Los Angeles office. Mr. Nott was for many years with the Standard Underground Cable Company, and has been latterly with the K. P. F. Electrical Company, which association he will continue. The Sangamo company will now carry a complete stock of meters, repair parts, etc., in San Francisco.

AINSLIE A. GRAY and CHARLES L. BENJAMIN have formed a partnership under the name of Gray & Benjamin, with offices in the Transportation Building, 608 South Dearborn Street, Chicago, to engage in business and trade advertising. The firm proposes to act as advertising counsel to manufacturers of electrical, mechanical and allied specialties, render copy, planning and reporting upon problems of manufacture and distribution and supervising the preparation of advertising. The firm has technical and trade papers, exhibit house organs, catalogs and booklets at its command. Mr. Gray was formerly managing editor of the *Electrical Review and Western Electrician*, and Mr. Benjamin prior to the last two years was advertising manager of the Cutler-Hammer Company.

New Incorporations

THE COURTNEY (W. VA.) ELECTRIC POWER PLANT COMPANY has been incorporated by Joseph Nelson, O. T. Fochtodt and A. G. Barker of Courtney.

THE HARDINSBURG (KY.) ELECTRIC LIGHT COMPANY has been chartered with a capital stock of $2,000 by Alfred Taylor, R. R. Compton and P. Compton.

THE SEWICKLEY (PA.) TOWNSHIP LIGHT COMPANY has been chartered with a capital stock of $5,000 to operate in Sewickley Township. E. S. Haymond of Wilkinsburg, Pa., is interested in the company.

THE SOUTH HEIGHTS (PA.) ELECTRIC COMPANY has been incorporated with a capital stock of $5,000 to operate in South Heights. E. S. Haymond of Wilkinsburg, Pa., is interested in the company.

THE ELECTRIC ENGINEERING & MANUFACTURING COMPANY of Chicago, Ill., has been incorporated with a capital stock of $1,000 by Charles S. Babcock, Walter F. Olds and William F. Kennedy.

THE SEYMOUR (WIS.) ELECTRIC COMPANY has been incorporated by W. E. Daniels, E. P. Daniels and S. D. Newell. The company is capitalized at $10,000 and proposes to furnish electrical service in Seymour.

THE WOODLAWN (PA.) ELECTRIC COMPANY has been granted a charter with a capital stock of $5,000 to furnish electrical service in Woodlawn. E. S. Haymond of Wilkinsburg, Pa., is interested in the company.

THE ILLUMINATING COMPANY of Greenspring, Ohio, has been chartered with a capital stock of $15,000 to supply electricity in Greenspring. The incorporators are: H. C. Gammeter, B. A. Young, A. E. Neikirk, J. C. Kinney and R. D. Reynolds.

THE STAMFORD (CONN.) ELECTRIC & MANUFACTURING COMPANY has been incorporated by Edward Heitman, William M. Foord and Matthew H. Kenealy. The company is capitalized at $150,000 and proposes to manufacture electrical and other machinery.

THE KINGSPORT UTILITIES of Bristol, Va., has filed articles of incorporation with a capital stock of $1,000,000 to construct and operate an electric-light and power plant. The officers are Sherwood E. Hall, president, and Edward C. Bailly, secretary, both of White Plains, N. Y.

THE POLITOWSKI MAGNETIC ENGINE COMPANY of Dover, Del., has been incorporated under the laws of the State of Delaware with a capital stock of $1,000,000 to manufacture magnetic, electrical and other machinery. The incorporators are: A. N. Jarvis and Samuel MacKechan Dayne, both of Chicago, Ill.

THE POWERLIGHT COMPANY of Dover, Del., has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $500,000 to manufacture lamps and illuminating specialties. The incorporators are: Samuel B. Howard, Arthur W. Britton and Louis H. Gunther, all of New York, N. Y.

THE HARDYSTON ELECTRIC COMPANY of Newton, N. J., has been incorporated by Thomas W. Waters of Haddon Heights, N. J.; Edgar S. Waters of National Park, N. J.; John L. Atwell of Brooklyn, N. Y., and Charles S. Rinds of Upper Montclair, N. J. The company is capitalized at $100,000 and proposes to furnish electrical service in this vicinity.

THE ELECTRONITE MANUFACTURING COMPANY of Salt Lake City, Utah, has been chartered with a capital stock of $1,000,000 to manufacture and deal in electrical fixtures, including electric robes, blankets, slippers and pads. The officers of the company are: L. C. Hornschurch, president; H. L. Bliss, vice-president, and Chester A. Elliott, secretary and treasurer.

Trade Publications

CONDUIT FITTINGS.—The Adapti Company of Cleveland has prepared catalog No. 6-6, descriptive of its conduit fittings.

RANGES.—The Standard Electric Stove Company, Toledo, Ohio, has prepared a catalog descriptive of its complete line of electric ranges.

APPLIANCES.—The Electric Construction Company of Little Rock, Ark., is preparing a new catalog and price list file on all electrical supplies.

RANGES.—The S. P. Stove Company of Wilmette, Ill., has prepared brochure No. 2, descriptive of its S-P electric stoves, ranges and appliances.

TAPS AND DIES.—The Greenfield Tap & Die Company of Greenfield, Mass., has prepared a manual containing instructions and information issued to its employees.

STOKERS.—The Laclede-Christy Clay Products Company of St. Louis has issued a folder the title of which is "How Can I Offset the Increased Cost of Coal?"

ELECTRICAL SUPPLIES.—The Mohawk Electrical Supply Company, 325 South Warren Street, Syracuse, N. Y., is distributing its 1917 electric fan price list.

POLE JACK.—The Templeton-Kenly Company, Ltd., 1022 South Central Avenue, Chicago, Ill., is distributing an illustrated folder descriptive of its "Simplex" pole jacks.

FLOOR SURFACER.—The "American Universal" floor surfacer for all kinds of wood floors is illustrated and described in a bulletin recently issued by the American Floor Surfacing Machine Company of Toledo, Ohio.

REFLECTORS.—The National X-Ray Reflector Company of Chicago is distributing the May issue of "Eye Comfort," published to aid advocates of good lighting. This issue includes papers on showcase lighting, theater lighting, show-window lighting, church illumination and artistic fixtures for X-ray lighting.

APPLIANCES. — The Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., has prepared an illustrated folder descriptive of three double-page *Saturday Evening Post* advertisements in four weeks, and big space in other magazines, used in opening the Westinghouse "reel" campaign.

ELECTRICAL APPARATUS. — The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has prepared leaflets on motors for paper-finishing mills, crane-protective panels, headstock equipments for woodworking lathes, curve analyzing and recording devices, outdoor metering equipment, electrical speed indicators, type HB overload relays, portable fault localizers, potentiometers and synchronous-booster converters.

ELECTRICAL TRADES' DIRECTORY AND HANDBOOK.—The thirty-fifth annual edition of the *Electrician* (London) "Electrical Trades' Directory and Handbook" has been received. Among the contents of the handbook section are a full digest of the law of electric lighting, electric power, electric traction, telegraphs and telephones, by A. C. Curtis-Hayward, and a digest of the law relating to patents, trademarks and designs, a list of the patents expiring in 1917, etc.; the various rules for the installation of electric light, power and traction in England, including the fire risk rules of the leading fire offices, the regulations of municipal authorities relating to electricity supply, etc.; the government regulations for the use of electrical energy in factories and workshops, and the regulations affecting the application of electricity to mines and collieries in Great Britain, the British colonies and the principal mining centers of the world; financial details relating to electrical joint stock enterprises, and information relating to the financial side of every branch of the industry; electrotechnical tables and data relating to electricity supply and traction, telegraphy and telephony, electrochemistry, etc. The directory division contains the name and address of virtually every person engaged in the electrical profession and industry throughout the United Kingdom. The classified trades section is complete. Sections are devoted to the British colonies, to the continent of Europe, to Asia and Africa, Central and South America, and the United States. These contain particulars of all officials in the electrical, telegraphs, radio, railways and tramways, and works departments of the governments of the world. There are in all about 1500 pages in the book, which is published at 15 shillings net.

New England States

BAR HARBOR, ME.—The Public Utilities Commission has granted its approval of a contract between the Bar Harbor & Union River Power Company and the American Smelting & Refining Company, whereby the former will furnish electricity for the mining operations at Bluehill. The contract is for a period of six months, with the privilege of renewal for two years and six months. The contract will necessitate additions to the power plant at Ellsworth.

BROWNVILLE JUNCTION, ME.—Bids will be received until June 26 for the construction of buildings at Brownville Junction, including 18-stall, semi-permanent engine house, machine, wheel and power house, 155 ft. by 50 ft.; boarding house, three-story and basement, frame building, 90 ft. by 45 ft. Also for construction at Holeb, Maine, of a single-track mechanical coal plant of 75 tons capacity. Plans and specifications may be obtained upon application to resident engineer C. P. R., Brownville Junction.

FORT FAIRFIELD, ME.—The Public Utilities Commission has granted the Limestone Light & Power Company permission to furnish electrical service in certain portions of the town of Fort Fairfield.

WEST POWNAL, ME.—Bids will be received by the board of hospital trustees for the Maine School for Feeble-Minded, addressed to Dr. Carl J. Hedin, superintendent, West Pownal, Me., until June 30, for construction of power house, conduit system, etc. Plans and specifications may be obtained at the office of Arthur B. Fels, 60 Union Street, Portland, Me.

CHESTER, MASS.—The purchase of the electric plant of the Chester Electric Light Company, to be owned and operated by the municipality, is under consideration.

NEWPORT, R. I.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 18 for furnishing and installing turbo-alternators, condensers, pumps, exciters, boilers, stokers, draft fans and piping at the naval training station, Newport, R. I. Specifications (No. 2362) may be obtained upon application to the above bureau or to the commandant of the naval station named.

WATERBURY, CONN.—The Chase Companies, Inc., of Waterbury, has petitioned the Public Utilities Commission for approval of the construction of an electric transmission system from the Chase Metal Works in Waterville to the Chase Rolling Mill Company in Waterbury.

Middle Atlantic States

BINGHAMTON, N. Y.—The City Council is considering the establishment of an ornamental lighting zone as permitted by the new charter.

BROOKLYN, N. Y.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until June 19 for furnishing blading for Curtis turbines, brass, phosphor bronze, bar and sheet copper, sensitive drill, milling machine, pipe fittings, brass pipe, copper tubing, brass voice-tubing unions, valves, etc. Proposal blanks may be obtained on application to the above bureau or to the supply officer, Navy Yard, Brooklyn, N. Y.

BUFFALO, N. Y.—The power house of the Pennsylvania Railroad Company on Babcock Street is being enlarged.

BUFFALO, N. Y.—The H. G. Trout Company of Buffalo is building a new foundry building and power house in connection with its iron works at Ohio and Moore Streets.

BUFFALO, N. Y.—Bids will be received by the Lighthouse Inspector, Buffalo, N. Y., until June 23 for furnishing four electric generating units. For details see Searchlight Section.

CLIFTON (BOROUGH OF RICHMOND), N. Y.—Plans have been filed by Dr. L. A. Dreyfus for a two-story brick power house at Clifton, to cost about $25,000, adjoining his rubber factory. Contract for construction of building has been awarded to the Turner Construction Company, 11 Broadway, New York, N. Y.

COOPERSTOWN, N. Y.—The Public Service Commission has approved the merger of the Hartwick (N. Y.) Power Company, the Deposit (N. Y.) Electric Company and the Southern New York Power Company of Walton into the Colliers Light, Heat & Power Company, and extensions of the transmission lines of the Standard Light, Heat & Power Company of Unadilla through the town of Guilford, Chenango County, to connect with the lines of the Norwich (N. Y.) Gas & Electric Company. The new lines of the Standard company will also distribute electricity in the town of Guilford.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

FREDONIA, N. Y.—The Board of Trustees has authorized H. C. Drake, village president, and Arthur Moore, village clerk, to enter into a contract with the Niagara & Erie Power Company to furnish electricity for lighting the streets and public places of the city for a period of five years. Heretofore energy has been generated at the municipal plant.

LOCKPORT, N. Y.—W. W. Wotherspoon, superintendent of public works, has denied the application of the city of Lockport for permission to divert water from the Erie Canal for municipal purposes. It was the intention of the city to use the water for generating electricity in connection with a proposed municipal electric light and power plant. The State authorities also informed the city that they would oppose any attempt to secure legislation that would authorize the diversion of water from the canal.

NEWARK, N. Y.—Bids will be received by Albert W. Beaven, president of board of managers of the New York State Custodial Asylum for Feeble-Minded Women, Newark, N. Y., until June 22 for furnishing two boilers; heating work, stokers, piping, etc., at the New York State Custodial Asylum for Feeble-Minded Women. Specifications may be seen at the Asylum, Newark; New York office of Department of Architecture, Room 1224, Woolworth Building, New York City. Drawings and specifications and blank forms of proposal may be obtained at the Department of Architecture, Capitol, Albany. Lewis F. Pilcher is state architect.

SALAMANCA, N. Y.—Work is under way on the construction of the new shop and power plant at the local yards of the Buffalo, Rochester & Pittsburgh Railroad Company. Westinghouse, Church, Kerr & Company of New York have the contract for construction of buildings.

YONKERS, N. Y.—The National Sugar Refining Company is contemplating the construction of a new boiler house at its plant at the foot of Main Street, to cost about $140,000.

BASKING RIDGE, N. J.—An election will soon be held to vote on the proposal to appropriate funds for an electric-lighting system for the township.

BERNARDSVILLE, N. J.—At special elections held June 5 the following townships have voted appropriations for street-lighting during the coming year: Livingston Township, Newmarket, Port Reading, Mountain Lakes, Little Falls and German Valley. The fund for the total work in these districts amounts to about $11,000.

GLOUCESTER, N. J.—The City Council is negotiating with the Public Service Electric Company for a new street-lighting contract, which is to include the installation of a new system, consisting of 60-cp. lamps in the business district and smaller lamps in other sections of the city.

IRVINGTON, N. J.—A new boiler plant, for factory operation, will be built by Kraeuter & Company, 571-585 Eighteenth Avenue, Newark, at their new tool-manufacturing plant being erected on Nye Avenue. The cost of the entire plant is estimated at about $160,000.

NEWARK, N. J.—The Nickelsburgh Brothers Company, manufacturer of leather, contemplates the erection of two one-story boiler plants at its factory on Meadow Street.

NEWARK, N. J.—The question of establishing a hydroelectric power station at the Wanaque water properties, recently acquired through agreement with the North Jersey District Water Supply Commission, will be investigated by the Board of Works.

NEWARK, N. J.—A boiler and engine house, one story, will be erected at the new plant of the Alcohol Products Company at the foot of Blanchard Street. The cost of the entire work is estimated at $75,000. Frederick A. Phelps, Union Building, is architect.

SALEM, N. J.—The City Council is considering the installation of a new engine, pumping equipment, etc., at the local water-works station, to provide for emergency service.

WEEHAWKEN, N. J.—Bids will be received by the board of education, West New York, until June 20 for electrical work and heating in Public School No. 6. Harry Kuhlke is clerk of board.

EASTON, PA.—The Pennsylvania Utilities Company is installing a 3000-kw. turbo-generator at its plant on Dock Street. Arrangements are also being made by the company to install four new boilers.

ELMHURST, PA.—The citizens of Elmhurst have organized a board of trade and will establish a water and sewer system and an electric lighting plant and also the extension of the Moosic Lake electric railway into the borough and other public improvements.

HAMBURG, PA.—The Metropolitan Electric Company of Reading has recently entered into a contract to supply energy for the central station of the Hamburg Gas & Electric Company.

JOHNSTOWN, PA.—Arrangements have been made by the Pennsylvania Electric with the Standard Quemahoning Coal Company for furnishing energy for mining operations. The coal company will install new electric haulage and other apparatus.

MILLERSBURGH, PA.—The Millersburg Electric Light, Heat & Power Company has begun work on the erection of a new electric transmission line to Halifax. Improvements are being made to the local station, including the installation of new boiler and other equipment.

MORRELLVILLE, PA.—Following the loss of its power plant by fire on May 29 the Morrellville Coal Mining Company has contracted with the Citizens' Light, Heat & Power Company of Johnstown to furnish energy for mine haulage and other operations at its properties. The company, it is understood, will rebuild the power station. Post office address, Johnstown.

READING, PA.—The City Council has approved an appropriation of $15,000 for improvements to the city fire alarm system.

ST. PETERSBURG, PA.—Contract has been awarded by General Utilities & Operating Company of Baltimore, Md., which owns and operates the St. Petersburg Electric Light & Power Company for a 4000-kw. steam turbine to be installed in the local plant.

YEADON, PA.—The Theodore Presser Company of Philadelphia has awarded the contract for the erection of a power house to cost $20,000 at its printing plant in Yeadon to the Wills-Ludwick Company, 34 South Seventeenth Street, Philadelphia.

WILMINGTON, DEL.—Plans have been filed by the Wilmington & Philadelphia Traction Company for an addition to its power station on the Brandywine River.

BALTIMORE, MD.—The Consolidated Gas, Electric Light & Power Company is contemplating the erection of an addition 36 ft. by 67 ft., to its Lexington Street plant, to be used for an engine house.

BALTIMORE, MD.—The contract for the construction of an engine house, 36 ft. by 67 ft., one story, at the Spring Garden plant, has been awarded by the Consolidated Gas, Electric Light & Power Company to the B. F. Bennett Building Company, 123 South Howard Street, Baltimore.

RISING SUN, MD.—The town of Rising Sun has awarded a contract for the installation of a new electric-lighting plant.

SPARROWS POINT, MD.—Arrangements are being made by the Dundalk Company, recently incorporated with a capital stock of $5,000,000, to develop property at Sparrows Point for an industrial city. The work will include the installation of an electric-lighting system, which, with other work, will cost about $150,000. Edward H. Bouton, Munsey Building, Baltimore, is president of the company.

FIELDALE, W. VA.—Plans and specifications have been prepared for the development of 2000 acres for industrial city, with large textile mills, for Marshall Field & Company of Chicago, Ill. The plans provide for the construction of an electric-lighting plant, water-works, sewer system, etc. The work will be done under the management of George W. Fraker and E. D. Pitcher of Spray, N. C.; the former is president of the Carolina Cotton & Woolen Mills Company, controlled by Marshall Field & Company.

MARTINSBURG, W. VA.—The Potomac Light & Power Company is planning to remodel dam No. 5 plant and install two 1000-hp. vertical shaft units. Construction work will be done by the company under the supervision of Sanderson & Porter, consulting engineers, 52 William Street, New York, N. Y. Contracts for machinery have been awarded.

LYNCHBURG, VA.—Bids will be received by the Council Committee on Water, Lynchburg, until June 25 for construction of a municipal filtration plant and appurtenances for the city of Lynchburg, the work to be let either in whole or part as follows: (1) Filter building appurte-

frames, 223 machine brackets, (7) locomotive cranes, (8) lifting appliances and parts, (9) miscellaneous machine tools and electrical equipment, (10) calculating and sedimentation tank and equipment, (11) pumping and purification apparatus, (12) miscellaneous equipment and wiring, (13) force main and distributing pipe. Plans and specifications may be obtained at the office of H. E. Abance, city engineer, Lansing, upon deposit of $10.

RICHMOND, VA.—The City Council has awarded a contract to the F. J. White & Sons Company for extensions to the municipal electric-light plant.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Brooklyn, N. Y., Schedule 1211—Miscellaneous blading for Curtis turbines. Schedule 1217—35,000 lb. brass wire, 5 lb. coils; 32,000 lb. soft copper wire. Philadelphia, Pa., Schedule 1211—miscellaneous turbine blading. Charleston, W. Va., Schedule 1220—three 6-ton electric furnaces. Schedule 1219—four motor-driven hydraulic power pumps for operating 500 and 3000-ton presses. Schedule 1218—two 500-ton hydraulic piercing presses, one 3000-ton hydraulic piercing press, including intensifier. Brooklyn, N. Y., Mare Island, Cal., Schedule 1205—eight fuel-oil heaters. Schedule 1221—two electric-driven portable drills, two motor-driven, 30-in. radial drills, two motor-driven, 16-in. sensitive drills, two motor-driven, two-wheel, column emery grinders, two motor-driven portable service grinders, two motor-driven 4-in. capacity hack-saws, two motor-driven back-geared extension gap, screw-cutting lathes, four motor driven, all geared head, tool room, screw-cutting lathes, two motor-driven, constant-speed drive, universal milling machines, two motor-driven tool room column shapers. Boston, Mass., and Brooklyn, N. Y., Schedule 1217—miscellaneous full spring, bronze phosphor wire. Norfolk, Va., Schedule 1203—four quick-change gear, high duty, 16-in. screw-cutting engine lathes. Boston, Mass., Schedule 1202—one steam windlass. Norfolk, Va., Schedule 1214—13,800 lb. hard-drawn brass tubing; Schedule 1209—30,000 lb. brass tubing, tinned inside and out; Schedule 1212—3000 lb. seamless-drawn copper tubing. Newport, R. I., Schedule 1212—10,000 lb. seamless brass tubing, miscellaneous hard-drawn copper tubing. Various, Schedules 1209-1216—miscellaneous drawn seamless brass pipes; Schedule 1209—miscellaneous seamless copper tubing. Puget Sound, Wash., Schedule 1209—miscellaneous hard-drawn seamless copper tubing. Brooklyn, N. Y., and Philadelphia, Pa., Schedule 1210—miscellaneous pressure-reducing light water and steam brass valves. Applications for proposal blanks should designate the schedule desired by number.

North Central States

CLEVELAND, OHIO.—Bids will be received by the commissioner of purchases and supplies, City Hall, Cleveland, until June 26 for rubber-covered, lead-incased cable for the division of light and heat. Specifications may be obtained at the office of the division of light and heat, Room 204, City Hall.

DAYTON, OHIO.—The power plant of the Dayton Power & Light Company on East Fourth Street is being remodeled.

FAIRFIELD, OHIO. — The Dayton (Ohio) Power & Light Company has offered to furnish the government electricity in any amount, at half rates, for service at the new aviation training field being established at Fairfield. If the offer is accepted, it is said, a transmission line will be erected to the field from the Huffman farm in the Springfield pike, a distance of 2 miles, or the line from the village of Osborn reconstructed.

HAMILTON, OHIO.—The Hancock Robernmeyer tract of land just beyond the eastern corporation limits of the city has been purchased by the Cincinnati Gas & Electric Company, which is to be used as a site for a large substation.

YOUNGSTOWN, OHIO.—The Brier Hill Steel Company is contemplating the construction of an additional blast furnace of 500 tons capacity at its works in the west end. A power station and boiler house for rolling mill will be erected in connection with the extension of the plant. Contract for furnace has been awarded to the Riter-Conley Company of Pittsburgh.

HAZARD, KY.—The capital stock of the Hazard Electric Light & Power Company has been increased from $20,000 to $25,000. Improvements are contemplated to the system.

BLOOMFIELD, IND.—The Public Service Commission has granted the Indiana Power & Water Company permission to purchase the electric-light and power plants in Vincennes, Linton and Petersburg, owned by the Eastern Power & Light Corporation of New York, N. Y.

DECATUR, IND.—Plans have been prepared by the Fort Wayne & Decatur Traction Company for the erection of a substation 25 ft. by 60 ft. at Decatur.

DUGGER, IND.—The Indiana Power & Water Company of Bloomfield has been given authority to purchase the local electric plant, owned by the Eastern Power & Light Corporation of New York, N. Y.

LIGONIER, IND.—The local electric-light plant, it is reported, has been purchased by the Indiana & Michigan Electric Company of South Bend. A transmission line 28 miles long, it is understood will be erected to connect the local system with the lines of the Indiana & Michigan Company.

PETERSBURG, IND.—The Public Service Commission has given the Indiana Power & Water Company of Bloomfield authority to purchase the local electric light plant, owned by the Eastern Power & Light Company of New York, N. Y.

VINCENNES, IND.—The Indiana Power & Water Company of Bloomfield has been granted permission by the Public Service Commission to purchase the properties of the Vincennes Electric Company and the City Electric Lighting Company, which are controlled by the Eastern Power & Light Corporation of New York, N. Y.

EDWARDSVILLE, ILL.—Steps have been taken by the Edwardsville Business Men's Association to make investigations relative to securing improvements to the street-lighting system in the business section of the city.

GIBSON CITY, ILL.—The City Council has instructed the city attorney to go ahead with the necessary legal proceedings for the construction of a municipal electric-light plant.

WAUKEGAN, ILL.—Plans, it is reported, are being considered by the Fulton-Alden Company, manufacturer of phonographs, for enlarging its factory buildings and equipping its plant for electric motor drive.

JUNCTION CITY, WIS.—The Wisconsin Valley Electric Company is contemplating the erection of a 44,000-volt electric transmission line from Mosinee to Stevens Point, a distance of 35 miles, with an extension to Junction City. The company has been granted a franchise to furnish electricity and given a contract for street-lighting in the latter city.

MILWAUKEE, WIS.—Contracts, it is reported, have been awarded by the Pawling & Harnischfeger Company of Milwaukee for new equipment for its plant, including a 500-kw. generating unit, consisting of a Nordberg poppet-valve engine, directly connected to an Allis-Chalmers generator. Two 300-hp. Badenhausen boilers will be installed. An addition, 50 ft. by 80 ft., is being erected to the power plant, to be equipped with a monorail bucket hoist, mechanical stokers and other apparatus. Two new 10-ton yard cranes are also being installed. Woodmansee & Davidson of Milwaukee, Wis., and Chicago, Ill., are consulting engineers.

ALDEN, MINN.—Improvements to the local electric-lighting system are under consideration.

MINNEAPOLIS, MINN.—The Northern States Power Company of Chicago, Ill., has recently purchased the properties of the Northwest Light & Power Company of Hutchinson; the Renville County Electric Company of Bird Island, and the Minnesota Valley Power Company of Montevideo, all operating in southern Minnesota. The three companies serve 28 communities.

ELLSTON, IOWA.—The Mount Ayr (Iowa) Light & Power Company has been granted a franchise to supply electricity for lamps and motors in Ellston.

MASON CITY, IOWA.—The Board of County Commissioners has granted the People's Gas & Electric Company of Mason City a franchise to erect an electric transmission line from Morning Sun to Mediapolis.

NEVADA, IOWA.—Bids will be received by the Commissioners of Story County, Nevada, until June 20 for the construction of a brick building, 118 ft. by 92 ft., two stories and basement, including electric wiring, steam heating, dumb waiters, vacuum cleaner, etc. The cost of the building is estimated at $70,000. Damon & O'Mera, Mason Building, Fort Dodge, are architects.

RUTHVEN, IOWA.—The citizens have voted to grant the Northern Gas & Power Company a franchise to supply electricity in Ruthven.

TINGLEY, IOWA.—The citizens of Tingley have voted to grant the Mount Ayr Gas & Power Light & Power Company a franchise to furnish electricity here.

BERNIE, MO.—The town of Bernie has granted a franchise to G. N. Lasswell and C. L. Coble of Kennett, Mo., to install and operate an electric light plant.

KANSAS CITY, MO.—Work has begun on the erection of a substation at Fifty-ninth Terrace and Swope Parkway for the Kansas City Railways Company.

KANSAS CITY, MO.—The Samuel F. Baker motor Company of Kansas City is planning to equip a repair and garage and and will receive bids until July 1 for equipment, including 20-in. drill presses, arbor presses, grinder and buffer, electric motors, compressor, etc. The cost is estimated at about $12,000.

ST. LOUIS, MO.—The Monsanto Chemical Works of St. Louis is contemplating the purchase of two 500-hp. water-tube boilers, stokers, etc.

MAX, N. D.—The Garrison (N. D.) Coal, Light & Power Company has submitted a proposal to the Commercial Club of Max offering to erect an electric transmission line to Max and furnish electrical service here. Frank McGray of Garrison is interested in the company.

RUGBY, N. D.—An ordinance has been adopted by the City Council granting the Northern States Power Company of Chicago, Ill., permission to install and operate an electric-lighting system in Rugby.

VALLEY CITY, N. D.—The Cheyenne Valley Light & Power Company, recently organized, is planning to erect a high-tension transmission line from Valley City to Dazey, Sanborn, Rogers and other places in this part of the state. Energy for operating the proposed system will be obtained from the municipal plant at Valley City. Later the line may be extended to Hannaford and Wimbledon.

HUMPHREY, NEB.—The local electric light company has been reorganized. The new owners, it is understood, propose to rebuild the electric distributing system and furnish an unlimited service. Frank Wheeler is local manager.

OGALALLA, NEB.—At a special election held June 5 the proposal to issue bonds for a new steam power plant and for extensions to the distributing system was carried. James H. Class is superintendent.

OMAHA, NEB.—Work has begun on the construction of a hospital building for the Swedish Mission Hospital, to cost about $100,000. Bids are wanted on all sub-contracts, including electric wiring, coal chute, fire escapes, etc. Julien Swanson, 2434 Pratt Street, is architect.

STERLING, NEB.—Bids will be received by R. F. Frerichs of the board of education of school district No. 93 of Sterling, until June 26 for the construction of a new school building. Separate bids to be submitted for heating, plumbing and electric work. Plans and specifications may be obtained upon application to Berlinghof & Davis, architects, Security Mutual Life Building, Lincoln, upon deposit of $25.

ATWOOD CITY, KAN.—At an election to be held June 19 the proposal to issue $20,000 in bonds for extensions and improvements to the electric-lighting system will be submitted to the voters.

BURLINGTON, KAN.—The City Council has instructed the city clerk to secure estimates of the cost of an additional Corliss engine and generator for the municipal electric-light plant.

COFFEYVILLE, KAN.—The Union Traction Company, operating in Coffeyville and Independence and interurban lines, has entered into a contract with the Kansas City Gas & Electric Company of Wichita to supply energy to operate its system from Parsons, Kan., to Nowata, Okla.

DOUGLAS, KAN.—At an election held recently the proposal to issue $5,000 in bonds for the installation of an electric-lighting system was carried.

FLORENCE, KAN.—Improvements are contemplated by the Florence Electric Company this summer, including the installation of a 50-kw., three-phase, 60-cycle generator.

OBERLIN, KAN.—The city of Oberlin is considering the installation of a municipal electric-light plant.

ST. MARYS, KAN.—The City Council is considering a proposal submitted by D. A. Course of the Rocky Ford Power Company to supply electricity in St. Marys. The company, it is reported, has made arrangements to supply energy in Alma and McFarland and will cross the river at Wamego.

TORONTO, KAN.—Contracts have been awarded by the city of Toronto for equipment for the proposed municipal electric-light plant. W. B. Rollins & Company, Railway Exchange, Kansas City, Mo., are engineers.

Southern States

BRIDGEWATER, N. C.—The Western Carolina Power Company of Charlotte is contemplating the construction of a 25,000-kva. hydroelectric plant near Bridgewater and another plant to develop about 70,000 kva. near Camden, S. C. The construction of these two plants will necessitate the extension of transmission lines and the erection of a new substation, etc.

CAMDEN, S. C.—The construction of a new 70,000-kva. hydroelectric plant near Camden is under consideration by the Western Carolina Power Company of Charlotte, N. C. The company is also considering the erection of another plant near Bridgewater, N. C., to develop about 25,000 kva.

PORT ROYAL, S. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 25 for construction of eight wood frame officers' quarters, including electric-lighting, plumbing and sewer systems, at the marine recruiting station, Port Royal. Drawings and specification No. 2405 can be obtained upon application to the above bureau or to the commandant of the naval station.

UNADILLA, GA.—The bond issue for the proposed municipal electric plant having been defeated, C. B. Morgan, Mayor, is considering granting a franchise for an electric plant.

MEMPHIS, TENN.—Bids will be received by the Mississippi River Commission, U. S. Engineer Office, Custom House, Memphis, Tenn., until July 2 for furnishing one troughing belt conveyor, one centrifugal discharge belt elevator complete with drive engine, one concrete mixer, bucket and distributing boom complete with drive engine and boiler; one steam capstan and one cement sack elevator complete.

FAYETTE, MISS.—Bonds to the amount of $17,000 have been voted for improvements to the municipal electric-light plant.

McCOMB, MISS.—Work will begin immediately on the construction of an interurban electric railway to connect McComb, Magnolia and Summit. The power plant to furnish energy to operate the line will be located at Fernwood, where waste from the large lumber mills will be used. Right-of-way for the entire length of the road has been obtained. A. H. Jones is manager.

BATESVILLE, ARK.—Bids will be received by the Board of Commissioners, Water and Light Improvement District No. 1, Batesville, Ark., until June 26 for furnishing and installing a 150-kva., three-phase, 60-cycle, 2300-volt generator and a single cylinder, four-valve-type counter-flow or uniflow unit, to operate condensing, directly connected. Specifications may be obtained from Frank L. Wilcox, engineer, Syndicate Trust Building, St. Louis, Mo., upon deposit of $5.

CAMDEN, ARK.—The Camden Electric Gin Company is contemplating installing an electrically operated plant, having a daily capacity of 50 bales.

PARIS, ARK.—Bids will be received by the Electric Light Improvement District, recently organized to establish an electric-light and power system, until June 29, for construction of power plant, the work to include a power house, 30 ft. by 86 ft., two 100-hp. boilers, two water-feed pumps, one 140-hp. steam engine and a 120-kva., three-phase, 60-cycle, 2300-volt engine-type generator, with exciter, switchboard, etc. W. N. Gladson of Fayetteville, Ark., is consulting engineer.

ADA, OKLA.—The Oklahoma Power & Transmission Company is planning to build electric plants at Ada and Shawnee, to cost about $500,000. The plans provide for a development of from 7000 to 10,000 kw. for transmission to Ada, Shawnee, Lawrence, Fitzhugh, Roff, Tupelo, Stonewall, Colgate and other places. The work will include construction of power house, equipped with two 3500-kw. steam turbines, 12 Heine boilers, etc.; also the erection of substations and about 100 miles of electric transmission lines. The work will be done under the supervision of W. H. Zimmerman of the W. H. Zimmerman Company of Chicago, Ill. Sinclair Mainland of Chicago, Ill., is president.

CUSHING, OKLA.—The Oil Field Water, Light & Power Company, recently organized with a capital stock of $250,000, is planning to supply electricity for lamps, heaters, and motors in the cities of Drumright, Cushing, Yale, Stillwater and other towns in this vicinity. It will also furnish energy to pump wells in the Cushing oil fields.

OKLAHOMA CITY, OKLA.—The State Capitol Commission has awarded the contract for construction of power house, 70 ft. by 100 ft., to the Gross Construction Company of Oklahoma City, at $62,500. Layton & Smith of Oklahoma City are architects.

STILLWATER, OKLA. F. M. Redlick of the Oklahoma Agricultural and Mechanical College, Stillwater, would like to receive prices on electrical equipment for science hall and gymnasium armory buildings, to cost $100,000 each.

SUPPLY, OKLA.—At an election to be held June 25 the proposal to issue $6,000 in bonds for the installation of an electric-light system will be submitted to the voters.

COLLEGE STATION, TEX.—Work will soon begin on the installation of ornamental lamp standards on the campus of the Agricultural and Mechanical College of Texas. F. C. Bolton is professor of electrical engineering.

COLUMBUS, TEX.—The Columbus Electric Light Company has leased the municipal water-works system for a period of 12 months. New machinery will be installed and the pumping facilities enlarged.

PORT ARTHUR, TEX.—An addition is being built to the local power station of the Eastern Texas Electric Company of Beaumont. New equipment, including a 4000-kw. turbo-generator, will be installed.

Pacific and Mountain States

CHEWELAH, WASH.—The Washington Magnesite Company has closed a contract with the Stevens County Light & Power Company of Colville for furnishing 1000 hp. at its mine and plant near Chewelah. To furnish the service the power company will have to extend its transmission lines about 8 miles from Chewelah. R. S. Talbot of Spokane is president of the Washington Magnesite Company.

NEWPORT, WASH. — The Northern Idaho & Montana Power Company is erecting a 11,000-volt, three-phase, 60-cycle transmission line from Newport to Dalkena, Wash. The transformer station will have an initial capacity of 300 kva.

OKANOGAN, WASH. — The Okanogan Valley Power Company of Brewster, it is reported, will rebuild its distributing system within the corporate limits of Okanogan.

SEATTLE, WASH.—Plans have been completed by the Pacific Telephone & Telegraph Company, Stuart Building, for improvements in the Yakima Valley, to cost about $100,000. From $15,000 to $20,000 will be spent in North Yakima in underground work and aerial cables and about $75,000 for extensions in the valley.

SEATTLE, WASH.—Bids will be received by C. B. Bagley, secretary board of public works, Seattle, until June 22 for furnishing four oil switches for the auxiliary steam electric station at Eastlake Avenue and Nelson Place, and for two transformers for a substation tie line between the Seventh Avenue substation and the steam plant; also for furnishing one 500-kw. motor-generator set for the Aloha Street substation.

SHELTON, WASH.—The property of the Shelton Electric Company has been purchased by T. E. Donaldson and W. G. Burger, who will operate the plant under the name of the Shelton Light & Power Company.

TACOMA, WASH.—The Wheeler-Osgood Company of Tacoma is planning to equip its sawmill for electrical operation, which will increase the output from 150,000 to 170,000 ft. per day. The new equipment will include four 465-hp. turbines, three boilers, one generator and one turbine. The cost of the work is estimated at $60,000.

CRANE, ORE.—Preparations are being made by Johnson & Johnson of Vale for the construction of a large irrigation project for Harney County, covering about 50,000 acres of land. The plans provide for the erection of a large pumping plant on Lake Malheur. Energy will be furnished by the Harney Hydro-Electric Company, which will develop about 5000 hp., about 18 miles above Drewsey on the Malheur River. The power company will also supply electricity for lighting purposes in Harney Valley, including Crane.

LOS ANGELES, CAL.—The Southern California Edison Company has petitioned the State Railroad Commission for permission to issue 10,000 shares in capital stock at $88 per share.

LOS ANGELES, CAL.—Plans have been filed by the Los Angeles Shipbuilding Company for the construction of its shipbuilding works on Smith's Island, Los Angeles Harbor. The cost of the initial plant is estimated at $750,000 and will consist of a one-story machine shop, 100 ft. by 400 ft.; one-story foundry, 100 ft. by 300 ft.; one-story rivet shop and storage, 80 ft. by 300 ft., one-story boiler shop, 100 ft. by 200 ft., two-story general construction works, 100 ft. by 600 ft., carpenter shop, 100 ft. by 300 ft., one-story pipe shop, 100 ft. by 200 ft., one-story electric shop, 30 ft. by 150 ft., and one-story general warehouse, 100 ft. by 350 ft. An aerial tramway and electric traveling cranes will be installed. The works will include four shipbuilding berths, 60 ft. by 500 ft. each, and wharf of same size. F. A. Gardner is chief engineer.

RIVERSIDE, CAL. The City Council has adopted a resolution providing for the installation of an ornamental lighting system on Chestnut Street from First to Sixth Street.

VENTURA, CAL.—The installation of an ornamental lighting system in Ventura is under consideration.

EAGLE, IDAHO. Surveys are being made by the Idaho Power Company of Boise for the erection of an electric transmission line from Eagle to what is known as the Wise Project, a distance of about 3 miles, to furnish electricity to irrigate a tract of approximately 700 acres.

WALLACE, IDAHO. — The Shoshone County Power Company, recently organized, proposes to erect and operate an electric transmission line from a point near the Ray-Jefferson mine and thence to Prichard Creek, down Prichard Creek to Murray, a distance of 12 miles, with laterals, branches and extensions, which will cost between $30,000 and $35,000. The line when completed will furnish energy for extensive dredging operations to be carried on along Prichard Creek by the Guggenheim interests.

MONROE, UTAH.—At a citizens' meeting held recently the proposal to rebuild the electric power plant, destroyed by fire on Feb. 22, was carried.

HARLOWTON, MONT.—The installation of an ornamental lighting system on Central Avenue is reported to be under consideration.

LIVINGSTON, MONT.—Bids will be received at the office of H. J. Reece, city clerk, Livingston, until June 26 for construction of water-works system, separate bids to be submitted as follows: (1) For furnishing material and labor and constructing concrete settling basins, filter basins, clear-water basin, filter and chemical house, pumping station and concrete reservoir, and erecting pumps, motors, etc.; (2) for furnishing and erecting four 750,000-gal. mechanical units; (3) for furnishing two 1,500,000-gal. low service and two 1,500-000-gal. high-service, motor-driven pumps, starters, etc.; (4) furnishing cast-iron pipe, specials, etc.; (5) furnishing hydrants, valves, etc.; (6) for trenching and laying cast-iron pipe, etc. Copies of plans and specifications may be obtained at the office of Burns & McDonnell, engineers, Interstate Building, Kansas City, Mo., upon deposit of $10.

BURNS, WYO.—Bonds to the amount of $17,000 have been sold, the proceeds to be used for the construction of a light and water plant.

BURNS, WYO.—The contract for furnishing and installing the electric equipment and machinery for the municipal electric-light plant has been awarded to the Cheyenne (Wyo.) Light, Fuel & Power Company.

ROCK SPRINGS, WYO.—The Union Pacific Coal Company of Cheyenne is planning to install a new 2500-kw. General Electric turbine in its local power plant, and to erect a new electric transmission line from Rock Springs to Superior, a distance of 19 miles. Wooden poles and No. 4 copper wire will be used. Energy will be transmitted either at 33,000 or 44,000 volts. Work has already begun on the power house in Rock Springs. The power plant at Superior will be used as an auxiliary. A new 1000-kw. General Electric turbine will also be installed at the company's plant at Hanna, where it is opening a new coal mine. Improvements involving an expenditure of about $200,000 will be made in Hanna.

Canada

HOLLYBURN, B. C.—The British Columbia Electric Railway & Power Company of Vancouver is contemplating extending its transmission lines to Hollyburn to furnish electrical service here.

NELSON, B. C.—Arrangements have been made whereby the Utica Mines, Ltd., and the Jackson Basin Mines, Ltd., both of Nelson, will construct jointly a hydro-electric plant on Twelve-Mile Creek. The Utica Mine now has a 100-hp. plant. Charles F. Caldwell of Kaslo, B. C., is interested.

ELLIOT, BUFFALO, N. Y.—The City Council is considering an application to extend water power rights in this section with a view of developing further hydro-electric power.

BATHURST, N. B.—The Bathurst Electric & Water Power Company has petitioned the New Brunswick Legislature for an amendment to its charter giving it authority to operate an electric railway in Bathurst and vicinity.

PORT WILLIAM, ONT.—Preparations are being made by J. A. Kellough, 240 Balmoral street, Port William, for the construction of a steamer, to cost about $5,000. Mr. Kellough is reported to be in the market for refrigerating machinery, motor, shafting, pulleys, ice crusher, boiler, etc.

NIAGARA FALLS, ONT.—The control of the Ontario Power Company at Niagara Falls will pass on Aug. 1, 1917, to the Hydro-Electric Power Commission of Ontario. The consideration is said to be $7,569,000. With the control of the new property the Hydro-Electric Power Commission will operate the largest hydro-electric system in the world.

GREENFIELD PARK, QUE.—Arrangements have been made by the Town Council with the Montreal (Que.) Light, Heat & Power Company for furnishing energy in connection with the proposed new street and domestic lighting system.

HERBERTVILLE STATION, QUE.—The Central Electricity Company, recently incorporated with a capital stock of $99,000, proposes to construct and operate electric-light and power plants, etc. J. H. Bassard, J. B. Desbiens, A. Plourde are among the incorporators.

MONTREAL, QUE.—A contract has been placed by the Montreal Tramways Company with the Canadian General Electric Company for a 12,500 kw. steam turbo generator, to be installed in the new power station at Hochelaga. It is to be delivered in April, 1918. The proposed improvements include a new substation, additional equipment and a conduit system linking up the various plants.

Record of Electrical Patents

Notes on United States Patents issued on June 5, 1917

1,228,410. CIRCUIT CONTROLLER; Winthrop K. Howe, Rochester, N. Y. App. filed June 9, 1916 (reissue). Circuit controller having three operative positions.

1,228,317. DEVICE FOR CONNECTING OUTSIDE WIRES TO BUILDINGS; Philip C. Ragolzky, Philadelphia, Pa. App. filed March 7, 1914 (reissue). For connecting telephone wires from poles to buildings.

1,228,397. SPEED INDICATING APPARATUS; Henry E. Belghlee, Cleveland, Ohio. App. filed Nov. 8, 1916. Means for indicating or registering the speed or variation in speed of a plurality of machines, engines or rotating parts.

1,228,408. CIRCUIT BREAKER; Fremont J. Cleaver, Carnegie Borough, Pa. App. filed Nov. 1, 1915. Air-tight receptacle of glass preferably having integral therewith, and internal open-top reservoir or cut into which extend the terminals of the electric circuit to be protected.

1,228,449. ELECTRIC MOTOR; Samuel E. Kurtz, Sac City, Iowa. App. filed Feb. 26, 1914. Variable-speed electric motor.

1,228,450. ELECTRIC WELDING MACHINE; Laurence S. Lachman, New York, N. Y. App. filed Sept. 17, 1915. Spot welders.

1,228,547. PROCESS OF MAKING PASTED STORAGE-BATTERY PLATES; Louis H. Flanders, Jenkintown, Pa. App. filed Oct. 20, 1913. A quantity of sulphate is mixed in the paste prior to its being applied to the grid, and the porosity of the finished plate is fixed and determined independently of the consistency thereof but with regard to the density of the lead oxide or oxides used and to the capacity desired.

1,228,551. NEGATIVE-POLE PLATE FOR STORAGE BATTERIES AND PROCESS OF MAKING THE SAME; William G. S. Grant, Hamilton, Ontario, Canada, and Louis H. Flanders, Jenkintown, Pa. App. filed Oct. 8, 1913. Active material is free from cracks.

1,228,577. ELECTRICAL PLUG AND SOCKET; James F. McElroy, Albany, N. Y. (Susie H. McElroy, executrix). App. filed Feb. 27, 1912. For temporary connection of an electrical device such as an electric heater to a supply circuit of high potential.

1,228,635. LAMP DIMMER; Harry Alexander, New York, N. Y. App. filed March 9, 1915. May be regulated within very narrow limits.

1,228,670. FLEXIBLE INSULATED ELECTRICAL CONDUCTOR; John C. Henderson, Washington, D. C. App. filed Nov. 3, 1916. Conductor having subdivided conducting portions in which there will be no readily combustible material touching the conducting elements.

1,228,675. STORAGE-BATTERY PLATE; William S. Hutchinson, Montreal, Quebec, Canada. App. filed July 16, 1913. Improvements.

1,228,710. BRUSH-LIFTING MECHANISM; Charles W. Steen, Norwood, Ohio. App. filed June 19, 1914. Improvements.

1,228,711. CONNECTING DEVICE FOR CHAIN-TYPE INSULATORS; Louis Steinberger, Brooklyn, N. Y. App. filed Dec. 6, 1912. Adjacent units may be readily assembled and disassembled without the use of tools.

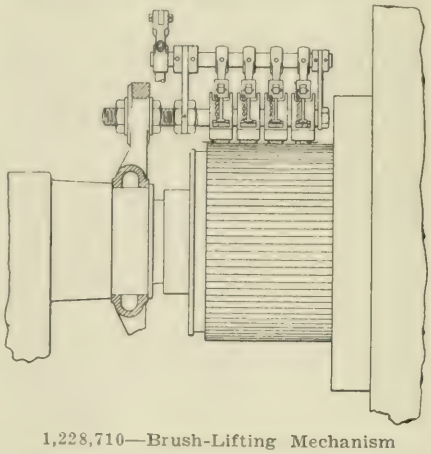
1,228,731. CIRCUIT EXTENSION BOX; Chauncey W. Abbott, Auburn, N. Y., and Henry R. Gilson, Baden, and James M. G. Fullman, Sewickley, Pa. App. filed May 26, 1914. Form of extension box whereby a circuit may be picked up at and extended from wall switch outlets, particularly flush switch outlets.

1,228,762. ELECTRIC LIGHT FIXTURE; C. F. Dolle, Cincinnati, Ohio. App. filed Sept. 14, 1912. Incandescent electric lights may be extensibly or adjustably supported from the wall or ceiling.

1,228,778. KNIFE-SWITCH RELAY; William Kaisling, Chicago, Ill. App. filed July 1, 1913. Armature-actuated switch blade is adapted to control circuit conditions in connection with a plurality of stationary switch blades.

1,228,839. SAFETY MEANS FOR SWITCH BOXES; Lester Siebenhauer, San Francisco, Cal. App. filed Sept. 27, 1915. Protecting covering for the exposed busbars and in spaced relation thereto, the covering being either of conducting or non-conducting material and either opaque or transparent as desired.

1,228,842. ELECTRIC WELDING MACHINE; James M. Sparkes, Peabody, Mass. App. filed Jan. 17, 1916. Single-transformer electric-welding apparatus.



1,228,710—Brush-Lifting Mechanism

1,228,843. WELDING MACHINE; William H. Spire, Cleveland, Ohio. App. filed Jan. 31, 1917. A platen longitudinally movable of the frame of the apparatus may be supported on and movable over a plurality of sets of bearing rolls in order to effect such longitudinal movement.

1,228,849. SYSTEM OF ELECTRICAL REGULATION; William A. Turbayne, Niagara Falls, N. Y. App. filed June 2, 1913. Storage batteries are caused to discharge into the system at periods of load demand greater than that desired to be held on the generators, while conversely the batteries are caused to charge when the external demand falls below the desired normal generator load.

1,228,852. CONTROL OF ALTERNATING-CURRENT MOTORS; Thomas W. Varley, New York, N. Y. App. filed June 18, 1914. Insures that the rotation of the motor will be always in the desired direction after it is once installed, independent of the reversal of the phases by accident or otherwise.

1,228,858. ELECTRIC SWITCH; Roger S. White, Washington, D. C. App. filed Oct. 31, 1914. Improvements.

1,228,859. METER SWITCH; Roger S. White, Washington, D. C. App. filed Aug. 22, 1916. For use particularly on meter test blocks.

1,228,907. ELECTRIC-SWITCH MECHANISM; David D. Gordon, Chicago, Ill. App. filed Nov. 21, 1916. Key-controlled snap-switch type.

1,228,924. DRAWN-LINK ELECTRIC FUSE; Slaughter W. Huff, Brooklyn, N. Y. App. filed Aug. 21, 1914. Cartridge.

1,228,936. COMMUTATION DEVICE FOR DIRECT-CURRENT MACHINES AND THE LIKE; Birger Ljungstrom and Axel D. Widstrom, Stockholm, Sweden. App. filed Feb. 24, 1913. Arrangement which will produce practically perfect commutation, but which will at the same time not disturb the magnetic design of the generator.

1,228,963. APPARATUS FOR CONTROLLING MECHANISM AT A DISTANCE; Jacob Perepelkin, Petrograd, Russia. App. filed Feb. 3, 1912. Improvements.

1,228,988. MACHINE FOR WATERPROOFING FIBROUS MATERIALS; Alfred O. Tate, Montreal, Quebec, Canada. App. filed Oct. 27, 1916. Improvements.

1,229,014. FIELD-CONTROL SWITCH; Winfield A. Atwood, Schenectady, N. Y. App. filed June 28, 1913. For dynamo-electric machines.

1,229,034. BURGLAR ALARM; Lee A. Collins, Louisville, Ky. App. filed Dec. 14, 1916. Transmits a signal to a central telephone office or other station with which it is connected by telephone.

1,229,056. ELECTRIC-LAMP RECEPTACLE; Melchor H. Freixas, Brooklyn, N. Y. App. filed Sept. 30, 1916. Improvements.

1,229,057. CARD-PUNCHING DEVICE; John W. Fritch and Delia E. Hoppes, Washington, D. C. App. filed Oct. 11, 1916. Such as those which are used for statistical data, as for instance in compiling statistics for the census or other similar uses.

1,229,075. APPARATUS FOR HANDLING METALLIC LEAF; Leon M. Harwood, Springfield, Mass. App. filed July 3, 1916. Improvements.

1,229,097. OIL-FEED SIGNAL DEVICE; Frank P. Lamar, Santa Ana, Cal. App. filed May 13, 1916. Device for indicating the flow of oil through an oil system.

1,229,128. ELECTRIC HEATING DEVICE; Leon F. Parkhurst, Pittsfield, Mass. App. filed June 18, 1915. Armored or sheathed wires lie in a single plane, so that the articles operated upon are uniformly spaced from the source of radiant heat.

1,229,149. COMMUTATOR; Carl J. Schwarze, Adrian, Mich. App. filed March 28, 1916. Relates to the grouping of relatively insulated terminals.

1,229,150. PROCESS FOR TANNING AND IMPREGNATING MATERIALS BY MEANS OF ELECTRICITY; Botho Schwerin, Frankfort-on-the-Main, Germany. App. filed Sept. 8, 1914. The invention utilizes the fact that a tanning liquor may be carried through the hide by the electric current—that is to say, electro-osmotically—whereby the hide is able to take up the tanning and become converted into leather.

1,229,185. INCANDESCENT ELECTRIC LAMP PLUG; George J. Stichtenoth, Cincinnati, Ohio. App. filed March 15, 1917. Having a plug adapted to be interchangeably employed with sockets of different types.

1,229,186. SAFETY SWITCH; Alexander K. Sutherland, New Britain, Conn. App. filed July 31, 1915. Ordinary knife-switch type.

1,229,203. METHOD OF PURIFYING AND SEPARATING FINELY DIVIDED SUBSTANCES; Botho Schwerin, Frankfort-on-the-Main, Germany. App. filed Jan. 5, 1912. Utilization of the effects of the electric current on the transport of the smallest particles in a suspension, a mixture of suspensions, or in so-called colloidal solutions.

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Getting at Costs

THE necessity of ascertaining costs in a uniform manner has been brought home to every concern in the electrical manufacturing industry very forcibly of late by the work of the cost accounting committee of the Electrical Manufacturers' Council, embracing the Electrical Manufacturers' Club, the Electric Power Club and the Associated Manufacturers of Electrical Supplies. Nor has this realization come any too soon. With war revenue measures designed to tax excess profits it is imperative to know exactly what profits are, and to obtain this information some recognized and authoritative accounting and cost system must be applied. The government is also now planning extensive purchases on a cost-plus-percentage basis so that the elements which go to make up manufacturing costs will be officially defined. If, therefore, there is a fair understanding of these matters before contracts are distributed, it will save both the manufacturer and the government considerable expense in checking up the cost figures. But, regardless of whether companies are at work for the government or not, it is plainly apparent that a standardized system of accounts should straightway be put into effect, if for no other than purely selfish reasons. We therefore urge whole-hearted and prompt co-operation with the accounting committee of the National Manufacturers' Council in the rapid adoption and promulgation of its system of accounts.

Room for Electric Vehicles

JUST now the air is resounding with the familiar wail of "Gas going up again," and those who drive motor vehicles may well pause and consider where the rise is likely to stop. Prices have an unpleasant way of being lifted on a ratchet with no available method of release. In this emergency it is certainly worth while to push the electric vehicle energetically, both for the ordinary work of the automobile and for trucking and industrial use. To those who use motor vehicles for pleasure only the supply of fuel perhaps will not count at first very heavily; but when it comes to the matter of commercial vehicles the situation is quite different. The owner counts the cost very carefully, and good as many of the gasoline trucks and delivery wagons are, the cost of fuel and the constant elements of wear and tear cannot be neglected.

As the war progresses a heavier and heavier demand for gasoline must be reckoned with. Thousands upon thousands of motor trucks, motor ambulances and tractors will be required at the front, thousands of aeroplanes must be kept supplied, and hundreds of powerful motorboats, consuming fuel at a tremendous rate, will be put into service on the seacoast. All these are likely to cause so huge a demand for gasoline that the price is bound to mount higher and higher. It would therefore seem to be sound policy on the part of the electric supply companies to encourage in every way possible the use of electric vehicles, following up the campaign which has been on for several years with still further energy. It not only will encourage the use of a thing which is extremely good in itself, but will tend greatly to relieve the gasoline situation at a time when the war demand for fuel is rapidly increasing. In the factory the opportunities are beginning to loom large, and the outlet here may eclipse in a few years the ordinary applications on the streets and highways. An article in this issue gives an excellent survey of conditions and possibilities in the industrial field and well merits close study. It shows applications of storage-battery trucks in work for which they are well fitted and in a direction in which there is no competition.

A New Trail Blazed in California

THE commendable spirit of co-operation among California power companies has made it worth while for the California Railroad Commission to propose the connection of all important transmission lines into a well-knit state-wide system. The purposes are to stabilize service, cut down cost of production, and utilize stream flow more effectively by facilitating interchange of energy; in other words, simply the end that would be sought were all companies managed by one parent body considering the welfare of each while acting for the best interests of all. The plan originated with the commission as outlined in the news item published last week; but before the scheme as a whole could be presented, even before the completion of the general survey, the power companies began to take a keen interest in the idea. The Pacific Coast Section of the National Electric Light Association is now working on it, and some companies are already responding cordially.

Technically, perhaps, the most important advantage in a territory served by streams of diversified flow is getting onto the same system a wide diversity of demand. Thirty thousand to 40,000 hp. of power can be added to the State's total without installing additional generating equipment, F. E. Hoar of the Railroad Commission believes, by merely connecting existing systems so that stream flow diversity can be considered as a whole instead of individually. The plan would foster closer co-operation between companies and re-

duce undesirable competition with its attendant litigation before the Railroad Commission. Once all companies are connected to a state-wide system the activities of commercial departments could be broadened most effectively, and of course these elements all tend to reduce the cost of operation. With the proposal of so comprehensive a plan for physical consolidation of California transmission systems, the question naturally arises, Will this tend toward consolidation of organizations? This was not a part of the original plan, but it has developed incidentally.

In fact, the merging of eight small companies into larger corporations which could probably serve the territory more economically is already being considered. In those cases where a small company is under the handicap of high overhead and finds efficient management difficult and costly, absorption is indicated. On the other hand, if present organizations are able to operate profitably with reasonable rates consolidation is not so desirable. The criterion must be economy of operation. The public has a right to the lowest fair rates, and if the greatest economy lies in a combination of systems, this will surely be the ultimate result. The small companies in critical financial condition should welcome the situation, and those that are doing well have no cause to fear it. The plan has merit from many angles, and the fact that it is being favorably received sets an excellent example for competitive companies elsewhere that have not learned to pull together.

Give Us More Water Pressure

WE BESPEAK earnest consideration of Hugh L. Cooper's paper on the water-power situation. It is quite in line with our editorial suggestion that true conservation requires the intensive use of electric power to remedy the waste of transporting coal. Mr. Cooper puts the case for water powers forcefully and in a way which should appeal to the intelligent public. Stupid lack of legislation is responsible for a great deal in this country of ours, among other things for the annual waste of water power—a waste irretrievable since every gallon of water that falls unutilized to sea level has failed of its duty toward mankind.

Ultimately one must expect an enormous increase in water-power developments, but the slow progress of the last fifteen years is not entirely due to either lack of legislation or improper legislation. Other facts enter into the situation. The first decade of water-power development, from 1893 to 1903, produced installations at a rate which in the nature of things could not be expected to continue. The first hydraulic privileges chosen for working were selected on sound economic principles. Either they could be developed very cheaply, or they were near certain profitable markets, or, being more distant from markets, they were in competition only with high-priced coal. The first few million horsepower represented a situation more promising than could have been obtained from the next few million, or from the succeeding millions of horsepower less favorably situated in cost of water developed. The large hydraulic privileges now existing are for the most part very far distant from markets or expensive to develop. Despite the short-sighted attitude of the government toward the powers in its control, these make up but a small part of the total 35,000,000 hp.

Very marked in its practical effect on the hydroelectric situation has been the advent of the great steam turbine, showing an efficiency hitherto unapproachable with steam plants and making it evident that, given reasonably cheap fuel, power could be supplied at a price scarcely attainable by the average hydroelectric station. The situation is therefore from the standpoint of dollars and cents far more complicated than Mr. Cooper indicates, but at this time his contentions should be taken very seriously as pointing the way to large savings in labor and transportation. We are living in a period in which the price of coal, including transportation, has reached a figure which upsets all previous calculations regarding the relative economy of steam and water power. We have been thrust long before our due time into a situation which makes it possible economically to develop water powers usually classed as undesirable. If pushed quickly into service, many of these would prove most valuable additions to the country's resources and would release, as Mr. Cooper shows, large amounts of labor and of transportation facilities. While many a water power is in and by itself relatively unprofitable to develop on account of its distance from any specific markets, it may still be tremendously useful if cut in on an existing system to form part of the general power supply. This is along the line of least resistance in hydraulic enterprises, and it should be assiduously followed if we hope to gain quickly the greatest return from our unutilized hydraulic privileges.

Low-Temperature Electrothermal Processes

IT IS a well-recognized fact that heat can be produced on a large scale more economically in a fuel furnace than in an electric furnace, except where water power is abundant and fuel difficult to secure. Nevertheless, heat can often be produced on a small scale much more economically by the electric furnace than by fuel; while in particular industries the electric furnace is more economical than the fuel furnace, even on a large scale, owing to special advantages attending the electric process. The electric toaster on many a breakfast table and the electric range in many a kitchen indicate that, in long-range economy, electrically produced heat may have a great advantage over heat produced by fuel.

A good example of the advantages accruing to electric-furnace heating in certain industries was cited in a recent paper by C. F. Hirshfeld, before the American Electrochemical Society, referring to low-temperature baking for japanning and foundry core work. It is well known that japanning is an art requiring considerable experience and skill for its successful conduct. Moreover, there has always been much uncertainty and guesswork about it, owing to the large number of variables

which enter into the process. Some of the most successful japanners appear to have no quantitative rules governing their procedure. They have reduced their success to a habit, but any departure from the stereotyped technique would be likely to perplex them. All industrial processes start in this rule-of-thumb fashion and gradually evolve into scientific processes as the meaning and value of the different steps become interpreted through painstaking research. Mr. Hirshfeld showed how research has already modified the japanning process to commercial advantage in certain industries by simplifying and stabilizing the technique. The electric furnace enables the baking to be carried on in a perfectly definite manner, capable of being repeated precisely through an indefinite number of trials. Moreover, electric heating of a lacquered metallic object appears to be largely from the metal outward; whereas gas-furnace heating is more from the outside of the lacquer inward, with a greater tendency to ebullition in and disruption of the layer. It is the great definiteness and reproducibility of electric heating that give the electric furnace its value in such cases.

In the competition among industrial processes those which can be scientifically adjusted and controlled are likely to displace, in the long run, the more primitive and rigid processes. The electric furnace enables the careful experimenter to study the effects of thermal changes in his processes much more surely and conveniently than is ordinarily possible with the fuel furnace. The electric furnace is often therefore a great aid to industrial research and to new results.

Centralizing Energy Production from Fuel

AT THIS time it is the plain duty of a central station to make as vigorous a drive for additional power load as it is possible to organize. The country is in a curious situation with respect to its fuel supply. Of fuel there is an indefinitely great amount. Facilities for fuel transportation we fondly believed were adequate until the strain of the last two years began to make itself felt. As the case stands those facilities have broken down owing to the enormous pressure of other kinds of freight, chiefly moving eastward, a limited supply of rolling stock to accommodate it and, above all, the inefficiency of freight distribution. The methods of handling cars destined for anything but through routes seems to be crude in the extreme, so that instead of actually utilizing the rolling stock it is laid up in indefinitely great quantities for transshipment and in process of unloading. The net result is that the consumer of coal who is not receiving it over a comparatively straight line and in large quantities finds himself trapped. He can only get his fuel with great difficulty and at enormously enhanced price. Water transportation counts for very little.

Now is the time to get after the consumers of fuel for industrial purposes to transfer their load as far as possible to the big central stations, which are able to obtain fuel somewhat directly and to utilize it at an enormously higher efficiency than is possible on a small scale. Now if ever, too, is the time for a further upbuilding of transmission networks so that small stations struggling with a rapidly increasing fuel bill may be able to utilize wires instead of railroads for obtaining their supply of energy. This phase of the matter is one on which it is difficult to lay too much stress. We have repeatedly discussed the meshing of electric systems into networks, but there has never been a time when the benefits to be obtained are comparable with those which may be secured at present.

The situation, in a word, is this: Owing to the difficulties, chiefly in transportation, due to the changes wrought by the war, fuel is at a figure which normally might not have been reached for another fifty years, perhaps not then. The economic conditions have changed enormously in the last two years, and everything points to the need of furnishing power to the country from the relatively few points at which fuel is readily obtained and where it can be most efficiently utilized. Wholesaling electric power has been one of the notable advances of the last few years. The present conditions call not only for the application of this for the relief of the smaller stations, but for an enormous increase in the retail business among manufacturers. The only adverse condition is the rise in price of electrical machinery. This from the standpoint of the central station man is unfortunate, but it should not check efforts to turn industrial power production into a business belonging to the central station, carried on on a great scale, and under favorable conditions, instead of allowing it to go on as at present wasting fuel and wasting transportation at a time when both are seriously needed.

The Coming Issues

RELATIVE estimates of the total power used for handling the large grain crops of this continent are not readily obtainable, but the aggregate power used for handling and cleaning grain must be many hundred thousand horsepower. Much, if not all, of this load is available to the neighboring central stations. On account of the unprecedented demand on this country for its grain output, every central station should be in readiness to serve grain elevators in its vicinity. Extensive data based on the performance of several elevators will be presented in the next issue of the ELECTRICAL WORLD to assist central stations in providing for such loads and to help engineers who are supervising the equipping of new elevators or trying to increase the efficiency or output of existing elevators. The fifth installment of C. E. Clewell's series on industrial illumination will also be presented. This article will point out the relation of the first cost of lighting equipment to the total cost of factory building and its components such as elevators, cranes and ventilating equipment. Costs of operating the lighting installation, nature of work as a factor in lighting problems, essential qualities of lighting systems and the use of tungsten lamps will also be discussed. Besides the regular departments, there will be an article showing the economy, both as regards labor and increased production, of electric industrial trucks in the Willys-Overland factory.



Timely Economy of Industrial Electric Trucks

Extraordinary Development in Last Two Years of These Electrically Driven Equipments, Which Intensify Production and Save Labor—Battery Charging a Valuable Off-Peak Load

WITHIN the last two years a wonderful development in what might be called the field of intensive transportation has taken place by aid of the industrial electric truck. In many quarters the achievements of these small but powerful units of transport are little realized. The attention given to electric and gasoline vehicles designed essentially for highway service over extended areas has led not a few central station men, mill owners, terminal operators and merchandise handlers to overlook the usefulness of the industrial type of truck. The increasing cost of labor and the pressure upon all plants allied directly or indirectly with war service to cut the time of production to the minimum consistent with high-grade work is leading to a much wider recognition of the accomplishments and possibilities of what has been so aptly called "the little brother of the commercial truck." It is a question if any motor-driven tool available to-day for the use of a hard-pressed industrial world stands ready to speed up production more efficiently than this specialized type of electric vehicle. This readiness to serve the nation's plants, warehouses, terminal yards, arsenals and merchandising establishments is based upon the successful operation of about 5000 industrial electric trucks in all parts of the civilized world, 4000 of which are in service in the United States and Canada. There is nothing experimental about the modern industrial truck as an efficient economic tool.

Recent Status of Manufacture

Industrial electric trucks are to-day being produced in America by about a dozen manufacturers. Their present cost ranges from about $1,100 to $2,500, according to size and design. Units of 2 tons (1.814 t.) capacity, costing around $2,000 each, are in general use. The average industrial truck saves from $5 to $7 per day in wages, depending upon the materials handled, the length of haul, local cost of labor, etc. In some munitions plants a saving of $18 per day per truck is being realized. With intensive use an industrial electric truck will often pay for itself in from one to two years. The average laborer employed in pushing a hand truck can be taught to operate an electric equipment in half a day, with the result that his duties are vastly lightened although increased production of transportation results to a fivefold degree. It has been found desirable in establishing such service to instruct the local superintendent or chief electrician in the use of the truck, running the unit light about the plant at first and then assuming loads. These local officials then select the truck operator or operators and in this way exercise a salutary control over the use of the equipment, the permanent truck operator being taught by his superiors.

The usual speeds of the industrial electric truck loaded range from 5 to 7 miles (8.0467 to 11.2654 km.) per hour, compared with about 2 miles (3.2187 km.) per hour in hand stevedore service. Well-designed trucks can be stopped almost instantly and well within their length when operating at full speed, a factor of great value in the rapid handling of merchandise in congested areas and aisles. The use of a single direct-current motor of the series type is general for truck driving; the control provides for several speeds forward and reverse in acceptable designs, and in case the operator steps off the machine current is immediately cut off by an automatic switch. Various types of driving gear are in service, including worm gearing, chain drive and spur gearing with differential. Steering is of the two-wheel and four-wheel type, and the turning radii of the latest designs are very short. A representative two-wheel steer type in which special attention has been given to this feature has a turning radius of 7 ft. 3 in. (220.98 cm.), the over-all length of the truck being 7 ft. 6 in. (228.6 cm.), and a drop-frame type of truck with four-wheel steer has a turning radius of 5 ft. 8 in. (172.72 cm.), the wheel base being 52 in. (132.08 cm.) and the over-all length 8 ft. 10 in. (269.24 cm.).

Roughly speaking, about half as many cells of storage battery are ordinarily installed for industrial truck service per unit as are required in heavy commercial truck work. Modern trucks are equipped with cells of various makes and numbers, twenty cells of lead battery



THE APPLICATIONS OF INDUSTRIAL ELECTRIC TRUCKS ARE MANY AND VARIED

Reading from left to right, top row first: (1) Handling Green Tires, (2) Hauling Fish Carts, (3) Transporting Pulleys, (4) Hauling Ammunition at Government Arsenal, (5) Truck with Trailers in Cotton Mill, (6) Speeding Up Machine Shop Production, (7) Loading Steamship on Pacific Coast, (8) Hauling Hospital Supplies, (9) Taking Cloth to the Bleachery, (10) Transporting Bolts of Cloth Through Heavy Snow, (11) Relieving Freight-Yard Congestion, (12) Eating Into Pile of Wire Fence Bales

or thirty-six cells of alkaline battery being frequent installations. Charging is accomplished by the aid of a variety of switchboard panel equipment, its design depending upon the number of batteries to be charged at any one time, the number of cells per battery, type of battery, capacity of cells and conditions of energy supply to the switchboard. A fair average of 18 kw.-hr. to 20 kw.-hr. per day covers the energy demands of a 2-ton (1.814-t.) truck in active service, and the charging may be done through a motor-generator set, rotary converter or rectifier, although the last-named appears to be going out of use in favor of the former types of equipment. Where direct current at 110 volts or lower is available, as in many mill plants, the charging panel need contain no provision for machine transformation, the reduction in voltage being obtained rheostatically. The use of the motor-generator or the rotary converter where alternating-current supply is utilized for truck battery service enables the central station to enter the field of battery charging at any point on its system. In the great majority of industrial plants truck battery charging occurs during the night, thus enabling the central station or the private plant to handle the service without additional investment in generating station equipment.

In round numbers, the cost of charging equipment for one industrial truck runs in the vicinity of $200 to $500, depending upon the amount and type of apparatus required. In some cases it is possible to use a second-hand motor-generator set of about 4-kw. rating to advantage; in others new equipment may be essential throughout, including automatic switching equipment to cut off the supply of energy in case the voltage of the charging circuit falls below a predetermined limit, or in case of reversal of the charging current. The cost of charging equipment per truck decreases rapidly with the number of trucks in service.

Wide Geographical Distribution of Trucks

Seventy-five industrials are in use at the North and South Stations in Boston, Mass., and in all New England about 600 trucks are in service. In the celebrated Naugatuck Valley of Connecticut 200 trucks are in service in brass plants and other establishments active in munitions work and other production. Many of these trucks are in use on steamship piers in New York, on the Pacific Coast, in New Orleans, in Pennsylvania Railroad stations, and in textile mills North and South. Later developments include trucks with an extra motor used in elevating the platform a few inches so that the platform can be run under a loaded frame, box on castors or cradle to take the merchandise without breaking bulk to a new location, where the platform is lowered and the merchandise delivered with minimum loss of time in plant departments. Another very useful development is the crane type of truck, which is proving a valuable labor-saving device in shops in the assembly of automobile engines, transfer of fabricated metal parts, loose material in buckets, etc. Trucks are giving admirable service even on grades of 15 to 30 per cent in mill yards, and the annual costs of operation are low. Thus, it is estimated that an ordinary industrial truck can be operated at a total cost of about $2.25 to $2.50 per day exclusive of wages, allowing $1 for interest, insurance, taxes and depreciation (10 per cent for the last) and $1 for battery and mechanical replacements. The cost of energy may run from $0.18 to $0.50, depending on the rate for energy, the latter corresponding to a central station rate of about 3 cents per kilowatt-hour. A central station should be able to count upon a revenue of at least $150 per truck per year in this class of service, at rates commonly in vogue for wholesale battery charging or large-scale energy supply.

Data from Many Industries

The proof of the pudding is in the eating, and in the following paragraphs data are given from industrial truck installations, indicating the economic advantages of these machines:

Handling Lumber.—Size of lumber carried, 12 in. by 16 in. by 11 ft. 2 in. (30.48 by 48.77 by 340.36 cm.); average load per truck, six pieces, 3600 lb. (163.29 kg.). In one hour truck made sixteen trips, carrying 28.8 tons (26,126.9 kg.); round-trip distance 800 ft. (243.84 m.); total distance traveled, 12,800 ft. (3901.44 m.). Eight men loaded, unloaded and operated the trucks at a cost of $2.40. Allowing for wear, tear, depreciation, etc., at 20 cents, the cost came to $2.60, or $0.09 per ton ($0.099 per t.). The cost of haulage and loading, unloading, etc., by hand, would be $0.36 per ton. ($0.386 per t.).

Savings in Cordage Plant.—Internal transportation cost $50 per week. Two months after installation of industrial truck it was found that the truck saved $15 per week in labor and enabled 25 per cent more work to be handled than before.

Tractor Handling L. C. L. Freight.—Service on three 16-ft. (4.88-m.) platforms 900 ft. (274.32 m.) long; average haul, 880 ft. (268.23 m.). Tractor handled 65 tons (59 t.) per hour, displacing eighteen to twenty men, who averaged but 3.3 tons (2.99 t.) per hour under fair conditions. Energy required, 3.6 days, 10.75 hours each, 55 kw.-hr. On another platform a truck saved $1,048 per month by eliminating pushers.

Dock Service.—Two 2-ton (1.81-t.) trucks load and unload metals and carry freight, Pacific Coast. With old hand trucks one man made trip every five minutes with two crates salmon and loaded twenty-four crates per hour. Electric truck makes trip in 2.5 minutes, carries eight crates and on tests has loaded 192 crates per hour. Only one man is required on the truck. Electric truck handled 1770 cases salmon in three hours with four men loading and unloading.

Storage Baggage Truck.—Record of week's service:

Number of packages handled	7,570
Average weight per package, pounds	230
Total weight handled, tons	900
Average distance load was moved, in feet	900
Percentage of time truck was working	80
Number of packages delivered per working minute	3
Number different jobs worked on	30
Heaviest single load drawn by tractor, tons	12.5
Cost of operator, interest, depreciation and energy	$24.00
Cost of moving 1 package, 900 ft., in cents	0.33
Cost of moving 1 ton, 9 packages, 900 ft., in cents	3.00

Handling Miscellaneous Way Freight.—

Total tonnage handled by three trucks	41
Round trip, in feet	560
Number of men required in loading and unloading	10
Time required in loading and unloading, hours	5
Cost of labor at 30 cents per hour, $15, or per ton	$0.366
Total cost of upkeep, per day	$1.00
Total cost of handling, per ton	$0.38

Comparing hand trucking on miscellaneous way freight, 27 tons were handled on a round trip of 200 ft. (60.96 m.) by ten men in five hours, or at the rate of $0.555 per ton. ($0.608 per t.)

Saving per ton by electric truck, 17.5 cents (19.3 cents per t.), and latter covered 2.8 times distance of hand trucks.

Handling Bagging.—Three electric trucks carried 35.5 tons (32.2 t.) a round-trip distance of 1600 ft. (487.68 m.) in two hours, requiring eleven men; labor cost of total handling, $0.191 per ton. ($0.21 per t.). Similar installation handling by man power, round-trip distance of 300 ft.

(91.44 m.), 54.5 tons (49.5 t.) required fifteen men for three hours. Total cost, 24 cents per ton (26.46 cents per t.), saving 5.7 cents.

Pier Service.—Four men required thirty minutes to unload and transport by hand thirty-eight bags of cement 500 ft. (152.4 m.). With electric truck, two men required seventeen minutes to unload seventy similar bags and transport them 750 ft. (228.6 m.).

Textile Plant.—Industrial truck with two men delivers six full beams and returns with six empties in eleven minutes. Formerly required fifty-five minutes to do same work with hand trucks. With electric truck 5 barrels of cottonseed oil have been loaded by two men and moved 280 ft. (85.34 m.) in 2.4 minutes. Five men with hand trucks required double the time, owing to having to push each barrel at slow walk over uneven planks.

Savings in Manufacturing Plant.—A large manufacturing plant eliminated the services of twenty-eight two-wheeled warehouse trucks, one two-horse team, thirteen four-wheeled trucks, eight wheelbarrows and eighteen men by the installation of two industrial electric trucks.

Coal Handling in Mill.—In a New England mill plant the work of hauling coal from the pockets to the boiler room, which formerly required three men, is now done with one man operating a small self-dumping electric industrial truck at a cost of not over $3.75 per day, including the operator's wages, repairs, tires and electricity.

Saving Labor on Grade Haul in Mill.—In a Massachusetts textile mill five men were formerly required to transport the goods from the packing room to a storehouse across the street, using the old-fashioned hand trucks. It was necessary to haul these goods up a grade of 15 per cent for a distance of 25 ft. (7.62 in.) to cross the street, and an additional man was required as a pusher. One electric industrial truck displaced five men in this service.

Economies of the Electric "Stevedore."—At Savannah, Ga., cotton is moved across the piers by industrial electric trucks equipped with hoists and cranes, carrying it directly into the holds of the steamers. Two such trucks handle more cotton in a day than twenty freight handlers can accomplish manually. At the Bush Terminal, Brooklyn, the same cotton is placed in cars by battery-truck cranes, with electrical "spotting" of cars. At the mills it is taken from the cars by industrial electric trucks capable of entering the cars and hauled to storage and spinning rooms by the same means.

On the Cunard Pier, New York.—In handling macaroni in boxes six industrial electric vehicles performed work in nine hours which would have required twenty-four hand trucks. The cost of labor with the electrics was $21, while at current longshoremen's rates it would have cost $87.60.

The development of the electric tractor enables from six to twelve times as much work to be done with one man as could formerly be handled manually. A daily service of 20 to 30 miles (32.18 to 48.28 km.) is common with industrial electric truck units, and where a boosting charge is provided in the noon valley this mileage may be increased 25 or 30 per cent. Special mention should be made of the value of these equipments in hospital service as labor savers, since by their use hot meals can be delivered to patients in widely separated locations with little or no loss of warmth compared with the slow progress of manual distribution. As the war progresses there is certain to be an increasing opportunity for labor-saving service by these units in the care of the wounded at base and home hospitals, releasing labor for other important tasks without the slightest prejudice to the patients' welfare.

Competent authorities estimate that in the United States alone a grand total of 720,000,000 tons (653,000,000 t.) of goods yearly passes through the railroad freight and transfer stations. The present lack of system in handling this freight and the time lost thereby represent a yearly loss of more than $80,000,000. The advance of the industrial electric truck into its rightful field of service here will do much to reduce congestion of shipping areas and streets, cutting down demurrage charges, releasing rolling stock and vessels for more frequent service and economizing in labor.

SOME ECONOMIES EFFECTED BY MEANS OF ELECTRIC HEAT

Production Processes Have Been Shortened and Labor Has Been Saved by Electricity in Industrial Heating

BY A. F. ALLSOP

In a doll factory at Chicago three 39-kw. electric drying ovens have been installed to drive moisture out of doll heads and bodies after they had been molded from a plastic composition. This installation shortens the drying time from three or four days to one hour. The previous method used was air drying. It was impossible to use gas owing to explosive vapors given off from the plastic composition. Steam heat was out of the question on account of its inability to give sufficiently high temperatures. The installation of electric ovens eliminated the labor of eight girls. These girls were paid $7 per week each. Besides eliminating some of the labor and greatly shortening the processes of production, electric heat also gave a much better product.

In another factory engaged in making paper roofing an application of heat was necessary to join the ends of the paper passing through the process of manufacture. At first three tailors' irons were used for applying heat to the joint. With this process it was necessary to stop the machinery for five or six minutes while the irons were brought to the machine from a distance of 30 ft. (9 m.), placed on the joint and removed to their accustomed place. A home-made heating unit has replaced the irons. This consists of a large block of iron approximately 60 in. long and 12 in. wide (1.5 m. by 0.30 m.), kept at a constant temperature by electric heat. The joining operation consists of uniting the end of one roll of roofing material to the beginning of another in order to make a continuous strip passing through the machinery. This machinery occupies a space approximately 175 ft. (52.6 m.) long, consisting of various tanks containing liquids, hot tar, coloring liquid, and sand and gravel. Formerly when the roofing machinery was stopped for the joining operation the parts remaining in the hot liquid, coloring liquid or sand received a surface of this material, thus materially reducing the quality of the roofing, which consequently had to be sold at a lower price. The installation of the iron block described made it possible to complete operations without stopping the machinery. This contrivance, while it did not reduce labor charges, materially increased the production and also the quality of the goods. Three of these heaters are in use. Two are rated at 18.5 kw. and one at 16 kw.

A third installation which is proving quite successful is a 236-kw. conveyor-type oven about 80 ft. long. It is used for japanning automobile parts and supplanted gas equipment and is showing a consumption of 9 kw.-hr. per 100 lb. (45.35 kg.) of metal baked, and still better results are expected when workmen become more proficient in handling it. When the change from gas to electric heat was made the number of workmen required was reduced by six.

Why Hydroelectric Development Lags

With a Labor Problem, the Country at War, Conservation Highly Necessary and Nitrates Essential for Crops, We Should Demand Fair Legislation from the Congress of the United States

BY HUGH L. COOPER

IN AN argument a legislator was told "The law of supply and demand will defeat you." He exclaimed in reply, "Then I will repeal the law."

This article is written with the idea of showing that in the United States for the last fourteen years we as a people, in our attitude toward sane water-power legislation, have shown an ignorance of our own interests as lacking in intelligence as that of the legislator alluded to. That the law of supply and demand is fundamental and inexorable no one will thoughtfully deny.

All over the world to-day people are suffering because of the high cost of living. This high cost of living is the direct result of a shortage in food supply, and this shortage in food supply obtains because the law of supply and demand is out of balance. To bring up the supply of food the principal need is for more labor, and yet our labor supply is daily being reduced below normal by war demands and their attending destruction of labor. If, then, we can devise a method of sensibly increasing our labor supply, we are beginning on a sure foundation if we are trying to relieve the high cost of living.

The labor problem is undoubtedly the greatest problem confronting the world to-day, and our best observers of this question are beginning to see that only as labor and capital devise plans looking to a permanent betterment of labor can peace between the two become happily permanent. To bring about this peace labor must work efficiently and labor must be conserved and used in a manner producing the greatest good to the greatest number. About the only commodities we can sensibly ignore in a campaign for efficiency are air and salt-ocean water.

Water Powers Conserve Labor

The writer will endeavor in what follows to set forth the claim that the harnessing of our water powers will conserve more labor and produce better living conditions in the United States than can result from any other agency or group of agencies that can be mentioned by the anti-water-power development crowd, who for the last fourteen years have labored so successfully in the use of misrepresentations to kill the water-power industry in the United States. Facts are almost always uninteresting reading, and the public at large is generally unwilling to stick to even one page of facts unless the public is hungry.

Secretary Lane has recently said that there is in the United States 35,000,000 water horsepower undeveloped. The attacks on water-power engineers and developers began in 1903, and since that time the aggregate falling off in water-power development amounts to more than 5,000,000 hp. In other words, if water-power development had been encouraged during this period and continued at the normal rate of development prior to 1903, we should have an additional 5,000,000 hp. at work to-day and the public would be fixing the rates to be paid for this great additional amount of energy. The consumers would be enjoying a saving of at least $50,000,000 annually in their power bills, and, most important of all, as will be shown later, 100,000 laborers now engaged in following coal from the bowels of the earth to the ash pile would be free for other more important work.

In addition to the foregoing, the development of this 5,000,000 hp. would have been of great benefit to our farmers, because of the cheap fertilizer it would have produced. Besides this, about $274,000,000 worth of railroad equipment now hauling equivalent coal would be available for other most important and crying needs. But the "conservationists" decreed otherwise and the waste goes merrily on.

Call Labor and Capital to Service

This is a fine price we are paying for following during the last fourteen years the proposals of impractical, uninformed, though probably well-meaning, men who have no intimate knowledge of our industrial life and the responsibilities related thereto. In this hour of the world's greatest trial the S. O. S. calls are now directed in the main to laboring men and to the great industrial organizations commonly called corporations. If our country is saved, it will be these two great elements that will achieve the result, aided by our men of finance and by the engineering profession, rather than by those whose principal job is talking loudly about matters they have been fooling and bulldozing the people about for a long time in the past.

The war should bring capital and labor nearer together in the future and so enable them to conserve our resources and help one another for the common good, and thus make us yearly more immune from the cranks in and out of our legislative bodies.

Much has been said in the past about conserving our coal. More important to-day, however, is the need to conserve our labor. The following analysis will be interesting to those who realize that conservation of our labor is important, first of all to labor itself and second to the public at large.

Let us therefore see what the government statistics reveal regarding this question, taking the 35,000,000 undeveloped water horsepower given by Secretary Lane as the basis. The government statistics available are for the year ended June 30, 1914, and for bituminous coal production for the year 1915.

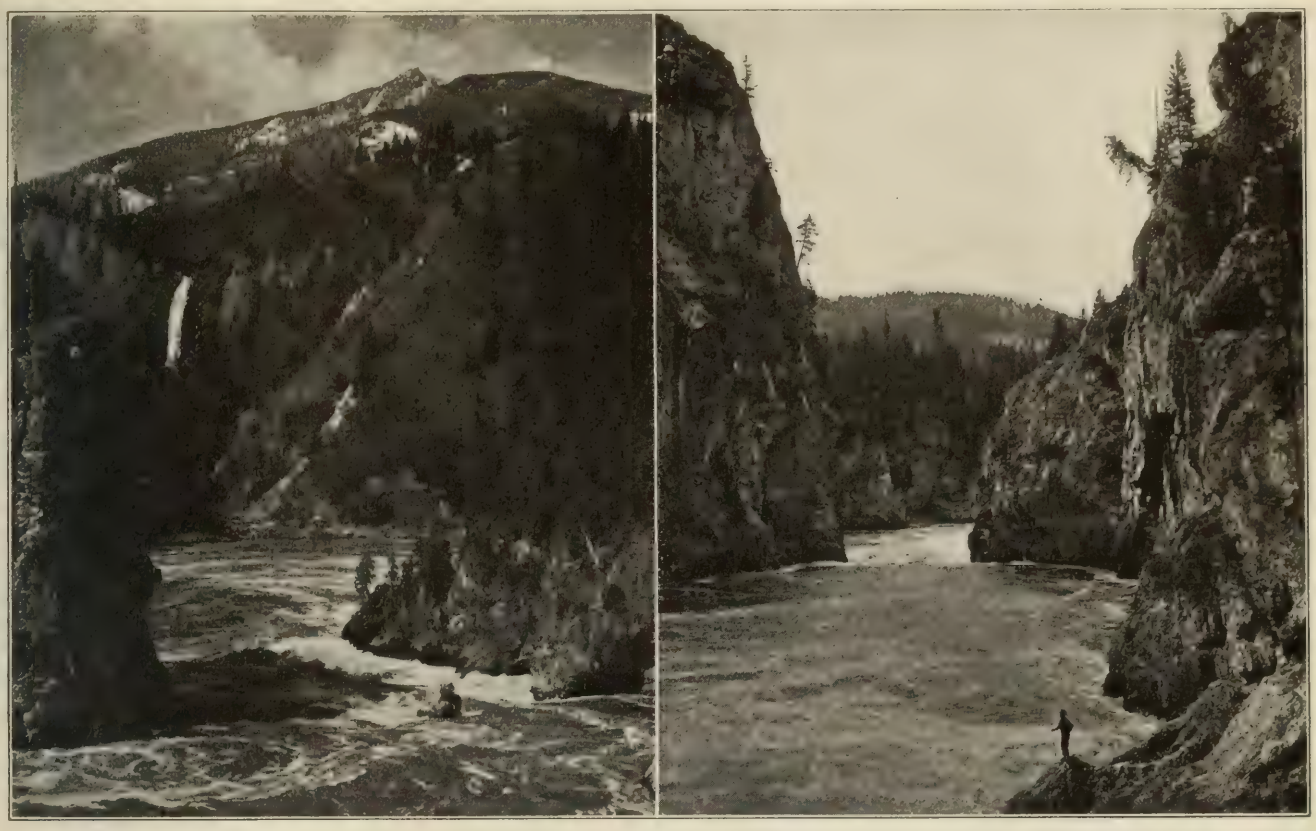
Saving in Labor

During 1915 442,000,000 tons of bituminous coal were mined, requiring the employment of 557,000 miners, from which it is apparent that the mining of coal is at the rate of 1.26 employees per annum per 1000 tons of coal mined. Of the above quantity of coal mined, approximately 380,000,000 tons were shipped on cars and required the use of about 800,000 gondola cars and

20,000 locomotives, and in the way of labor in all of the branches of the railroad serving the movement of this freight there were required approximately 388,000 men; hence for every 1000 tons of coal transported the services of 1.02 men were required to work a year.

This coal finally landed in the ash pile, and we find from statistics relating to employees in central steam stations that for every 1000 tons of coal consumed there were required the services of half a man for one year. Therefore the total labor required for the consumption of every 1000 tons of coal on the basis of one year's time is 2.78 men.

To transport 280,000,000 tons of coal there are required among other things 600,000 freight cars that cost about $1,200,000,000 and 20,000 locomotives that cost about $400,000,000 more, and if we add to the above figure other financial expenditures that are necessary so that the freight cars and the locomotives can do their work, we have as a result around $1,920,000,000 of our railroad investment employed in the hauling of a commodity that could be dispensed with entirely and this great amount of equipment employed in the transportation of our farm products, certainly at a less cost than now obtains.



ONE OF THE HUNDREDS OF UNDEVELOPED SOURCES OF WATER POWER IN THE WEST

On the average, 1000 tons of coal in the United States produces 125 hp. for a year of time; 35,000,000 water horsepower developed and in commission would save the necessity of mining 280,000,000 tons of coal per annum. As regards labor this vast tonnage requires for its production, transportation and consumption 280,000 × 2.78 men, or 778,000 laborers of one kind and another. The amount of labor required to operate this 35,000,000 water horsepower may be put conservatively at 40,000 men. Therefore the net saving in the way of labor alone by the installation of this water horsepower would be approximately 740,000 men available for other industries.

The above figures brought down to a statement that can be easily remembered amount to this: Every time 50 hydroelectric horsepower is developed and put in commission one laborer is permanently released for other uses.

The foregoing figures are of themselves of great moment with respect to the saving of labor, but there is still another tremendous conservation that has directly to do with the cost of food and to the cost of many other needs of life.

The spectacle of hauling 280,000,000 tons of coal (35,000,000 hp. at 8 tons per year per horsepower) over our railroads each year when we could avoid so doing in a perfectly practical way is just as foolish as would be a proposal to make the railroads haul the salt water of the ocean on cars to interior points and there evaporate it for the salt it contains instead of using as we do the natural inland salt deposits.

Power in all its forms in the United States has been steadily going downward in cost for many years, yet in spite of this the average selling price of hydroelectric power is about $10 per horsepower per annum less than the price of the same unit by steam.

The crops in France, in England, in Germany and in the United States are all suffering to-day from want of fertilizers. Volumes have been written showing that fertilizers, intelligently used, would about double the present farm production of the United States. The primary basic need of fertilizers is nitrogen, which can be most economically produced by the arc process from the air. We are the only large country in the world where fertilizers by this process are not in successful use.

Page after page could be filled with the enumeration of other blessings along the same lines that are now denied our community because of lack of water power, and in this category could be included wide benefits in the way of reduction in the cost of news print paper instead of the maintenance of a monopoly therein as is now the case because no new water powers are being developed.

Direct Economic Saving

Let us now "sum up" the above direct economic values that the construction of 35,000,000 hp. from water would produce:

Annual saving to consumers, 35,000,000 hp., at $10..	$350,000,000
Annual interest and depreciation on $1,920,000,000 worth of railroad property needlessly employed, at 8 per cent	153,600,000
Annual production along other lines due to the labor of 738,000 men, assumed at $1,000 per laborer....	738,000,000
Total	$1,241,600,000

In other words, we are following a program that is absolutely wrong relating to $1,241,600,000 annually of our business life, to say nothing of the reductions in the cost of food if every State in the Union could be provided with fertilizer factories for the furnishing of fertilizers that the farmers need to increase greatly the production of the farms and correspondingly reduce the cost of living to all of our people. How can we claim as a government even moderate intelligence in the face of a misfit in our industrial methods because of which we are going wrong respecting $1,241,600,000 yearly? Private business so conducted could not survive.

If the reader has arrived thus far in this discussion, the very first question he will ask will be, "What is the matter and why don't the engineers and the bankers develop our water powers?"

The answer is that there is no law now on our federal statute books that will permit of a dollar of investment in water powers if the investor demands safety. Revocable permits, subject to cancellation at the will of any politically ambitious cabinet officer, are offered in the way of security of tenure for those trying to bring about development on public lands, and on navigable rivers there is no authority at all. Much the largest element in the cost of developing water power is interest on the investment, and this interest rate, in the interest of the consumer and the investor, should be kept as low as possible.

When we consider that the construction of dams and hydroelectric work generally is undoubtedly the most hazardous of all of our industrial undertakings except possibly powder manufacture, and then when we come to add to the exigencies of construction the uncertainty of tenure, we find an amount of risk which first of all is not in the interest of the consumer and secondly forbids construction.

How to Do It

The government can remove the risk incident to the question of tenure by giving the water-power companies fixed tenure for fifty years and at the end of fifty years agreeing to extend the tenure for a further term upon a mutually satisfactory basis, or, failing in this, take the property over on payment of its fair value at the time the property is taken over, excluding franchise and other values granted by the government. The final and equally important requisite of law would be that these water powers should have the service they render and the prices they charge both regulated by the state public utility commissions of the states in which the power is consumed.

The reader will be surprised to know how easily, by the passage of fair legislation, the resumption of water-power development can be brought about. If he wants to learn of something really difficult instead of simple, let him talk to the few Congressmen and Senators—not more than 5 per cent of the entire representation—who have for years kept the Congress from passing constructive water-power legislation. Their claim has been that our water powers are to be grabbed and stolen from the people, but they have no facts or reasonable assumptions to support this claim, and when challenged, as they have been time after time, to bring forward sound reasons for their position, they have always failed.

The fact that absolute regulation of rates and service is asked for by the water-power people, which in itself fully protects the public, is brushed aside. We successfully regulate our railroad rates and service and could in the same intelligent manner regulate our water powers and in this way protect the public and encourage development.

Time for the Rank and File to Awake

Statements attacking capital, for some reason or other, make about a thousand times as much impression as can possibly be created by stating the simple unanswerable truth in reply thereto; and until the people generally realize the gravity of this entire situation we shall go right along allowing the present penalties to accumulate until startling necessities make the rank and file wake up and demand of the government encouraging laws for the development of an industry that can do more for them than any other single branch of our industrial life.

SLAG PREVENTIVE FOR FLAME-ARC LAMPS

Boracic Acid Prevents Formation of Slag in Flame-Arc Lamps—Amount Needed Depends on Salt in Positive Electrode

Boracic acid, it has been found, prevents the formation of slag in arc lamps more effectively than borates or other salts of alkalis and also makes the light of the arc steadier. The advantage of boracic acid is found to be particularly great in open-arc lamps, whereas in inclosed-arc lamps the resulting advantage is less marked. It has, moreover, been found that the beneficial action occurs only when the amount of the admixture exceeds a certain limit, depending on the percentage of salt in the positive electrode. The correct proportion must be found experimentally in each case. For example, when positive carbons are used containing about 30 to 40 per cent of luminous salts it has been found that about 3 to 5 per cent of ordinary boracic acid is required, according to the nature of the luminous salts in each case, or a correspondingly smaller quantity when the anhydrite is employed. An invention to this effect has been claimed by Georg Egly, assignor to Messrs. Siemens Brothers & Company, in patent No. 1,221,039.

Legal Requirements of Factory Lighting

Need of Expressing Lighting Specifications in Simple Terms That Can Be Readily Understood and Enforced—Too Much Legislation Not Desirable —Difficulties in the Way

BY C. E. CLEWELL

Assistant Professor of Electrical Engineering, University of Pennsylvania

SUMMARY.—Progressive industries look upon adequate light as an economic necessity, and it is only for those cases where lack of information or lack of progressiveness causes certain manufacturers to lag behind that legislation becomes necessary. In this article brief reference is made to the efforts of the Illuminating Engineering Society to promote intelligent legislation and to the contents of its typical code. In addition, the regulations now in force in Wisconsin and New York are contrasted with the new factory lighting codes which became effective in 1916 in the States of Pennsylvania and New Jersey. The importance of such regulations is brought out by a quotation from a commissioner of labor in one of the States foremost in the enactment of such rules. The author comments on the problem of enforcing these codes, and, to show that the present regulations are not a hardship, he compares the minimum requirements of representative State codes with actual cases of good lighting practice.

THERE is little or no call for legislation to enforce minimum standards of factory lighting in industries which appreciate the economic value of good light. The best evidence perhaps of the truth of this statement is the fact that the working illumination intensities in many well-lighted factories are considerably higher than the minimum requirements of the latest state factory lighting codes. In Fig. 1, for example, the minimum requirements for rough and for fine manufacturing work in the 1916 Pennsylvania state code are contrasted with actual intensities of illumination as measured in a number of lighting installations within the State which were in service before the code became effective and even before it was drafted.

Many other cases are to be found, however, where manufacturers have lagged behind in grasping the fundamental ideas of good light as an aid to production, or where ignorance of the advances in the art exist. It is mainly for the purpose of causing such operators to keep their lighting facilities above a desirable minimum that legislation in one form or another may be looked upon as a need.

Too Much Legislation Not Desirable

As a general proposition, too much legislation for the industries is unfortunate, since it unduly complicates the conditions surrounding the manufacturer. In the case of lighting many fragmentary and unsatisfactory enactments have been on the statute books of various states for years. However, some work has been conducted on the part of several states to draft more comprehensive regulations to govern factory lighting. In view of lighting legislation becoming more general, persons who are qualified and able to do so are fully warranted in making an effort to see that such regulations when enacted are adequate and definite for the purposes they are intended to cover.

Fundamentally this service or duty is the basis for the efforts which are under way, and which have been made for several years by the committee on lighting legislation of the Illuminating Engineering Society. This committee has sought to assemble the best ideas available on the subject, and with this task accomplished intends offering its services to those commissions which may plan to undertake drafting rules of this kind. In its work this committee has made an examination of the regulations which apply to lighting in a number of states. This examination shows conclusively that most of the efforts in this direction in the past have been ineffective, if not actually worthless. Among the reasons for the ineffectiveness of the rules are their indefinite nature and the impossibility of placing upon them a specific interpretation, which must obviously precede enforcement if justice to those affected is to result.

Why Lighting Legislation Is Needed

That there is a real need for such legislation is made apparent by the results of actual tests of lighting systems where the intensities are far below the minimum values dictated by good practice for such work. Thus, in Fig. 2, the minimum values of intensity in the new Pennsylvania code are again shown by the horizontal lines for rough and for fine manufacturing work, while the points of the irregular line show the actual measured intensities in a number of poorly lighted factories within the State. The voluntary decision on the part of progressive manufacturers that light is needed in the quantities evidenced by Fig. 1 is a condemnation of the unprogressive class of industries for forcing their employees to work under the low quantities of illumination shown by Fig. 2. Taken together, therefore, these two diagrams indicate that the effect of legislation on the class of industries represented by Fig. 2 can hardly be other than a benefit.

Lighting legislation is the past has in nearly all cases consisted in the specification that the light shall be adequate or suitable or proper. Such modifying terms are, of course, indefinite and subject to different interpretations by factory owners and state inspectors. To determine whether lighting conditions are adequate or suitable depends on the personal judgment of the person on whom the decision rests. For many reasons, therefore, it cannot be classed as legislation which will result in maintaining a certain standard of illumination for any particular class of work. One merit which may be justly claimed for these older forms of regulation is that they at least called attention to the necessity for light. Aside from this, they show by their negative practical results that in effect they are of little or no value.

One of the first problems, therefore, which confronted the committee on factory lighting[1] in the preparation of a typical code was that of drafting specific rules in

[1]On which the writer served as chairman. This committee was appointed late in 1914 by the Illuminating Engineering Society.

such a manner that they could be readily interpreted, definitely understood and easily enforced. There is, of course, quite a variety of ways in which the specification of quantity may be made. One of the common schemes in earlier practice was to specify the watts per square foot of floor area. This is a readily understood term and is one which can easily be checked on a basis of the lamp ratings and the floor space lighted.

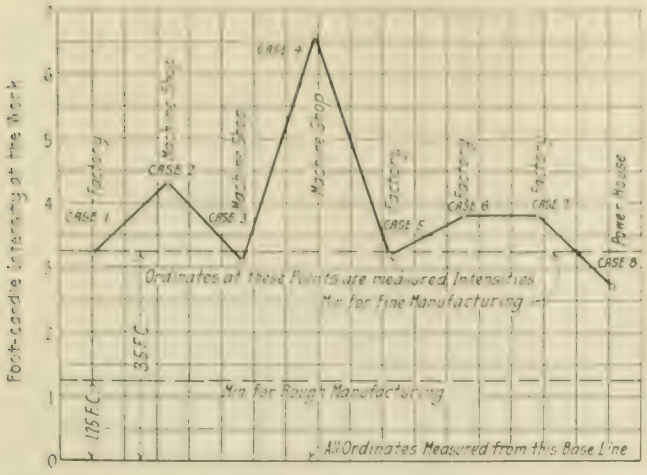
The obvious fundamental difficulty in the use of the watts per square foot as a basis of specification is illustrated in a striking manner by Fig. 3. The values of this factor are shown graphically for seven different lamps and for the same intensity at the work in each case, it being assumed in calculating these values that 40 per cent of the total generated light flux is effective on the working area in each case. From Fig. 3 it may be noted that the wide differences in the values of the watts per square foot to produce a given intensity are due to the differences in the ratings of the lamps in lumens per watt. Thus the use of carbon-filament lamps, because of their low flux per watt, requires a much greater watts density per unit of floor area than the metallized-filament or tungsten lamps, which produce greater quantities of flux per watt in each case.

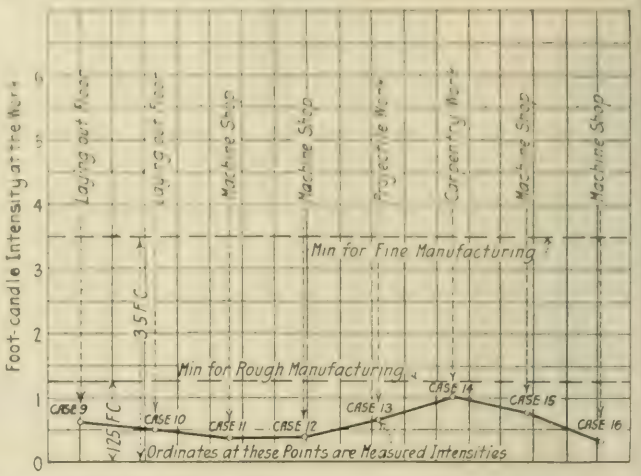
Furthermore, owing to the variation in the ratings of different sizes of lamps of a given type, the watts per square foot required for a given intensity would change for various sizes or styles of units of a given type. This is well illustrated by the differences in the lumens per watt rating for the various sizes of vacuum and gas-filled lamps. The assumption that 40 per cent of the total generated flux is effective on the working surfaces is based on the condition that there is an efficient distribution of the light in useful directions from the lamp, and on certain ceiling and wall-surface conditions, variations in which would again make it necessary to modify the watts-per-square-foot value.

For numerous reasons, therefore, any specification which applies to the lamp directly and which at the same time attempts to specify the quantity of light on the work must take adequate account of all the variables which enter between the light sources and their effective illumination on the work. Because of the many uncertain factors a specification of this type is likely to result in a cumbersome scheme that will often be difficult or even impossible to reduce to a definite basis. As stated before, however, the use of this factor has the advantage that the two elements—watts consumed per lamp and the floor area—are in themselves easy to understand and to determine.

Candlepower per Square Foot

Other factors applying to the lamp might be employed in a manner quite similar to the use of the





FIGS. 1 AND 2—ILLUMINATION INTENSITIES MEASURED IN DIFFERENT INSTALLATIONS

The irregular line of Fig. 1 refers to installations where fine work is being done, and that of Fig. 2 to places where rough work is being performed. The horizontal broken lines indicate the minimum illumination intensities specified by the new Pennsylvania code for fine and rough manufacturing.

Other factors applying to the lamp might be employed in a manner quite similar to the use of the watts per square foot. For example, the number of lamps to install for producing a certain intensity might be based on the mean spherical, the mean lower hemispherical or the mean horizontal candlepower, or on the total generated lumens per square foot of floor space in each case. All of these factors are open to much the same objection that has been pointed out for the watts-per-square-foot factor.

To show what specification by these schemes amounts to, the following values have been worked up for use with 100-watt vacuum tungsten lamps on a basis of a rating of 10 lumens per watt, a utilization efficiency of 40 per cent and an intensity of 4 ft.-candles at the work.[2] Thus, for this particular utilization efficiency the specification might take the form of 1 watt per square foot, 0.8 mean spherical candlepower per square foot, ten generated lumens per square foot, or about one mean horizontal candlepower per square foot. From these values it is obvious that to use a specification of candlepower per square foot it is essential to state whether this refers to the mean spherical, the mean lower hemispherical or the mean horizontal values.

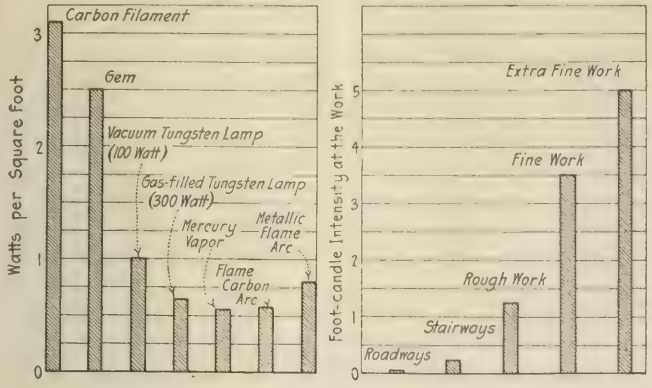
The Wisconsin shop-lighting orders,[3] issued in January, 1913, constitute an example of legislation which makes use of a candlepower per square foot specification. One of these orders (No. 2102) will illustrate this point. This order, which refers to artificial light where there is no gas or smoke, reads: "Each place of employment in which hand or machine operations are performed must be supplied during the working hours, when daylight is not available, with artificial light

[2]The utilization efficiency of a lighting system is defined as the ratio of the effective lumens on the working surface to the total generated lumens of those lamps lighting the surface, expressed as a per cent.

[3]It should be noted that plans are now under way for making a complete revision of the original Wisconsin orders.

equivalent in amount for each 4 sq. ft. of floor space to not less than the light produced by a 1-cp. lamp hung 10 ft. from the floor."

This order has the objection that it does not specify what kind of candlepower is referred to—that is, whether mean spherical, lower hemispherical or horizontal—and is further open to the disadvantages of any of the methods which refer such a specification back to the lamp. In brief, there is no assurance that a lighting installation which conforms to such an order will be what was intended by those who drafted the regulation. However, with this basis as with the watts-per-square-foot specification the candlepower is a term which can be grasped quite readily by the practical man to whom the code specifically applies.



FIGS. 3 AND 4—UNIT POWER REQUIREMENTS WITH DIFFERENT TYPE LAMPS, AND ILLUMINATION REQUIRED FOR DIFFERENT PURPOSES BY NEW JERSEY AND PENNSYLVANIA CODES

The requirements indicated by Fig. 3 are based on securing the same illumination intensity in each case, 4 ft.-candles having been selected as the intensity at the work and 40 per cent as the utilization efficiency.

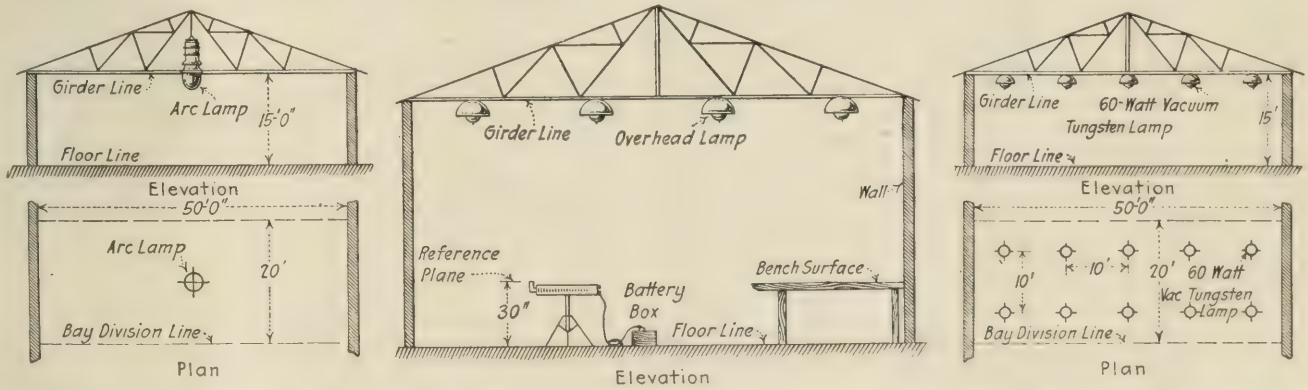
SPECIFICATION OF INTENSITY AT THE WORK

The most obvious improvement over the foregoing methods is to specify the intensities of illumination at the work for various manufacturing operations in terms of the foot-candle. This plan, however, has three fundamental disadvantages from a practical standpoint—first, it makes use of a unit (the foot-candle) which is not generally grasped and which is difficult to understand; second, the quantities of illumination for various operations, as at present understood, are largely arbitrary—that is, not determined on a scientific basis; third, to check up such rules requires measurements with instruments which in general are not well adapted to the every-day use of a factory inspector upon whom rests the responsibility of passing upon the factory lighting conditions.

Notwithstanding these difficulties, the use of foot-candle intensities at the work forms the basis of the Illuminating Engineering Society's code,[4] which was issued late in 1915. This code, in its essential features, has since been adopted by the States of Pennsylvania (effective on July 1, 1916) and of New Jersey (effective on August 1, 1916). Fig. 4 shows graphically the minimum requirements in the foot-candle intensities for various classes of work as listed in these new codes. The accompanying table also furnishes a convenient means for comparing the minimum and desirable intensities in the various codes with those dictated by good practice from other sources.

TWO CODE REQUIREMENTS ILLUSTRATED

To illustrate differences in two of the present codes, Figs. 5 and 7 refer to lighting plans for a given bay based (in Fig. 5) on order No. 2102 of the Wisconsin orders and (in Fig. 7) on the specification for rough work in the Pennsylvania and New Jersey codes. The use of a single arc lamp (Fig. 5), while a very poor arrangement, may, in a general way, be said to fulfill the Wisconsin order, since the 4-amp. metallic-flame arc lamp produces 250 mean spherical candlepower for 1000 sq. ft. of floor area, or 0.25 mean spherical candlepower per square foot. The illumination from a single arc lamp at such a low height is likely to be far from uniform on the working surface and the glare very objectionable. Fig. 7, on the other hand, shows a plan designed to furnish a uniform intensity of 1.25 ft.-candles on the working surfaces, in accordance with the minimum requirement for rough manufacturing in the Pennsylvania and New Jersey codes. The superiority of Fig. 7 over Fig. 5 is obvious, and yet each conforms to the minimum requirements for rough work in given states.



FIGS. 5, 6 AND 7—FACTORY BAY LIGHTED BY METALLIC-FLAME ARC LAMP; PORTABLE PHOTOMETER IN POSITION FOR CHECKING ILLUMINATION INTENSITY, AND FACTORY BAY ILLUMINATED BY INCANDESCENT LAMPS

Figs. 5 and 7 represent the same bay (floor area, 1000 sq. ft.), illuminated in one case by an arc lamp and in the other by incandescent lamps. With the 4-amp., 250-cp. (mean spherical) metallic-flame arc lamp the illumination obtained in Fig. 5 would meet the Wisconsin code requirements now in force—that is, 1 cp. per 4 sq. ft. of floor area—but the lighting would be unsatisfactory. Vacuum-type tungsten lamps rated at 60 watts each and arranged as shown in Fig. 7 meet the Pennsylvania and New Jersey requirements of 1.25 ft.-candles. The utilization of efficiency assumed is 27 per cent.

No similar comparison diagrams can be given to include the revised New York regulations, issued in proposed form in 1913, because they do not contain speci-

[4]Fully discussed by the writer in the ELECTRICAL WORLD, Vol. 66, No. 21, p. 1135, under the title "A Code for Better Industrial Lighting." A revision of this original code is now under way.

fications of quantity. These New York rules were drafted at that time expressly for minimizing abuses of eyesight by the use of unshaded lamps, no attempt having been made to include definite specifications of any kind. It should be noted that the effort to reduce the most apparent evils of bad lighting, even without the more definite specifications of quantity included in later regulations, made this New York bill an improvement over much of the existing lighting legislation at the time. The latter in nearly all cases was limited to such general modifying terms as "adequate" and "proper," which, as previously stated, are so indefinite as to be of little or no practical use.

Need Felt for Improved Legislation

One indication of the need which has been felt for improved rules to govern industrial lighting has been the attitude of the commissioners of labor in those States which have taken the greatest interest in the subject. As an evidence of this attitude, the following comment[5] on the part of a State commissioner of labor is of interest:

> "Why shouldn't a workman be expected to have proper light, the same as proper air to breathe? If he is forced to work in an improperly lighted workroom or where the light is shining in his face, as I have seen in factories, why isn't that just as much an injury, by reason of his occupation, as having his finger cut off, for instance? It may be very much more serious to him; it may be a very much greater handicap in his occupation during future life. . . . What surprises me is the absolute lack of intelligence on the part of so many good manufacturers in the use of light. They do not know anything about it. I have often explained to the factory inspectors that the mere use of a piece of paper to screen lights from the eyes would often constitute splendid work. I believe that this matter should be taken up in the form of scientific standards and that these standards should be expressed in language which the ordinary layman will understand."

In addition to the foregoing comment, it should also be noted that the Industrial Commission of Wisconsin, through its deputy in charge of lighting, has in hand at this time a complete draft of a revised set of lighting rules which are proposed as a substitute for the older and somewhat unsatisfactory shop lighting orders issued early in 1913 and still in force.

The Problem of Enforcement

The recently enacted codes, with the specification of intensities at the work, present a number of more or less difficult problems in their practical enforcement. The tendency of the casualty insurance companies to penalize with higher premiums the poorly lighted factories will be helpful as an influence, and particularly so in those States where workmen's compensation laws are rigidly enforced.

It is obvious, however, with every good intention on the part of manufacturers to live up to the requirements of a code, like that, for example, in Pennsylvania and New Jersey, that the check on an intensity of illumination on a working surface is not a simple matter like the check on watts per square foot or even that of candlepower per square foot. Illumination intensity is not susceptible to an accurate and often not even to an approximate determination by the eye, and hence both of the recent codes specify that for purposes of measurement a horizontal reference plane 30 in. above the floor is to be taken and a properly standardized portable photometer or illuminometer used. This means, of course, a check by an instrument somewhat as suggested by Fig. 6, and this immediately suggests the need for simple and inexpensive devices for measuring intensity, without which the problem of enforcing such rules is sure to be more or less unsatisfactory.

In this connection it may be suggested that manufacturers in States with industrial lighting codes would do well when purchasing new lighting equipment to require the lamp manufacturers to furnish specifications to govern the installation of lamps, with a guarantee that if they are installed according to these specifications they will provide an average illumination intensity in keeping with the requirements of the code applicable to the class of work to be performed under the lamps.

There does not seem to be any fundamental objection, as regards the way of conducting the enforcement of such rules on the part of State boards, to having a list of accredited lamp manufacturers from whom a guarantee that certain requirements are fulfilled by a new lighting system may be accepted without further check by inspectors other than a general inspection. With old installations the problem could not, of course, be solved so readily.

ILLUMINATION INTENSITY REQUIREMENTS IN FOOT-CANDLES IN VARIOUS CODES AND BY DIFFERENT AUTHORITIES

Class of Work	Clewell's "Factory Lighting," 1913	G. E. Co.'s "Handbook on Lighting," 1913	Wisconsin "Orders,"[1] Minimum, 1913	I. E. S. Code of Lighting, Minimum, 1915	British Report,[2] Minimum, 1915	Pennsylvania Code, 1916		New Jersey Code, 1916	
						Minimum	Good Practice	Minimum	Good Practice
General lighting	....	0.08	....	....	0.25	....	.....	....	.....
Yards, roadways, etc.	....	....	....	....	0.05	0.05	0.05 to 0.25	0.05	0.05 to 0.25
Stairways, etc.	0.50	0.50	....	0.25	0.10	0.25	0.25 to 0.50	0.25	0.25 to 0.50
Foundries	....	3.00	1.50	1.25	0.40	1.25	1.25 to 2.50	1.25	1.25 to 2.50
Rough manufacturing	3.00	2.00	0.75	1.25	....	1.25	1.25 to 2.50	1.25	1.25 to 2.50
Fine manufacturing	5.00	5.00	1.50	3.50	....	3.50	3.50 to 6.00	3.50	3.50 to 6.00
Extra fine work	....	....	....	....	....	5.00	10.0 to 15.0	5.00	10.0 to 15.0

[1]The intensities in this column have been estimated from the specifications of candle-power per square foot as listed in the original Wisconsin orders.
[2]In the 1915 British report no recommendations are made concerning the illumination required for the work, and hence the intensities specified in this column are merely given for general illumination, without regard to the needs of the work itself.

Other Requirements

Other items are included in these new codes in addition to the quantity specifications, which are also most important. One of these is the rule against glare from unshaded lamps. To reduce the question of glare to a simple measurement suitable for inspectors is another difficult matter. Suggestions have been made looking to such a measurement, but as yet no very satisfactory scheme has been advanced. From the viewpoints of both State labor commissions and manufacturers cooperation is required in a special manner during these transition years, when the change is being made from old and indefinite statutes to these recent codes with their more definite regulations, so that regulations may be introduced which will not complicate enforcement.

[5]Discussion by Col. L. T. Bryant, Commissioner of Labor in New Jersey, found in *Transactions*, Illuminating Engineering Society, Vol. XI, No. 1, pp. 65, 66. Abstracts from Colonel Bryant's notes.

Working Toward Saturation in Thirty-two Towns

An Interesting Development in Central Station Salesmanship in an Iowa Territory—Methods of Soliciting That Were Employed and Summary of the Results That Followed

BY ARTHUR HUNTINGTON
New-Business Manager Iowa Railway & Light Company, Cedar Rapids, Iowa

THE Iowa Railway & Light Company, with headquarters in Cedar Rapids, operates at present in thirty-two Iowa towns and cities with a range in population from 40,667 down to 125 according to the local census figures of 1915. In this total population of slightly more than 100,000, which can be reckoned as about 30,000 homes, the company is serving at the present time over 22,000 customers. Rather more than 4000 of these consumers have come on the lines since the house-wiring month of 1916. At the time when the writer became new-business manager of the company, the territory had already about twenty customers connected for each hundred people, and the impression seemed to prevail that the market had been combed to the limit. The staff consisted of one experienced salesman, one inexperienced salesman and a small wiring department. House-wiring month was right ahead, and it was decided that the first thing to do was to organize a wiring campaign.

On account of the present high price of material it was deemed advisable to select that form of business which called for as small an outlay of money as possible. It was decided to confine our efforts to wiring old houses along the company's lines, limiting extensions to one pole and one span of secondary construction, plus a service drop. The following scale of prices was adopted, all jobs to be complete, ready to burn, with lamp inspection paid for by the company and free energy for one month:

STANDARD SCHEDULE

Three rooms complete with lamp drop and lamp ready to burn, complete with entrance and meter loop	$10.00
Four rooms, same as above	12.00
Five rooms, same as above	14.00
Six rooms, same, one floor	16.00

ADDITIONS

Sockets, pull chain	0.25
Shade and holder	0.15
One light fixture, with lamps and shades	1.00
Two light fixtures, with lamps and shades	3.00
Three light fixtures, with lamps and shades	4.00
Hanging fixture while man is on job	0.50
Hanging fixture where special trip is necessary	1.00
If fixture does not replace drop cord, add	0.50

SWITCHES

Snap	2.25
Flush	2.75
Snap three-way	5.25
Flush three-way	5.50
Basement light snap switch	4.75
Additional light on same circuit	1.50
Attic light snap switch	2.75
Porch light snap switch with 40-watt lamp and bowl	4.75
Porch light flush switch	4.75
Iron outlet in kitchen with key wall receptacle	3.50
Taking up floors over six rooms	2.00
Each additional drop	2.00

It was decided to work entirely on schedule without regard to whether the houses were easy or hard to wire. The whole campaign was planned before a man was sent out, bearing in mind that our men were inexperienced and that the results desired were the development of one particular branch of the business, and only a few changes have been made from that day to this. The cardinal points of our plan were as follows:

CARDINAL POINTS OF PLAN

1. A price within the reach of all. In fact, the whole basis of our advertised figures was to interest the small home owner, and no figure was used that was excessive The figures for the simplest kind of a job were very low, but the extras such as fixtures, switches, etc., were figured at a good profit and made the wiring as a whole pay.

2. Conservative and good advertising. We presented the whole plan to the people through the medium of the daily and weekly press.

3. A good wiring department kept busy. The jobs were given to the wiring department in such numbers that they could be handled on a wholesale basis. By keeping a man on the same class of work all the time he was able to become very proficient, and in a short time we found that our cost of labor per outlet had been almost cut in two. The men always had a job to go to and were never permitted to leave a job until it was completed.

4. A soliciting force well directed, working with a unity of purpose backed up by the office.

The writer has always found it more advisable to develop his own men rather than to hire men of experience from other companies, but as time was short he sent for a man that he had schooled in another property and began looking for some men to develop. Two men were selected, one a wire man who had worked in a carhouse as repair man but had had no soliciting experience, and later a young man who was driving a bread wagon for a bakery. This last man was selected for no other reason than that he could talk Bohemian, there being a large Bohemian population here.

The men were paid at the rate of $2 per customer, together with railroad fare both ways from headquarters to the town under canvass, with instructions that they were expected to make at least $150 per month. They were instructed to take each house in town in rotation without regard to whether it was a big house or a small one. They were not permitted to go after "prospects" off the regular route chosen. If one of them heard of a specially good prospect, he was supposed to get the order when he arrived at that house. Incidentally a surprising amount of business was closed after supper. It figured fully 60 per cent of all business in the winter time and as high as 75 per cent in summer.

Our very first efforts were crowned with success, and with an average of four men working we secured on the Iowa Railway & Light property 3861 customers by the end of the year and at the same time secured on the Iowa Electric Company's property (a subsidiary) about 685 more. We loaned one solicitor to wholesale

towns, where he secured forty-one customers. One solicitor secured twenty-eight contracts a week straight through the year, and another, a man who had never solicited previously, twenty-seven customers a week.

At Belle Plaine eighty-nine contracts were secured by one man in nine days. At Nevada another man secured seventy-seven contracts in six days. The men worked strictly on the schedule above referred to. The cost of securing a contract on the average was $2.22 for soliciting, and the gross selling expense was $5.04. The average profit per job from the wiring department has been $4.26, which goes a large way toward paying the overhead expenses of securing and connecting new business.

To give some idea of how closely we confined ourselves to the existing lines, it need only be said that the average amount of service and secondary copper per customer was 13 lb., while only 104 poles were set to connect up 3861 customers, most of these being used in crossing streets. Meanwhile 112 customers were rejected for being off the line and sixty-four on account of credit. None of this shows in the records.

The men of the wiring department entered into the spirit of the campaign so enthusiastically that, working without a boss miles from headquarters, they established a standard of an outlet an hour, in and out of town, which included hanging fixtures—in fact, completing the job.

The result of the year's work shows up conclusively in the following statement comparing the activities of the wiring department in 1916 with results in 1915. This, of course, does not touch in any way the large amount of other work done by the local contractors.

	1915	1916
Total sales expense	$16,153.57	$22,588.98
Total customers	2,323.00	*4,448.00
Cost per customer	7.05	5.04
Jobs handled by Iowa State	1,353.00	3,320.00
Gross business	19,897.79	52,447.21
Profit of Iowa State Electric Company	1,106.70	14,863.17

It will be noted in the 1916 report that this statement shows that we gained 4448 customers during the year. This figure is correct, but about 600 of these customers this department is in no way responsible for, which accounts for the discrepancy between 3861 customers previously claimed and 4448 customers.

While the prices in our schedule seem rather low, we made money in spite of the high price of material by utilizing our force so constantly and keeping our workmen busy at all times. At one time we were over 500 contracts ahead of a wiring department that was capable of handling fifteen contracts a day. All labor was paid the rate of $4.50 for eight hours, and the men are working under rigid inspection, with no apprentices or helpers, each man being a journeyman wireman. The head of the wiring department made an effort to keep the men on as near one class of work as possible, taking advantage of the fact that the same piece of work done many times in succession can be done very much better and very much more quickly at the end of a large number of operations.

The effect of this campaign on the degree of saturation in our various communities is interesting, as shown in the accompanying table.

Some of these towns were just connected during the year and showed remarkable saturation in a short time

*This does not include 399 customers on Iowa Electric nor 41 on wholesale towns.

Baxter is the best example. As a matter of experiment the people of this town were told that if they came on the line with 110 customers each customer would receive one month's light free, and if they came on the line with 120 customers we would give each customer one month's free light and also light the street lights a month free. It will be noticed from the table that Baxter at the end of four months had more than twenty-five customers per 100 people. Saturation in this town is 176 customers. Luther and Berlin are 100 per cent towns. Gilman has 100 per cent of its houses and business places connected or under contract, but on Jan. 1 they were not all on the line. The same is true of Colo.

INCREASE IN CONNECTED CUSTOMERS IN COMMUNITIES SERVED BY IOWA RAILWAY & LIGHT COMPANY

Town	Population		Customers		Increase	Customers per 100 Pop. (1915)
	1910	1915	January 1, 1916	January 1, 1917		
Luther	130	141	39	63	24	44.66
Sheldahl	202	226	46	61	15	27.00
Slater	473	670	148	168	20	25.22
Boone	10,347	12,253	1,947	2,238	291	18.34
Nevada	2,138	2,686	542	670	128	25.02
Colo	463	536	0	123	123	22.90
Marion	4,400	4,675	738	831	93	17.79
Montour	383	413	84	103	19	24.93
Le Grand	338	364	64	77	13	21.15
Gladbrook	869	959	161	247	86	25.73
Tama	2,279	2,621	554	625	71	23.46
Toledo	1,627	1,721	481	551	70	32.02
Chelsea	507	582	93	121	28	20.78
Blairstown	532	584	115	149	34	25.51
Berlin	143	143	0	37	37	25.87
Morrison	173	218	0	42	42	19.26
Marshalltown	13,374	16,065	3,110	3,598	488	22.44
Gilman	430	477	95	176	81	36.90
Belle Plaine	3,121	3,668	681	806	125	21.71
Perry	4,630	5,455	1,339	1,408	69	25.83
Dana	183	213	40	54	14	25.35
Grand Jct	1,012	984	173	209	36	21.24
Rippey	407	403	0	90	90	21.33
Woodward	712	820	193	240	47	29.26
Cedar Rapids	32,811	40,667	7,076	8,182	1,106	21.66
Oxford	614	577	25	112	87	19.41
Solon	450	441	0	76	76	22.11
Shellsburg	527	605	0	133	133	22.10
Coon Rapids	1,084	1,218	(285)	294	9	24.13
Baxter	527	572	0	145	145	25.35
Rhodes	500	451	0	76	76	16.90
Tiffin	176	196	0	29	29	13.06
Robins	50	125	0	19	19	15.20
Luzerne	160	161	0	23	23	14.25
Scandia	Power	Power	1	2	1	.....
Traer	1,373	1,378	.....	315	....	22.86
	87,156	103,268	18,030	22,093	3,748	21.39

Another interesting feature of the campaign is the method of soliciting employed. The further the writer goes into the question of the best method of securing new business the more he is convinced that the rotation soliciting is the best and gets a larger percentage of contracts with a fewer number of calls. We have one man, for instance, who is regarded as rather a slow worker, but he makes his call clean and concise and closes 80 per cent of his contracts on the first call.

This was the method employed throughout our campaign. Every salesman had but one thing to sell, and that was housewiring. The writer has found that more young solicitors fail on account of having too many things to sell than for any other one reason.

This personal selling in our campaign was supported strictly by publicity, including advertisements in the local newspapers and in Cedar Rapids, with an electrical page which created a great deal of most helpful interest.

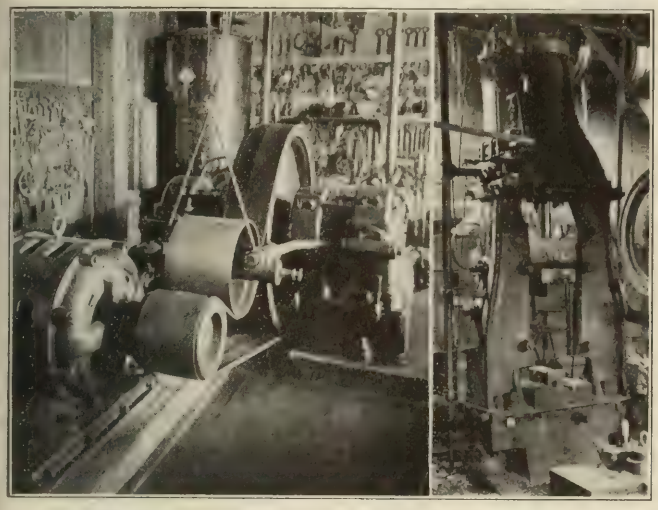
STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

REPLACING STEAM HAMMER WITH ELECTRIC DRIVE

How a Steam Hammer Was Converted Into an Electro-Pneumatic One and Satisfaction Obtained Therewith

The Cumberland County Power & Light Company of Portland, Me., has recently been successful in the conversion of steam-hammer equipment to electro-pneumatic service, a pioneer installation being made at the plant of the Marine Hardware & Equipment Company. At this place a 1200-lb. (544-kg.) Bement-Niles steam hammer was in service, steam at about 90 lb. per square inch (6.3 kg. per sq. cm.) being required over many hours daily. To avoid condensation troubles it was necessary to run the hammer practically all the time. As electric motor drive had been adopted for other purposes throughout the plant, it was found possible to do away with the demand for continuous high-pressure steam by adapting the steam hammer to air operation and installing a motor-driven compressor to supply air for this purpose and other requirements. The valve of the hammer was rebuilt for a fit of 0.0025 in. (0.064 mm.) compared with a previous fit of 0.005 in. (0.127 mm.) under steam service. The hardware company purchased a 50-hp., 220-volt, three-phase Westinghouse squirrel-cage induction motor designed for 900 r.p.m., and belted it to a 12-in. by 7-in. by 12-in. (30.5-cm. by 17.8-cm. by 30.5-cm.) Sullivan compressor delivering air at 90 lb. (6.3 kg. per sq. cm.). An idler pulley was employed as the maximum distance between the motor and compressor pulley was only 6 ft. 4 in. (1.92 m.). Connected with the compressor is a storage tank 8 ft. (2.4 m.) high and 48 in. (1.2 m.) in diameter, from which air is supplied to the hammer.



MOTOR-DRIVEN AIR COMPRESSOR OPERATING CONVERTED STEAM HAMMER ON RIGHT

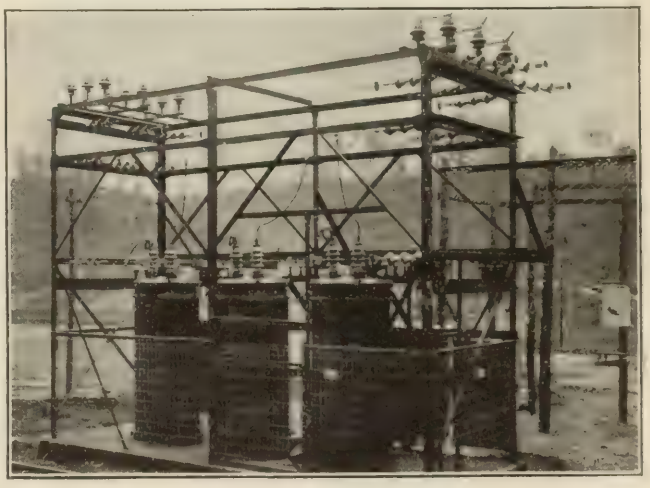
The hammer is supplied with air through a 2-in. (5.1-cm.) main and it exhausts through a 3-in. (7.6-cm.) pipe into a 1½-in. (3.8-cm.) reduction outlet at the roof of the factory. A branch exhaust terminating in two ½-in. (1.3-cm.) pipes is led down the frame of the hammer to outlets directed upon the working anvil surface, so that all chips and scale are immediately blown away in operation. Compressor cylinder oil is used in the air cylinders, a small mechanically driven oil pump being mounted on top of the hammer cylinder head for this service. It has been found that harder and quicker blows can be struck than under steam conditions. Control of the hammer is obtained by a foot valve and lever.

The success of this installation has led to the prospective early application of electro-pneumatic service to four hammers in another plant where one 1000-lb. (454-kg.), one 1200-lb. (544-kg.) and two 2000-lb. (907-kg.) hammers will be supplied with air furnished by a 150-hp. motor-driven compressor with a 12-in. by 48-in. (30.5-cm. by 1.2-m.) storage tank.

STANDARDIZATION IN OUTDOOR SUBSTATIONS

Southern Company Working with View Toward Simplification of Construction and Reduction of Cost per Station

About five years ago the Georgia Railway & Power Company began the installation of outdoor substations. It did not find in the market the kind of material desired, and for this reason it has manufactured its own horn-gap lightning arresters, switches, framing and similar apparatus.



STANDARD OUTDOOR SUBSTATION

The accompanying illustration shows a substation at Cartersville, Ga., which is typical of the substations being built by the company. This is a three-phase, 60-

cycle station with three General Electric 38,000-2300-volt transformers. The insulator pins used are made of paraffined locust which is the company's standard, and they are screwed into the split castings instead of being cemented therein. Care is taken to anchor the lines directly to the framing so that the side strain on the pins does not exceed 600 lb. (272 kg.). The insulator cap and pin are removable, so that by making proper jumper connections insulators can be replaced without opening the circuit. Unlike standard apparatus, the transformer taps can be changed to raise and lower the voltage without shutting down the station.

The company estimates that during the year 1917 it will manufacture about $75,000 worth of high-tension apparatus. During 1916 it built substations of the kind described above at the rate of about one a week.

SHADING STREET LAMPS

Practicable and Inexpensive Substitute for Unsightly Black Paint Inside Globes

Some time ago when the residents along the boulevards on Chicago's North Side complained of the excessive light entering windows of their homes from the incandescent street lamps, one-half of each globe



FIGS. 1 AND 2—PAINTED GLOBE WHICH WAS OBJECTIONABLE IN APPEARANCE AND METAL SHIELD WHICH WAS SUBSTITUTED

was painted black on the inside to reduce the light causing the objection. In order to maintain the paint in satisfactory condition it was necessary to repaint each globe once every six months. Besides causing a continual expense, this method of cutting down the undesired light was considered very unsatisfactory because the blackened globe detracted from the appearance of the street-lighting system.

To overcome the difficulty, Claude H. Shepherd, electrical engineer for the Lincoln Park Commission, has fitted each offending standard with a device like that shown in Fig. 2. It consists of a curved metal shield attached to a brass clamp which fits the neck of the straight-sided type of lamp used. The jaws of the clamp in each instance have been covered with asbestos tape which was shellacked so that it would not be necessary to clamp the bare metal against the glass. These shields were made at a cost of 50 cents each. In the daytime they give no evidence of their existence. At night they do not produce nearly such objectionable black spots in the street-lighting fixtures as were caused when the paint was used.

Aluminium instead of black paint was tried, but it also made the globes look dirty and had to be renewed frequently. The method employing the shields is now considered more economical and more sightly.

PECULIAR TROUBLE WRECKS WHOLE TRANSFORMER BANK

Destruction of Three Transformers by Siphoning of Oil Indicates Need of Periodic Inspection and Preventive Measures

BY ALBERT MARTINEAU

It seems hardly possible that the combination of two things—a transformer lead that siphoned oil and a heavy load—should combine to interrupt an important load and do considerable and expensive damage. However, one transformer of a bank of three pole-type distributing transformers recently burned out, caught fire and resulted in the wreckage of the whole installation. What actually happened, so far as could be ascertained after the event, was as follows: The oil from one distributing transformer had been escaping along one of the secondary leads, the latter acting much like a siphon. As this had been in progress for some time, the oil level had been considerably lowered, likewise the heat-dissipating ability of the oil, since there was less of it, and the unit had been running hotter than the other two units making up the three-phase bank. As the load was maintained at about full rating for ten hours or so daily, the transformer with the low oil level became hotter and hotter until eventually the oil gave off vapor (the flash point is about 160 deg.), which caught fire owing perhaps to an internal or lightning arc.

In the usual case the transformer would merely have burned and been destroyed, service being interrupted, but the other two units would have been unaffected. In the present case, however, the oil in siphoning out of the transformer had trickled down to the platform upon which the three transformers rested. The fire from the transformer followed the oil-soaked rubber transformer lead and ran up to the woodwork above and down to the oil-soaked wooden platform below. As the latter burned through it failed under the burden of the three transformers, and these fell to earth, one being destroyed and the other two damaged as the result of the fall.

While this incident is rather unusual, it is only what might be expected to occur oftener when the vast number of distributing transformers in use is considered. Ordinarily, however, the destruction of only one transformer and perhaps one cross-arm would result.

The moral of the accident is that it is advisable to inspect all distributing transformers before installation, and at least once soon afterward, to make sure that the oil is not siphoning out and that the oil level is maintained at the proper height. Siphoning of oil may appear to be a very small matter, but it is capable of reducing the capacity of a transformer and interfering

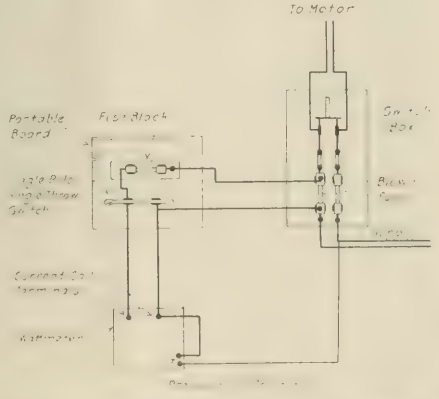
with voltage regulation, consequently with the maintenance of balanced phase relations, and resulting in the damage, if not eventual failure, of the transformer itself as well as service interruptions. Moreover, a transformer with low oil level is more susceptible to damage from lightning.

Probably the most satisfactory manner of preventing oil from siphoning up the leads of distributing transformers, where the distances are small and clearances close, is to cut back the insulation for 1.5 in. to 2 in. (3.81 cm. to 5.08 cm.) and solder the strands of the conductor. This overcomes the capillary attraction between the strands and thus prevents the leakage of oil. It should be done above the oil level, of course.

THE WAY TO AVOID DELAYS IN TESTING

Reliable and Convenient Method of Connecting Test Apparatus in Line Without Long Interruption of Service

Sometimes it is desired to take power or energy-consumption readings without interrupting the operation of the apparatus on the circuit. The accompanying diagram shows a method by which a wattmeter or watt-hour meter may be connected into the circuit in the short time required to stop the motor and start it again. As shown in this diagram, leads are soldered to the ends of a blown fuse. The terminals of these leads are connected through a fuse block and a single-pole switch, which are mounted in series on a portable board. Shunted across the switch are the leads from the current coil of the wattmeter. When the portable meter is to be used the switch in the power circuit is opened. one of the fuses therein replaced by the blown fuse mentioned, the power-circuit switch closed, and the motor started again. One of the terminals of the pressure coil of the meter is connected to the current-coil terminal and the other terminal is connected to the opposite side of the line. By opening the single-pole switch on the test board the wattmeter is connected



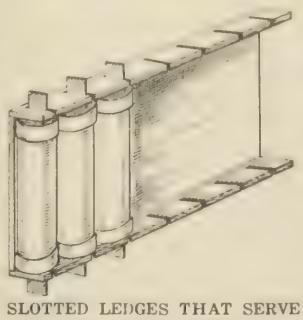
METHOD OF CONNECTING PORTABLE TEST SET

in series with the line. The value of this switch is apparent, as it may be closed and the meter removed and replaced by one of different rating, if so desired. To insure providing the same protection for the power circuit that is afforded when the test set is not being used, the fuse removed from the power circuit may be inserted in the clips provided on the test board.

LOW-COST FUSE RACK

Designed to Hold Seven Cartridge Fuses so That They Can Be Removed Quickly

A rack from which fuses can be taken quickly and which costs little or nothing to construct is in use at the Indian Orchard station of the United Electric Light Company of Springfield, Mass. As shown, it consists of a pair of ¾-in. (1.9-cm.) strips of wood with slots 2 in. (5.1 cm.) apart and attached to a 13-in. by 8½-in. (32.9-cm. by 21.6-cm.) base, which is screwed to the wall at two points. The slotted pieces are 1¾-in. (4.4-cm.) deep and accommodate seven 150-amp. inclosed-type fuses. No time is lost in hunting for fuses with this simple but effective arrangement.



SLOTTED LEDGES THAT SERVE TO HOLD FUSES

COST DATA ON INSTALLATION FOR LIGHTING CITY STREETS

Low-Voltage Series System Operated with Pole-Type Constant-Current Regulators at Lincoln, Neb., Proves Economical

The cost data given here apply to a series tungsten-lamp circuit equipped with a pole-type constant-current regulator and recently installed in Lincoln, Neb. The lighting system consists of fifty-two 100-watt type C lamps spaced 150 ft. (45.7 m.) on the boulevards that have a parking space in the center. On the other streets the posts are staggered. The primary side of the regulator is equipped with an oil-immersed time switch. The only attention required for this installation is to wind the clock of the time switch once in every eight days. An adjuster coil is used in conjunction with the regulator but is mounted separately on the pole. The total cost of the installation, including iron posts, steel-taped armored cable, etc., was as follows:

4,550 ft. No. 8 two-conductor steel triple-armored cable	$939.36
3,600 ft. No. 8 single-conductor triple-armored cable	373.44
52 iron posts with outer globes and series sockets	1,033.85
52 100-cp mogul-base series type C lamps	52.00
52 concrete bases for poles	103.00
150 iron anchors for concrete	6.50
15 lb. rubber tape, 10 lb. friction tape and 3 pails insulating compound	20.00
5-kw. pole-type regulator	159.60
Primary time switch	75.00
Plow, tool box, 12 wooden forms for concrete base, lumber for pole platform, 40 ft. 1½-in. galvanized pipe put in ahead of paving, and 100 ft. of 1-in. conduit for side of regulator pole	175.95
Paint and painting poles	47.50
Labor, digging and electrical work	417.24
Total	$3,403.44
10 per cent for superintendency and administration expense	340.34
Total	$3,743.78

The average cost per pole is $72. The maintenance on this system is very low and the amount of power demanded with fifty-two lamps burning is just a trifle over 4 kw. This installation was carried out under the supervision of Paul W. Doerr, assistant superintendent water and light department, Lincoln, Neb.

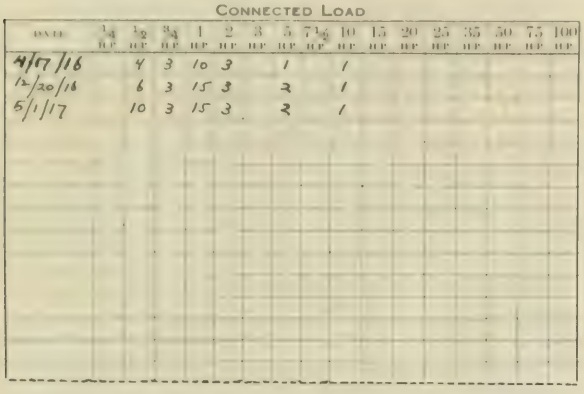
CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

LISTING CONNECTED MOTORS ON POWER CONTRACT CARD

Brockton Company Thus Maintains Up-to-Date Record of Power Service Which Is Very Convenient for Billing

By listing the electric motors connected in each installation upon a power contract card, as illustrated, the Edison Electric Illuminating Company of Brockton,



CONTRACT CARD, SHOWING MOTOR LISTINGS

Mass., maintains at all times an up-to-date record of its power service. In figuring the monthly service charge these data are highly convenient and occupy but little space.

MOVING A CENTRAL STATION OFFICE TO MAIN STREET

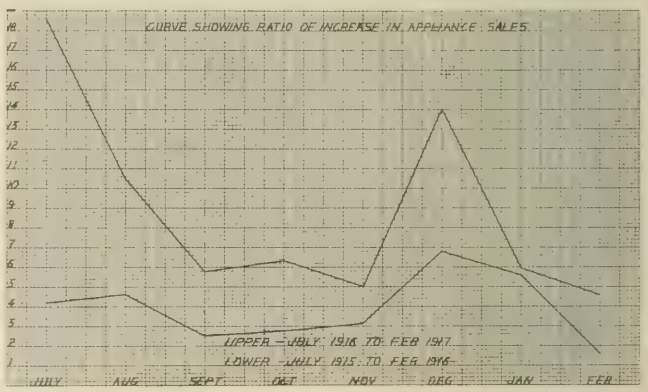
A Change of Location to the Business Center Proves Entirely Profitable at Indianapolis—Business Increases Shown Graphically

On July 10, 1916, the Merchants' Heat & Light Company of Indianapolis, Ind., opened a new salesroom on the most prominent corner in the city. Every opportunity was accepted to acquaint the public with the change from the company's old unfavorable location to the new "daylight corner," as it was called. The move was one to give the company's patrons more convenient office and store service and to get in return more business. The location was selected as the best in the city, since it is on a corner past which most pedestrians, most vehicles and most street cars must go in the ordinary course of traffic. Since the change took place records have been kept to determine whether or not the move, with its attendant increased expense, has paid as a purely business proposition. From these records, according to R. A. MacGregor, the company's sales manager, the decision is that the move was entirely profitable. Figures on comparative growth, which may be read from the accompanying curve, show to what degree the business of the company increased after the change over the same months of the preceding year.

The appliance sales for the month of July, for instance, showed a gain in the ratio of 4.2 to 18.6, or more than 340 per cent. It will be observed that this same ratio of increase was not maintained continuously. The falling off in August and September may be attributed partly to the fact that the July sales were forced by newspaper publicity given the new store. But the fact that the average gain in appliance sales for the period covered was approximately 140 per cent is one which should not be overlooked. It is a true indication of the general popularity of the more favorable location. It should also be pointed out in connection with these curves that appliance sales have not been pushed with all the vim that might have been exercised on account of the competitive central station situation which exists. It is considered, therefore, all the more remarkable that the continued growth in appliance sales should be sustained, even after the novelty has worn off the new store.

When the company was established on a side street in the wholesale district it was not in a position to impress itself upon the general public. Now, in its new location, the very fact that over three times as many people in July, over three times as many in August, over twice as many in September, and almost one-third more in October, practically the same number in November, over three times as many in December, nearly three times as many in January, and one and one-half times as many in February, voluntarily came into the office and sought its service certainly can be attributed to the removal.

In addition to the absolute traceable dollars and cents



CURVES SHOWING RATIO OF INCREASES IN APPLIANCE SALES AT "DAYLIGHT CORNER"

increases in various departments of the business, the new location is felt to have other value. Its convenience for patrons is seen as a part of the service the company owes the public. It presents an opportunity for the company to form points of contact with greater numbers of people and to emphasize its desire to provide uniformly courteous service.

COMFORT AND CONVENIENCE OF PUBLIC UTILITY SERVICE

Customers' Subconscious Realization May Be Awakened to the Relation that It Bears to Progress and Life

A letter was recently received by the ELECTRICAL WORLD in which the following suggestion was contained:

"In view of the service furnished the public by water, gas, electric and street railway companies, it has occurred to me that these companies could be more properly referred to as 'public comfort companies' rather than as corporations, public utility or public service companies. The public seldom realizes the comfort and conveniences furnished by these companies until a calamity of some nature interrupts the service tem porarily."

The idea in the last sentence is particularly significant in that it affords utilities an opportunity to impress upon customers and the public generally the fact that, although service may temporarily be interrupted owing to one condition or another, as a matter of fact the amount of time during which service is interrupted is considerably less than 1 per cent. Furthermore, electric service can be put almost in the same category as food, because a slight interruption in a service causes considerable annoyance, inconvenience and displeasure. It is very doubtful if the customers realize to what an extent they depend upon electric service. The mere fact that they become displeased with an interruption of service indicates quite clearly that customers look upon electric service as indispensable, although this feeling may be subconscious. It is not impossible to awaken this subconsciousness to a realization of the service rendered by utilities and what an important relation it bears to progress and every-day life.

ELEMENTS INVOLVED IN RATE INVESTIGATION

Report of Committee of Canadian Electrical Association Analyzes Factors by Means of Comprehensive Chart

Printed herewith is a chart which is intended to show in a readily appreciated form the possible elaboration of a rate research study. This chart was developed by the rate research committee of the Canadian Electrical Association, which deems it advisable to indicate all factors required to enable any one interested in rate making to proceed with an investigation.

In view of the variety of subjects deserving investigation the committee felt that it could only suggest the most pressing topics for investigation and comment briefly on the problems thus chosen. Taking the main branches in order, the following were found to be the most important:

Legal Contracts and Consequential Damages.—A standard form of non-liability clause should be included in all contracts, and the following is a form which is used by one of the larger companies: "The company does not guarantee a constant supply of electricity and shall not be liable for any damages to the consumer in consequence of its failure to supply electricity at any time or times."

Standardization of Rate Forms.—It would be a good thing if rate forms for similar classes of service could be of the same type in various parts of the country. All of us are familiar with the difficulties experienced in dealing with a new customer from another part of the country who is accustomed to a rate form which is not included in the rates available. A difference in price is not difficult to explain, as the prices of many things vary with location, wages, etc., but a totally different form of rate, not easily understood by customers, is more difficult to explain, and creates a feeling of distrust which no explanation will eradicate.

DURATION OF PEAK LOADS

Demands.—There is at the present time an absolute lack of uniformity in the definition of what constitutes a "horsepower"; in some cases a twenty-minute average load is taken, in others a five-minute average load; in some cases three demands per month, in others a single demand.

The width of demand taken, especially in flat-rate contracts, is a determining factor in the revenue obtained from any service, and while in some cases the demand taken over a short period does not differ much from a demand taken over a fairly long period, in other cases the demand is a constantly fluctuating one, reaching maxima of short duration with regular frequency which if taken over a long period would not represent the capacity which has to be furnished to supply such demands.

Again in other cases the extreme maxima may be reached infrequently and be of short duration when demanded. Generally speaking, the central station company has the right to regard the question from two points of view—first, the reserve capacity for overloads existing in the plants supplying the demand; second, the amount of plant which would have to be installed by the customer to take care of the demand if the load were carried by an independent plant.

TO COLLECT DATA ON PEAK-LOAD CHARACTERISTICS

The committee proposes to collect data on the question of the characteristics of the demands taken by different industries which central stations supply, anticipating that such information may be of use to the members in providing data upon which rates can be based.

It has been suggested that steady loads are best rated upon long-demand intervals and fluctuating loads upon short intervals, but while on the face of it this may appear fair it is open to the objection that the steady load with no diversity is rewarded and the fluctuating load with high diversity is penalized.

Undoubtedly where water storage is possible or where the system is large compared to the demand to be rated this solution is open to criticism.

Another solution is to abandon flat rates altogether and substitute mixed rates with a flat-rate portion of the charge producing only 30 to 50 per cent of the total revenue. Under these conditions the matter of peak period can be more easily standardized, as a short peak period will not unduly penalize any customer, and a low-load factor, i.e., of high diversity, will be taken care of equitably by the meter rate portion of the charge.

Measurements for Revenue.—Instruments for the determination of demand have been slow of development. The instruments required can be divided into

two groups—those required for small loads, say up to 50 hp., and those required for larger loads.

The requirements for small loads are low first cost and low operating costs; for large loads companies are warranted in obtaining high-class instruments and employing specially trained help for watching and calibrating the instruments used.

While there are now obtainable a few instruments for small loads filling the above requirements, they are all of a type which register energy only and leave a record of only one demand without indicating the time at which the demand occurred. There is without doubt a great need of an instrument for the small load, and the lack of one has forced most companies to the expedient of depending on haphazard tests or of taking the rating or some fraction of the rating of the apparatus connected as the basis of charge for the flat-rate portion of the account.

For the large customers many excellent graphic meters are obtainable. These, however, are open to the objection that a fluctuating load cannot be accurately integrated, and also the record is very bulky and the instruments require continual attention.

Temporary Loads and Cost of Service.—The tremendous demands created by the war on the central station have produced a problem in rate making which requires careful consideration. While the central station has a patriotic duty to perform in trying to accommodate all loads offered, nevertheless where such demands require the installation of generating plant and lines which are liable to be idle when the demands are lessened and when such extensions can only be purchased at supernormal prices and will be depreciated from 50 to 70 per cent when prices become normal again, it is obviously the part of the customer to pay either in the rate or as a separate item at least the depreciation plus the interest on such capital as will have to be carried idle for the period after the demand is withdrawn until normal business again requires extensions. If this is not done, companies are liable to be faced with lower earnings and higher fixed charges after the war. Broadly speaking the rate should cover the investment required in all cases plus a fair profit, and if this cannot be obtained the business will be well refused.

Psychology.—The modern trend of thought is also toward the scientific study of cause and effect, and some problems of rate research can hardly be classified under another head.

Good Will.—Technicians and experts too often make rates which are far beyond the comprehension of customers, and while such forms are possible of application between expert and expert they savor too much of the methods attributed to autocracy to be advisable in dealings between public service corporations and their customers.

Expediency.—This again is a question which will bear discussion and one which should not be hidden under a bushel.

The central station has a duty in the community to promote mutual growth, and if the granting of a low rate to an industry will foster that industry, bringing in its train increased population and wealth to the community and incidentally new customers for the company from whom it can obtain its regular profit, then the central station company can afford to serve that industry at almost cost price, to the mutual well-being.

Again, where the cost of energy is the critical factor in the success of the enterprise—i.e., electric product manufacture—a low rate is justifiable, but where the cost of energy is an incidental cost in a highly profitable industry the central station has a right to a good profit.

Charity.—With reference to low rates for hospitals, schools, etc., it is an understood thing that no one wishes to make an ordinary profit out of such institutions, inasmuch as they represent the manifest desires of the community to promote its well-being, so therefore there should be no disposition on the part of the stockholder *per se* to take a profit indirectly through his holdings in a central station company.

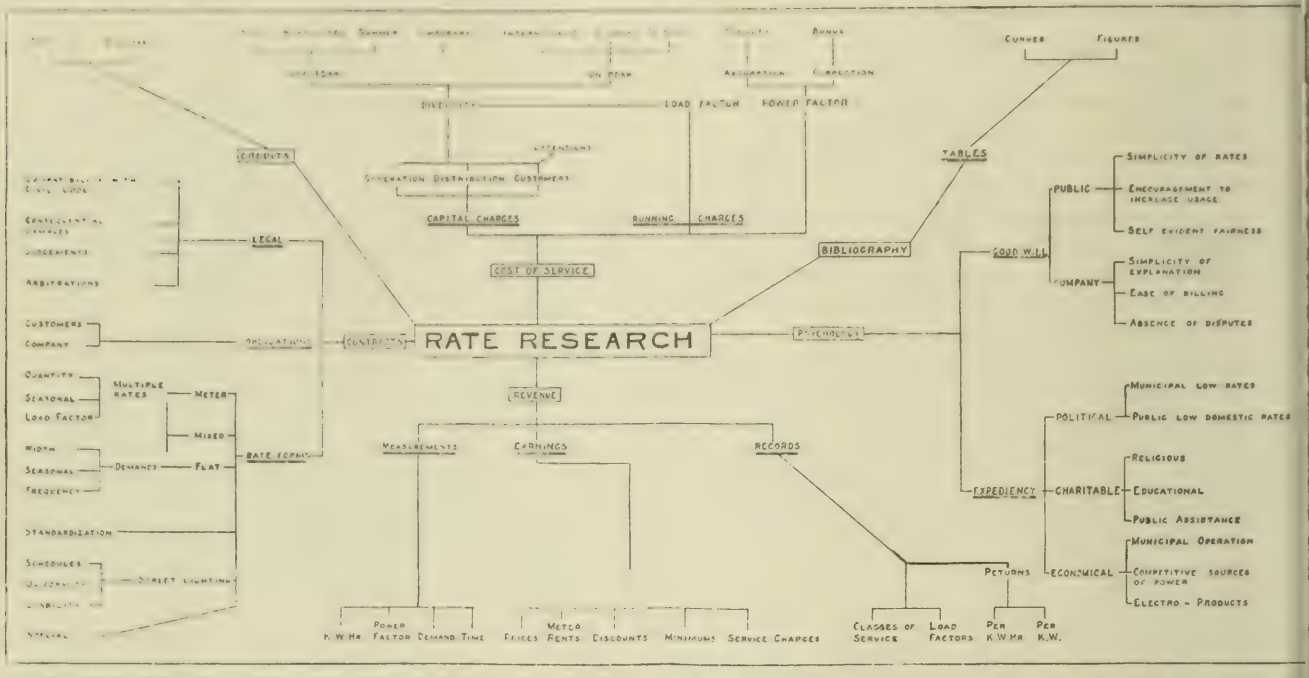


CHART DEVELOPED TO BRING OUT THE POSSIBLE ELABORATION OF A RATE RESEARCH STUDY, INDICATING THE FACTORS OF AN INVESTIGATION

ADVANCE IN TECHNICAL THEORY AND PRACTICE

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DIELECTRIC LOSSES IN INSULATING MATERIALS

Materials Treated with Varnish or Compounds Requiring Drying or Curing Show Higher Losses Than When Saturated with Fluid Insulators

DURING the last five years the research division of the Westinghouse Electric & Manufacturing Company has been carrying on almost continuous investigations of the losses in dielectrics. A considerable variety of insulating material has been studied in a preliminary way, and measurements have also been made on completed apparatus such as transformers, generators, condenser bushings, etc. In a paper presented before the joint meeting of the Electrical Section of the Franklin Institute and the Philadelphia Section of the American Institute of Electrical Engineers, C. E. Skinner, engineer of the Westinghouse research division, called attention to some of the apparatus used in these studies and the results thereof.

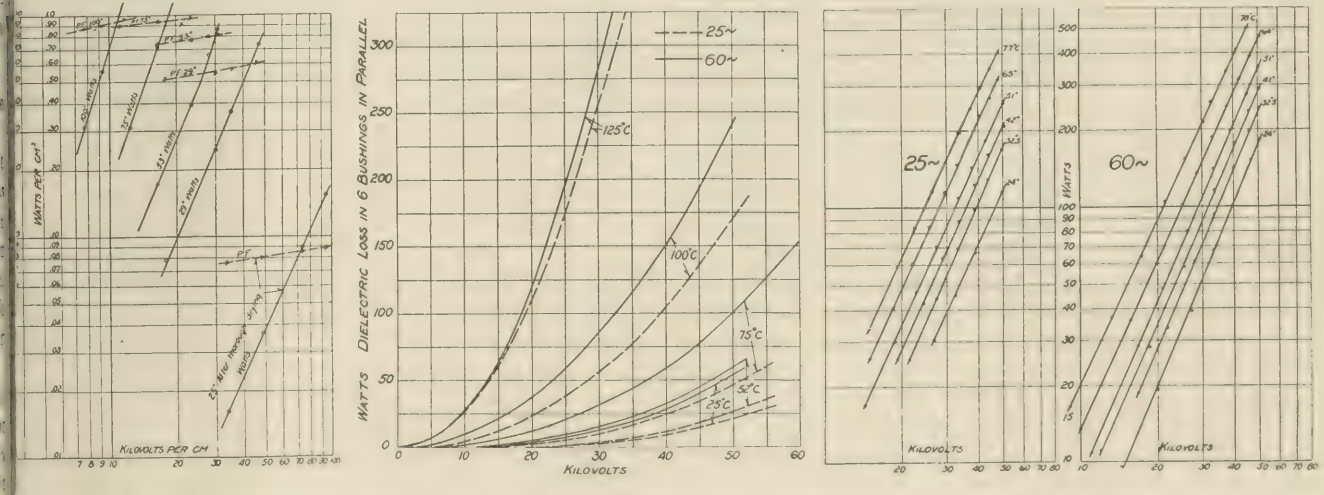
The quadrant electrometer wattmeter was adopted as the most convenient and satisfactory instrument for this study. The voltmeter which was used was of electrostatic type, designed by Prof. H. B. Smith of Worcester Polytechnic Institute. An ammeter adapted from the Kelvin multicellular static voltmeter was used.

The accompanying curves give a number of interesting examples of the results obtained by this investigation, but they should not be taken as representative of the various classes of materials, owing to the fact that in practically all cases investigated different samples of the same material often showed as much variation as different kinds of materials. The results were influenced considerably by various kinds of treatment. In general it may be said that the lower the losses and power factor and the higher the insulation resistance the better the quality of the insulation. As a rule, low specific inductive capacity is desirable, but not for all uses.

In tests of fuller-board to show the relation between power factor and kilovolts per centimeter thickness, and also the relation between watts per cubic centimeter and kilovolts per centimeter thickness at two temperatures, it was noted that there was a very wide difference in values of the two samples, particularly at a temperature of 100 deg. C. The only difference between the two samples was that the first was exposed to ordinary atmospheric influences for a period of ten days after being vacuum-dried and oil-saturated. Although it was oil-soaked, this sheet had undoubtedly absorbed a small amount of moisture which affected its insulation resistance at high temperatures as well as its other characteristics.

A sample of micarta sheet which was only partially processed showed excessive losses. The same sheet was again tested after thoroughly drying, and very decided improvement was shown. The uncured condition of the power factor of this material reached almost 100 per cent at the higher temperatures to which it was subjected (100 deg. C.). This factor can be greatly reduced by proper processing. With these data plotted to logarithmic scale, the slope of the watt-voltage curve increased with temperature. The critical point can be readily determined in this way. Attention should be called to the fact that at ordinary temperatures the dielectric loss is a far better indication of the quality of the material than the insulation resistance.

On account of the very low dielectric losses and power factors of condenser-type bushing at normal operating voltages, tests were made by measuring six bushings in parallel to secure more measurable quantities. Since the normal operating voltage stress to ground on these bushings when applied to apparatus on a 44,000-volt transmission line is approximately 25,000 and the maxi-



FIGS. 1, 2 AND 3—CHARACTERISTICS OF MICARTA SHEET, CONDENSER-TYPE BUSHINGS, AND INSULATION OF A CORE-TYPE TRANSFORMER

mum temperature which they will likely reach in service will not be over 75 deg. C., owing to conduction of heat from other parts of apparatus, it was concluded from the tests made that the loss per bushing, even at 60 cycles, will not be over 3 watts or 4 watts in normal operation. At temperatures below 75 deg. C. the loss varies practically as the frequency. It is also noted that the increase in loss is very rapid at 100 deg. C. or higher.

The charging current for the same bushings at 25 and 60 cycles followed practically parallel curved lines, their curvature increasing more rapidly with the higher temperatures (100 deg. C. to 130 deg. C.). The insulation resistance of the bushings at 10,000 volts direct current was found to decrease in proportion to the increase in temperature, the resistance being about 100,000 times as great at 25 deg. C. as at 125 deg. C. This change of insulation resistance is so great that the losses due to actual conduction are much greater than those due to the so-called hysteresis or dielectric losses. This explains the reason why the losses at both 60 and 25 cycles are so nearly the same at 125 deg. C.

From measurements of the condenser bushings to show the relation of dielectric loss to temperature and the relation of power factor to temperature, it was found that the critical losses begin to manifest themselves at temperatures between 80 deg. C. and 90 deg. C. When the relation between dielectric loss and kilovolts applied to the same bushings was plotted on logarithmic scale, it was noted that the loss at 25 cycles is increased approximately fifteen times by raising the temperature from 25 deg. C. to 100 deg. C. At 60 cycles the corresponding change is approximately six times.

With two micarta sheets of somewhat different character, it is noted that the insulation resistance decreases with the increased voltage used in its measurement in one case, and in the other the insulation resistance remains practically constant as the measuring voltage is increased. In both cases the power factors are relatively high, this being the condition found at the higher temperatures at which both sets of measurements were made. Furthermore, it was observed that the power factor as well as the insulation resistance of the condenser-type bushing remains practically constant with varying voltage, while with the micarta sheet the power factor increases with increased voltage in about the same proportion as the insulation resistance decreases with increased voltage. This relation between insulation resistance and power factor, which it is believed is here shown for the first time, appears to hold only for power factors of more than 15 or 20 per cent. It was found possible to carry the treatment of micarta sheet to a point where the insulation resistance and the power factor will remain constant with varying voltage.

Tests were made of the insulation of a synchronous condenser stator rated at 400 kva., 6000 volts and 50 cycles, in which it was found that the loss was about 0.007 watt per cubic watt per cubic centimeter for 6000 volts at 15 deg. C. and about 0.0315 watt per cubic centimeter at 71 deg. C., 60 cycles. The average under actual operating conditions would not be over one-third of these amounts.

Extremely interesting measurements were made in connection with a number of transformers. In all cases the measurements were made from the high-tension winding to the low-tension winding and the core connected together. A considerably higher rate of increase of watts per kilovolt was observed at the higher frequency (60 cycles) than at the lower one (25). The power factor was observed to increase with the voltage much faster at high temperatures than at low temperatures. On the other hand, the watt loss increase with voltage is more rapid at low temperatures than at high temperatures.

Generators, Motors and Transformers

Theory of Armature Windings.—S. P. SMITH.—In this paper the author discusses the arrangement of single-layer windings, the determination of the number of slots to use, the whole and fractional number of slots to employ per pole, and the use of empty slots and unequal coil groups. Double-layer windings are also taken up, their arrangement, phase tappings off closed windings, polygon tappings and open double-layer windings being discussed.—*Part of Abstract from Proceedings of London Inst. of Elec. Engrs., London Electrician,* May 25, 1917.

Generation, Transmission and Distribution

Notes on Construction of Turbine Pumps.—ALAN E. L. CHORLTON.—(Portion of paper read before the London Institution of Mechanical Engineers.) The paper traces the development of some of the methods of successfully overcoming the difficulties experienced with turbines, and calls attention to points in design which are the result of the author's experience extending back to the infancy of the application of the turbine-pump principle. These subjects are taken up under the following headings: (1) the stator, which consists of the casing or housing and the guide vanes or appliance for converting velocity energy into pressure energy; (2) the impeller (considered separately); (3) the balancing appliance—hydraulic or mechanical; (4) the rotor, considered as a whole, and including the spindle, with its projecting sleeves, impellers, and in most cases the balancing appliance; (5) the bed, and other details, bearings, stuffing-boxes.—*London Engineering,* May 25, 1917.

Wires, Wiring and Conduits

Effect of Stretching on the Thermal Conductivity of Wires.—A. JOHNSTONE.—Description of experiments in which the wire to be tested was fixed at each end between the jaws of screw clamps joined to brass cylinders, through which water could be circulated. Attached to one clamp was a rod passing through a framework, enabling tension to be applied by a nut working on a thread. Heat was supplied to the center of the wire by passing a current of electricity through a manganin coil wound on the wire, and the temperature difference between two points on the same side of the center was ascertained by two platinum coils, also wound on the wire. The resistances of the coils were determined by means of a Callendar-Griffiths bridge, enabling a temperature difference of 0.01 deg. C. to be read, and making it possible to detect a difference in conductivity of 0.05 per cent. If R_1 is the resistance of the platinum thermometer nearer the heating coil, and r_1 is that of the other platinum coil when both are at the jacket temperature, and if R_2 and r_2 are corresponding values when a temperature difference exists, then it may be shown

that the conductivity K is proportional to $(R_2 \div R_1) - (r_2 \div r_1)^{-1}$. For all the wires used (copper, steel, nickel, aluminium, brass, zinc), stretching produced a slight increase in thermal conductivity. The most satisfactory experiments showed an increase of about 0.5 per cent for a tension of about 0.7 of the elastic limit. After the tension was withdrawn the conductivity returned approximately to its original value.—*Abstract of paper presented before Imperial College of Science, London Electrician,* May 25, 1917.

Telegraphy, Telephony and Signals

Range of Wireless Stations.—CAPT. R. CHENEVIX TRENCH.—Modifications of Austin-Cohen empirical formula for range of radio stations so as to take into account the effect of actual working conditions. The results obtained are incorporated in a number of curves, and these curves are utilized in working out certain empirical examples. The curves shown apply to a sending set of 25 per cent efficiency between the alternator output and the power developed in the aerial. Where this efficiency in any particular case is known, or known approximately, the value of $h_1 h_2 \sqrt{P}$ should be

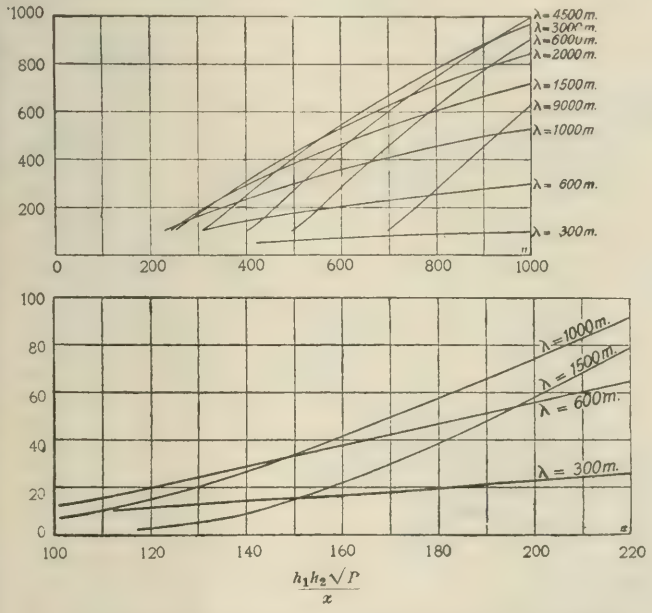


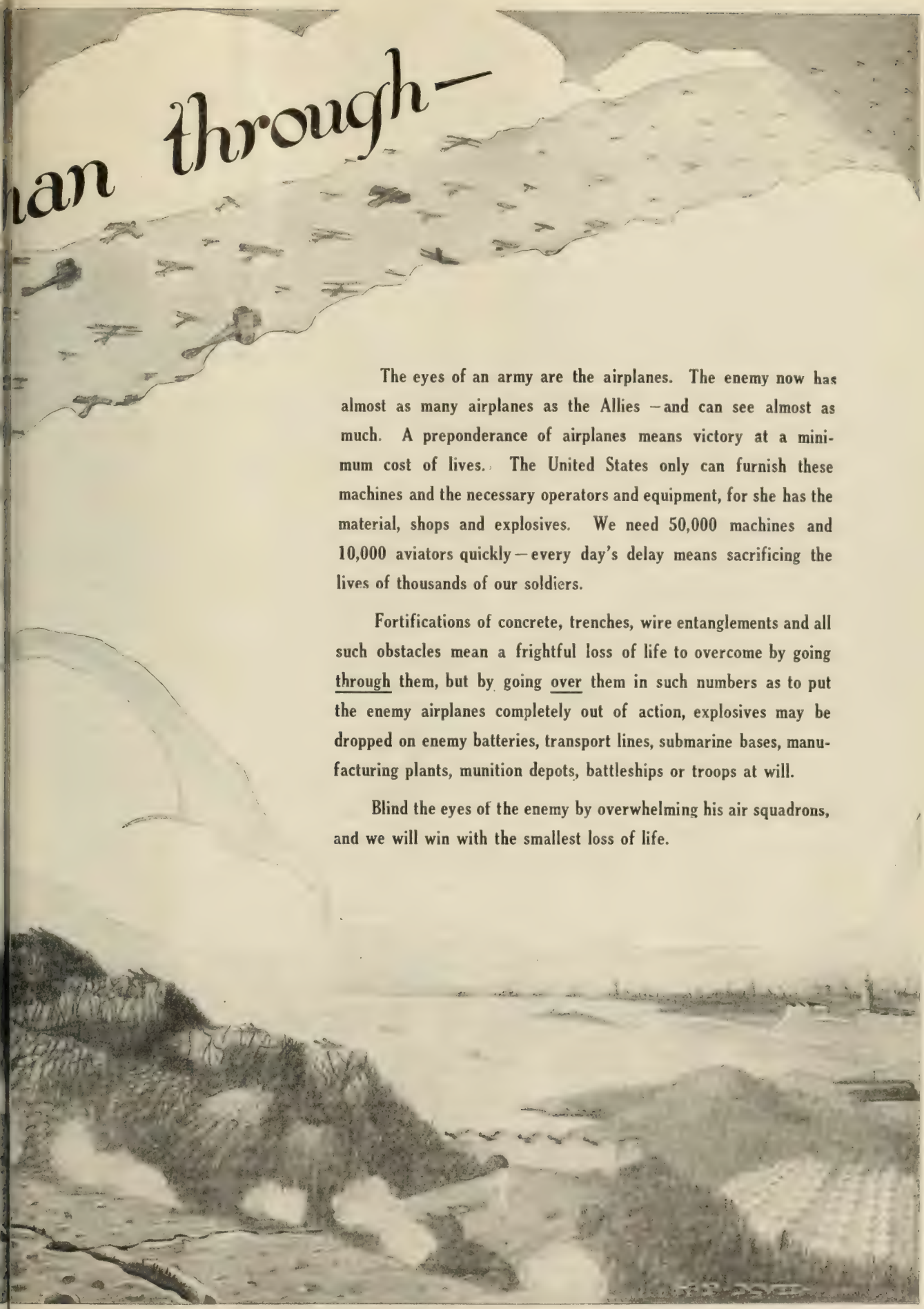
FIG. 4—RADIO RANGE WITH 25 PER CENT SENDING EFFICIENCY

multipled by $\sqrt{25/E}$, where E is the known efficiency. The large factor of sixty-four times audibility power which is taken should cover such variations (since sixteen times audibility is considered to give good communication), and so long as there is nothing seriously wrong with the receiving set the curves may be applied without modification for all ordinary purposes. Although there is no doubt that short waves travel better by night, there is some difference of opinion as to the night effect on long waves. It is probable, however, that all wave lengths travel better by night, and for general purposes this may be allowed for by replacing the absorption coefficient 0.0015 by a smaller coefficient 0.001, or by multiplying the daylight value of $h_1 h_2 \sqrt{P}$ by the factor $\varepsilon^{-0.0005x/\sqrt{\lambda}}$. In conditions under which little or no atmospheric interference may be expected, such as is the case with small-capacity low aerials, or in districts notedly immune from atmospherics, a smaller power than sixty-four times audibility may safely be taken, but the minimum power received should not be less than sixteen times audibility. That is, in such favorable cases, the value of $h_1 h_2 \sqrt{P}$ given may be modified by $\sqrt{0.25}$ or 0.5. When only a few short messages must be transmitted daily the received power may be reduced to about sixteen times audibility.—London *Electrician,* May 4, 1917.

Miscellaneous

Engineering Specifications.—J. SHEPHERD.—Some interesting methods of specifying the quality of supplies and engineering equipment and methods of contracting for certain kinds of engineering work were brought out in this paper. Among the subjects discussed were specifications for coal. Roughly the specification for minimum quality to be accepted which has been found satisfactory in purchasing 1,000,000 tons of coal is as follows: Calorific value must not be less than 11,000 B.t.u.; moisture must not exceed 14 per cent for washed nut coal or 9 per cent for unwashed nut coal; small coal must not exceed 30 per cent; ash must not exceed 15 per cent. Methods of sampling are given in detail, but in later specifications the final sampling was done by a motor-driven crusher and sampler. Methods of testing are then specified, namely, (a) for small coal, through a sieve with a mesh ⅜ in. square; (b) calorific value by Mahler bomb calorimeter; (c) moisture after drying at a temperature of from 104 deg. to 111 deg. C., and (d) ash determined by ignition at a low red heat. The specification provides for the adjustment of the price paid for any particular cargo, the adjustment being made as thus set out: "Should the quality of the coal in any cargo, as ascertained by samples tested, be found different, as regards calorific value, moisture, small or ash from the values offered in the schedule, the prices or sums payable shall be varied in the manner following, viz.: (a) If the calorific value be greater than the number of B.t.u. per pound offered in the schedule, the price per ton shall be increased in the same percentage ratio as the increase in the calorific value. (b) If the calorific value be less . . . . the price per ton shall be decreased in the same percentage ratio as the decrease in the calorific value. The right to reject the whole cargo if the calorific value be less than 11,000 B.t.u. per pound is always reserved. (c) If the moisture be less by weight than the figure offered in the schedule, the weight of the coal to be paid for shall be increased beyond the quantity actually weighed out by a percentage equal to the percentage decrease of moisture. (d) If the moisture exceeds the figure, the weight of the coal to be paid for shall be decreased below the quantity actually weighed out by a percentage equal to the percentage increase of moisture. The right to reject the whole cargo if the moisture exceed 14 per cent by weight for washed nut or 9 per cent by weight for unwashed nut is reserved. (g) If the percentage of ash when determined in the manner set out in this specification be less than the figure offered in the schedule, the net rate per ton of coal shall be increased by 1 penny (2 cents) for every 1 per cent reduction in ash. (h) If the percentage of ash be more, the net rate per ton of coal shall be reduced by 1 penny (2 cents) for every 1 per cent increase in ash. The right to reject the whole cargo if the proportion of ash exceeds 15 per cent is reserved.—*Journal of Inst. of Elec. Engrs.* (London), May, 1917.


As the Eagle flies
It is easier to go ove



The eyes of an army are the airplanes. The enemy now has almost as many airplanes as the Allies—and can see almost as much. A preponderance of airplanes means victory at a minimum cost of lives. The United States only can furnish these machines and the necessary operators and equipment, for she has the material, shops and explosives. We need 50,000 machines and 10,000 aviators quickly—every day's delay means sacrificing the lives of thousands of our soldiers.

Fortifications of concrete, trenches, wire entanglements and all such obstacles mean a frightful loss of life to overcome by going through them, but by going over them in such numbers as to put the enemy airplanes completely out of action, explosives may be dropped on enemy batteries, transport lines, submarine bases, manufacturing plants, munition depots, battleships or troops at will.

Blind the eyes of the enemy by overwhelming his air squadrons, and we will win with the smallest loss of life.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

ELECTRICAL SUPPLIES NEEDED BY CANTONMENTS

Quartermaster's Department Issues Schedules for Material for the Entire Sixteen Cantonments—Large Quantities of Wire and Sockets Specified

The quartermaster's department has finished its estimate of the amount of building materials required in each of the cantonments for the National Army. The quantities may be more or less varied by construction needs which develop while the work is in progress, and the difference in climate between the northern and southern parts of the country has its effect on the quantities of some of the materials.

The amount of electrical equipment will vary with the shape of the cantonments. The estimate for the total requirements for the sixteen military cities amounts to 20,800,000 ft. (6,339,853 m.) of insulated wire, 260,000 ft. (79,248 m.) of lamp cord, 125,000 key sockets

SCHEDULE OF ELECTRICAL MATERIALS FOR SIXTEEN CANTONMENTS

Item	*Make	Quantity
Cleat receptacles	G. E. 031	150,000
Cleat rosettes	G. E. 430	125,000
Brass-shell key sockets	G. E. 012	125,000
Shades	Ivanhoe-Regent C.A.E. 10	120,500
Shades	Ivanhoe-Regent B.A.E. 10	125,000
Wire lamp guards	Morse No. 8 A	29,500
Single-pole snap switches, with porcelain sub-bases	G. E. No. 60450	22,600
Combined switch and plug cut-outs	G. E. No. 42688	27,800
Two-pole single-branch plug cut-outs	G. E. No. 61935	5,000
Single-pole main-line plug cut-outs	G. E. No. 62569	5,000
Edison plug fuses, 6-amp.	G. E. No. 66329	15,000
Edison plug fuses, 10-amp.	G. E. No. 66331	60,000
Lamp cord	No. 18 N.E.C. standard type P	261,000 ft.
Rubber-covered wire, No. 14	N.E.C. std. single-braid	20,000,000 ft.
Rubber-covered wire, No. 10	N.E.C. std. single-braid	816,000 ft.
Two-wire unglazed porcelain cleats		3,000,000 pr.
Single-wire glazed porcelain cleats for No. 10 wire		175,000 pr.
Porcelain tubes, 4-in. by 5/16-in. by 9/16-in. diameter		1,250,000
Round-head, blued globe wood screws, No. 10, 2¼-in.		6,400,000
Round-head, blued globe wood screws, No. 8, 1¼-in.		550,000
Round-head, blued globe wood screws, No. 8, 1½-in.		81,000
Ball cord adjusters		24,000
¾-in. friction tape, black		9,600 lb.
Strip solder		4,800 lb.

NOTE.—Item No. 7, single-pole snap switches, and item No. 11, 6-amp. plug fuses, include 5000 each for outside lighting. Item No. 10, single-pole cut-outs, is for outside lighting.

*Where catalog numbers of a single manufacturer are given, it is understood that materials of equivalent value of other manufacturers are acceptable.

and about the same number of shades, 150,000 cleat receptacles, 22,600 snap switches, 27,800 combined switches and plug cut-outs, 75,000 plug fuses, mostly for 10 amp., 3,000,000 pairs of two-wire unglazed porcelain cleats and 175,000 pairs of single-wire cleats, 1,250,000 porcelain tubes 4 in. (10.16 cm.) long with a 9/16-in. (1.43-cm.) hole, about 7,000,000 1¼-in. to 2¼-in. (3.81-cm. to 6.85-cm.) wood screws, 9600 lb. (4354 kg.) of friction tape, 4800 lb. (2177 kg.) of solder, and other items on a similar scale.

It is estimated that about 4000 cars will be required to transport all building materials to each cantonment, and while they are being delivered many more cars will be required to furnish the supplies needed for the workmen, who will number between 3500 and 5000, according to the condition of the work and the size of the cantonment. Furthermore, in order that the recruits may be accommodated as soon as they arrive large quantities of cantonment furniture will arrive before the construction is finished.

POOLING OF COAL AND OF ITS DISTRIBUTION RECOMMENDED

Large Shipments of Coal to Europe Likely to Be Embargoed by Executive Order—Government Ownership of Mines and Railroads Not Improbable

After a conference with President Wilson, the Federal Trade Commission has submitted to Congress a report, following months of investigation, recommending that the government shall establish pools providing for coal production and distribution and rail and water transportation. The commission declares in its report that the coal industry is paralyzing all the other industries of the country and that the coal industry itself is being paralyzed by the failure of the transportation industry.

The commission in its report confirms the investigation of newspapers all over the country which have taken the trouble to send correspondents and photographers to railroad terminals where long lines of empty coal cars have been found standing idle upon sidings and other tracks. Notwithstanding a recommendation of the commission to Congress, however, that legislation shall be passed providing for a limitation upon the export of coal, the Washington correspondent of the ELECTRICAL WORLD reports that President Wilson will undoubtedly give orders under the war powers which have been conferred upon him by Congress specifically preventing the shipment of coal to Europe in large quantities in future. Some of the private advices of the government are to the effect that coal is bringing as much as $70 a ton in Paris for the use of private industry.

Under the recently enacted espionage law there is a clause giving the President power to embargo any necessities. It is stated at the White House that coal and wheat are the two principal necessities upon which embargoes should be placed, and these embargoes are expected to be enforced by Monday morning as the result of a proclamation by the President. The report of the

Federal Trade Commission to Congress states that the present production of soft coal is 40 per cent under the possible maximum, the cause being the alleged railroad car shortage. There is a very interesting paragraph in the report of the commission to Congress recommending a pooling operation by the government to the effect that "the operation both of the mines and of the transportation agencies could be carried on by the present employees and officials, and after the war they could be returned unimpaired to private operation." This paragraph, it is said in Washington, will raise in Congress without doubt the question of government ownership, which is hovering around so many of the government war-time activities.

PROBLEMS THAT CONFRONT THE ORDER OF SONS OF JOVE

Relations of Central Office to League, Distribution of Four-Dollar Dues, and Question of Annual Meeting Discussed

At a meeting of the Past-Jupiters and the Fifteenth Congress of the Jovian Order with the representatives of some of the Jovian leagues at Chicago on June 12 and 13, the problems of the Jovian Order were discussed. Henry L. Doherty, Jupiter of the order, presided at the meetings.

The discussion revolved mainly upon the point of whether or not the distribution of the present four-dollar dues should be changed to increase the amount going to the local leagues. The question of decreasing the expense of the central office was given consideration.

Jupiter Doherty set forth a possible solution of the problem of the distribution of Jovian dues in a manner that would be satisfactory to all concerned. The suggestion was concurred in by all present and was turned over to a committee of five for further consideration.

Briefly the plan is as follows. It recognizes that it would be disastrous to contemplate any reduction of the proportion of the dues now going to the central office unless positive assurance can be given of a proportionate increase in membership. It aims to give some incentive to the local leagues to make a sincere effort to increase memberships by offering a reward commensurate with the results secured. The plan aims to accomplish this by making the maximum dues to the national office $4 and the minimum dues $2. The amount of dues paid by the local league to the central office shall then be determined by the number of Jovians in good standing represented in its membership. A bogie established for each league and based upon the population of its city would be set, and arrangements would be made so that the nearer the Jovian membership approached the bogie the nearer the league would approach the minimum per member, or two-dollar, dues which it would send to the national office.

The committee of five to which this suggestion has been turned over will analyze not only this plan but all other questions which came before the meeting and will make a complete report of its decision to a meeting of the Congress and Past-Jupiters to be called not later than Aug. 20, 1917.

The meeting decided that the annual convention of the Jovian Order will be held as usual within ten days of Oct. 15, but that all forms of entertainment will be omitted and the meeting be strictly a business gathering. It was also decided that attendance at the meeting will be promoted in every way possible consistent with the money available for the purpose. The place and date of the meeting will be selected by Henry L. Doherty, Jupiter.

TAX ON ELECTRICITY UNLIKELY AT PRESENT

Secretary of the Treasury May Have to Stipulate What the Administration Desires if Congress Is to Take Any Other Action

Indications in Washington at the end of the week are that there will be no tax upon electricity in the bill designed to raise $1,800,000,000 war revenue. Representative Lenroot of Wisconsin, who offered an amendment to the bill when it was in the House of Representatives to strike out the electricity tax as it was reported from the House ways and means committee, has told friends in Washington that his canvass of those who are for and against the proposed electricity tax in the House indicates that the proposal will fail. Representative Lenroot is also of the opinion that he will be able to convince members of the House of Representatives that a proposed tax upon any form of electricity, light, heat, power, or telephone, will inevitably be passed on to the ultimate consumer by the companies. In this view, it is understood in Washington, Mr. Kitchin, chairman of the House ways and means committee, is likely to concur. Mr. Kitchin is reported to have told friends privately that he doubts if either the committee or the House will sustain the proposal for the tax when the bill comes back to the House from the Senate. On the other hand, it is reported in Washington that Secretary McAdoo of the Treasury Department may insist upon some features of the proposed electricity tax, and in view of the fact that he is the mouthpiece of the administration in regard to all war revenues and expenditures, it is believed that the House ways and means committee will, in the final analysis, require Mr. McAdoo, possibly even the President himself, to say just what is wanted.

ELECTRICAL INDUSTRY TO THE FRONT IN RED CROSS DRIVE

Westinghouse, Crocker-Wheeler and Baltimore Consolidated Gas Contribute an Aggregate Total of More Than Half a Million

The Red Cross campaign for $100,000,000 is now well under way, almost half this sum having been subscribed up to Thursday morning. In this drive the electrical industry has come to the front in helping the Red Cross to secure the required sum.

While no definite information is at hand relative to the industry as a whole, the following subscriptions have been announced by the New York branch of the Red Cross:

Westinghouse Electric & Manufacturing Company, a dividend of one-half of 1 per cent on both its common and preferred stock, amounting to	$375,000
Crocker-Wheeler Company	80,000
Consolidated Gas, Electric Light & Power Company of Baltimore, Md.	50,000

PRIZE WINNERS OF THE 1917 WIRE-YOUR-HOME-TIME CONTEST

Society for Electrical Development Announces Names of Those to Whom Money Awards Are Made and Results of Campaign

G. M. Sanborn, president Sanborn Electric Company of Indianapolis, chairman of the "wire-your home-time" committee, has announced names of the prize winners in the twelve-hundred-and-fifty-dollar prize contest conducted by the Society for Electrical Development in connection with the nation-wide house-wiring campaign, April 1 to May 15. While the campaign was participated in by hundreds of lighting companies and dealers, the prize contest was restricted to members of the society.

The society offered thirty-five prizes. They comprised $150 as first prize, $50 as second prize and five other prizes of $10 each, and were allotted to employees of member companies in cities of five classes as follows: Class A, under 15,000 population; Class B, between 15,000 and 50,000; Class C, between 50,000 and 100,000; Class D, between 100,000 and 500,000; Class E, 500,000 and over. A contract was construed as "a signed agreement with a new customer for wiring at least three rooms with four sockets or over, in a house already built, located along existing lines, and requiring no other than ordinary service connection."

The prize winners were:

CLASS A—CITIES LESS THAN 15,000

Prize	Name	Houses Wired	Watts Conn.
$150	R. L. Ralston, Manistee, Mich.	119	39,270
50	C. H. Van Gorder, Oelwein, Iowa.	96	33,172
10	V. O. Stafford, Humboldt, Iowa.	83	35,000
10	F. P. Gaireus, Ridgway, Pa.	69	28,980
10	G. P. Cox, Wilmerding, Pa.	46	25,000
10	S. A. Lipscombe, Bartelsville, Okla.	43	14,000
10	T. J. McGee, Duryea, Pa.	40	10,000
10	R. E. Martin, Kankakee, Ill.	40	18,150
	Total Class A.	536	203,572

CLASS B—CITIES 15,000 TO 50,000

$150	Fred Vos, Muskegon, Mich.	109	35,425
50	A. L. Dumire, Elmira, N. Y.	100	48,000
10	D. C. Calhoun, Springfield, Mo.	91	33,735
10	H. A. Pendergraph, Durham, N. C.	83	23,000
10	F. A. Root, Lockport, N. Y.	82	52,240
10	W. J. Graham, Joliet, Ill.	74	46,600
10	J. M. Killian, Perth Amboy, N. J.	64	51,700
	Total Class B.	603	290,700

CLASS C—CITIES 50,000 TO 100,000

$150	M. G. Sanders, Flint, Mich.	147	117,600
50	L. B. Brown, Chattanooga, Tenn.	72	36,000
10	H. E. Shelton, Wilmington, Del.	50	30,000
10	E. E. Fouratt, Trenton, N. J.	50	37,500
10	J. H. Clark, Bayonne, N. J.	40	30,000
10	C. B. Parks, Chattanooga, Tenn.	33	16,500
10	L. C. Dye, Chattanooga, Tenn.	25	12,500
	Total Class C.	417	280,100

CLASS D—CITIES 100,000 TO 500,000

$150	J. J. Montgomery, Syracuse, N. Y.	116	42,010
50	T. V. Carpenter, Cincinnati, Ohio.	111	85,000
10	W. R. Adams, Newark, N. J.	68	65,400
10	J. M. Walsh, Scranton, Pa.	56	20,550
10	F. W. White, Cincinnati, Ohio.	55	55,000
10	F. Reynolds, Scranton, Pa.	47	14,550
10	A. Rodenhuis, Grand Rapids, Mich.	47	30,180
	Total Class D.	500	322,690

CLASS E—CITIES 500,000 AND OVER

$150	R. A. Le Comte, Chicago.	110	180,700
50	A. J. Kay, Chicago.	108	119,150
10	F. T. Wing, Chicago.	82	115,800
10	J. A. Gordon, Chicago.	77	80,400
10	S. G. Powell, Chicago.	61	97,700
10	F. L. Richardson, Chicago.	59	48,300
10	W. K. Bridgman, Chicago.	55	50,700
10	George Lovett, Philadelphia.	55	73,500
	Total Class E.	607	716,250

In two classes there were two winners of the seventh prize, so that thirty-seven prizes had to be awarded. The thirty-seven prize winners wired 2663 houses, an average of seventy-two each, or an average of two houses during each working day during the contest.

The committee which had charge of the contest was: G. M. Sanborn, chairman, Sanborn Electric Company, Indianapolis; E. W. Lloyd, Commonwealth Edison Company, Chicago; A. L. Oppenheimer, Enterprise Electric Construction Company, Cleveland; H. C. Heidrich, Electric Motor & Repair Company, Newark; T. J. McManis, Edison Lamp Works, Harrison, N. J.; Elliot Reid, Westinghouse Lamp Works, New York; N. H. Boynton, National Lamp Works, Cleveland; E. W. Rockafellow, Western Electric Company, New York; Robert Montgomery, Louisville Gas & Electric Company; M. S. Seelman, Jr., Edison Electric Illuminating Company, Brooklyn; J. M. Wakeman, general manager Society for Electrical Development; H. W. Alexander, director of publicity Society for Electrical Development.

FURTHER REDUCTION IN RATES FOR PORTLAND (ORE.) COMPANY

Commercial Lighting and Heating Schedule Lowered Between 5 and 10 Per Cent by Order of Public Service Commission

Commercial lighting and heating rates of the Portland (Ore.) Railway Light & Power Company have been reduced between 5 and 10 per cent, effective July 1, 1917. The order of the Public Service Commission of Oregon calling for the new rates has just been issued and is the second of a series of rate orders resulting from the valuation of the property during the last three years.

The commission has acted on the theory that a reduction in rates will result in the Portland company retrieving some of the business that has been lost to the Northwestern Electric Company, as that concern has had lower rates in force than the Portland company tariffs.

That the commission does not view with approval the present unrestrained competition may be inferred from the following extracts from the findings:

"The commission in the former rate order took into account the existence, in the field covered by the respondent's light and power operations, of a competing electric utility, which, by service at lower rates in only a restricted territory of greatest business activity and density of population, has been able to attract a large percentage of the most profitable business from the respondent's system. The competitor has not been required to serve any except this most advantageous business and has left the respondent with the continuing responsibility to serve, without increased compensation, the outlying territory involving much greater expense per unit of service delivered.

"The sharp decrease in the electric revenues during the last few years, and the probability, under the inequality of rates which has existed, of continuing reductions, with consequent damage to the investors, has resulted primarily from this competition.

"In view of these existing conditions and other features surrounding the business of the respondent, including the practical and successful reduction of the value of service to the consumer by the competitor's

lower rate, the commission found that the charges under investigation, although not producing any excessive or even fair return on the investment, were, in some respects, unreasonable, and not such as ultimately to produce the greatest use of the service by the consumers or yield the greatest return to the investors in the property. Under these findings rates for residence lighting and commercial power were ordered.

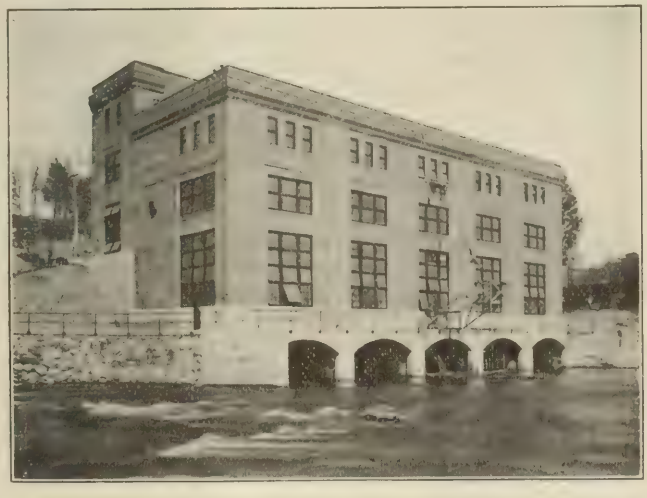
"The commission now further finds that these conditions apply with equal force to the present commercial lighting rates and that, in so far as the present schedule differs from that hereinafter set forth, such rates are unreasonable. The following commercial lighting rates will reduce to a minimum the effect of the elements hereinbefore discussed and, under the particular conditions surrounding the business, are just, reasonable and not unjustly discriminatory, either in themselves or in comparison with other rates established for this utility.

"It must be borne in mind that the following schedule is designed to meet purely local conditions. A peculiarity of expression has been introduced in the allowance of 1 cent per kilowatt-hour for a certain block of energy under the secondary rate. We believe this rate is correct in principle and the inclusion of this provision overcomes, without affecting the equitable application of charges, inequalities which arise from existing competition."

GROWING BUSINESS OF THE CONNECTICUT POWER COMPANY

Output of Electricity Practically Doubled in 1916, and Future Prospects for Development Are Excellent

The Stone & Webster Management Association, Inc., general manager of the Connecticut Power Company, says in the annual report of that company for 1916 that prospects for further growth are excellent.



FALLS VILLAGE POWER HOUSE OF CONNECTICUT POWER COMPANY

The general prosperity prevailing throughout New England continued to favor the territory served by the New London, Middletown and Housatonic divisions of the company. Total gross earnings increased approximately 29 per cent over 1915, and the balance after fixed charges was 33 per cent larger than a year ago. The output of electricity was practically doubled and sales of gas were 13 per cent in excess of the 1915 figure. Although operating expenses increased 24 per cent, net earnings show a growth of 34 per cent.

The Lyme Light & Power Company, which takes power at wholesale, has a constantly growing business.

EXTENSIVE PLANS FOR THE ARMY CANTONMENTS

Sites for the Camps at Which New National Army Forces Will Be Instructed—Call for Electric Service

The War Department is preparing to construct, the work to be finished by Sept. 1, sixteen cantonments in which members of the new National Army, raised by selective conscription, are to be instructed. It will also construct a number of National Guard camps. Sites for cantonments have been selected, as follows:

Ayer, Mass.; Wrightstown, N. J.; Columbia, S. C.; Atlanta, Ga.; Chillicothe, Ohio; Louisville, Ky.; Battle Creek, Mich.; Little Rock, Ark.; Des Moines, Ia.; Fort Riley, Kan.; Fort Sam Houston, Tex.; American Lake, Wash.; Yaphank, N. Y.; Admiral, Md.; Rockford, Ill., and Petersburg, Va.

Sites for the National Guard camps have been selected, so far, as follows:

Fort Worth, Tex.; Fort Sill, Okla.; Deming, N. M.; Waco, Tex.; Houston, Tex., and Linda Vista, Cal.

This construction work will be in charge of Col. I. A. Littell, U. S. A., Quartermaster Corps, Adams Building, Washington, D. C. Details are being worked out by the committee on emergency construction of buildings and engineering works of the Council of National Defense, which has brought to its aid a number of engineers, architects, town planners and authorities on construction. William A. Starrett of Starrett & Van Vlock, architects, is chairman of the committee.

Extension of the service of the Louisville Gas & Electric Company to the site of the Federal Army mobilization camp, which will serve as the place for assembling and training the men drafted in Kentucky and Indiana, is to be undertaken at once.

COMPETITION IS FELT BY WASHINGTON POWER COMPANY

Revenues from Electric Light and Power in Business District of Spokane Affected by Reductions to Meet Competition

In the annual report of the Washington Water Power Company for the year 1916 the following statements appear:

"The electric light and power revenues in the business district of Spokane were materially affected in the last four months of 1916 by reductions in rates, made necessary in order to retain the business in competition with a steam-heating company which has installed an electric power station operated by steam. The effect of these reductions will continue in 1917. Over 90 per cent of the business in the competitive district has been secured by your company.

"Lighting and power revenues in the country districts have shown an increase of 10 per cent over those of 1915."

MUNICIPAL PLANT ADVOCATES DEFEATED IN PORTLAND, ORE.

Election of George L. Baker as Mayor Believed to Show Unfavorable Attitude Toward Public Plant Project

In the election held in Portland, Ore., on June 4 the interests which have been contending for a municipal lighting plant were decisively defeated.

The two principal candidates for Mayor were Will H. Daly, representing the labor element, and George L. Baker, a lifelong Republican.

Mr. Baker was elected and an ordinance allowing unregulated use of the streets by jitney operators was overwhelmingly beaten. An ordinance requiring $2,500 bonds for jitneys was adopted by a very large majority. An ordinance against picketing was also adopted.

B. S. Josselyn, for many years president of the Portland Railway, Light & Power Company and well known in the industry throughout the United States, ran third on the ticket for Mayor.

It is believed that the election shows that the people do not look favorably at this time upon the agitation for a municipal lighting plant.

WAR-TIME ECONOMIC BENEFIT OF TRANSMISSION TIE LINES

In Hearing on Petition of Fall River Company to Construct 66,000-Volt Line Chairman Weed Discusses Concentration

At a recent hearing by the Massachusetts Gas and Electric Light Commission upon a petition of the Fall River Electric Light Company for authority to construct a 66,000-volt transmission line from Fall River to the Massachusetts-Rhode Island boundary in Seekonk, a discussion took place as to the economic advantages of high-tension power interchange between adjacent central station and hydroelectric transmission systems. As recently noted in the ELECTRICAL WORLD, the Fall River company has applied to the Massachusetts Waterways Board for permission to build a 66,000-volt crossing over the Taunton River at Fall River, and the general advantages of the plan of interconnecting the Fall River system with that of the Rhode Island Power Transmission Company were presented to the Waterways board by Philip Cabot, vice-president of the Fall River company. At the hearing before the Gas and Electric Light Commission the question of public convenience and necessity was taken up.

Mr. Cabot pointed out that it is planned to connect the Fall River system with that of the Narragansett Electric Lighting Company in Providence, the latter being interconnected with the Rhode Island Power Transmission Company and in this way tied in with the great system of the New England Power Company. Growth of business in Fall River has made immediate development of power facilities necessary, and it is estimated that a two-circuit steel-tower line of 40,000 kw. rating and allowing for the supply of 20,000 kw. with one line out of service can be built for about $300,000. Enlargement of the existing steam generating plant in Fall River by an addition of 15,000 kw. would cost about $1,250,000. Delivery of a turbo-generator of this size could not be had before the spring of 1919, and Mr. Cabot contended that the company is not in a position to finance such a steam-plant extension at this time. The present plant has an installed capacity of about 10,000 kw. The units have some overload capacity, and with one of the existing 4000-kw. machines out of commission about 7500 kw. could be carried. The peak load of December, 1916, was over 6000 kw. Last summer the company ordered a new unit of about 6000 kw. rating to take the place of a 1000-kw. machine, so that when this installation is completed the safe maximum capacity of the plant with the largest unit out of service will be about 9000 kw. It is anticipated that by the fall of 1917 the peak load on the station will be at least 9000 kw.

TIME-SAVING IN TRANSMISSION LINES

Fall River cotton mills, Mr. Cabot said, now use about 100,000 hp. in steam power; many steam plants are old. There is a strong tendency toward electrification of mills since war began, and high coal cost has accentuated this. The Fall River company's power load has virtually been doubled in the last year. Within a few weeks mill contracts have been awarded orally which will take about 3500 kw. from the central station company. The outlook for future business is largely from users of from 1000 kw. to 2000 kw. in mill service. The cost of adding two units of 15,000 kw. to the steam plant of the company, including all auxiliary equipment, building, boilers, etc., would be about $1,500,000. The proposed transmission line can be built in about a year, whereas it will require about two years to install and begin to operate the turbo-unit. A ten-year contract with the Rhode Island Power Transmission Company is under consideration.

The Fall River company believes that it would be a mistake to add units of 4000 kw. to 6000 kw. rating to the steam plant, as these would become obsolete with reference to demands upon the station almost before they were installed. A multiplicity of small units is much more expensive to purchase and more costly to operate than a larger unit, taking disproportionate space and exhibiting lower economy of operation. Cost of coal in Fall River to-day is more than double the normal price. The construction of the high-tension line will make it necessary to carry one spare unit for Providence and Fall River instead of two, the line being available for relay service at all times. On account of the large amount of underground construction which would be required, the interconnection of the Fall River and New Bedford stations has not appeared so desirable from the engineering standpoint as the building of the line to Rhode Island. The line will be about 14.5 miles (23.3 km.) long.

Mr. Cabot said that in case of a conflagration or explosion the steam plant could be put out of commission for perhaps three months, but two or three days would be the longest period of interruption possible for a transmission line. The New England Power Company is rarely short of water except in the summer, while in this period coal is easier to obtain at Fall River. By providing transformer banks in duplicate service continuity would be arranged for, and in case of trouble it would be a simple matter to transfer temporarily transformers from other points on the New England or Connecticut Valley 66,000-volt systems to Fall River. Transformers could be taken from the Connecticut Val-

y in a week or less. In connection with all the high-nsion lines in Massachusetts there is considerable oare transformer equipment which can be moved.

Opponents urged that Fall River taxable property ould not be increased unless a new steam-plant ex-nsion were built. Mr. Cabot said that it would cost 50 er cent more to build a station addition than three ears ago. Ultimately a large station will have to be uilt in Fall River, but with present excessive costs the ompany prefers to spend one-quarter as much and se-ure additional energy by transmission line.

Possibilities of Concentration

Chairman Weed pointed out the great waste in the rection of many scattered plants and that the possi-ilities of economical production by concentration are ery great. Anybody who can bring cheaper power into manufacturing community, Mr. Weed said, is doing great public service, and the cheaper it is brought n, the better it is. The aggregate generating capacity f electricity supply companies in the State is at least 0 per cent greater than actual demands upon them, nd some plants necessarily, in order to be safe in aking care of the demands placed upon them, have to e developed to a greater degree than is absolutely es-ential if they can be relayed from some other source. Mr. Weed recognized that any city would like to secure ax returns, but pointed out that any introduction of ower at lower cost is a public benefaction and noted hat there has been a disposition to sell local utility roperties when the resident owners have been offered vhat they considered a proper price for their holdings. Desirable as control of central stations by local inter-sts would be, development often requires outside apital.

RELATIONS BETWEEN N. E. L. A. HEADQUARTERS AND SECTIONS

George B. Muldaur, Field Secretary, Completes Tour of United States and Canada—Result Is Closer Co-operation

George B. Muldaur, field secretary of the National Electric Light Association, has just completed a tour of the United States and Canada, during which he has represented the association at the conventions of five geographic sections and at executive meetings and conferences with the officers of eight others, discussing and reporting suggestions for the improvement of service and the betterment of relations. He has visited fifty member companies where local sections exist, attending their meetings and assisting them in taking full advantage of the educational opportunities offered by the association. He has also been instrumental in the formation of twelve new company sections and the reorganization of seven others which had become inactive.

The trip has resulted in a closer understanding and sympathy between the national body and the affiliated and kindred organizations throughout the country, and has supplied association headquarters with a mass of first-hand information regarding the problems and requirements of individual sections, localities and members. This service is being followed up with a view to keeping all geographic sections, associations and individual company members in close personal touch with the national body for co-operative effort.

G. H. STICKNEY ELECTED PRESIDENT OF THE I. E. S.

Council Confirms the Selection for the Fiscal Year 1917-1918—Officials of the Various Sections Are Also Approved

Election of the following officers of the Illuminating Engineering Society for the fiscal year 1917-1918 was confirmed by the council on June 14:

President, G. H. Stickney; vice-presidents, W. G. Hoyt and C. E. Stephens; general secretary, Clarence L. Law; treasurer, L. B. Marks; directors, R. F. Pierce, S. C. Rogers and P. S. Young.



GEORGE H. STICKNEY
President-Elect of Illuminating Engineering Society

The election of the following section officers also was confirmed at the meeting:

New England Section—Chairman, S. C. Rogers; secretary, M. R. Pevear; managers, J. W. Cowles, David Crownfield, C. A. B. Halvorson, R. G. Hudson and George P. Smith, Jr.

New York Section—Chairman, A. S. McAllister; secretary, Norman D. Macdonald; managers, D. F. Atkins, S. B. Burrows, W. J. Clark, Alexander Maxwell and A. L. Powell.

Pittsburgh Section—Chairman, L. O. Grondahl; secretary, W. P. Hurley; managers, E. J. Edwards, L. J. Kiefer, Harold Kirschberg, J. L. Minick and H. N. Muller

Philadelphia Section—Chairman, Walton Forstall, secretary, Unit Rasin; managers, John R. Hare, J. B. Kelley, H. H. Ganser, G. B. Regar and C. W. Wardell.

Chicago Section—Chairman, E. H. Freeman; secretary, James J. Kirk; managers, C. A. Carpenter, Alfred O. Dicker, A. H. Meyer, Fred A. Rogers and J. L. Stair.

G. H. Stickney, the new president, was born in Buffalo, N. Y., in 1872. He was graduated from Cornell University with the degree M.E. (E.E.) in 1896, and immediately afterward went to the General Electric Company's works at Schenectady, where he spent one and a half years in the student course. Following this he acted as first assistant to W. D'A. Ryan in charge of the lighting department of the works at Lynn, Mass. At this time his work consisted of factory, commercial and engineering development of the arc lamp. Later he was instrumental in the development of the high-efficiency incandescent lamps and equipments. The next two years were spent by Mr. Stickney as the first assistant to Mr. Ryan in similar work at the Schenectady plant.

In May, 1911, Mr. Stickney took charge of illuminating engineering of the Harrison works of the General Electric Company as assistant to the sales manager. At this plant he developed a number of lighting appliances and collaborated in designing many more.

Numerous company publications and many articles and papers on illumination which have been published from time to time in various technical journals have been writen by Mr. Stickney. He has served on many committees in different societies, whose functions dealt with work having a bearing on illumination. In the I. E. S. he has served as secretary (charter) New England Section; chairman New York Section, 1911 (two years); vice-president, chairman of committee on papers and general secretary.

SECURE GOVERNMENT DEPOSITS BY PUBLIC UTILITY BONDS

Direct First Mortgage Listed Obligations on Physical Property Acceptable as Collateral at 75 if Yielding 5½ Per Cent or Less

A revised list of the classes of approved securities which will be accepted by the Treasury Department as collateral security for government deposits of funds in connection with the Liberty Loan bond issue was announced by Assistant Secretary Oscar T. Crosby on June 12. It includes public utility as well as other classes of securities.

Among the securities now approved are:

"Bonds of electric railway and traction companies, of telephone and telegraph companies and of electric light, power and gas companies, secured by direct mortgages upon their physical properties in the United States and listed on some recognized stock exchange, taken at 75 per cent of the market value thereof, not exceeding par, but not including any such bonds which on May 29, 1917, were at a market price to yield more than 5½ per cent per annum, if held to maturity, according to standard tables of bond values."

At least 25 per cent in value of the securities deposited by any bank or trust company to secure its deposits must consist of bonds and certificates of indebtedness of the United States government of any issue, including bonds of the Liberty Loan and interim certificates for payments therefor, all at par.

The Secretary of the Treasury reserves the right to call for additional collateral security at any time.

W. E. Stanley, Chicago, representing E. W. Clark & Company of Philadelphia, protested on June 4 to Secretary of the Treasury McAdoo against the original circular dated May 29, which did not include public utility bonds among the securities acceptable as collateral.

ELECTRIC POWER CLUB TENDERS ITS RESOURCES

In Full Sympathy with the Objects of the War, It Offers Loyal Support and Assistance to the President

Clarence L. Collins, 2d, president of the Electric Power Club, has sent to President Wilson, by unanimous vote of the members, the following resolution passed at the meeting held at Washington on June 11 and 12:

Whereas the United States is now engaged in a great war in which it participates only for the purpose of lending its aid to establish and safeguard the democracy and peace of the world, and

Whereas the Electric Power Club, representing the electrical machinery manufacturers of the nation, is in full sympathy with the objects of this war, and desires to lend its best assistance and effort toward a speedy and successful conclusion of the conflict, be it

Resolved, That the Electric Power Club, being now in convention assembled, does hereby tender to the President of the United States the loyal support and assistance of its officers, committees and members, together with the facilities and resources at its command, all to be made available to him when and as he may require the same; and be it further

Resolved, That, in order to facilitate the making and fulfilling of any demand on the Electric Power Club for such assistance as it may be prepared to render the government, a committee, to be known as the Electric Power Club committee of national defense, be at once created, consisting of two executive members and the president of the club, the latter as chairman of the committee, through which the officers of the government may be promptly and effectively brought into contact with the officers and working committees of the club and all manufacturers who are members thereof.

Other business transacted at the meeting, in addition to that reported in last week's issue of the ELECTRICAL WORLD, page 1173, was:

A suggestion for publishing the Electric Power Club book of standards in foreign language for distribution to Central and South America was favorably acted upon.

A resolution was also passed covering the purchase of Liberty bonds with the surplus cash now in the bank.

COMMITTEE TO SURVEY CALIFORNIA OIL RESOURCES

President Thelen of the Railroads Commission Is Chairman—Industrial Development and National Needs Lead to Action

The extent to which fuel oil has replaced coal on the Pacific Coast makes oil supply a matter of great importance. Governor Stephens of California has selected two members of a committee of three to obtain facts and make recommendations relating to production, distribution and utilization of petroleum. The committee is to study measures to be taken to meet emergencies arising from war and to increase production and most effective utilization of these resources of the State.

Max Thelen, president State Railroad Commission, will be chairman of the committee, and Prof. David M. Folsom of Stanford University is a member. Experts

of both the Railroad Commission and the State Mining Bureau are to assist the committee.

Oil companies state that the supply of oil held in storage has been decreasing rapidly. There was a daily decrease in the storage during 1916 of 35,800 barrels, and in the first three months of this year the rate of decrease has been considerably greater.

ENGINEERING COUNCIL TO SPEAK FOR ENGINEERS

Appointment of Members of the American Institute of Electrical Engineers to New Organization Is Announced

Steps have been taken to form an engineering council to speak for engineers in general upon subjects of common interest to engineers and the public. As representatives of the American Institute of Electrical Engineers the following have been appointed: H. W. Buck, E. W. Rice, Jr., N. A. Carle, P. Junkersfeld and C. E. Skinner.

Amendments to the bylaws of the United Engineering Society have been adopted to provide for the engineering council as a new department of that society. Each founder society shall have five representatives upon the council; the United Engineering Society shall have four representatives.

HOLD SCIENTIFIC MEETINGS MORE FREQUENTLY IN WAR

Dr. Colin G. Fink, President American Electrochemical Society, Urges the Great Stimulus of Professional Discussion as War Measure

Dr. Colin G. Fink, Edison Lamp Works, Harrison, N. J., president of the American Electrochemical Society, makes the following statement:

"A number of our scientific societies have deemed it advisable 'on account of the war' to either cancel or postpone their future meetings and conventions. The American Electrochemical Society disapproves of this action and at its recent board meeting adopted resolutions encouraging rather than discouraging the holding of meetings.

"Modern warfare is not so much a matter of prowess at arms as it is a stupendous engineering undertaking. To hasten this war to an early and victorious close our many thousand engineers must bring to bear every possible effort. However, individual, independent effort is not desirable at this time; concerted action is absolutely essential for the most efficient service.

"In order to expedite the solution of many of the new problems that have arisen as a direct consequence of our martial state, unrestricted discussion of the problems (with but few exceptions) at scientific meetings is bound to give all of us a clearer understanding of the real points at issue, of the urgent needs of our country at this momentous hour.

"Meetings of scientific and technical societies have ever served as a great stimulus for their members and have been a 'clearing house' for many of the best thoughts and ideas of our professional men.

"Let us follow the good example set us by England. Let us encourage rather than discourage the holding of scientific meetings in these war times. When England found herself confronted with a very serious shortage of sulphuric acid, glass, dyes, electrodes, brass, furnaces, etc., the scientific societies arranged symposiums on these subjects and not only invited all of the members to attend but, further, urged those factory men who were not members to come to the meetings to give their views and experiences and to learn all they could in return.

"Just as a large business corporation depends upon the organized effort and efficiency of the several units and departments, so does our government, now more than ever, look to the organized concerted effort of its large engineering bodies for quick and efficient results. Let us continue holding our meetings and hold them more frequently than ever before."

PATRIOTIC ELECTRIC SIGN SHOWN IN CAMBRIDGE, MASS.

Central Station Company Displays Large Sign to Meet Public Sentiment of Loyalty to Our Country

The Cambridge (Mass.) Electric Light Company is devoting one of the largest electric signs in the Greater Boston district to patriotic service. The sign is on the roof of a building in Central Square, the most densely populated business section. It is about 40 ft. wide by 24 ft. high (12 m. by 7.2 m.). It is provided with a four-line interchangeable center with female figures at each end, with corner shields between which the word "Electricity" is formed. Lightning is simulated by the use of a flasher requiring about 1300 10-watt lamps.



CAMBRIDGE COMPANY ADVERTISES PATRIOTISM

FORM OF ANNUAL REPORT FOR THE PENNSYLVANIA COMPANIES

At Conference in Harrisburg Chairman Ainey of the Pennsylvania Commission Asks the Judgment of Representatives of the Electric Utilities

A conference with representatives of electric companies on the subject of a form of annual report was held by the Pennsylvania Public Service Commission at Harrisburg on June 6.

The commission prepared a tentative draft of a form of report. This was filed with the Pennsylvania Electric Association before the hearing and other copies were available at the commission office. At the hearing the Pennsylvania Electric Association represented member companies.

In opening the conference the chairman, Commissioner Ainey, said:

> Gentlemen, the Public Service Commission is indebted to you for your compliance with our request that you attend this conference for the purpose of giving us, from your experience, your comments concerning the program which the commission has in mind with respect to the promulgation of an order calling for reports from certain classes of utilities, of which you are representatives.
>
> We have therefore asked you to come and sit with us for the purpose of discussing all features incident to the promulgation of a series of reports which seem to be called for by the terms of the public service company law and which are calculated to aid us in carrying on the work of the Public Service Commission.
>
> Let me say to you that we do not wish you to feel that this proceeding or this conference is in the nature of an adverse proceeding. We are inviting you here for the purpose of getting the benefit of your judgment, which, put together with the experience of our accounting force, will enable us to ascertain how any order that might be made will be least burdensome upon the utility companies and most serviceable to the public at large, and with your aid the Public Service Commission, through its officers and bureau chiefs, may be able to solve this problem. So we invite your fullest expression and your freest criticism upon any features of this matter. In order to aid us, there has been tentatively prepared a report which represents a great deal of study on the part of the chief of our bureau of accounts, but we are not saying to you that it is perfect or that it is to be adopted in just exactly the form in which it is presented. We realize that it is subject to careful examination and perhaps modification.

Following the conference the commission has taken the matter under advisement. No form has yet been adopted.

NEBRASKA POWER COMPANY ACQUIRES THE OMAHA SYSTEM

Extension of Transmission Lines Into Outlying Territory a Feature of the New Plans for Development

The plant and property of the Omaha Electric Light & Power Company has been acquired by the Nebraska Power Company. Extensions will be built into the territory near Omaha. An official announcement says:

"Serving a territory 100 miles from the central station in Omaha is within the expectation of the men who are directing this new forward movement of the company."

Officers and directors of the Nebraska Power Company are: George H. Harries, president; W. D. McHugh, vice-president and general counsel; Ward M. Burgess, vice-president; J. E. Davidson, vice-president and general manager; S. E. Schweitzer, secretary and treasurer; T. C. Byrne, Gould Dietz, G. W. Holdrege, Joseph E. Barker, J. H. Millard and C. E. Yost.

FAIR TO INCREASE RATES OF LARGE INDUSTRIAL CONSUMERS

L. P. Hammond of William P. Bonbright & Co., Inc., Says That Burden of Higher Operating Costs Will Fall Upon Large Users

L. P. Hammond of William P. Bonbright & Company, Inc., New York, vice-president Colorado Power Company, says:

"It is apparent that if operating expenses increase in fairness the rates paid by the large industrial consumers must be correspondingly increased.

"That the inherent police powers of the state are such that no contract can stand against the authority of a public utility commission to increase or decrease rates has been so firmly established in the courts as to nullify any argument that contracts with large industrial consumers will prevent increase of their rates.

"There is therefore every reason to anticipate that public utilities will materially increase their gross revenues through increase of rates to large industrial consumers; that not only is this possible, but it is highly probable that the commissions will compel it.

"The commissions are coming to realize that, no matter how much of a necessity public service is for the small user, it is not a necessity for the large industrial user who can always exercise his alternative of operating his own plant.

"This being the case, no political agitation or disturbance will result, since the burden of the increased cost of operation will rightfully fall upon the relatively few large industrial consumers instead of upon the many small users.

"Now all the factors bearing upon the increased operating cost of the utility bear with equal force upon the cost of producing electricity or gas in isolated industrial plants. It goes without saying that utilities are far ahead of the average isolated plant in the use of modern, economical equipment. It follows that the increased cost of fuel and labor will be more serious in small isolated plants with more or less obsolete equipment than it will with the utilities. The result will be to force many power prospects who have, for one reason or another, hitherto declined to use central station service over to that service. In this way, despite increased rates, the utilities can anticipate an increase of revenue.

"This is of equal importance in answering the argument that industrial users will put in their own plants if the central station rates are increased. But here there is the added fact that the present high cost of machinery and difficulty in obtaining reasonable deliveries thereupon will militate against abandoning central station service.

"Finally, we are aware of notable instances where large consumers have already acquiesced in increased rates in recognition of the situation and of the impossibility of obtaining public service to the detriment of the small consumer."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Injury to Shade Trees.—A telephone company is not relieved from liability for damages to a property owner for unlawfully cutting his shade trees, it is held by the Supreme Court of Iowa (162 N. W. 612), because of the fact that the company's servants did no more cutting than in the exercise of their honest judgment they thought necessary and proper. If the honest judgment of the agents of defendant was in fact faulty, it and not the plaintiff must suffer the consequences of the mistake in judgment.

Modification of Contracts.—Where an electric power company and a town contracted that the power company should furnish the town with electrical energy for lighting at the lowest rates given any other town, the contract containing nothing which prevented the town from changing the form and substance of the contract or from making an entirely new contract upon the same subject, the company and town could make a new contract for a fixed rate per lamp, the Supreme Court of North Carolina held in the case of Southern Pacific Utilities Company versus town of Bessemer City (92 S. E. 331). Where an electric power company and a town with which it had contracted to furnish energy for lighting at the lowest rate given any other town five years later made another written contract wherein every detail was provided for without reference to the first contract or any of its stipulations, the latter contract stating that the prior contract was canceled and annulled except to enable the power company to collect what was then due it by the town, the power company and the town made a new and entire contract for the future, canceling the previous one.

Negligent Placing of Lines.—A complaint charging that a city operating an electric lighting plant strung wires of high voltage negligently through the lower branches of a small tree where wires might injure children who should climb the tree not knowing the danger, and that the wires were insufficiently insulated, and that the city knew or could have known of the condition in time to have remedied it, and that the plaintiff climbed into the tree and was burned by the wire, is sufficient, after verdict, to sustain judgment for plaintiff, it was held by the St. Louis Court of Appeals (193 S. W. 971). An electric company maintaining a dangerous wire near a tree is bound to anticipate that persons may lawfully climb the tree and must exercise due care to prevent injuries. Where a boy climbed a tree after a bird's nest and a limb of the tree broke, throwing him against a high-voltage electric wire which was insufficiently insulated and negligently placed, the proximate cause of his injuries was negligence and not the breaking of the limb of the tree. To charge the city with negligence in placing its wires it is not essential that it could have known that the precise injury would happen as it did, but it is sufficient if the city should have anticipated that some injury might result, and that plaintiff's injury did result as a natural and probable consequence. In action for injuries to minors by electric light wires, instruction authorizing jury to find that the tree through which the wires were strung was an object likely to attract children, and that the city knew or by the exercise of ordinary care could have known that children might climb the tree, was proper where the tree in question was a small tree with branches only a few feet from the ground.

Capitalization of Public Utility.—Findings of the Public Service Commission are considered prima facie correct on appeal, but the court will consider the relative weight of the evidence in the record, the Supreme Court of New Hampshire held in the case of Grafton County Electric Light & Power Company (100 A. 668). A public utility corporation may capitalize what it owns, but can charge rates only on basis of such property as is devoted to the business in hand. When increasing capital stock of a public utility corporation, where securities are to be sold, in determining the value of its property the amount which a prudent investor would pay at date of proposed capitalization, including all elements of value, such as cost of reproduction less depreciation, investment cost and future returns under customary rates, and looking at the plant as a going concern, will be considered. Although no market value of an electric light and power plant exists in the ordinary sense, the items composing the plant have separate market values, but their total with cost of combination will be the reproduction cost, which decreased by depreciation is properly considered as indicative of value. An isolated sale of an electric plant with no competition is not conclusive as to its value, and it is immaterial whether a profit was made by the transaction. The method of water-power valuation by comparison with expense of operation by steam of an electric plant, although correctly determining amount of owner's damages if water power is taken away, is no test of price as a part which would be paid for it of a purchase of whole plant, in view of finding that other water-power might have been secured. Where electric company purchased another plant, its increased capitalization may include value of plant, including expense of additions and improvements and legal expense of organization, including expense of litigation, before the Public Service Commission and on appeal, and the mere fact that the expense will be large is immaterial and does not alter the principle that is involved in ascertaining the correct basis of capitalization.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Street-Lighting and Domestic Lighting Contracts.—The Pennsylvania Public Service Commission has handed down an order revoking the proposed contract for street and domestic lighting made by the borough of Girardville with the Schuylkill Electric Company for ten years. The commission says: "Inasmuch as the contract for street lighting and the contract for domestic lighting are inseparably connected, we are of the opinion and find and determine that it is neither necessary nor proper for the service, accommodation, convenience and safety of the public that either of the contracts above mentioned be approved. In the present case the commission would approve the street-lighting contract entered into by the borough and the applicant if the same had not been bound up with the contract for domestic lighting."

Accounts in New York.—A decision has been rendered by the New York Public Service Commission, First District, as to conformity with the commission orders relative to a uniform system of accounts and the form of annual report for the year 1915 on the part of the New York Edison Company, United Electric Light & Power Company, New York & Queens Electric Light & Power Company and Edison Electric Illuminating Company of Brooklyn. Among the points are: "Held, that the proposition that meaningless property accounts carried on the books of public utility corporations prior to the establishment of the uniform system of accounts should be combined with accounts representing cash cost and identifiable with specific property cannot be entertained by the commission except where the records have been properly kept, in which case the accounts may, with the approval of the commission, be reclassified on the basis of the uniform system of accounts and the old capital account eliminated. . . . Objection to the term 'depreciation' in the uniform system of accounts and the substitution for depreciation charge of a charge representing the amount estimated by the company to be necessary to equalize the average annual cost of property withdrawn from the service will not be approved, because small profits would tend to defer necessary charges and because the method adopted by the commission for depreciation charges is in entire agreement with decisions of the courts. . . . Where a fixed amount for depreciation is allowed by the commission in a rate case, such amount is paid by the consumers in rates and should be charged to reserve for depreciation."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

American Cities Company Passes Preferred Dividend.—The usual semi-annual dividend of 1½ per cent on the preferred stock of the American Cities Company has been passed.

Northern States Stock Sales in Home Territory.—During May 188 customers in the territory served by the Northern States Power Company purchased $82,500 of the preferred stock, making a total of $1,652,100 of this issue held by 3298 shareholders.

Westinghouse Stockholders Approve Merger.—At the annual meeting of stockholders of the Westinghouse Electric & Manufacturing Company at East Pittsburgh on June 13 the merger with the Westinghouse Machine Company was approved unanimously. Westinghouse Machine Company stockholders approved the merger on the same day.

Water Power Committee in West Virginia.—Governor Cornwell of West Virginia has appointed the following water power committee provided for by the recent Legislature: Frederick Fox, Sutton; C. C. Coalter, Hinton, and Wells Goodykoontz, Charleston. Investigations will be made of State water power and recommendations for proper legislation.

Patriotic and Welfare Work of Southern Sierras Company.—A plan of aiding in war measures and assisting employees in carrying their risks and burdens has been worked out by the Southern Sierras Power Company and associated and interconnected companies. Life insurance, Liberty bond subscriptions, re-employments and employees' savings are embraced within the measures which have been adopted.

Sandusky Company May Furnish Electricity for Municipal Pumping Station.—By the enactment of a law at the last session of the Legislature, central stations in Ohio are now in a position to make contracts with municipalities for pumping the city water supply. On application, the city commission of Sandusky, Ohio, by unanimous vote adopted a resolution allowing the Sandusky Gas & Electric Company to make an engineering investigation as to whether or not the company could furnish power for pumping water at the central water station at a less price than the city is able to do this.

Summer Session of College of Engineering, Wisconsin.—The nineteenth annual summer session of the College of Engineering of the University of Wisconsin will be held at Madison during the six weeks' period beginning June 25, 1917. Special courses will be given in chemistry, electrical, steam and hydraulic engineering, gas engines, machine design, mechanical drawing, mechanics, shop work and surveying. All courses given in the university summer session are open to engineering students. Special courses have been arranged for engineering, manual arts and vocational teachers. For information address F. E. Turneaure, dean, Madison, Wis.

Jovian Order Remits Dues of Enlisted Members.—Announcement is made by the Jovian Order that dues of members who enlist in the military service of the United States or any of our allies will be canceled during the war. Enlisted members will be carried on an "honor membership roll" without cost to them. Their cards, magazines and other Jovian material will be forwarded to them at the front and elsewhere whenever possible. The central office has requested all leagues to report enlistments promptly. Members are also requested to report their enlistment and where possible keep the central offices posted concerning their mail addresses.

Westinghouse Company Raises Wages.—The Westinghouse Electric & Manufacturing Company recently announced to its employees another advance in wages amounting to 10 per cent. This affected all workmen in the shop and practically all of the office force except a few higher-salaried employees. It was one more of a number of raises in wages granted to shop workmen which represent a general increase in two years of practically 40 per cent. The Westinghouse company has never made a practice of granting horizontal raises to the entire force, but has rather pursued the policy of granting increases to cases of individual merit, basing them on individual accomplishments.

Improving Shop Lighting in Wisconsin.—A committee to assist the Wisconsin Industrial Commission in revising orders relating to shop lighting has been announced by the commission. F. M. Wicks of the Westinghouse Lamp Company of Milwaukee has been invited to serve as chairman, and John A. Hoeveler, deputy of the commission, will be secretary. Other members are: Fred Schwarze, Pfister-Vogel Leather Company; Richard Finn, Cutler-Hammer Manufacturing Company; Howard Ilgner, Bureau of Illumination Service; Max Freschl, Holeproof Hosiery Company; George F. Rohn, electrical contractor, and H. G. Monger, Milwaukee Electric Light & Railway Company. At least one prominent oculist will be added later. This committee has been appointed to give Wisconsin an up-to-date shop-lighting code, similar to codes adopted recently by New Jersey and Pennsylvania. It will draft minimum standards for both natural and artificial lighting in industrial plants. With the desire of helping manufacturers to solve this problem it has also prepared a bulletin on industrial lighting, which will be available for distribution soon. The commission announces that it has made arrangements with the United States Public Health Service to detail one of its experts to Wisconsin, to study shop lighting and suggest improvements. The Public Health Service has detailed David M. Tuck for this work.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

National Electrical Credit Association.—On June 28 and 29 the National Electrical Credit Association will hold its eighteenth annual meeting at Boston, Mass. An interesting program of papers has been prepared.

New York Electrical Society.—The annual meeting of the New York Electrical Society for the election of officers was held June 14. The result of the election was as follows: President, Dr. A. S. McAllister; vice-presidents, J. F. Carey, Walter Neumuller and George H. Barbour; secretary, George H. Guy; treasurer, Thomas F. Honahan.

Convention of Pennsylvania Contractors.—The Electrical Contractors' Association of Pennsylvania held its annual convention and electrical show in the Hotel Adelphia, Philadelphia, June 19 to 21. Among the speakers at the first day's session were J. B. McCall, president Philadelphia Electric Company, who spoke on "The Central Station's Message;" Washington Devereaux, chief Philadelphia Underwriters' Electrical Department, "The Practical and Ethical Aspects of the Electrical Business;" J. W. Hooley, contracting electrical engineer, New York, "The Necessity for Competent Estimating;" Frank H. Stewart, F. H. Stewart Electric Company, Philadelphia, "The Manufacturer's Territorial Sales Agency;" H. W. Alexander of the Society for Electrical Development, "Selling the Electrical Idea," and C. M. Ripley, "Floodlighting." M. Edwin Arnold, Philadelphia, is president of the association, and M. G. Sellers, Philadelphia, is secretary-treasurer.

Managing Committee of Canadian Electrical Association.—At the recent annual meeting of the Canadian Electrical Association, held in Montreal, the Class A members of the association elected the following members to the managing committee: John W. Lieb, ex officio; P. T. Davies Civic Investment and Industrial Company, Montreal; M. C. Gilman, Toronto Electric Light Company; James Gould, Citizens' Electric Light Company, Smith Falls, Ontario; H. M. Hopper, St. John (N. B.) Railway Company; E. L. Milliken, Cape Breton Electric Company, Sydney, N. S.; Louis Pratt, Dominion Power & Transmission Company, Hamilton, Ontario; James B. Woodyatt, Southern Canada Power Company, Quebec; W. H. McIntyre, Ottawa Light, Heat & Power Company; R. J. Beaumont, Public Service Corporation of Quebec; A. P. Doddridge, Quebec Railway, Light, Heat & Power Company; P. Ackerman, Toronto Power & Light Company; C. S. Bagg, Civic Investment & Industrial Company, Montreal.



D. H. M'DOUGALL

Douglas H. McDougall of the To-onto (Ontario) Power Company, who as recently elected fourth vice-presi-ent of the National Electric Light As-ociation, was re-elected president of ie Canadian Electrical Association at s recent annual meeting. Mr. Mc-ougall, who was born in Toronto in 374, is treasurer of the Electrical De-elopment Company, the Toronto & iagara Power Company, and the ondon (Ontario) Electric Company. e received his early experience in ac-unting in the United States, and re-irned to Canada in 1893 as treasurer the Electrical Development Com-any of Ontario, Ltd. This company as leased in 1908 to the Toronto ower Company, and Mr. McDougall as appointed assistant to the general anager, and when in 1911 the To-onto company purchased the Toronto lectric Light Company he became as-stant to the manager of the enlarged rganization.

G. R. C. Wiles, Charleston, W. Va., as been appointed a member of the ublic Service Commission to succeed lliott Northcott, whose term expired ne 1.

Samuel Insull, president of the Com-onwealth Edison Company, Chicago, ast week received the degree of doctor f science from Union College, Schenec-ady, N. Y.

Peter Junkersfeld, assistant to the ice-president of the Commonwealth dison Company, Chicago, has been ap-ointed a major general and has re-orted to Washington for duty.

H. C. Berry, who was district super-ntendent of the Electric Company of ew Jersey at Salem, is now engaged n high-tension construction work with he American Railways Company, Phil-delphia, Pa.

Professor Boris Alexandrovitch akhmeteff, head of the Russian com-ission to the United States, is a hy-roelectrical engineer of considerable xperience both in the United States nd Russia. After receiving his en-ineering degree, he became instructor n the Petrograd Polytechnical Insti-ute, and later professor. About thir-een years ago he came to the United tates to acquire experience.

Men of the Industry

Changes in Personnel and Position— Biographical Notes

L. Scott Schilling has been appointed superintendent of the Electric Company of New Jersey in the Salem district, succeeding H. C. Berry.

Dr. A. S. McAllister, electrical and illuminating engineer and former editor of the ELECTRICAL WORLD, was elected president of the New York Electrical Society at the recent annual meeting.

L. S. Small, formerly with the Texas Power & Light Company, Dallas, Tex., has been appointed manager of the Concordia (Kan.) Electric Light Company, a subsidiary of the Commonwealth Light & Power Company.

Capt. Gustave Paul Capart, a member of the general staff of General Pétain, commander-in-chief of the French armies, and formerly of Brown-Boveri, a Swiss electric manufacturing company, and still sub-director of the Société Générale de Condensateurs de Fribourg, is in the United States for three or four months, attached to the French scientific mission as General Pétain's representative to see what electrical material can be made here to serve the French army. His headquarters are with the French Embassy at Washington. Captain Capart has been a frequent contributor to the European press, besides being a writer on electrical subjects.

A. G. Carson has been appointed manager of the Eastern Wisconsin Electric Company at Fond du Lac, Wis., in charge of the electric and gas departments at that place. Mr. Carson began his public service work with the Grand Rapids, Grand Haven and Muskegon interurban lines in the power and transportation departments. Leaving Michigan, he became connected with the Winnebago Traction Company at Oshkosh as chief engineer, and when that company was consolidated with the Eastern Wisconsin Railway & Light Company he was sent to Fond du Lac as superintendent of the electric department, which position he has filled for the last eight years. For the last year he has also been superintendent of the gas department.

Obituary

Sidney W. Winslow, president of the Beverly (Mass.) Gas & Electric Company, and also founder and chief executive of the United Shoe Machinery Company, died at Beverly June 18. He was sixty-two years of age, and was also president and a director of the Newburyport (Mass.) Gas & Electric Company and other gas and industrial organizations.



S. J. DILL

Samuel J. Dill, vice-president of the United Gas & Electric Engineering Corporation, died at his home in Jamaica, Long Island, N. Y., June 14. Mr. Dill was born in Wallkill, N. Y., Oct. 3, 1864. In his early days he was connected with the Pennsylvania, New York, New Haven & Hartford and West Shore railroads. Afterward he was with the Staten Island Rapid Transit Company, later associating himself with the Metropolitan Street Railway Company of New York City. After this he became superintendent of the Forty-second Street and Manhattanville Railroad. He held this position at the time the street railways of New York City abandoned the cable-car system and adopted electric traction. From New York Mr. Dill went to Ypsilanti, Mich., as general manager of the traction company, and later held like positions in Kalamazoo, Mich., and Youngstown, Ohio. It was in 1908 that he became associated with the Susquehanna Railway, Light & Power Company, when he was appointed general manager of the Elmira Water, Light & Railroad Company, one of its subsidiaries. Two years later he became vice-president and general manager of this property. From Elmira he was transferred to New York as assistant to the president of the Susquehanna Railway, Light & Power Company, upon the reorganization of which he was made vice-president of the United Gas & Electric Corporation and also held the office of vice-president and director of many of its subsidiary companies. Early in 1915 he went to New Orleans to assume charge of the work of the company in the South, returning a year later to New York. At the time of his death he held the position of vice-president of the United Gas & Electric Engineering Corporation, and during the past year he devoted all of his time and energy to the oil developments in the Oklahoma field. There have been few men in the gas, electric and street railway fields who have had a wider circle of friends and acquaintances than did Mr. Dill, in large part because of the great geniality and approachability that were among his prominent traits and endeared him to those who knew him in the different parts of the country where he had lived.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

AGENCY SYSTEM EXTENDED TO CENTRAL STATIONS ON LAMPS

Manufacturers Recognize Utilities as Distributers—Arrangement Will Not Interfere with Free-Renewal Policy

Central lighting stations which through many years have supplied lamps to customers on their circuits in conjunction with the supply of energy have in several cases been led by the attitude of public service commissions to separate their transactions in lamps from their sale of energy. At the same time their disposition to co-operate with local electrical dealers and their desire to maintain a high standard of lighting on their circuits have maintained their interest in the actual distribution of lamps to their energy customers. This condition has led to the entry of central lighting stations into the merchandising field, and the manufacturers of incandescent lamps have recognized the exceptional value of the central lighting station as a distributing medium and have arranged to extend their agency system to include such central stations as are found in this situation. The arrangement contemplates the continuance of the free-renewal policy where desired by the central station.

Therefore, it is the opinion of the manufacturers that central lighting stations may hereafter be engaged in the merchandising of lamps for the manufacturer without neglecting or impairing the technical service of their customers which they have rendered in the past in the matter of maintaining high standards of illumination. By this arrangement the manufacturers believe the interests of both the central station and the consumer will be well conserved.

POST-WAR FOREIGN TRADE COMPETITION MEASURES

German Electrical Manufacturers Laying Aside Surpluses to Be Used Probably in Keeping Down Prices

Ever since the European war started in the summer of 1914 countless rumors have gone out regarding the action that was to be taken by German industries in foreign trade after the war was over. The most persistent rumor has been that German goods would be dumped upon the markets of the world in such quantities as to flood them.

This question has come up recently from another angle and is of such significance that it will bear investigation. The dye manufacturers of the world know full well the methods employed by the German dye manufacturers to secure the control of the dye industry of the world. It was a very simple thing to do and amounted to nothing more or less than putting German goods in foreign markets to be sold at a price less than it cost the domestic manufacturer to produce goods of similar quality Of course, the German manufacturers were losing money on the transaction, but they had prepared for it for a long time and had laid up a reserve to be used for just such a campaign. As a result it was not long before the German manufacturers had this market in their control, and when the war broke out the world found itself at a loss to secure sufficient materials of this character.

Recent investigations show that the German electrical manufacturers have undoubtedly something of the same kind in mind for foreign trade competition after the war is over. It is now definitely known that certain of the more important German electrical manufacturers have since the war began been accumulating large surpluses designated as reserves to be used in after-the-war commerce. Therefore, in view of the past performances of German manufacturers, it is not difficult to read between the lines and understand what German electrical manufacturers have in mind to do as soon as the war is over.

Right now American and English manufacturers are enjoying practically the entire foreign trade of the world in electrical goods, but their prices are high, particularly those of American-made goods. The American foreign trade in electrical goods has virtually doubled since the war began. In order to retain this trade after the war, German competition will have to be met, and if the above indications are finally borne out, then it becomes evident that American manufacturers must employ some similar measures in order to protect their interests in foreign trade as soon as the war is over. American manufacturers are now enjoying a larger business than ever before and are in a position, generally speaking, to lay aside sufficient reserve for just such a contingency.

FOREIGN INCANDESCENT LAMP PRICES ADVANCE

Supremacy of American Lamps in the World's Market Now Seems Assured on Both Quality and Price Basis

Advices received from abroad are to the effect that the principal German lamp manufacturers, including the Allgemeine Electricitäts Gesellschaft, Siemens-Schuckert, Auer company, Bergmann company and Julius Pintsch, have further increased the price of metal-filament incandescent lamps as of May 1. The increase averages 20 per cent. It is also known that Holland manufacturers had definitely decided to increase prices a few months ago. No information could be had relative to an English advance in lamp prices, and the opinion was expressed that since English prices have always been high in all probability the margin of profit has been sufficient not to warrant any increase.

American incandescent lamps, as is well known, have not been increased in price. Although production costs for labor and material have increased, considerable economies of manufacture have been effected so that manufacturers have been enabled to keep costs down sufficiently to be able to continue taking orders at the same low prices.

The higher prices for foreign-made lamps appear to be significant in connection with foreign trade. Germany, of course, now has but little foreign trade. Some German lamps are being shipped to Scandinavian countries and to German allies, and a considerable quantity are said to find their way into Russia. German lamps, it will be remembered, were used almost entirely in Russia prior to the war, and furthermore the sockets used for the most part in Russia are of a design to fit German lamps only. Consequently there is a demand there for German lamps, although the Russian government has imposed a high import tax on them.

England, so far as can be learned, is exporting no incandescent lamps to speak of, and Holland is shipping large quantities of lamps to England and is attempting to cultivate the Scandinavian and Russian markets to the exclusion of some of the other markets at a much greater distance.

Because Germany has been bereft of almost all of her export business the volume of lamp production has fallen somewhat, but in view of the increased domestic market it is doubtful if the decrease in production has been very great. Other foreign manufacturers have been operating under

maximum production conditions. Therefore it is not unfair to assume that prior to the war the lamp prices of foreign manufacturers, except the English, were as low as could be. Furthermore, the price increases would indicate that economies of production had not been effected abroad to the same extent that they have in the United States.

Consequently it seems reasonable to suppose that after prices of labor and material return to lower levels American incandescent lamps will be able to compete in the world markets, not only on a quality basis as formerly, but on a price basis as well. In fact, it will be strange if American lamps do not undersell all foreign-made lamps of anywhere near the same quality.

Exports of American standard incandescent lamps are now running at the rate of 9,000,000 to 10,000,000 lamps a year, in comparison with about 2,000,000 lamps two years ago. Foreign inquiries for American lamps are very large, and right now there are foreign buyers who would place orders for millions of lamps if they could be produced.

American supremacy in the world incandescent-lamp market seems assured. American producers have so perfected their manufacturing processes that there now seems no doubt that better incandescent lamps can be manufactured in the United States at a smaller cost than anywhere else in the world.

ADEQUATE RESERVES HELD AGAINST LOWER PRICES

Average of 33 1/3 Per Cent of Profits Made on Advancing Market Thought to Be Sufficient to Protect Jobbers

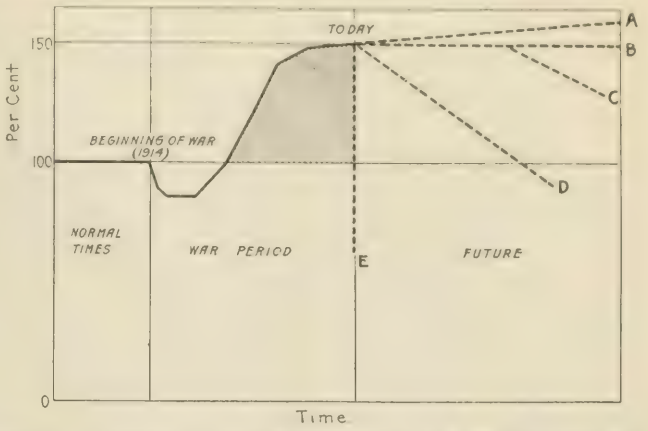
That whatever goes up must come down is axiomatic. The prices of electrical goods have soared within the last two years, and while as yet the peak may not be reached, although it is not thought that prices will go much higher, eventually, when conditions generally return to normal and the nations of the world are again at peace and engaged in a commercial struggle, lower prices will result. While it may be true that the low levels of the period immediately preceding the war will not again become general, it is certain that the prices of that day will be lower than to-day's.

It is just this certainty that prices will eventually become lower that is disturbing the electrical supply jobbing trade to-day. There is no doubt in the jobber's mind that when prices begin to tumble he will lose money directly as the rate at which prices begin to fall and also according to the volume of stock he is carrying. As was shown in the ELECTRICAL WORLD for June 2 and June 9, the supply jobbers of the East—and these figures certainly will be no lower for any other section of the country—have had to lay in an excess stock of 40 per cent in volume, owing to the present conditions of delivery, and the entire investment in stock is now, roughly speaking, 120 per cent greater than under normal conditions, while the increase in the price of goods on the average has amounted to around 50 per cent.

Jobbers generally agree that something must be done to take care of this loss, which will eventually occur, and it is pretty certain that all of the progressive jobbers at least have laid by a reserve fund to meet this contingency or will do so.

During all that period in which prices were advancing rapidly jobbers had an opportunity, by selling at the market, to make large excess profits. They bought the goods when they were low and had an opportunity to sell them after an advance had gone into effect. Of course, it is known that a good many jobbers hesitated to raise their prices until the prices had been raised on them; in fact, some are still hesitating. Goods they bought at the low market they continued to sell at the low market until it was necessary to buy further supplies. For the customer of course this was excellent, but it is certainly extremely doubtful if when prices begin to come down he will show the same courtesy to the jobber and pay high prices for high-priced stock when the market is lower.

The size of the reserve that shall be laid by to take care of the loss resulting from a weakening market depends of course upon individual conditions. Those who are carrying small stock and operating on the principle of very rapid turnover will, of course, not have an occasion to set aside so large a reserve as those carrying larger stock with less rapid turnover. Besides, the character of the stocks will influence the reserve to a certain extent. It is believed, however, by those who have been asked to express an opinion that on the whole a reserve of 33⅓ per cent of the profits during the period in which prices were increasing—the shaded area in the accompanying graph—would, in the



TREND OF PRICES OF ELECTRICAL SUPPLIES WITH RESPECT TO PRICES IN EFFECT AT OUTBREAK OF WAR IN EUROPE

Future prices may follow along *A*, but probably only for a short time. Doubtful if market will drop off suddenly as *E* or even as quickly as *D*. Also doubtful if peak condition will continue indefinitely as *B*. More probable course of market prices is such as is suggested by *C*, namely a continuation of peak conditions for a time and then a more or less gradual falling off.

average case, be an ample reserve to set aside to take care of the losses that will have to be met through a decrease in prices. This is an average figure and anticipates that the drop will be neither too sudden nor too slow. If the drop is very sudden—such as *E* in the graph—in other words, if the bottom absolutely falls out of the market—then, of course, such a reserve would not be adequate; while on the other hand, if the market trails off very, very slowly, as *C* in the graph, and good business conditions can be expected for two or three years after the close of the war, then, of course, the 33⅓ per cent will prove to be more than adequate.

METAL MARKETS CONDITIONS

Copper Is Somewhat Easier, While Other Metals Are Generally on a Firm Basis

Definite action on the part of the government regarding what course it purposes to pursue with regard to its future purchases of metals is having its effect on the metal markets. Copper, which it is expected will be purchased by the government at about 5 cents under the present market, is gradually easing down. Lead, however, is doing just the reverse.

Nominal quotations on electrolytic copper on Tuesday were as follows in New York: June, 32.62½ cents; July, 31.62½ cents; third quarter, 31 cents; fourth quarter, 29.25 cents.

NEW YORK METAL MARKET PRICES

	June 11 Selling Prices Bid	Asked	June 18 Selling Prices Bid	Asked
Copper:	£ s d		£ s d	
London, standard spot	130 0 0		130 0 0	
Prime Lake	31.00 to 32.00†		31.00	to 32.00†
Electrolytic	32.50 to 33.00†		32.50	to 32.75†
Casting	30.00 to 31.00†		30.00	to 31.00†
Copper wire base	37.00 to 38.00†		37.00	to 38.00†
Lead	11.00		11.00	
Nickel	50.00		50.00	
Sheet zinc, f.o.b. smelter	19.00		19.00	
Spelter, spot	9.55 to 9.67½		9.42½	to 9.55
Tin, Straits	60.75†		63.00†	
Aluminum, 98 to 99 per cent.	56.00 to 58.00†		56.00	to 58.00†
OLD METALS				
Heavy copper and wire	28.00 to 28.50		27.75	to 28.25
Brass, heavy	17.50 to 18.00		17.50	to 18.00
Brass, light	14.50 to 14.75		14.50	to 14.75
Lead, heavy	10.00 to 10.25		10.00	to 10.25
Zinc, scrap	7.25 to 7.50		7.00	to 7.25

†Nominal.

Current Prices of Electrical Supplies

NEW YORK AND CHICAGO QUOTATIONS

The prices quoted are those prevailing in standard package or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists to contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

The variation in prices may be due to the difference in grade of products made by different manufacturers, to local conditions or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List, per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

No. 14 solid:	
Less than coil	+10% to $54.90 Net
Coil to 1000 ft.	3% to 48.80 Net
No. 12 solid:	
Less than coil	+10% to 63.90 Net
Coil to 1000 ft.	3% to 56.80 Net

Twin-Conductor

No. 14 solid:	
Less than coil	+10% to $78.00 Net
Coil to 1000 ft.	3% to 75.00 Net
No. 12 solid:	
Less than coil	+10% to 121.00 Net
Coil to 1000 ft.	3% to 108.00 Net

CHICAGO

Single-Conductor

	Net Price
No. 14 solid:	
Less than coil	$51.85 to $67.10
Coil to 1000 ft.	48.80 to 54.90
No. 12 solid:	
Less than coil	60.35 to 78.10
Coil to 1000 ft.	56.80 to 63.90

Twin-Conductor

No. 14 solid:	
Less than coil	$85.00 to $114.40
Coil to 1000 ft.	77.50 to 93.60
No. 12 solid:	
Less than coil	114.75 to 148.50
Coil to 1000 ft.	108.00 to 121.50

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	+20% to 12%
1/5 to std. pkg.	10% to 20%
Std. pkg.	24% to 34%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20% to 12%
1/5 to std. pkg.	Net to 20%
Std. pkg.	34% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.35	$0.35
12 to 50	.30	.30
50 to barrel	.28	.28 to .29
Barrel lots	.24	.25

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.35	$0.35
12 to 30	.30	.30
50 to barrel	.26¼	.27¼ to .29
Barrel lots	.24¾	.25¾

CONDUIT, METALLIC FLEXIBLE

Size. In.	Ft. per Coil	List per 100 Ft.
5/16	250	$5.00
⅜	250	7.50
½	100	10.00
¾	50	13.00
1	50	21.00
1¼	50	26.00
1½	25-50	35.00
2	25-50	45.00
2½	25-50	52.00

DISCOUNT—NEW YORK

	Less than Coil	Coil to 1000 Ft.
⅜-in. single strip		
⅜-in. double strip		
½-in. single strip	Net to 10%	7% to 20%
½-in. double strip	Net to 5%	4% to 15%

NET PER 1000 FT.—CHICAGO

	Less than Coil	Coil to 1000 Ft.
⅜-in. single strip	$71.25 to $75.00	$60.00 to $63.75
⅜-in. double strip	67.50 to 71.25	75.00 to 78.75
½-in. single strip	95.00 to 100.00	80.00 to 85.00
½-in. double strip	100.00 to 105.00	90.00 to 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size. in.	List, per Foot	Size, in.	List, per Foot
7/32	$0.05½	1	$0.25
¼	.06	1¼	.33
⅜	.09	1½	.40
½	.12	1¾	.47
⅝	.15	2	.55
¾	.18	2¼	.65

DISCOUNT—NEW YORK

Less Than $15 List	$15 to 60 List	$60 to $150 List
Net to 33⅓%	45% to 50%	53% to 55%

NET PER 1000 FT.—CHICAGO

	Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.	$36.67	$37.50	$24.75
¼-in.	40.00	30.00	27.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 38

Size, in.	Conduit, List per Foot
¼	$0.08½
⅜	.08½
½	.08½
¾	.11½
1	.17
1¼	.23
1½	.27½
2	.37
2½	.58½
3	.76½

	Couplings. List	Elbows, List
¼	$0.05	$0.19
⅜	.06	.19
½	.07	.19
¾	.10	.25
1	.13	.37
1¼	.17	.45
1½	.21	.60
2	28	1.10
2½	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	¼ In. to ½ In.	¾ In. to 3 In.
Less than 2500 lb.	6% to 8%	8% to 10%
2500 to 5000 lb.	9% to 11%	11% to 13%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ In. to ½ In.	¾ In. to 3 In.
Less than 2500 lb.	3.8% to 7.8%	5.8% to 9.8%
2500 to 5000 lb	6.8% to 10.8%	8.8% to 12.8%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

Net ..... $3.15 to $3.50

CHICAGO

Net ..... $3.10 to $3.85

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	28%
1/5 to std. pkg.	38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	28%
1/5 to std. pkg.	38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	$5.75 to $6.30
1/5 to std. pkg.	4.50 to 5.25

Standard package, 500. List, $0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	$6.25
1/5 to std. pkg.	5.25

Standard package, 500. List, $0.07.

LAMPS, MAZDA

105 to 125 Volts

Regular, clear:	Std. Pkg.	List, Each
10 to 40-watt—B	100	$0.27
60-watt—B	100	.36
100-watt—B	24	.65
75-watt—C	50	.65
100-watt—C	24	1.00
200-watt—C	24	2.00
300-watt—C	24	3.00
Round bulbs, 3½ in., frosted:		
15-watt—G 25	50	.50
25-watt—G 25	50	.50
40-watt—G 25	50	.50
Round bulbs, 3¾ in., frosted:		
60-watt—G 30	24	.72
Round bulbs, 4⅜ in., frosted:		
100-watt—G 35	24	1.05

105 to 125 Volts

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net list
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$30.00 to $35.17
Coil to 1000 ft.	21.00 to 26.73

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$37.20 to $38.16
Coil to 1000 ft.	27.90 to 28.62

LAMP GUARDS, WIRE

Standard packages from 50 to 150.

NEW YORK

Net per 100	$18.00 to $29.00

CHICAGO

Net per 100	$20.00 to $28.35

OUTLET BOXES

Nos.	List, per 100
101—A, A1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200 S.E., 300, A.X. 1½, 4 S.	30.00
103—C.A., 9, 4 R., B 1½	25.00
106—F.A., 7, C.S. 1½, 3 R.	20.00

DISCOUNT—NEW YORK

Less than	Black	Galvanized
$10.00 list	List to 33%	List to 27%
$10.00 to $50.00 list	42%	18% to 37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	40%	35%
$10.00 to $50.00 list	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	$14.00 to $20.00
1/5 to std. pkg.	13.00 to 15.80

Standard package, 2200. List per 1000, $20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	$14.00
1/5 to std. pkg.	13.00

Standard package, 2200. List per 1000, $20.

PORCELAIN KNOBS

NEW YORK

Per 1000 Net	5½ N.C.—Solid Std. Pkg. 3500	Nail-It—N.C. Std. Pkg. 4000
Less than 1/5 std. pkg.	$10.50 to $24.30	$21.10
1/5 to std. pkg.	9.75 to 12.15	28.00

CHICAGO

Per 1000 Net	5½ N.C.—Solid Std. Pkg. 3500	Nail-it—N.C. Std. Pkg. 4000
Less than 1/5 std. pkg.	$8.40 to $10.50	$28.00
1/5 to std. pkg.	7.80 to 9.75	21.50

SOCKETS AND RECEPTACLES

	Std. Pk.	List
⅛-in. cap key and push sockets	500	$0.33
⅛-in. cap keyless socket	500	.30
⅛-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15 to 20%

DISCOUNT—CHICAGO

Less than 1/5 std. pg.	Net list
1/5 to std. pkg.	15%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

Perkins or Trumbull Type A:	List
30-amp. S. P. S. T.	$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Perkins Type or Trumbull Type C:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

Less than $10 list	
$10 to $25 list	11% to 16%
$25 to $50 list	14% to 24%

DISCOUNT—CHICAGO

Less than $10 list	+5%
$10 to $25 list	11% to 16%
$25 to $50 list	14% to 24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single pole	250	$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp., three-point	100	.56
10-amp., three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	15%
Std. pkg.	25%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg: List	20% to net list
1/5 to std. pkg.	Net list to 15%
Std. pkg.	30%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar	List, Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

Less than	Black	Galvanized
$2.00 list	Net to 23%	Net to 18%
$2.00 to $10.00 list	23% to 50%	18% to 40%
$10.00 to $50.00 list	23% to 60%	18% to 52%

DISCOUNT—CHICAGO

Less than	Black	Galvanized
$2.00 list	25% to 50%	20% to 40%
$2.00 to $10.00 list	25% to 50%	20% to 40%
$10.00 to $50.00 list	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

Net price	$2.10 to $3.50

CHICAGO

Net price	$2.80 to $3.50

WIRE, ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.52 to $0.62
No. 18, full spools	0.48 to 0.53

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.565 to $0.6885
No. 18, full spools	0.495 to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$15.00-18.00	$12.00-14.50	$11.50-12.50
12	21.06-27.05	18.96-22.85	18.01-20.95
10	29.60-39.27	26.64-33.66	24.68-25.31
8	42.40-51.44	38.16-48.42	33.51-36.25
6	72.19-89.57	64.98-76.80	56.63-61.73

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$18.00	$16.00	$14.00
12	25.92-29.89	21.96-25.62	19.44-23.48
10	36.48-42.28	30.84-36.24	27.36-33.22
8	43.80-52.24	40.15-47.25	39.18-47.25
6	69.24-88.72	63.47-77.63	56.55-66.54

WIRE, WEATHER-PROOF

Solid-Conductor, Triple-Braid, Sizes 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	$40.25 to $45.00
25 to 50 lb.	39.25 to 42.00
50 to 100 lb.	38.00 to 38.25

CHICAGO

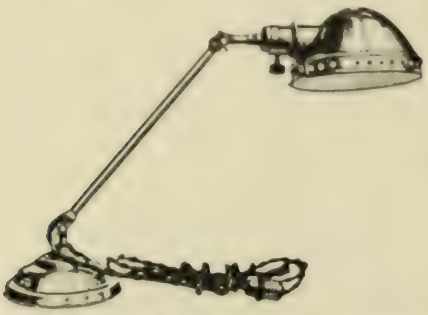
	Per 100 Lb. Net
Less than 25 lb.	$40.35 to $45.50
25 to 50 lb.	41.35 to 44.50
50 to 100 lb.	40.35 to 43.50

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Light Diffuser

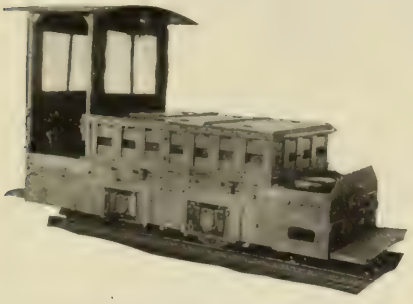
The F. H. Trimble Manufacturing Company of Los Angeles, Cal., has developed the light diffuser shown in the accompanying illustration. This device throws a soft light, doing away with all glare. It is made in different sizes, and can be attached to any metal shade. The metal part is brushed-brass finish, and the glass is sanded.



DIFFUSER THAT FITS ANY METAL SHADE

An Industrial Electric Locomotive

An industrial electric locomotive, which is provided with a canopy for the trip-rider and which has a single-charge rating of 240 ton-miles (3.46 t.-km.) on the level, is being manufactured by the Jeffrey Manufacturing Company of Columbus, Ohio. The battery consists of 63 A-10 Edison cells, having a rated output of 28 kw.-hr. If the battery is boosted at the normal rate for one hour in the middle of the ship, it is claimed that it will handle 300 ton-miles (4.33 t.-km.). Totally inclosed double-reduction type motors are used, each having a rating of 160 amp. for one hour. The journal box is of special construction to take inthrust of the wheels and axles. A steel pin in the end of the axle bears against a plate in the head of the journal box, thus eliminating the wear between the wheel hubs and the journal boxes.



LOCOMOTIVE ADAPTED TO OPERATION DURING LOW TEMPERATURES

The Jeffrey company is also making a truck equipped with a single motor with chain drive between axles, and a battery of 63 A-4 Edison cells, or 48 M.V. 9 Ironclad Exide cells. One of the features of this truck is the lack of projecting parts. The headlight is set in the end frame and is provided with a very thick lens. This position minimizes the chance of damage and provides good light on the track ahead of the operator. Protection to the operator is afforded by the arrangement of the driving end of the truck. The weight of the truck complete is 2.5 tons (2.25 t.). It is claimed that on the average a performance of 100 ton-miles (144 t.-km.) is obtained with a single charge of the battery.

Projector Using a Gas-Filled Lamp

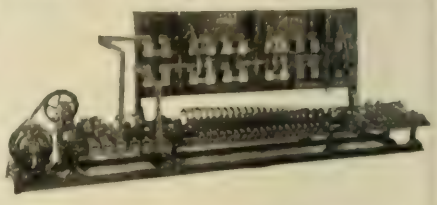
A projector for use in protective floodlighting and designed to use a gas-filled tungsten lamp is being manufactured and marketed by the Luminous Unit Company of St. Louis, Mo. A simple focusing arrangement is provided by means of which it is possible to adjust the light ray from a narrow searchlight beam to a wide flood of light, as conditions may require. By means of an external control it is possible to make this adjustment quickly. Two sizes are available, ranging in capacity from 200 to 500 watts. The large size is arranged for mounting on ¾-in. (19-mm.) pipe, while the small style is designed for ½-in. (12.7-mm.) pipe.



FLOODLIGHTING PROJECTOR WITH ADJUSTABLE-DISPERSION BEAM

Remote-Control Switch for Sign Flasher

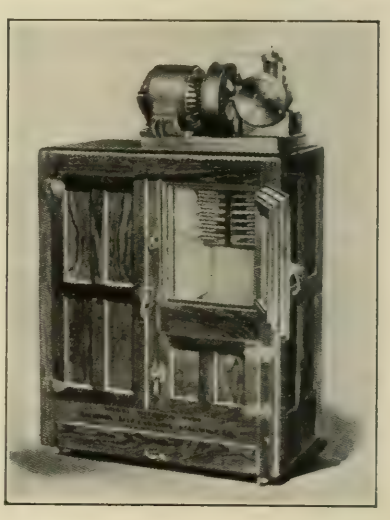
A remote-control switch for use with electric sign flashers is being manufactured by the Betts & Betts Corporation, 511-513 West Forty-second Street, New York City. One of the advantages claimed for this switch by the manufacturers is that it is impossible to burn out the magnet or center of the switch. One magnet is used for opening the circuit and one for closing. The contacts are interchangeable and secured by one screw, making it easy to introduce changes in the flashing order and to install new sectors.



MAGNETIC SWITCHES ON FLASHERS

Household Refrigerator

Motor-driven refrigerating apparatus that can be placed on top of an ordinary ice box is being manufactured by the National Self-Cooling Machine Company of Youngstown, Ohio. It consists essentially of a motor driving a compressor and a fan. These units are arranged with unusual compactness. As the pump draws the refrigerating fluid from the refrigerator into the radiating coil the fan blows air away from the coil and over the compressor. Thus the fan does double duty. A pressure regulator or

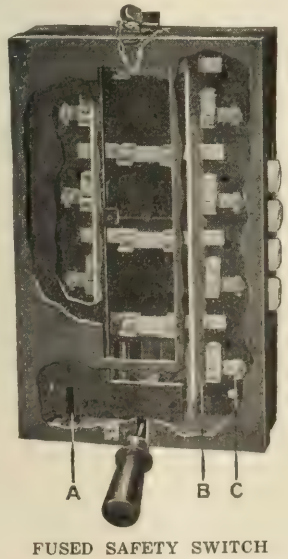


DOMESTIC REFRIGERATING SET

controller breaks up the fluid into a fine gas as it enters the expansion chamber or cooling coils. A thermostat regulates the temperature of the refrigerator and is ordinarily set at 38 deg. or 40 deg. Fahr. (3.3 deg. or 4.4 deg. C.). It controls the motor, which under usual conditions runs from three to six minutes in every hour. The pressure to which the fluid is compressed is about 60 lb. (4.2 kg. per square cm.), but the machine has a factor of safety of about seven. An ice-making attachment that will make enough ice for the general requirements of the household is supplied with the device. The refrigerating fluid is not inflammable and will not support combustion. Furthermore it is not poisonous to inhale. The manufacturer points out that the refrigerating unit contains no chains or belts and that practically all moving parts operate in oil.

Safety Switches

Fused switches the current-carrying parts of which are inclosed in cabinets which prevent access thereto when operating the switch or re-fusing the cut-outs have been developed by the Palmer Electric & Manufacturing Company, 62 K Street, Boston, Mass. From the accompanying illustration, which shows sections of the different parts of one switch, it may be seen that the switch blades are carried by a panel which also supports the fuses, the panel being moved up or down by a handle protruding through the cover, thus opening or closing the switch. When the contacts are closed the current-carrying parts of the fuses and the knife blades are covered by a shutter in the front of the cabinet. This shutter cannot be opened to expose the fuses except by opening the switch, in which position it is held until the shutter is again closed. Barriers on each side of the



FUSED SAFETY SWITCH

panel opening prevent access to the "live" parts when the contacts are open. With this construction it is obvious that when the switch is open the fuse terminals must be "dead," as the shutter positively interlocks with the switch handle. When the fuses are exposed the barriers at each side of the panel opening effectively prevent access to any energized part.

Temperature Indicators for Electrical Apparatus

Temperature indicators have been developed by the General Electric Company of Schenectady, N. Y., which when used in conjunction with temperature coils in electrical apparatus afford a convenient and rapid means of indicating continuously at the switchboard the temperature of various portions of the windings of electrical apparatus under various conditions. The indicator is a direct-current differential indicator with three terminals. Its operation depends on the variation of resistance of a copper resistor placed in a slot of the machine stator in contact with the insulation of the winding, or in any loca-

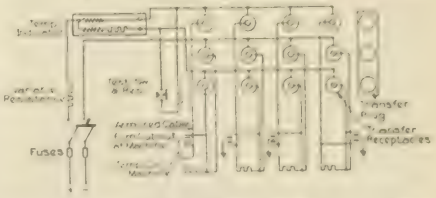


TEMPERATURE INDICATOR MOUNTED ON SWITCHBOARD

tion external or internal where the resistor may be protected from the conductors by suitable insulation. Four temperature coils are used on machines rated at 500 kva. to 3125 kva., two of the coils being considered as spares. Above 3125 kva. six coils are used, three of which are spares.

One of the windings of the temperature indicator is in series with a coil of manganin, having a resistance equal to that of the temperature coils (usually at 80 deg. C.) The other winding is in series with the temperature coil itself. When the temperature in the upper coil rises, the current in the branch of the circuit including the temperature coil decreases, causing a corresponding deflection toward the higher temperature end on the indicator scale. The reverse action occurs when the temperature of the temperature coil falls. The scale of the standard instrument has a range of 20-120 deg. Fahr., or 0-90 deg. C., marked in 1-deg. divisions.

The temperature coils are made of copper wire wound in a thin form and pressed flat so as to be non-inductive. Terminal boxes are provided for attaching to each machine. Above each terminal box is a protective device which protects the operators and the apparatus in case a coil becomes grounded to the power winding. The protective



WIRING PLAN OF TEMPERATURE INDICATOR

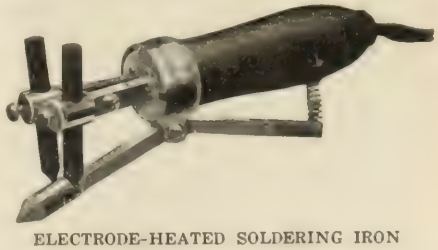
equipment consists of six pairs of film-disk cut-outs supported by spring clips with a grounding connection between them, the spring clips being connected to the terminals of the coil. Abnormal pressure between the temperature coil and ground breaks down the corresponding film and thus brings that particular circuit to ground potential.

To permit compensating for variations in the voltage of the supply circuit a variable resistance with a dial switch and index is furnished. A single-pole, single-throw pole button test switch is provided on the indicator board to connect the resistance in muliple with any of the temperature coils. If the outfit is in proper working order when this is done, the indicator will show a reduction in reading.

Special three-point receptacles and plugs are used to permit transferring the connections of the temperature indicator to any of the coils in the machine winding. The center point of each plug is made shorter than the other two, so that the circuit is broken before the instrument is disconnected from the coil.

Soldering Iron

A copper-pointed soldering iron which is heated by the contact resistance, with two carbon electrodes, or more specifically by the white heat produced at the electrode tips, is being manufactured by the Clemens Electrical Corporation of Buffalo, N. Y. The copper point is brought in contact with the electrodes by releasing a catch on the spring. The iron may be heated ready for use in less than two minutes, it is claimed. The outfit is designed for tinning, running of seams and soldering of low-fusing metals such as zinc



ELECTRODE-HEATED SOLDERING IRON

and lead. Two sizes are put out, one requiring 60 watts and the other 150 watts. Any special pointed copper can be attached to this soldering iron. To heat these irons only 5 to 7 volts is used, transformers being provided to give this low voltage.

Trade Notes

THE FRANKEL CONNECTOR COMPANY, INC., has moved its salesrooms to 1140-1146 Broadway, New York City.

THE ROSS POWER & EQUIPMENT COMPANY has been appointed Indianapolis representative of the Lincoln Electric Company, with offices at 617 Merchants' Bank Building, Indianapolis.

THE NEW-WAY MOTOR COMPANY, Lansing, Mich., has added to the list of service stations the following: Hubbard & Floyd, New York City; T. T. Burchfield, Philadelphia; Frank & Allan, Chicago.

CHRISTIAN E. BROWN, for a number of years with the Western Electric Company and later at the Edison Laboratory, is now chief engineer for the American X-Ray Equipment Company and the General Optical Company, and will specialize in the development of X-ray, high-frequency and scientific apparatus.

THE PACKARD ELECTRIC COMPANY, Warren, Ohio, at a recent meeting of directors, named the following officers for the coming year: President, N. A. Wolcott; vice president, Charles Fillius; secretary, R. E. Gorton; treasurer, N. A. Wolcott. Mr. Wolcott, the new president, has been associated with the Packard organization in the position of treasurer for the last fourteen years. No immediate change in the company's policy is contemplated by the new officers.

FRANCIS C. SHENEHON, for the last eight years dean of the College of Engineering of the University of Minnesota and head professor of civil engineering, has opened offices in the New Metropolitan Bank Building, Minneapolis, and will give his entire attention to his practice as a consulting hydraulic engineer. Mr. Shenehon will specialize in water power, water supply, sewerage and sewage disposal, river improvements, docks and terminals, flood control and drainage. He will also give attention to settlement of engineering controversies and act as counsel in litigation involving engineering matters.

THE PACKARD ELECTRIC COMPANY, Warren, Ohio, has purchased a group life insurance contract which insures the life of every employee for the amount of one year's salary. The insurance increases with salary increases and also provides an increase of $100 for each year of service after Dec. 1, 1916, with a maximum increase of $500. The premiums are paid wholly by the company and have no bearing whatever on any of the welfare activities of the employees themselves. The benefits derived from this insurance feature are in addition to those provided for by the Ohio compensation law. In addition to the distribution of the insurance policies those employees who have been with the company for five years or more received bonuses, the size of the bonus being governed by the number of years each recipient had been connected with the company.

WESTINGHOUSE COMPANY ERECTS BUILDING FOR BACHELOR EMPLOYEES.—In connection with the working out of plans to better in every way possible the working and living conditions surrounding its employees the Westinghouse Electric & Manufacturing Company has just completed the erection of a building at East Pittsburgh for housing bachelor workmen. This building, which has been christened Hill Lodge, is two stories high in front and three in the rear and is designed to accommodate 130 men besides the steward and his assistants. All the rooms except six will accommodate four men, and each is equipped with a single bed for each man, a table and chairs. The other rooms are equipped for two men each. Bedding and towels are furnished by the company. Kitchen, pantry, storeroom and dining room large enough to seat all the boarders at one time are in the basement. Adjacent to the dining room are compartments in which each man may place his dinner pail, so that it may be cleaned and left ready for the next morning. Breakfast and dinner are served every day, and the mid-day meal on Saturdays and Sundays, in the dining room. On the other days lunches are taken out in the dinner pails. In the basement are also the living quarters of the superintendent and his assistants. The entrance room, office, lavatories and shower baths are on the first floor. The building is steam-heated and fire protection is afforded. Four large porches provide ample space for the men to gather to enjoy the outdoor air. Employees are assigned to the lodge by the employment department of the company upon request. A nominal weekly charge is made for the accommodations furnished.

LAWFORD GRANT has been appointed managing director and treasurer of the Eugene F. Phillips Electrical Works, Ltd., Montreal.

A. PRESS, consulting engineer and patent attorney, has changed his address from Norman, Okla., to 1777 Broadway, New York City.

THE EDISON LIBERTY LOAN CLUB, formed of employees of Thomas A. Edison, Inc., and affiliated companies, Orange, N. J., has oversubscribed its pledge of $500,000 by $560,000, making a total subscription of $800,000, or almost $100 for every employee connected with the Edison interests.

STRACHAN, OSWELL & COMPANY, LTD., of 6 Broad Street Place, London, E. C., have formed a subsidiary company under the title of Strachan, Oswell & Jepson, Inc., with offices at 32 Broadway, New York City, following the precedent established by several British export houses that have opened big branches in New York City. Strachan, Oswell & Company, Ltd., have been established in London for nearly twenty years, trading with South Africa, Mauritius, the Strait Settlements and China, in which countries they have extensive organizations. The New York branch will work on the same lines as the London house, both as buying agent for firms abroad and as selling agent for American manufacturers. It handles machinery and electrical supplies and conducts a general export commission business.

Trade Publications

ANCHORS.—The W. M. Matthews & Brother Company of St. Louis, Mo., is distributing a folder descriptive of its "Scrulix" anchors.

MOTORS.—The Universal Motor Company, Oshkosh, Wis., is distributing a mailer descriptive of its Universal 4-kw. generator set.

GRINDERS.—The Stow Manufacturing Company of Binghamton, N. Y., is distributing a folder descriptive of its grinders and portable tools.

STOVES.—The Allmur Manufacturing Company, Marion, Ind., has prepared a leaflet descriptive of its Allmur automatic electric cook stove.

REDMANOL.—The Redmanol Chemical Products Company, 636 West Twenty-second Street, Chicago, has prepared a bulletin descriptive of its Redmanol molding compounds, impregnating liquids and transparent Redmanol.

EXPANSION JOINTS.—The Ross Heater & Manufacturing Company, Inc., of Buffalo, N. Y., is distributing a folder descriptive of its crosshead-guided expansion joints, for high or low pressure, high or low temperature.

GLASSWARE.—"Street-Lighting Glassware" is the title of a new bulletin recently prepared by the Gleason-Tiebout Glass Company of Brooklyn, N. Y. The bulletin presents a new departure in illustrating this type of glassware by printing it in imitation of blueprints.

LAMPS.—The Westinghouse Lamp Company of New York City has prepared a book of engineering data on incandescent lamps to supersede all data books of prior dates. This company has also prepared an incandescent-lamp data book for agents and purchasers. Price schedules of large Mazda and metallized filament lamps are also given.

ELECTRICAL EQUIPMENT.—The General Electric Company, Schenectady, N. Y., has issued bulletins on the following subjects: Electrical equipment for heating industrial ovens, individual vehicle taper charging set with automatic panel, "Tungar" rectifier, temperature indicators, aluminum lightning arresters for alternating-current circuits, ventilated commutating-pole railway motor, type G.W. 203—P, index to descriptive bulletins and sheets.

SYNCHRONOUS MOTORS.—A bulletin explaining the characteristics, the uses and the advantages of synchronous motors in comparison with induction motors has been prepared by the Electric Machinery Company, Minneapolis, Minn. It gives photographic reproductions of machines illustrating practical applications of motor drive. The subject of power factor and power-factor correction is explained in a simple and understandable way. Charts showing the operation of certain sizes of synchronous motors on systems of lagging power factor are given.

New Incorporations

THE KINGSTON (OKLA.) ICE & LIGHT COMPANY has been incorporated with a capital stock of $20,000 by J. F. Wilkins and others.

THE HOUSTON (TEX.) STORAGE BATTERY COMPANY has been incorporated with a capital stock of $2,500 by E. S. Van Dyke, M. I. Keller and C. B. Clayton.

THE CAREY ELECTRIC & MILLING COMPANY of Spring Grove, Ill., has been incorporated with a capital stock of $5,000 by Walter Carey, B. Carey and J. E. Carey, to furnish electricity for lamps and motors in Quincy.

THE SHEPHERD-RUST COMPANY of Wilkes-Barre, Pa., has been incorporated with a capital stock of $75,000 to manufacture lighting fixtures. The company works are located at 42 West Market Street, Wilkes-Barre, Pa.

HOLLOWAY, BENTZ & COMPANY of New York, N. Y., have been chartered with a capital stock of $5,000 to do a general electrical business. The incorporators are: Charles B. Bentz, Russell C. Bentz and Walter A. Van Ness.

THE WAGNER ELEVATOR COMPANY of New York, N. Y., has been incorporated by Mahnus Tornquist, Frederick Wagner and Gustave Lienhard. The company is capitalized at $3,000 and proposes to install elevators, pumps and motors.

THE HURLBURT GASOLINE ENGINE COMPANY of New York, N. Y., has been incorporated by G. P. Hurlburt, Louis M. Eiller and Herbert H. Maass. The company is capitalized at $5,000 and proposes to manufacture motors, turbine engines, etc.

THE DUGAN-FOERST ENGINEERING COMPANY, Twenty-second Street, Bayonne, N. J., has been incorporated by John J. Foerst, J. E. and John J. Dugan. The company is capitalized at $25,000 and proposes to do a general electrical engineering business.

A. SHEMEL & COMPANY of New York, N. Y., has filed articles of incorporation with a capital stock of $30,000 to deal in electrical supplies and machinery. The incorporators are: M. Zucker, M. S. Hoham and A. Shemel, 11 West 113th Street, New York, N. Y.

THE PERMALIFE STORAGE BATTERY COMPANY of Poughkeepsie, N. Y., has been incorporated with a capital stock of $1,000,000 to manufacture storage batteries and electrical machinery. The incorporators are: E. P. Sheehy, E. T. Coffin and G. Pagnani.

THE OIL FIELD WATER, LIGHT & POWER COMPANY of Cushing, Okla., has been organized with a capital stock of $250,000 for the purpose of furnishing electricity for lamps and motors in Drumright, Cushing, Yale, Stillwater and other towns in this vicinity.

THE NORTHWESTERN IOWA POWER COMPANY of Clermont, Iowa, has been incorporated with a capital stock of $750,000 for the purpose of developing a water power plant. The officers are: Christian Miller, president, and Howard C. Runyeon, secretary, both of Clermont.

THE AIR ENGINEERING COMPANY, 225 Main Avenue, Passaic, N. J., has been chartered with a capital stock of $25,000 to carry on a general electrical engineering business. The incorporators are: Edward T. Moore, Thomas Foxhall of Passaic, and John H. Thomas of Belleville, N. J.

THE NATIONAL ELECTRIC VENDING COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $500,000 to manufacture and sell automatic vending machines. The incorporators are: Leonard L. Cowan, R. Montgomery and B. F. Cowan of Chicago, Ill.

THE KANSAS LIGHT & POWER COMPANY of Augusta, Me., has filed articles of incorporation under the laws of the State of Maine with a capital stock of $100,000, to acquire, install and operate electric-light and power plants, etc. The incorporators are H. A. Carmichael of Duluth, Minn.; R. W. Ferris and L. J. Coleman of Augusta, Me.

THE CHEYENNE VALLEY LIGHT & POWER COMPANY of Valley City, N. D., has been incorporated with a capital stock of $50,000 by K. G. Schmidt of Grand Forks; R. M. Stee of Dazey and L. C. Thomas of Fargo. The company proposes to erect electric transmission lines and supply electricity in Cheyenne Valley, including Dazey, Sanborn and Rogers.

New England States

BURLINGTON, VT.—Owing to the excessive cost of coal the commissioners of the municipal electric-light plant are considering purchasing energy from the Burlington Light & Power Company to operate the municipal system.

BOSTON, MASS.—The Boston Elevated Railway Company has awarded a contract to the Union Switch & Signal Company for signal apparatus to be installed in the Dorchester subway extension of the East Boston subway. The equipment will include double impedance bond layouts, track transformers, automatic train stops, style L, three-lens light signals, etc.

CAMBRIDGE, MASS.—Steps have been taken by the residents of Riverbank Court, Technology and others to secure the extension of the ornamental lighting system from Lafayette Square to the Harvard Bridge.

CHELSEA, MASS.—The Edison Electric Illuminating Company of Boston has petitioned the Board of Aldermen for permission to lay underground conduits and cables on Crescent Avenue, between Eastern Avenue and Mill Street.

DUNSTABLE, MASS. — Arrangements are being made by the Connecticut River Valley Power Company to extend its electric transmission lines to Dunstable to establish an electrical service in the town. The Tyngsboro Electric Light Company now furnishes electricity here.

FRANKLIN, MASS.—Right of way is being secured by the Union Light & Power Company of Franklin for the erection of a high-tension transmission line from Foxboro to North Attleboro. Additional power is needed to meet the demands in North Attleboro.

MILFORD, MASS.—The Milford & Uxbridge Street Railway Company expects to place contracts for two 750-kw. rotary converters and one 300-kw. rotary converter with transformers and switchboards in the near future.

PLYMOUTH, MASS.—Preparations are being made by the Plymouth Electric Light & Power Company to establish a switching station near West Ponds, where the circuits of the company branch out to Middleboro, Chiltonville, the Cape Cod Canal and Marion. A private telephone line is to be erected from the power plant to switching station.

SHELBURNE FALLS, MASS.—The New England Power Company has petitioned the Board of Gas and Electric Light Commissioners for permission to issue $4,000,000 in additional capital stock and $3,000,000 in bonds, the proceeds to be used for extensions and improvements to its property. The company operates through western Massachusetts and southern Vermont and distributes electricity as far south as Woonsocket, R. I.

SOMERVILLE, MASS.—The installation of an ornamental lighting system on Highland Avenue, between Central and Cedar Streets, is under consideration.

WESTFIELD, MASS.—The Westfield Power Company has closed its electric generating plant and will purchase energy from the Municipal Light Department during the summer.

PROVIDENCE, R. I.—The City Council has granted the Providence Telephone Company permission to construct underground conduit extensions in Walnut and Burrill Streets.

NEW HAVEN, CONN.—Work has begun on the erection of an addition to the power house, 41 ft. by 42 ft., one story, at the local plant of the American Steel & Wire Company on Fairmount Avenue.

SEYMOUR, CONN.—The Seymour Electric Light Company has petitioned the Public Utilities Commission for permission to lease the property of the Beacon Falls Electric Company.

Middle Atlantic States

BUFFALO, N. Y.—The City Council has indorsed a bill which would create a State hydroelectric commission, similar to that of the Province of Ontario. The bill also provides for the development of power at Niagara Falls, N. Y., by the State.

CORFU, N. Y.—The residents of the village of Corfu have voted to install an electric-lighting system.

FREDONIA, N. Y.—Extensions and improvements involving an expenditure of $120,000 contemplated by the Niagara & Erie Power Company have been approved by the Public Service Commission. The work will include the extension of the Fredonia distribution system (4000 volts) to the east line of Pomfret and to Sheridan. The Angola system will be extended to the towns of Evans and Hamburg. The Gardenville substation will be equipped to furnish 22,000 volts to the street-lighting system and to the distribution system of the Depew & Lancaster Light, Power & Conduit Company. A 4000-volt distribution line will be erected from the substation on the grounds of the Atlas Crucible Steel Company to the municipal power plant of Dunkirk.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

LE ROY, N. Y.—The LeRoy Electric Porcelain Company has awarded contract for four new kilns and other equipment to increase the output of its plant.

NEW YORK, N. Y.—The Interborough Rapid Transit Company will install at its Seventy-fourth Street station a new 60,000-kw. generating unit, consisting of a high-pressure and two low-pressure turbines, each coupled to a generator. The equipment will be furnished by the Westinghouse Electric & Manufacturing Company.

NEW YORK, N. Y.—Bids will be received by the Board of Water Supply, twenty-second floor, Municipal Building, New York City, until July 10, for fitting up a chemical and bacteriological laboratory, including the furnishing and installing of fixtures, piping and lighting, ventilating and drainage systems. The laboratory is located in the lower gate chamber of Ashokan reservoir in the town of Olive, Ulster County. Drawings, etc., may be obtained at the office of the secretary upon deposit of $10 for each pamphlet. Further information may be obtained at the office of the principal assistant engineer at the above address.

JERSEY CITY, N. J.—The Delaware, Lackawanna & Western Railroad Company is planning to build a new boiler plant in connection with the roundhouse and shops to be erected on Sixteenth Street. The cost of the proposed work is estimated at $50,000.

LIVINGSTON, N. J.—At an election held recently the proposal to install a street-lighting system was carried.

NEWARK, N. J.—The Board of Freeholders has approved a fund of $25,000 in addition to the recent appropriations, totaling about $165,000, for improvements and new equipment for the power plant at the Essex County Hospital at Overbrook.

ROSELAND, N. J.—Bids will be received by the committee on street lighting until July 13 for lighting the streets of the borough. The plans provide for 32 lamps. E. Oscar De Camp is borough clerk.

SOUTH RIVER, N. J.—Plans are being considered by the Borough Council and the Board of Public Works for increasing the output of the municipal electric-light plant.

TRENTON, N. J.—Work has begun on the construction of the proposed new plant of the Imperial Porcelain Works of Trenton near Neptune City. The buildings will be 130 ft. by 250 ft., and 50 ft. by 150 ft., and will be used for the manufacture of electric porcelain goods.

TRENTON, N. J.—The Delaware & Atlantic Telegraph & Telephone Company is planning to erect new trunk lines to Wrightstown, the site for the United States Army Department. A large local exchange station will be installed, equipped with about 10 switchboards and auxiliary apparatus. An electric-lighting system will be installed at the camp.

BEAVER FALLS, PA.—Plans have been submitted to the City Council by W. G. Westphal, illuminating engineer of the Duquesne Light Company of Pittsburgh, for the installation of an ornamental lighting system on Seventh Avenue.

BENTON, PA.—Application has been made to the Public Service Commission by the Benton Hydro-Electric Company for permission to issue $75,000 in bonds for improvements, etc., to its system.

ORRTANNA, PA.—The Orrtana Electric Light & Power Company has applied to the Public Service Commission for permission to issue $11,000 in capital stock, the proceeds to be used for improvements.

PHILADELPHIA, PA.—Plans are being considered by Baugh & Son Company, manufacturer of chemicals, oils, etc., for the construction of an addition to its engine plant at its works on the Morris Street wharf.

PHILADELPHIA, PA.—Contract has been awarded by the Philadelphia Electric Company to the John R. Wiggins Company of Philadelphia for the construction of an addition to its substation on Schuylkill Avenue.

PHILADELPHIA, PA.—Contract has been awarded by C. & H. Barnett, 1078 Frankford Avenue, Philadelphia, manufacturer of files, for the construction of a new boiler plant, 30 ft. by 70 ft., one story high, at their factory.

PHILADELPHIA, PA.—The Penn Chemical Company has awarded a contract to Nickson, Duggan & Company of Philadelphia, for construction of a power house, 40 ft. by 100 ft., to be erected at its new factory. The cost of the new plant is estimated at about $75,000.

PHILADELPHIA, PA.—The M. J. Roche Construction Company, Johnson Building, Cincinnati, Ohio, has been awarded the contract for the construction of an electric power plant, 100 ft. by 250 ft., at the League Island Navy Yard, Philadelphia. Also for the construction of a similar plant at Norfolk, Va.

PHILADELPHIA, PA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 25 for an electric-lighting system for the structural shop at the navy yard at Philadelphia. Drawings and specifications (No. 2415) can be obtained on application to the bureau or the commandant of the navy yard named.

PHILADELPHIA, PA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 2 for a ventilating system, including blowers, motors, plenum chambers, ventilators, air ducts and accessories, in building 17, at the United States Navy Yard, Philadelphia, Pa. Drawing and specification (No. 2424) may be obtained on application to the bureau or to the commandant of the navy yard named.

PITTSBURGH, PA.—Plans have been filed by the Duquesne Light Company for improvements to its building at Broad and Beatty Streets, to cost about $17,000.

WEST CHESTER, PA.—The Philadelphia Suburban Gas & Electric Company, it is reported, has purchased the coal yards of Isaac H. Bailey, adjoining its property in West Chester.

WILLIAMSTOWN, PA.—The Lykens Valley Light & Power Company has filed notice of an issue of $11,000 in bonds, the proceeds to be used for improvements.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 23 for construction of addition to the nautical instrument repair shop, including electrical work, at the Naval Observatory, Washington, D. C. Drawings and specification (No. 2409) can be obtained on application to the bureau.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations as follows: Puget Sound, Wash., Schedule 1250—72 spools of silk insulating tape. Various, Schedule 1223—miscellaneous seamless voice brass tubing. Brooklyn, N. Y., Schedule 1244—one motor-driven, 24-in. upright drill, one motor-driven grindstone, one motor-driven back-geared, screw-cutting tool-room lathe, one variable-speed, motor-driven milling machine. Charlestown, W. Va., Schedule 1252—eleven 36-in. by 20-ft. motor-driven, triple-geared lathes, four motor-driven, heavy-duty, 24-in. turret machines. Washington, D. C., Schedule 1242—one motor-driven milling machine. Chelsea, Mass.—Schedule 1240—one universal woodworking machine. Applications for proposal blanks should designate the schedule desired by number.

North Central States

MONROE, MICH.—At an election held recently the citizens voted to grant the Detroit Edison Company a 30-year franchise to furnish electricity in Monroe. Under the terms of the franchise the company will purchase the municipal electric plant for $83,300.

ST. JOHNS, MICH.—Investigations are being made by the Board of Public Works with a view of enlarging the municipal electric-light plant and installing new machinery, at a cost of from $30,000 to $40,000.

CINCINNATI, OHIO.—Plans are being prepared for the erection of a substation, 75 ft. by 100 ft., for the Union Gas & Electric Company. Sargent & Lundy of Chicago, Ill., are consulting engineers.

CINCINNATI, OHIO.—Plans have been completed by Stetgner & Hughes, architects, for the construction of a coal bunker

with a capacity of 1100 tons for the Richardson Paper Company of Lockland. The specifications call for a considerable amount of conveying machinery.

CINCINNATI, OHIO.—The Thum & Wing Paper Goods Company has awarded a contract to the M. Marcus Building Company for the construction of a combination power plant and garage building in connection with its works on the Eighth Street Viaduct. Fiehs & Lee are architects.

ELMWOOD PLACE, OHIO.—The Union Gas & Electric Company of Cincinnati has awarded a contract to the Ferr Concrete Construction Company for the construction of an electrical service station at Elmwood Place. The building will be 60 ft. by 150 ft., and is one of the improvements planned by the company in connection with the building of its new generating station on the river front.

NEW PHILADELPHIA, OHIO.—The Wise McClung Manufacturing Company, recently incorporated with a capital stock of $500,000 to manufacture electric vacuum sweepers, has taken over the foundry of the Rath Aluminum Company and is planning to erect an addition to the building. W. A. Wise is president and general manager.

NILES, OHIO.—The Ohio Steel Products Company has recently contracted with the Trumbull Public Service Company for energy to operate its local plant. The capital stock of the Ohio steel company has been increased from $70,000 to $100,000, the proceeds to be used for improvements and extensions to its local plant.

SPRINGFIELD, OHIO.—The Ohio Electric Railway Company, it is reported, contemplates extending its system from Cincinnati to Defiance.

YOUNGSTOWN, OHIO. — The steam heating plant of the Mahoning County Light Company and the Youngstown Heating Company, both of Youngstown, serving a number of large buildings with steam for heating and other purposes, has been taken over by the Mahoning & Shenango Railway & Light Company, which will give the same service next winter from one of its own plants.

HENDERSON, KY.—The City Council has adopted an ordinance providing for the installation of an ornamental street-lighting system. A resolution authorizing the construction of a new boiler room for the municipal electric-light plant was also passed.

BLOOMFIELD, IND.—The capital stock of the Indiana Power & Water Company has been increased from $200,000 to $500,000.

LAFAYETTE, IND.—The Northern Indiana Gas & Electric Company, a Geist syndicate, is considering making a new offer to the city of Lafayette for lighting the streets of the city. The present contract of the company with the city expires next year. The company, it is understood, is preparing to build a new plant to cost about $200,000. Preliminary plans are being prepared by the city to install a plant to supply electricity for street-lighting.

ROCHESTER, IND.—The City Council has decided to accept the proposal of the United Public Service Company to furnish electricity for pumping the city water. The company will also operate the pumps.

CHICAGO, ILL.—The Electric Steel Company, 3100 South Wood Street, contemplates the erection of a two-story brick addition, 66 ft. by 100 ft., to its foundry.

DIXON, ILL.—The Public Utilities Commission has authorized the Illinois Northern Utilities Company to issue $525,000 in bonds. Of the proceeds $408,325 will be used for extensions and improvements and the remainder to reimburse the company for money already spent.

GALESBURG, ILL.—Negotiations, it is reported, have been closed whereby the Galesburg Railway, Lighting & Power Company will take over the holdings of the Weinberg Brothers and subsidiary companies. Extensive improvements are contemplated involving an expenditure of $50,000 for improvements to the acquired properties. Next year the company will probably enlarge and develop the water power of Lake Lady Washington, at a cost of about $25,000, for water-power purposes. The present plans provide for an electrically driven pumping station at the lake, together with a pipe line from the lake to the McKinley power plant; also raising the dam to increase the capacity of the lake to 33,000,000 gal.

EAU CLAIRE, WIS.—Improvements, involving an expenditure of about $30,000, to its local system are contemplated by the Wisconsin Telephone Company. Placing wires underground in the business district is included in the proposed work.

MILWAUKEE, WIS.—A power house, 25 ft. by 60 ft., will be erected in connection with St. Joseph's Convent at Twenty second and Greenfield Avenue.

MILWAUKEE, WIS.—The Chicago & Northwestern Railroad Company is building a 35-stall roundhouse and a steam-driven power plant at the Chase yards, near the south limits of Milwaukee. The cost of the work is estimated at $250,000. W. H. Finley of Chicago, Ill., is chief engineer.

NEENAH, WIS.—Preparations are being made to change the street lighting system in Neenah. Lamps of greater candlepower will be used in the business district and smaller ones in the residence district. Electrical service is furnished by the Wisconsin Traction, Light, Heat & Power Company.

SHAWANO, WIS.—Bids will be received at the office of the city clerk of Shawano, Wis., until July 2 for an electric generating unit for the municipal electric light plant as follows. One simple, high-pressure, non-condensing heavy-duty Corliss engine suitable for direct connection to a 250-kw., 2300-volt, three-phase, 60-cycle, revolving field, engine type generator, speed not exceeding 120 r.p.m.; exciter to be of the 125-volt, belted type, with the exciter driving pulley bolted on engine flywheel arms; switchboard to control generator, exciter and voltage regulator; three motor-driven pumps. No separate bids will be considered on generating unit. B. Royer is president.

WATERTOWN, WIS.—The Wisconsin Gas & Electric Company is erecting an electric transmission line from Okauchee to Ashippun to supply electricity in the latter place. The company will soon start work on the construction of a transmission line to extend several miles south of Fort Atkinson to furnish electrical service to farmers in that district.

BENSON, MINN.—At an election to be held June 29 the proposal to issue $30,000 in bonds for rebuilding the municipal electric-light plant will be submitted to the voters.

CYRUS, MINN.—The local electric-light plant has been purchased by the Glenwood (Minn.) Light, Heat & Power Company, which has been granted a franchise to furnish electrical service in Cyrus.

DETROIT, MINN.—Bids will be received by W. B. Carman, clerk, Detroit, until July 2 for construction of grade school building, separate bids to be submitted as follows: (a) General contract; (b) plumbing; (c) electrical work; (d) heating and ventilating; (e) temperature regulation; (f) fans, motor drives and heaters. Copies of plans and specifications may be obtained at the office of Tyrie & Chapman, architects.

DULUTH, MINN.—An ordinance appropriating $40,000 for the installation of an electrically driven pump at the Lakewood pumping station will be introduced at the next meeting of the City Council.

MONTEVIDEO, MINN.—The Northwestern Telephone Company has purchased a site in Montevideo on which it proposes to erect a telephone exchange, to cost about $35,000.

ST. PAUL, MINN.—A preliminary order has been passed by the City Council providing for extending the ornamental lighting system on West University Avenue from Rice Street to Bedford Street, a distance of about 5 miles.

CORYDON, IOWA.—A special election will be held July 2 to submit to the voters the proposal to grant the Southern Iowa Utilities Company of Mount Ayr a franchise to supply electricity in Corydon.

DEXTER, IOWA.—The proposal to grant an electric-light franchise to a private company was defeated at a special election held recently.

HAMILTON, IOWA.—The Keokuk (Iowa) Electric Company is contemplating building an electric transmission line and railway between Hamilton and Warsaw.

LORIMOR, IOWA.—The Lorimor Light & Power Company has made arrangements to secure electricity from the Creston (Iowa) Electric Light & Power Company to operate its system. The Lorimor Company will erect an electric transmission line through Thayer and Talmage, connecting with the lines of the Creston company at Afton.

MASON CITY, IOWA.—Arrangements are being made by the People's Gas & Electric Company to extend its electrical service to Kensett and Northwood.

RIVER JUNCTION, IOWA.—The Iowa City Light & Power Company has applied for a franchise to erect an electric transmission line from Iowa City to River Junction to supply electricity here.

WATERLOO, IOWA.—The Board of Railroad Commissioners of the State of Iowa has granted the Cedar Valley Electric Company of Waterloo permission to erect and operate electric transmission lines along and upon certain highways in Black Hawk County, Butler County, Grundy County, Ringgold County, Carroll, Sac and Calhoun Counties, to supply electricity for lamps, heaters and motors in various towns and communities through which its lines pass. Clarence L. Melchet of Charles City is engineer for the company.

JEFFERSON CITY, MO.—Bids will be received at the office of the State Capitol Commission, Jefferson City, until July 2 for furnishing electric lighting fixtures for the Missouri State Capitol Building. Specifications and further information may be obtained upon application to J. Kelly Pool, secretary State Capitol Commission.

JOPLIN, MO.—At an election held June 12 the proposal to issue $225,000 in bonds for the installation of a municipal electric-light plant was defeated.

KANSAS CITY, MO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 2, for resetting four boilers and furnishing and installing steam-flow meters, feed-water regulators, etc., in the United States post office and court house at Kansas City, Mo. Specifications, etc., may be obtained at the above office or at the office of the custodian, Kansas City, Mo.

ST. JOSEPH, MO.—Work will begin at once on the construction of an addition to the power house of the St. Joseph Light, Heat & Power Company at Second and St. Felix Streets, to cost about $10,000.

BISMARCK, N. D.—The McLean County Farmers' Telephone Company is contemplating the erection of about 100 miles of telephone lines at a cost of about $10,050. A. B. Buck of Ruso is interested in the company.

GARRISON, N. D.—The Garrison Coal, Light & Power Company is contemplating furnishing electricity for lamps and motors in Garrison, Max and Douglas.

OMEMEE, N. D.—The installation of an electric-lighting plant in Omemee is under consideration.

HOWARD, S. D.—Work has begun on the erection of an electric transmission line from Howard to Winfred.

BAYARD, NEB.—At an election held recently the proposal to issue $4,500 in bonds for the installation of an electric-lighting system was carried.

BEAVER CITY, NEB.—An election will soon be called to vote on the proposal to issue $10,000 in bonds, of which the proceeds of $5,000 will be used for the municipal electric-light plant and $5,000 for water-works system.

COLUMBUS, NEB. — The Columbus Light, Heat & Power Company, it is reported, will install a new ornamental street-lighting system.

LEXINGTON, NEB.—The Lexington Mill & Elevator Company, which owns and operates the local electric-light plant, has filed an application with the State Railway Commission for approval of the erection of an electric transmission line from Lexington to Cozard, a distance of 18½ miles.

LINCOLN, NEB.—Bids will be received by the Board of Regents of the University of Nebraska, care of J. S. Dales, secretary, Station A, Lincoln, until June 25 for the construction of a teachers' training building. Separate bids to be submitted on heating, ventilating and electric wiring, etc. The cost of the building is estimated at $125,000. Coolidge & Hodgden, Corn Exchange Bank Building, Chicago, Ill., are the architects.

OMAHA, NEB.—The Nebraska Power Company has taken over the plant and holdings of the Omaha Electric Light & Power Company. Extensions to the transmission lines, it is understood, will be made.

THEDFORD, NEB.—Negotiations, it is reported, have been closed for the installation of an electric power plant in Thedford.

AUGUSTA, KAN.—Bids will be received by C. W. Hawes, city clerk, until July 2 for improvements to water-works plant, separate bids to be submitted as follows: Filter equipment—one 10-ft. by 12-in. filter unit, including wash-water pump; centrifugal pumps—one 500-gal. per minute, 200-ft. head, horizontal, motor-driven centrifugal pump; general contract—building filter house addition and pump pit and laying 3600 ft. 8-in. cast-iron pipe. Black & Veatch, Interstate Building, Kansas City, Mo., are the engineers.

DOWNS, KAN.—The Solomon Valley Power Company, it is reported, has applied for permission to sell its local power plant to A. E. Fitkin & Company of Chicago, Ill. It is expected that the plant will close down and that energy will be furnished from Concordia.

GREAT BEND, KAN.—Bids will be received by the Commissioners of Barton County, Great Bend, until July 16 for construction of court house in Great Bend, including electric wiring, heating, plumbing, etc. W. E. Hulse & Company, First National Bank Building, Hutchinson, are the architects.

JUNCTION CITY, KAN.—The Union Light & Power Company is contemplating the construction of underground pits for storing coal in large quantities; also the installation of two large engines to meet the increasing demands of service from the plant.

LA CROSSE, KAN.—Bids will be received by the city of La Crosse until June 26 for construction of brick building, foundation for machinery and oil-storage tank. Hydrants, valves and pump are yet to be purchased. The total cost of the work is estimated at $50,000.

LEAVENWORTH, KAN.—Work has begun on improvements to the power plant of the Leavenworth Light, Heat & Power Company, involving an expenditure of about $100,000. The work will include the installation of new stokers, new cooling apparatus, an additional Stirling boiler, a 2000-hp. Allis-Chalmers turbine, etc.

MANHATTAN, KAN.—The electric transmission line of the Rocky Ford Milling & Power Company is being extended from Manhattan to Alma, to furnish electricity in the latter city. The company has submitted a proposal to the towns of Wamego and Marys to furnish electrical service.

McPHERSON, KAN.—The City Commissioners have awarded a contract to the Merkel Machine Company of Kansas City for the installation of new machinery at the municipal electric-light plant, at a cost of $23,268.

PRATT, KAN.—The local electric-light plant was destroyed by a tornado on June 5.

TOPEKA, KAN.—Bids will be received by the Executive Council, care of J. T. Botkin, secretary, State House, Topeka, until June 28 for repairing east wing of the State House, including flood lighting of dome, indirect lighting system for Senate Chamber and connecting rooms. C. H. Chandler is state architect.

Southern States

ATLANTA, GA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 6 for repairs to heating apparatus, elevators, etc., in the United States post office and court house at Atlanta, Ga. Specifications, etc., may be obtained at the above office or at the office of the custodian, Atlanta, Ga.

MARIETTA, GA.—The Glover Machine Works is planning to install a steel foundry and forge shop to be operated in connection with the present plant. The equipment will include electric furnace, steam hammers, sand-blast machinery, etc.

KNOXVILLE, TENN.—The City Council has authorized an issue of $100,000 in bonds for improvements to the fire apparatus and the fire-alarm and police-call systems.

ANNISTON, ALA.—The Southern Manganese Company has awarded contract for erection of an addition, 270 ft. by 60 ft., to its plant. The extension will provide space for eight electric furnaces of type and design built by the Anniston Steel Company. The initial installation will include two furnaces.

ROBERTSDALE, ALA.—The installation of an electric-light plant is reported to be under consideration by the owners of the Robertsdale feed mills. Joseph A. Baldwin is manager.

BATON ROUGE, LA.—The Yazoo & Mississippi Valley Railroad Company is planning to equip a roundhouse, machine shop, etc., at Baton Rouge, at a cost of about $150,000.

BATON ROUGE, LA.—Contract has been awarded by the Yazoo & Mississippi Valley Railroad Company for construction of railroad shops, to cost $150,000, to T. S. Leake & Company, 608 South Dearborn Street, Chicago, Ill. The work will include eight 100-ft. stall engine-house; an 85-ft. turntable pit, machine shop and power house; two boilers and space for third boiler in boiler room; standard double cinder pit with Robertson cinder conveyor, conveyors operated by air from locomotives, etc.

BINGER, OKLA.—The installation of an electric-light plant in Binger is under consideration. Robert Baker is interested in the project.

HAILEYVILLE, OKLA.—The City Council will, it is reported, consider proposals for the installation of an electric-light plant in Haileyville.

KINGSTON, OKLA.—The Kingston Ice & Light Company, recently incorporated with a capital stock of $20,000, it is reported, has taken over the Kingston Service System. George F. Blethen is president and manager.

RED FORK, OKLA.—The town of Red Fork is contemplating the construction of a water-works system, to cost about $20,000. New equipment, including a gas engine, pump, etc., will be required. W. E. Kerr is clerk.

BEAUMONT, TEX.—The City Council has called an election for July 10 to enable the voters to pass on the proposed consolidation of the Jefferson County Traction Company, the Beaumont Traction Company and the Beaumont Electric Light & Power Company, all of which are controlled by the Stone & Webster Engineering Corporation of Boston, Mass. Under the present plans the Jefferson County Traction Company, which operates an interurban railway between Beaumont and Port Arthur, a distance of 25 miles, is to take over the two local companies as well as the property of the Port Arthur Light & Power Company. If the consolidation is authorized important extensions and improvements will be made.

DEL RIO, TEX.—The capital stock of the Del Rio & Western Telephone Company has been increased from $100,000 to $200,000.

STAMFORD, TEX.—The Hydro-Electric Metallic Battery Company, recently incorporated with a capital stock of $20,000, will use the electrical process for mining and treating copper ore in its mines near here. C. L. Pittmann is interested in the company.

Pacific and Mountain States

EDMONDS, WASH.—The City Council is considering a proposal submitted by the Washington Coast Utilities Company of Arlington for lighting the streets of the city.

EVERETT, WASH.—The Everett Gas Company, it is reported, has applied to the County Commissioners for a franchise to erect and operate an electric transmission line over certain roads in Snohomish County.

PORT ANGELES, WASH.—Notice of appropriation of 4000 cu. ft. per second of waters from the Sol Duc River, and north branch of the Sol Duc, to be used for manufacturing, milling purposes and power development, and from Lake Crescent and Lyre River, has been filed by Theodore F. Rixon, engineer, of Port Angeles. Mr. Rixon, it is said, proposes to locate a power plant near the outlet of Lake Crescent and build a series of impounding and diversion dams.

TACOMA, WASH.—Plans have been prepared by Heath & Gove of Tacoma for a new power plant for the Kapowsin School.

TACOMA, WASH.—Bids will be received by H. F. Gronen, commissioner of light and water, Tacoma, until July 2 for furnishing two lighting feeder panels and appurtenances for installation at the municipal substation. Bids will also be accepted as a whole or in separate items as follows: Polished marble switchboard, switchboard material, voltage regulators, disconnecting switches, oil circuit breakers, insulated cables, fiber copper and busbar copper.

ALBANY, ORE.—The Oregon Power Company has submitted a proposal to the City Council offering to sell its water plant to the city for $250,000. This offer does not include the electric-light plant.

ASTORIA, ORE.—The Astoria Port Commission is planning to install a semi-Diesel engine and electric generating equipment to supply electricity for lamps and motors. Fuel oil will be used. The cost of the plant is estimated at about $16,000.

GRESHAM, ORE.—Preliminary plans for a municipal electric-light plant have been filed by H. J. Stocker, city engineer of Gresham, with the State Engineering Department at Salem. The present plans provide for an expenditure of about $125,000. Work will begin about Sept. 1.

MEDFORD, ORE.—The California-Oregon Power Company is contemplating extending its electric transmission line from near Glendale through Riddle to Myrtle Creek.

MYRTLE CREEK, ORE.—The City Council is considering calling an election to submit to the voters the proposal to issue $25,000 in bonds for the construction of a municipal electric power plant.

COVELO, CAL.—George Ellis is installing an electric plant to supply electricity for lighting and irrigating purposes.

CROCKETT, CAL.—Within a few weeks the Great Western Power Company of San Francisco will complete its high-tension transmission line from Moraga Valley through Lafayette, Happy Valley and Briones to Crockett, to connect with its high-tension line from Antioch and Napa. Steel towers, 89 ft. high, will carry four cables.

LOS ANGELES, CAL.—The property owners and residents on Hill Street between Washington and West Jefferson Streets have formed an improvement organization for the purpose of securing an ornamental street-lighting system similar to that which is to be installed on Broadway. F. R. Feitshans is temporary president.

NOVATO, CAL.—The Public Service Commission has approved the sale of the property of the Novato Light & Power Company, including electric, telephone and water utility properties in Novato and surrounding territory in Marin County, owned by J. W. and Albert Cain, to the Novato Utilities Company.

PORTOLA, CAL.—The United States Smelting & Mining Company has increased activities at Five Bear, Iron Dyke, Eagle Hill and other mines in the vicinity of Taylorsville and Genesee and has started aggressive developments at Native Son, Austrian Syndicate and other groups. Arrangements, it is reported, are being made by the company for the erection of a large power plant and installation of reduction equipment.

SANTA BARBARA, CAL.—Plans have been completed by the Santa Barbara Gas & Electric Company for connecting its system with the hydroelectric system of the Southern California Edison Company. The cost of the transmission line, substation and equipment is estimated at $200,000.

MURRAY, IDAHO.—The Yukon Gold Company has closed a contract with the Washington Water Power Company of Spokane, Wash., to erect an electric transmission line to Pritchard Creek dredging ground, near Murray.

SALT LAKE CITY, UTAH.—The public Service Commission has granted the Salt Lake & Utah Railroad Company permission to construct an electric railway from Granger to Magna.

SALT LAKE CITY, UTAH.—Plans have been prepared and surveys made by the War Department for the construction of a hydroelectric power plant and storage reservoir in Red Butte Canyon, to furnish electricity for lamps and motors for the army post and water supply for a division of the army.

CHLORIDE, ARIZ.—Plans have been completed by the Desert Power Company for the construction of a new transformer station, to cost about $12,000.

LIVINGSTON, MONT.—The contract for the installation of an ornamental lighting system in the business district has been awarded to the Montana Power Company, at $9,000.

Canada

VANCOUVER, B. C.—Steps have been taken by the City Council to establish a municipal electric plant to furnish electricity for lamps and motors in Vancouver. A by-law will be introduced by Mayor McBeath to provide funds for the investigation, acquiring, purchasing and developing of water-power sites.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until July 6, for elevators, galvanized steel, checkered steel plates, steel drums, engine lubricators, grease cups, etc. Blanks and information relating to this circular (No. 1150) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York City; Audubon Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until June 30 for furnishing electric cable and wire, phosphor-bronze rope, copper rod, clamp connectors, packing gaskets, belt lacing, etc. Blanks and information pertaining to this circular (No. 1149) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York City; Audubon Building, New Orleans, La., and Fort Mason, San Francisco, Cal., and also from the United States Engineer offices in the principal cities throughout the United States.

1,229,311. Combination Lock and Switch. Bennie L. Beckett, Anderson, Ind. App. filed Sept 23 1916. Adapted for use on automobiles, motorcycles, motorboats and other transportation means.

1,229,331. Lamp Locking Base. William A. Chew, Atlantic City, N. J. App. filed Oct. 28, 1916. An electric lamp base comprising an outer socket-engaging shell and an inner bulb carrying shell which slide on each other, thus preventing unauthorized removal of lamp.

1,229,272. Insulator. John J. Irwin, Cleveland, Ohio. App. filed Dec. 30, 1916. Transverse groove in top within which the line wire rests.

1,229,288. Electric Welding. Otis A. Kenyon, New York, N. Y. App. filed March 3, 1917. Relates primarily to controlling the length of the arc by a voltage limitation, adjustable and independent of the voltage of the generator.

1,229,294. Automatic Switch; Frank A. Kuntz, Richmond Hill, N. Y. App. filed Aug 19, 1915. Acts as a magnetic blow-out to destroy arcs.

1,229,308. Electric Generator. John C. Morgan, Los Angeles, Cal. App. filed April 25, 1916. Designed to eliminate the use of dry batteries.

1,229,317. Telephone-Call-Registering Device; Victor Thompson, Vancouver, B. C., Canada. App. filed April 14, 1916. Provides means by which a subscriber may buy as many "flat-rate" calls as may be desired.

1,229,351. Ignition System; Harry R. Van Deventer, Sumter, S. C. App filed Dec. 28, 1916. Igniter controlled by the ignition current.

1,229,444. Control System; Arthur J. Hall, Wilkinsburg, Pa. App. filed Oct. 23, 1913. Controller-actuated device arranged to permit of operation singly or in multiple with others.

1,229,446. Accelerator and System of Control; Arthur J. Hall and Lynn G. Riley, Wilkinsburg, Pa. App. filed Sept. 27, 1916. Electrically controlled fluid-actuated operating mechanism for moving a controller drum in opposite directions either in a step-by-step movement or continuously.

1,229,460. Indicating Electric Connector; Charles Horn, Millbourne, Pa. App. filed May 18, 1914. Improvements.

1,229,463. Electric Signaling System; Harvey Hubbell, Bridgeport, Conn. App. filed Aug. 10, 1916. Transmits signal simultaneously to several stations.

1,229,464. Pull Socket; Harvey Hubbell, Bridgeport, Conn. App. filed Nov. 29, 1916. Means for increasing the current-carrying capacity of the switch.

1,229,473. Automatic Make-and-Break Device; Patrick S. Keenan, Denver, Col. App. filed March 30, 1916. Improvements.

1,229,489. Switch; Alexander J. Loguin, West Allis, Wis. App. filed Sept. 6, 1910. Relates especially to automatically operated switches to be used in systems of remote control.

1,229,530. Means for Operating Switch Mechanisms; Ralph A. Schoenberg, New York, N. Y. App. filed Aug. 13, 1915. contact stud operated by oscillating member and buckling spring.

1,229,544. System and Apparatus for Controlling Electric Motors; Norman W. Storer, Pittsburgh, and Arthur J. Hall, Wilkinsburg, Pa. App. filed Sept. 27, 1916. Power-actuated drum controllers which can be used singly or in multiple with others.

1,229,566. Switch-Point Operator; Rafael Alcolea, New Orleans, La. App. filed Feb. 24, 1915. For automatically operating the switch point or points from a vehicle moving on a railway track.

1,229,576. Outlet Box; John C. Boyton and Oris H. Nickerson, Cleveland, Ohio. App. filed Jan. 25, 1913. May be enlarged without special tools.

1,229,596. Non-Grounded Repeater System; Edward D. Fales, Chicago, Ill. App. filed June 4, 1907. Automatic or semi-automatic telephone-exchange system in which the automatic switches are controlled through the medium of non-grounded line circuits.

1,229,634. Telephone Transmitter; Ray H. Manson, Elyria, Ohio. App. filed Aug. 17, 1914. Keeping the parts in proper adjustment.

1,229,635. Snap Switch; Fredrich W. Marschke and William A. Marschke, Indianapolis, Ind. App. filed Sept. 11, 1916. For electric motors, and designed automatically to increase the electromotive force impressed on the motor after the closing of the circuit.

1,229,651. Means for Attaching Electrical Appliances to Conduit Outlet Boxes. John E. Parker, Syracuse, N. Y. App. filed June 19, 1911. Conduit outlet box having an opening in one side and means for attaching an electric appliance.

Record of Electrical Patents

Notes on United States Patents issued on June 12, 1917

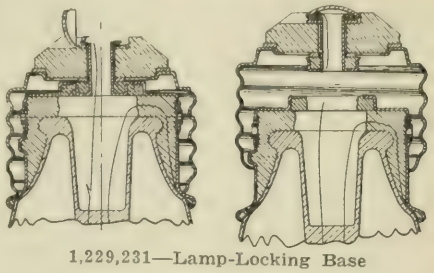
1,229,665. Fitting for Electrical Conduits. Klaas Sixma, Brooklyn, N. Y. App filed May 5, 1914. Externally threaded bushing, which may be used with or without internal threads to coact with threads on the conduit.

1,229,670. Starting Switch; Alexander K. Sutherland, New Britain, Conn. App. filed May 11, 1916. Handle is slightly retracted to permit moving from one position to another.

1,229,689. Current Transforming and Rectifying Apparatus; Julius B. Wantz, Chicago, Ill. App. filed Nov. 5, 1914. A rotary member carrying current-conducting members adapted to co-operate with stationary shoes.

1,229,699. High-Potential-Measuring Device; James C. Armor, Ingram, Pa. App. filed April 30, 1915. Spark gap in multiple with one of several condensers to prevent undue voltage strains or surges.

1,229,700. Electric Welding Process; Carl B. Auel, Wilkinsburg, Pa. App. filed Dec. 10, 1914. For joining thin sheets and ribbons of metals.



1,229,231—Lamp-Locking Base

1,229,703. Latching Device; Harold G. Baxter, Wilkinsburg, Pa. App. filed June 9, 1914. To prevent knife blade from becoming accidentally disengaged from contact members.

1,229,709. Springless or Floating Suspension for Vehicles; Giuseppe Bravi, Allentown, Pa. App. filed Nov. 29, 1915. Movable members coacting with equalizing bars in such manner that the coacting or adjacent parts operate as a variable triangle.

1,229,719. Cut-out; Frank Conrad, Swissvale, Pa. App. filed April 2, 1913. Automatically closes the charging circuit at a predetermined voltage and opens the circuit when current begins to flow from the battery to the generator.

1,229,727. Welding System; Earl E. Eby, Wilkinsburg, and Sidney W. Farnsworth, Pittsburgh, Pa. App. filed Oct. 15, 1914. Auxiliary circuit is employed for maintaining the rectifier arc.

1,229,728. Welding System; Earl E. Eby, Wilkinsburg, Pa. App. filed Oct. 15, 1914. Current rectifiers are employed to convert the alternating current into direct current for the welding circuit.

1,229,740. Measuring Instrument for Roentgen Rays; Robert Furstenau, Berlin, Germany. App. filed Jan. 28, 1914. Wheatstone bridge having a selenium cell for exposure to the rays in one of its two parallel resistance branches.

1,229,749. Phonograph; Newman H. Holland, West Orange, N. J. App. filed Sept. 17, 1914. Telephonic connections whereby sounds may be recorded and transmitted to any desired distance.

1,229,750. Knife-Blade Switch; Frederick B. Holt, Antrobus, England. App. filed Aug. 25, 1916. Terminal members are formed of a continuous piece of strap copper that extends from the front to the back of the panel or base.

1,229,759. Support for Armature Cross-Connectors; George H. Krauskopf, Pittsburgh, Pa. App. filed Jan. 15, 1913. Z-shaped ring member which fits beneath projecting flange upon the end plates of the armature.

1,229,767. Electrical Measuring Instrument; Paul MacGahan, Pittsburgh, Pa. App filed July 29, 1913. Means for adjusting the zero position of spring over any range without changing the counter-torque of the spring.

1,229,768. Circuit Interrupter; Joseph N. Mahoney, Wilkinsburg, Pa. App filed Aug. 11, 1913. Means for inserting a reactor in an electrical circuit under predetermined conditions of operation.

1,229,785. Water Stage Indicator; Delbert W. Prochatel, Treadwell, Alaska. App. filed March 31, 1914. Intermittent rotation of indicator produced by successive changes in polarity of magnets.

1,229,789. Circuit Interrupter; Karl C. Randall, Edgewood Park, Pa. App. filed June 9, 1914. Means for equalizing the currents traversing circuit interrupters, which are connected in parallel relation.

1,229,796. Telegraph and Telephone System; Josef Schlessler, Baden, near Vienna, Austria. App. filed May 22, 1914. Relates to electric telegraphy or telephony by submarine cables and long-distance overhead.

1,229,823. Ignition Apparatus of Gas Engines; Claude S. Sydenham, Kilmarnock, Scotland. App. filed Feb. 17, 1914. Improvements of the type having a stationary insulated electrode and a moving uninsulated electrode.

1,229,841. Dynamo-Electric Machine; Wilhelm Weller, Pankow, and Hermann Nehlsen, Niederschonhausen, Germany. App. filed July 16, 1915. Provided with both commutator and collector rings.

1,229,856. High-Frequency Alternator; Ernst F. W. Alexanderson, Schenectady, N. Y. App. filed June 22, 1915. Inductor type having wide slots for the armature winding.

1,229,876. Magazine Arc Lamp; James Brockie, Forest Hill, London, England. App. filed Feb. 16, 1914. Arc is restarted when the new carbons have been fed forward to within a distance less than that between the burning carbons.

1,229,914. Electrical Condenser; Philip Dubilier, New York, N. Y. App. filed May 2, 1916. Compact construction capable of radiating heat quickly.

1,229,915. Electrical Condenser; William Dubilier, New York, N. Y. App. filed Jan. 18, 1916. Made up of a plurality of sections connected so that the potential applied to the unit is divided among the sections.

1,229,931. Safety Signal; Charles R. Funk and Lewis H. Smith, Emporia, Kan. App. filed July 14, 1916. Direction indicator for attachment to a motor vehicle.

1,229,939. Electrical Thermostat and Circuit; Albert Goldstein New York, N. Y. App. filed Nov. 18, 1914. Air expansion in a closed chamber actuates a diaphragm to close a circuit.

1,229,950. Arc Lamp; Charles E. Harthan, Lynn, Mass. App. filed Aug. 12, 1915. Differential type.

1,229,995. Cable Pothead; George F. Mainer, San Francisco, Cal. App. filed March 20, 1916. Elimination of wiped joint.

1,230,003. Safety Attachment for Synchroscopes; Pliny E. Means, Tyrone, N. M. App. filed Aug. 6, 1915. Prevents tying together of two sources of alternating electric current until the same are in synchronism.

1,230,004. Incandescent Cathode Device; George S. Meikle, Schenectady, N. Y. App. filed Sept. 18, 1915. Electrical discharge devices of the gas-filled incandescent cathode type, provided with a rugged main cathode and a separate or auxiliary electrode which operates in conjunction with a start arc that heats the cathode to incandescence preliminary to starting the main arc.

1,230,063. Time-Limit Relay; George A. Burnham, Saugus, Mass. App. filed April 14, 1913. Solenoid operates a switch against the resistance of a retarding device on moderate overloads, while on heavier overloads the solenoid compresses a spring which thereafter closes the switch against the resistance of the retarding device.

1,230,077. Ignition System for Internal-Combustion Engines; Guy H. Silva, San Diego, Cal. App. filed March 16, 1916. Automatically advances the spark with increase of the speed of the engine and vice versa.

1,230,089. Switch; Walter L. Hamilton, Holyoke, Mass. App. filed March 13, 1915. Operable by sudden changes in temperature.

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Keeping Faith with the Public

RELATIONS between associated companies, the connection between a subsidiary operating property and a controlling holding corporation, are mysterious to the general public. They are open books to the state commissions. Those bodies have authority and usually the requisite training for analyzing the ramifications of intercorporate financing. Facts must appear in the accounts. Written on the books, they are subject to scrutiny to reveal entries prejudicial to consumers. Financiers do not always have the point of view of operating officials; they do not have the intimate touch with the public which the men at operating headquarters keep. They see a financing necessity which they would meet in a method perfectly legitimate for a private corporation, but open to question and criticism under the modern theory of regulation. In such cases the operating official should act. Speaking authoritatively from his greater knowledge of the quasi-public institution, he can show the new standards of financial exactness which the times demand, he can insist that the records shall not confront him in a future rate case with figures which undermine his argument.

Technical College Graduates in War Time

ONE of the first effects of the entry of America into the war has been the volunteering of the graduating classes, nearly en masse, throughout the country, into national defense service, with a considerable number of enlistments also in junior classes. This dedication of our trained youth for the maintenance of justice against brute-strength aggression is an admirable thing, and no one who believes in the ideals of young men will oppose it. It is important to remember, however, that injudicious dedication to the world's good may actually do the world harm, and well-intended action may by over-haste defeat its own purpose.

War is a vast country-wide engineering enterprise. Theoretically speaking, an all-wise and powerful board of experts should determine where each man and woman should be posted in the great war chain of fighters, for it is obvious that all specially trained men, and particularly all technically trained men, should keep at the posts where their training is needed. It was an inevitable mistake made by our allies at an earlier stage in the war which led many young physicians, engineers, mechanics and valuable specialists to rush as volunteers for the front. It may overtax human intelligence to decide whether any particular man of military age is more needed at the front or at the rear. Mistakes must occur, and many of them; but the technically trained men should be kept at their profession unless there happens to be a superfluity of them. So long as there are earnestness and determination to serve, they also serve who only stand and wait. The junior men in colleges, and particularly in technical or medical colleges, will probably serve their country better by working hard at their educational preparation than by abandoning their college work before their training is completed. In general, however, every day's work done in any sort of productive employment contributes to the war and therefore hastens the end of the war. To do any useful thing hard is to fight for the Allies.

"Business as Usual"

THIS is the slogan which is just now resounding through the country. It sounds well and is a very comfortable hypnotic for the considerable section of our people who still do not know that we are at war. Like many another epigrammatic phrase it is specious but somewhat delusive. One need only recall the indignation with which our British friends repudiated the notion that the war was going to make any particular difference with the orderly conduct of their commercial affairs. With four or five million men in the field they know better at the present moment, and are at last devoting all the energy of the nation toward the grim work in hand of making a way for the next generation to carry on "business as usual." The necessity of concentrating all possible energy on one deadly purpose has been driven home to the belligerent nations at awful cost, and it will be a sorry thing for us in America if we insist on learning only from our own bitter experience.

We are not disposed to be calamity howlers and to think that the country is going to the dogs from the very start, but if we travel on the theory that we can pursue the even tenor of our profitable way undisturbed by the greatest war that history has ever known we are due for a terrible awakening. This country is not going to go backward, grass is not going to grow in the streets, nor will the fields be given over to weeds and brambles. On the contrary, business has been so far from going on as usual of late among our allies that we shall have to strain every effort to keep them in supplies, as well as to reinforce, probably by several millions, their armies in the field. There will be no lack of work for every ready hand in these United States. It will be business—but not as usual, unless we choose to court disaster; business, rather, molded and directed to do the one thing needful for national salvation. A few far-seeing merchants have already sounded a warning and have begun to bear in mind the real needs of the

near future. Others, we are sorry to say, are trying to cajole themselves and the public into the notion that everything will go along swimmingly and that we shall never know the difference, living cheerfully along in our wonted way and taking no thought for the morrow.

As regards those lines of work in which our readers are particularly interested, there will be business enough, but it certainly will not be quite as usual. The central stations, as we have recently pointed out, will have their work cut out for them in trying to meet the needs of the hour. The amount of electrical equipment of various kinds which will be absolutely needed in carrying on the war ahead of us will keep factories in almost every line of electrical production as actively engaged as the coming scarcity of labor will permit. They will not only have more business, but more business than they can easily do, and before another year is past there will be need for every wheel that can turn and every man that can be found. There will be plenty of business—business enough for every man and woman whose services are not needed at the front or just back of it. But it must turn itself into new channels that are being laid out for it, and before the war is over it will be very far removed from "business as usual."

Earning Power of Electric Signs

VERY definite evidence of the real earning value of electric signs has been brought out in connection with the movement on some streets of a number of cities to do away with all overhanging signs. For example, one restaurant concern which operates a large number of restaurants having a very steady income credits quite definitely a certain amount of gross income per month enjoyed by a restaurant on a certain street to its overhanging electric sign. The absence of this sign, which could be seen from a distance down the street by strangers in the city or those not acquainted with the location of the restaurant, is said to have caused a definite decrease in gross earnings. While a popular-priced restaurant run by a concern of a national reputation may be the business which benefits the most from electric signs on the streets and can most easily measure the results, the benefit to other lines of business, if it could be accurately measured, would doubtless be found similar.

Insulation Characteristics of Cables

HIGH-TENSION aerial systems of transmission, with their towers and poles, are only possible, as a general rule, in open-country districts where the density of population falls below a certain value. In cities and in densely populated areas it becomes necessary to carry the power lines in cables underground. At the present time 25-kv. cabled systems have been developed in America, and yet higher voltages have been developed in Europe under the exigencies of the denser populations there. The problem of economic long-distance distribution of power in urban districts is therefore closely bound up with the development of high-tension cables.

A paper by W. S. Clark and G. B. Shanklin before the A. I. E. E. June meeting in New York discusses a large number of experimental tests on samples of high-tension cable under various impressed conditions as to temperature and voltage, but at constant frequency. As is well known, it is the duty of a self-respecting high-tension cable to keep cool throughout, under all normal conditions of service and demand. If a hot spot occurs, the dielectric losses accumulate at that spot and tend to make the temperature rise yet more. This, in turn, aggravates the losses; so that in this vicious circle a breakdown of the cable may soon occur.

The various curves indicate that in all the samples tested the power factor, the permittivity and the leakance all tend to get worse as the temperature rises. If, however, the working temperature of the cable can be kept normal, it is remarkable how permanent and safe such cables can be made.

Improvement of Insulators

THE Institute paper of W. D. Peaslee on the insulator situation will bear close study, particularly in its bearing on the composition of insulators as affecting their permanency. A few years ago attention was directed chiefly toward the production of insulators of correct design and general mechanical and electrical properties. That is, an insulator should not flash over at working voltages even when dirty and wet; it should not puncture on an accidental flash-over; it should not leak materially and should be mechanically strong. Now, particularly since the introduction of the suspension type, it has been mechanically easy to secure high-voltage insulators meeting these general conditions admirably. Experience has shown, however, that these superficial good qualities may not be permanent and that insulators which have passed all reasonable tests along these lines may fail in use or even in storage. Investigation of causes shows that at least four elements co-operate to produce deterioration—mechanical stress due to temperature change as between the metal, cement and porcelain, complicated by the effect of moisture on the cement; concentration of dielectric flux at particular points due to improper design or to coarse defects of the porcelain; similar flux concentration resulting from the fact that the porcelain, consisting of crystalline structures and binder, is far from homogeneous, and finally mechanical stresses due to difference of expansion between these two elements.

Careful and frequent testing of insulators in service helps to forestall failure, so that the service records of many high-voltage lines are exceedingly good. However, there is always left an element of uncertainty. The most obvious means of relief is in increasing the factor of safety in the insulators themselves. A factor of safety of four instead of two or less would certainly greatly increase the reliability of the system. Mr. Peaslee, however, brings up another matter of very vital interest, the substitution of fused quartz for

porcelain or glass. The remarkable qualities of this material are now well known from the standpoint of insulator manufacture, and it possesses the singularly valuable property of being successfully homogeneous so that the dangers due to long-continued internal minute stresses should be practically obviated. That fused-quartz articles can now readily be made on a large scale, provided that there is sufficient call for them, seems to be satisfactorily demonstrated, the only question being the cost at which the work can be accomplished. At all events, one thoroughly good insulator is worth the price of several moderately good or poor ones, and the experiment is extremely well worth trying as a measure of relief from difficulties which, while considerably reduced by improvements in porcelain manufacture, are still troublesome.

Electric Power for Grain Elevators

GRAIN elevators are scattered over the major inhabited portion of North America and they demand annually a very large amount of power. Unless electrically driven, this power means the consumption of fuel here, there and everywhere, in many cases where the freight rates are almost prohibitively high. The nature of the power problem is somewhat as follows: Grain finds its way from the farms to the primary elevator at the nearest available railway. This is generally a crude affair, taking the grain from the farm wagon into a hopper, lifting it into storage by a conveyor, and then dropping it by gravity into the cars as they are available. The power requirement here is of the simplest possible character. Troublesome details are involved, however, since the grain comes in irregularly but rapidly during the harvest season and then the plant lies in comparative idleness for the better portion of the year. The annual load factor of such an establishment is about as bad as can be imagined, but its maximum fortunately comes at a time when the lighting load at least is low.

Next comes the main elevator at the shipping center. Here the grain-laden cars are shunted onto an elevator siding and pulled in turn over the hoppers by a power-driven winch. Cable-operated drag shovels unload the grain into the hopper, under which is a belt conveyor which transfers the grain to the bottom of the "leg," where the chief elevating conveyor lifts the grain 150 ft. to 180 ft. to the top of the structure, where it is weighed and then passed on other conveyors to the storage bins. From the bottom of these still other conveyor belts take the grain from storage to the leg, thence to the scales, and finally by gravity into the car or steamship. This program of lifting and conveying is a considerable one, and in addition still more power is required for cleaning and handling the grain which passes out once more in much the same cycle as loading or unloading. Much of the work is rush work, calling for heavy output, since it is more important to load and release the cars or steamers quickly than it is to save a little on maximum demand. The conveyors must sometimes be started under full load. The work is very irregular, though with a better annual load factor than in the small elevators, and hence requires large motor capacity. F. F. Espenschied in this issue cites one typical elevator of a capacity of 3,250,000 bushels (1,145,746 hectoliters) which handled last year some 52,000,000 bushels (18,323,930 hectoliters) of grain going in or out. The plant was in operation for about 3500 hours during the year and evidently was filled and emptied approximately eight times. For this work motors of 2325 rated horsepower were needed and the consumption in kilowatt-hours was nearly 1,250,000, but the average load during the hours of operation was only about 20 per cent of the motor rating.

Despite these unfavorable load conditions and relatively high peaks, the power cost was barely over 40 cents per 1000 bushels (352.38 hectoliters). These figures show how economically the motor service does the work in spite of unfavorable conditions, and they are by no means the lowest figures cited in the paper before us. From the standpoint of the central station the grain elevator makes a useful summer load desirable in spite of its poor load factor. And because of that unfavorable condition the fuel demand of an elevator without electric drive is an item so big as to be well worth saving from the standpoint of conservation. Here is one more added to the long list of cases in which the central station can add to its profitable business and at the same time serve the community in lowered cost and in fuel and transportation saved.

The Coming Issues

IN THE issue of July 7 space will be given to articles of interest to officials who concern themselves with questions of public policy. Conditions which underlie the central station industry are undergoing radical change. To gage the effect of these conditions upon operating results is one of the most important responsibilities of managing executives. An article in the next issue will discuss this subject. Owing to the fact that only about 2 per cent of the sunlight which could enter a building if the roof were removed may penetrate many factories having lateral windows it is very essential that artificial light be provided. This condition is especially liable to exist in machine shops and foundries where the light may be absorbed by the black surroundings. In the next issue of the ELECTRICAL WORLD C. E. Clewell will point out some illumination requirements of such places and show how they may be fulfilled by artificial lighting. Many central stations may find at this time that they have to provide more steaming facilities and generating capacity and are handicapped by space limitations. In the July 14 issue will be explained how one company, which was fortunate in having stokers and boilers that could be forced to high ratings, overcame this difficulty. A particular feature of the following issue will be an article pointing out the shortcomings of existing equipment for outdoor switching and transformer stations and suggesting improvements that should relieve this situation very materially.

Power Requirements of Grain Elevators

Performance Data of Six Motor-Driven Terminal Grain Elevators at Port Arthur and Fort William, Ontario — Features of the Power Rates

BY F. F. ESPENSCHIED, M.E.

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RELIABLE estimates on the total power used in handling the large grain crops of this continent are not readily available, but the aggregate power used for handling and cleaning must total many hundred thousand horsepower, as grain elevators are spread over practically the entire inhabited portion of North America. Much, if not all, of the power load represented is available for the local central stations. While many elevators are now operated with purchased power, their number appears relatively small, judging from visits to large grain centers and the data available in the technical press. In this article an analysis is made of grain elevator loads and some detailed data are submitted from actual practice.

In tracing the movement of grain from the farm to the mills the first elevator encountered is usually the small-town elevator adjoining the railway. Frame construction, sometimes covered with sheet iron, is generally used, and few refinements either in structure or in power application are present. Owing probably to the poor load factor (annual), the usual high cost of central-station power in such localities, and the fact that such elevators have often been built before the advent of modern central stations, most of the small-town elevators are operated by steam or gas engines. Some of the elevators are run in conjunction with a local feed and flour business using a grain grinder or chopper. The electric drive for such cases is very simple, consisting, as a rule, of a single squirrel-cage motor, or possibly two motors. Grain is unloaded from the farmer's wagon into a hopper and elevated to the bins, from which it flows by gravity through spouts to the car. Such elevators have probably the poorest annual load factor of all, since the rate at which grain comes in is greatly reduced once the local crop is harvested, and since there are long periods when no grain comes in. Only in a few instances is power needed for shipping.

Some of the grain goes direct to millers, but the bulk goes either to inland storage elevators or to the Great Lakes or ocean terminal elevators. Grain from the Northwestern States and Canada destined for Eastern cities or for Europe goes usually to one of the large lake terminals, such as Chicago, Milwaukee, Duluth, Port Arthur and Fort William, where the great storage and transfer elevators are situated.

To illustrate the power requirements of these terminals the grain movement will be followed from the time when a string of loaded box cars is shunted onto an elevator siding. The cars are "spotted" over the receiving hoppers by a wire cable operated from a drum. The grain is removed from the cars by drag shovels operated by power-driven cables. Under the receiving hopper is a horizontal belt which carries the grain to the "boot" or foot of a receiving "leg." This "leg" elevates the grain 150 ft. to 180 ft. (45.7 m. to 54.9 m.) into the weighing scale. From the hopper outlet of the scale belts carry the grain to storage bins. To load cars or a boat grain is drawn from the bottom of a storage bin onto a horizontal conveyor belt, then carried by an elevating "leg" to the scales, and thence by gravity into the car or boat, as the case may be. Cleaning and handling grain requires power also and in considerable quantities, the cycle of handling being practically the same as for loading or unloading.

Operating Difficulties

Economy of energy consumption is in many cases of secondary importance, speed in unloading grain being the principal requirement. This is true because cars must be released to the railways promptly, particularly

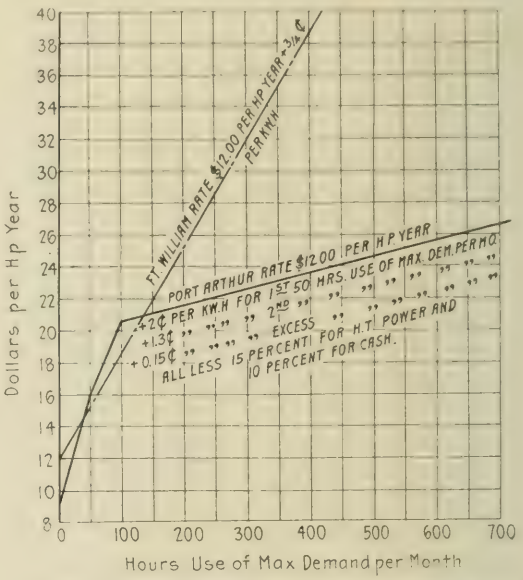


FIG. 1—GRAPHICAL REPRESENTATION OF TWO POWER RATES FOR GRAIN ELEVATORS

during the fall grain rush, and because the fixed charges on steamers lying at dock are very high. A car of wheat containing, say, 1000 bushels (352 hectoliters) can be unloaded into storage with practically the same kilowatt-hours and about one-half the horsepower maximum demand in twenty minutes that would be required to do the same work in ten minutes. While slower operation on a maximum-demand rate will permit a considerable power saving, unfortunately the usual elevator manager cannot take advantage of it.

Few elevators work twenty-four-hour days, owing apparently to railway movements and labor difficulties. Night work appears to be more the exception than the rule, although during the rush season near the end of lake navigation elevators operate late into the night, or all night, to unload cars or load a boat. Meal hours are usually marked, however, by an almost complete cessation of work. These observations apply to Canadian practice, but are generally applicable elsewhere.

Belts and legs, or elevators, must sometimes be started fully loaded, and for this reason elevator designers and managers insist on ample power reserve. If an elevator is driven with individual motors over-motoring usually results when gaged by the usual industrial standards. Owing to this tendency and also to the fact that some motors must operate nearly without load for short periods the substation power factor is very poor (50 to 60 per cent frequently). Furthermore, the load is far from uniform, owing to the practice followed in unloading an entire car into a hopper before beginning to elevate the grain. With five hoppers on one track five leg motors are thus required to operate at the same time, giving heavy short peaks.

TABLE I—MOTOR EQUIPMENT OF PORT ARTHUR AND FORT WILLIAM GRAIN ELEVATORS (60-CYCLE, THREE-PHASE, 550-VOLT UNITS)

Service	Number and Hp. of Motors Serving Six Grain Elevators											
	G.C.		D.S.		P.A.		W.T.		CON.		G.T.	
	No.	Hp.	No.	Hp.	No.	Hp.	No.	Hp.	No.	Hp.	No.	Hp.
Elevator Legs:												
Receiving	5	75	1	75	..	..	3	75	2	75	5	100
Shipping	5	100	1	100	..	..	3	75	4	60	5	100
Cleaner	5	50	2	25	5	50	2	60	1	40	5	50
Flax	2	50	1	25	..	..	1	15	1	15	..	..
Screenings	1	50	1	20	1	15	4	25	2	25	1	75
Oat	1	40	..	..	..	..	..	..	..	..	..	..
Dryer	1	30	1	25	..	..	1	20	..	..	1	25
Conveyor Belts:												
Cupola transfer	1	25	2	20	5	15	..	..	2	20	1	25
Cupola storage	5	25	2	30	5	25	5	20	1	7½	1	100
Receiving	5	10	..	..	..	..	..	..	1	40	..	..
Basement shipping	5	20	..	..	6	20	12	15	7	15	1	100
											1	35
Basement storage	5	15	1	15	6	15	1	15	..	..	2	30
											3	40
Basement storage	5	5	..	..	1	40	..	..	..	..	1	40
											2	25
Screenings	..	..	..	..	1	5	..	..	..	..	..	..
Miscellaneous:												
Screw conveyor	1	10	..	..	..	..	1	3	1	10	1	20
							1	7½				
Car puller	2	50	1	40	..	..	2	40	2	40	1	100
Car returns	1	5	..	..	..	..	*1	25	..	..	..	..
							*1	75	1	30	1	75
Car shovels	2	50	1	15	..	..	*1	30			1	40
Cleaners	5	30	2	10	1	75	10	10	4	15	5	40
Cleaners	2	15	1	10	1	40	3	7½	..	..	..	..
Cleaners	2	10	1	10	..	..	1	7½	6	10	..	..
Separators	..	..	1	20	1	10	2	5	1	2	1	7
Scalpers	..	..	..	..	..	..	1	10	*2	40	1	6
Exhaust fan	1	30	..	..	..	..	1	20	..	..	1	60
Dust collector	1	40	1	30	1	60	1	15	1	20	1	40
Dryer fan	1	100	1	40	..	..	..	..	..	..	1	25
Air compressor	..	..	..	..	..	..	..	..	..	..	..	..
Machine shop	..	..	..	..	..	..	..	..	..	..	1	5
Passenger elevator	1	10	1	7½	..	..	1	5	1	7½	1	10
Humphrey elevator	1	5	..	..	..	..	1	5	..	..	..	..
Fire pump	1	125	..	..	..	..	..	..	..	..	1	50
Totals, exclusive of fire pump	66	2345	22	602½	34	905	60	1415½	40	1037	45	2468

*Main shafts

To illustrate the character of load encountered in modern electrically operated elevators in Port Arthur and Fort William, Ontario, several typical charts are reproduced. These should be noted in connection with the data tabulated herewith. The periodic unloading peaks are especially noticeable in the G. C. elevator charts, where they indicate conditions with five unloading legs in use.

Elevator Equipment

Brief descriptions of the electrical equipment of the elevators referred to will serve to interpret the performance results indicated.

Elevator G. C. has a storage capacity in its workhouse of 500,000 bushels (176,192 hectoliters) and in its storage bins of 2,750,000 bushels (969,054 hectoliters), making the total storage 3,250,000 bushels (1,145,246 hectoliters). Energy is purchased from the city system (Port Arthur hydroelectric plant) at 22,000 volts, three-phase, 60 cycles, on a ten-year contract at standard high-tension rates. This elevator was built by the Barnett-McQueen Company of Fort William, Ontario, during 1912 and 1913 and is a typical modern terminal elevator. There are four unloading tracks, each with five unloading hoppers so that five carloads of grain may be unloaded and elevated at one time.

All the motor and substation equipment is Canadian Westinghouse make. Three 400-kva., 22,000/575-volt oil-insulated, self-cooled transformers and one spare are installed. To correct the power factor a 1000-kva., three-phase self-starting synchronous condenser is provided. Ample capacity allows for additions to the elevator and the avoidance of overheating, for experience in some elevators has shown the wisdom of not overtaxing the condenser.

In studying the operating data for the Port Arthur elevators, which data have been carefully kept and recorded monthly since the elevator began operations, it is necessary to consider the power rate. The features of the rate are as follows:

Service Charge—$1 per horsepower per month, based on the maximum ten-minute sustained demand plus consumption charges.

Consumption Charges—2 cents per kilowatt-hour for the first fifty hours' use of maximum demand per month; 1.3 cents per kilowatt-hour for the second fifty hours' use, and 0.15 cent per kilowatt-hour for all monthly consumption in excess.

Discount on total bill is 15 per cent for high-tension power and 10 per cent for prompt payment.

Minimum monthly horsepower demand is taken as not less than 75 per cent of highest peak previously recorded.

Power factor to be maintained at 92 per cent lagging. For low power factor accounts are corrected as follows: (Hp. demand × 92 per cent) ÷ actual power factor = hp. to be paid for.

No fixed increments are made for additional power taken; graphic records are used.

This rate is shown graphically in Fig. 1, which also indicates one rate charged in Fort William, where the usual increment is 50 hp. In connection with the Port Arthur rate it should be observed that after a customer's consumption exceeds the equivalent of 100 hours' monthly use of his maximum demand the increased cost is very slight. The same rate applies to low-tension power customers, except for high-tension discount, and automatically takes care of load factor. A rate similar to that shown for Fort William does not take into account high load-factor customers, so a different rate is necessary for each class of customer served.

Elevator P. A. has a total storage capacity of 9,250,000 bushels (3,259,546 hectoliters). Only part of the energy used is purchased from Port Arthur city system and that at standard high-tension rates. This elevator, which is a modern tile structure, consists of two separate workhouses and three large sets of storage bins. The elevator was built for shaft and rope drive from two steam engines, one rated at 650 indicated hp. and one rated at 1000 indicated hp. Owing to insufficient power, part of the elevator was electrically equipped, using group and individual drives. A small brick substation near one of the workhouses contains three 150-kva. oil-insulated, self-cooled transformers. A synchronous condenser made from a refitted alternator has given good service as a power-factor corrector.

The load factor is high and the load steady since the steam equipment drives the part of the system having the most fluctuating load. The operating data are of little value without complete steam costs, which are not available at this time.

Elevator D. S. has a total storage capacity of 1,750,-

000 bushels (616,671 hectoliters). Energy is purchased from the Port Arthur city system at standard high tension rates. As this elevator has been operated as a hospital terminal since its erection, the operating characteristics are different from those of ordinary terminal elevators, which do little or no "doctoring" of grain; that is, grading and sorting. Data on the grain handled prior to 1916 are not available from this elevator. It may be noticed from the performance data that the load factor is quite high.

The substation contains three 150-kva. oil-insulated, self-cooled transformers and a 200-kva. synchronous condenser for power-factor correction.

Elevator W. T. has a total storage capacity of 2,000,000 bushels (704,767 hectoliters). Energy is purchased from the electric service company in Fort William at the high-tension rate of $25 per horsepower-year for half the maximum demand plus 1½ cents per kilowatt-hour for all excess consumption. This elevator is also a modern concrete terminal structure.

Elevators Con. and G. T. are also in Fort William and purchase all energy, the former at 2300 volts and the latter at 22,000 volts. Data which are omitted are not available.

Operating Data

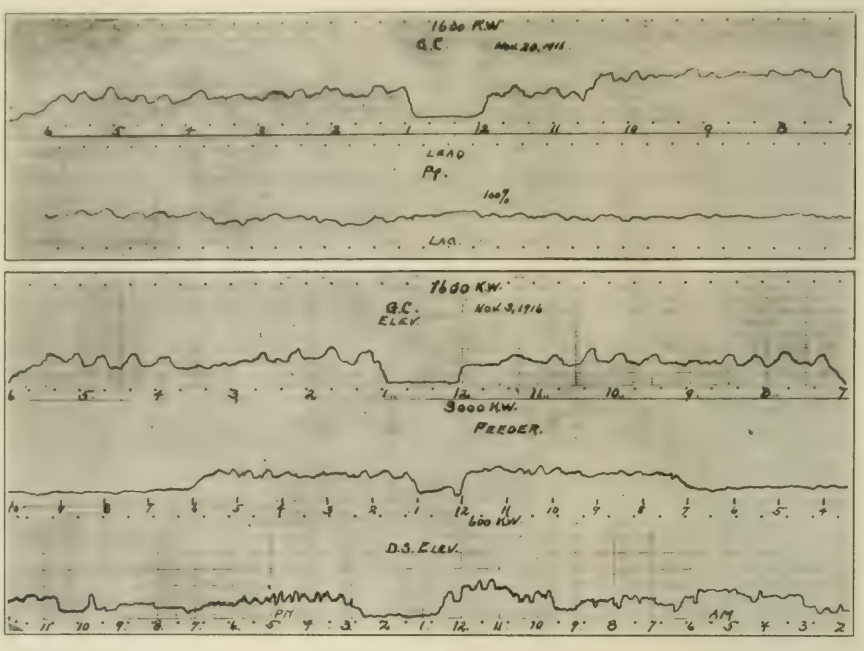
The operating results of six elevators have been carefully compiled and studied in an effort to obtain useful constants, but the results so far have been disappointing. The chief reasons are: (1) The energy and power required for terminal grain handling depend on the size of the grain crop and its general quality. Clean, dry grain requires less handling in the elevator. Cleaning and drying grain requires power in addition to that necessary for unloading and loading. (2) Railway and lake-boat operations affect the rate of grain receipts and shipments. (3) The skill and policy of the elevator management are important factors. Some managers sacrifice power for greater speed, and sometimes it is impossible to keep down the peak load despite every precaution. Naturally the highest power demand occurs when the elevator is performing its three chief functions of receiving, cleaning and shipping at the same time. Conditions sometimes occur which make it necessary to continue cleaning when the other two processes are being carried on, although as far as possible this combination is avoided.

Interpretation of Performance Data

The charts reproduced as Figs. 2 and 3 show distinct peak cycles due to unloading. To avoid establishing high peaks it is customary in most places to have a regular attendant in the substation, who notifies the foremen to reduce loads when necessary.

The daily and monthly data from the G. C. elevator, as well as from others of this type, show wide fluctuations in all factors. For instance, with elevator G. C. the load factor or hours' use of maximum demand per month ran from 95 hours to 184 hours during 1914 and from 44 hours to 260 hours during 1915. It should be recalled that the 1915 crop was very heavy, much of it not reaching the elevators until the spring of 1916. During the fall of 1915, to care for the rush, the elevator managers in Port Arthur were granted the right to increase temporarily their maximum demand without permanently increasing the minimum.

Unfortunately, it has been impossible to secure data on the total number of bushels elevated. This figure, with the number of bushels cleaned, should serve as a basis for more consistent operating results, owing to the fact that each time grain is moved inside the elevator, either for cleaning or to change from one storage bin to another, it must be elevated, with a corresponding increase in kilowatt-hours consumed. It is hoped



FIGS. 2 AND 3—CHARACTERISTIC LOADS OF TWO TERMINAL GRAIN ELEVATORS, SHOWING DISTINCT PEAKS DUE TO UNLOADING

that this important item of internal grain handling will receive greater attention on the part of elevator managers interested in power costs.

The ratios of maximum demand to installed capacity (item 8) agree fairly well for the various elevators represented excepting D. S., which had a ratio of 33.2 per cent during 1915. Owing to elevator P. A. operating partly by steam, its demand factor is higher than for the elevators that are fully equipped with electricity. The ratios of average monthly peak to the annual peak (item 10) show fair agreement for the same years, but will always depend upon grain crops and movements. Items 12, 13 and 14 indicate months of heavy and light grain movements and the lake navigation periods. All except the G. C. elevator have about the same average hours' use per month of the monthly maximum demand (item 18). Evidently the G. C. elevator is not yet operating at maximum handling capacity, a condition which is still further emphasized by item 4. Of the various load factors probably item 19 will prove most reliable, although item 21 would prove most useful for rate-making purposes.

The number of bushels handled per kilowatt-hour of energy consumption (item 24) is probably the most useful figure to the power salesman, and for a strictly terminal elevator operating near capacity it appears fairly consistent. The effect of the load factor on the price

paid per kilowatt-hour is reflected in item 27, since elevators G. C., P. A. and D. S. operate on the same rate. The energy-cost figures are interesting, but it should be noted that the Port Arthur rates were reduced on Sept. 1, 1915, approximately 7½ per cent.

While the data given are reliable, the Port Arthur figures being obtained from monthly records and compiled by the author, great care should be exercised in using the figures without duly considering local conditions. In comparing these figures with coal costs it should be remembered that data referring to steam operation are seldom if ever obtainable in the same detail that electrical data are. Attention is also called to the fact that the power costs given herewith are complete with the exception of fixed charges, maintenance on the substation equipment and the expense of necessary attendance. As a rule a man is kept in the substation during the time the elevator is in operation, but in many cases automatic arrangements could be made to care for peak loads, and an occasional visit by the electrician in charge of the elevator would be sufficient. Whether electric power be generated or purchased, an electrician is necessary to care for the equipment about the elevator.

Elevator superintendents who have not had experience with purchased power usually appear strongly to favor steam operation with slow-speed engines directly connected to a heavy line shaft. They argue that since an elevator must have some steam for drying grain and must burn some dust or waste, it is cheaper to make power on the premises by steam than it is to purchase electricity. However, dryer plants are not operated continuously and are of relatively small size, requiring little space and few refinements. To operate a steam engine or turbine which would meet the total power requirements of a grain elevator is probably more costly per kilowatt-hour or per average monthly-peak horsepower than is generally recognized owing to the usual low load factor. That purchased power at the rates obtainable in Port Arthur and Fort William is satisfactory is indicated by the additional elevators now under construction and using purchased power.

TABLE II—OPERATING DATA FOR SIX GRAIN ELEVATORS

Item	Formula for Calculating Data	Capacity of Elevator									
		G. C. 3,250,000 Bu.			P. A. 9,250,000 Bu.		D. S. 1,750,000 Bu.		W. T. 2,000,000 Bu.	Con. 1,750,000 Bu.	G. T. 5,750,000 Bu.
		1914	1915	1916	1915	1916	1915	1916	1916	1916	1916
1. Total bushels grain handled—receipts plus shipments		23,101,399	38,504,923	52,028,758		94,913,953		26,637,578	54,069,158	38,691,171	50,105,627
2. Working hours, elevator in operation		3,265	3,618	3,509		3,735		7,076	5,785	3,301	
3. Average hours operated per day (300 days	(2)÷300	10.9	12.0	11.7		12.44		23.6	19.25	11.0	
4. Bushels handled per bushel total storage capacity	(1)÷Total storage	7.11	11.85	16.0		10.25		15.22	27.0	22.1	8.7
5. Bushels handled per hour operated, average	(1)÷(2)	7,070	10,650	14,850		25,400		3,760	9,350	11,720	
6. Total rated hp. of motors installed		2,345	2,345	2,345	905	905	542.5	602.5	1,415.5	1,037	2,468
7. Hp. maximum demand, sustained 10-minute peak		956	1,159.5	1,125	424	460.75	180	321.75	777	697	1,397
8. Ratio of maximum demand to installed capacity (per cent)	(7)÷(6)	40.7	49.4	48	46.9	51.7	33.2	53.3	54.9	67.2	56.5
9. Hp., average of monthly maximum demands		763.3	733.0	1,006	272	392	132.6	246	643	595	
10. Ratio of average monthly peak to yearly peak (per cent)	(9)÷(7)	79.8	63.3	89.3	61.4	85.1	73.6	76.6	82.7	85.3	
11. Ratio of average monthly peak to installed capacity (per cent)	(9)÷(6)	32.5	31.2	42.8	30.1	43.3	24.4	40.8	45.4	57.4	
12. Date of yearly maximum demand		May and Nov.	Dec.	May	May	May	Dec.	Dec.	Nov.	May and Dec.	
13. Date of heaviest monthly kw.-hr. consumption		June	Oct.	July	Oct.	Aug.	Nov.	Nov.	Nov.		
14. Date of least monthly kw.-hr. consumption		Aug.	Aug.	Feb.	Jan., July, Aug.	Feb.	Feb.	Mar.	Mar.		
15. Total yearly kw.-hr. consumption		970,300	901,443	1,231,834	676,274	781,040	279,580	453,190	1,251,367		
16. Average hp. load during hours operated	(15)÷[(2)×0.746]	398	334	471		280.5		85.6	290		
17. Average kw.-hr. per month	(15)÷12	80,800	75,100	102,600	56,400	65,100	23,300	37,700	104,300		
18. Average hours' use per month of monthly maximum demand		140.4	120.2	133.7	212	221	209.5	198.5	207		
19. Load factor, based on hours operated and average of monthly peaks (per cent)	(15)÷[(2)×(9)×0.746]	52.1	45.5	46.7		71.5		34.8	46.6		
20. Load factor, based on hours operated and maximum demand for year (per cent)	(15)÷[(2)×(7)×0.746]	41.6	28.8	41.7		60.9		26.65	38.6		
21. Load factor, based on total time and average of monthly peaks (per cent)	(15)÷[8760×(9)×0.746]	19.4	18.73	18.7	38	20.4	32.2	28.2	29.7		
22. Load factor, based on total time and maximum demand for year (per cent)	(15)÷[8760×(7)×0.746]	15.5	11.9	16.7	24.4	25.9	23.7	21.6	24.6		
23. Ratio of average load to average rate of handling (per cent)	(16)÷(5)	5.62	3.14	3.17				2.275	3.1		
24. Bushels handled per kw.-hr. (average)	(1)÷(15)	23.8	42.7	42.3				58.8	43.2		
25. Total power cost (power bills)		$19,816.47	$17,959.29	$20,971.92	$7,197.99	$8,634.02	$3,089.96	$5,272.99	$11,863.13	$10,857.00	$24,168.21
26. Power cost per hour operated	(25)÷(2)	$6.07	$4.97	$5.97		$2.31		$0.745	$2.05	$3.29	
27. Power cost per kw.-hr., in cents (average)	(25)÷(15)	2.045	1.99	1.702	1.64	1.106	1.104	1.165	0.948		
28. Power cost per thousand bushels grain (cents)	(25)÷[(1)÷1000]	85.7	46.6	40.2				19.8	21.9	28.05	48.-
29. Power cost per hp.-year, based on yearly peak	(25)÷(7)	$20.72	$15.50	$18.63	$16.95	$18.73	$17.16	$16.40	$15.26	$15.57	$17.28
30. Power cost per hp.-year, based on average of monthly peaks	(25)÷(9)	$26.0	$24.50	$20.83	$26.42	$22.90	$23.30	$21.45	$18.45	$18.23	

Labor Economy of Industrial Trucks and Tractors

Factors Influencing the Purchase of a Fleet of Forty-nine Storage-Battery Vehicles in an Automobile Plant—Data on Labor-Saving and Cost of Operation

IN THE modern growing automobile factory systems for transporting material are as varied and various as probably could be found employed by any single industrial concern. The cause for this is obvious. The automobile industry in its mushroom growth has cried out for increased production; increasing production has meant speedier movement of raw materials to machines and more rapid movement of parts from machines to assembly. To get this rapid movement factory men have employed hand trucks, gasoline automobiles of all kinds, industrial locomotives, motor-driven conveyor systems, electric industrial trucks and electric industrial tractors. Of all these the two last-named conveyances are newest to the business, but they effectively fill a field which is distinctively their own in the general scheme of material transportation.

Factors That Influence Selection of Trucks

To cite definite experience with these electric storage-battery-driven trucks and tractors, the results at the plant of the Willys-Overland Company at Toledo may be taken as an example. That company bought its first two industrial trucks about five years ago. From time to time it has added to that nucleus of its fleet until it now has forty 1-ton (0.907-t.), 1.5-ton (1.36-t.) and 2-ton (1.814-t.) trucks. Within the last year this fleet was further augmented by the addition of nine storage-battery tractors. The first trucks were bought because one of the Overland company's officials, seeing similar trucks at work in a freight station, grasped the idea that by using them in the factory he could reduce labor costs, which were then beginning to increase alarmingly. In fact, when the first two units were bought it was figured that they would save their own cost in three years, even if the price of labor remained at the level where it then was. When the first two units arrived they immediately proved that with the same force of labor immensely large quantities of material could be handled.

That the performance of these trucks was satisfactory in every respect is evident from the growth of the fleet. In each instance wherein trucks were purchased it was necessary, however, to take into consideration many factors entering into the haulage problem. The first of these was the length of the haul. For any distance above 150 ft. (45.72 m.) it was found economical to employ a tractor to move trailers, but for hauls slightly longer than this, and especially for mixed loads going to several destinations, industrial trucks were found to be more economical. Hand trucks are employed on shorter hauls. In the Overland plant, which covers about 110 acres (44.52 hectares) of floor space and an actual ground area of 105 acres (42.49 hectares), hauls as long as 150 ft. (45.72 m.) are the rule, not the exception. Grades are also a factor, since for hand trucks extra laborers for pushing are required. Trucks and tractors at the Overland plant both successfully pull loads up 12 per cent grades 135 ft. (41.15 m.) long.

The second consideration is the relative weight and bulk of the material to be handled. The heavier the material in relation to its bulk the more suitable it is for electric trucking. A third consideration is the width of factory aisles, for the electric trucks and tractors can traverse narrower aisles than most other conveyances. Aisle widths are, of course, governed by real-estate values and, in these days of poor delivery, by the necessity for storing material in every available inch of floor space.



FIG. 1—THIS TRACTOR HAULING ELEVEN TRAILERS IS PULLING A LOAD OF 16,195 LB.

The load is made up as follows: Two trailers with surmountable rims weighing 1695 lb.; one trailer with automobile hubs weighing 3135 lb.; two trailers with automobile cylinders weighing 1870 lb.; two trailers with automobile springs weighing 2165 lb.; two trailers with automobile top bows weighing respectively 450 lb. and 420 lb.; two trailers empty weighing 385 lb. each.

In the fourth place, the amount of material of any one kind to be moved at one time from one fixed point to another must be considered. If there is a constant stream of material moving between two fixed points, a conveyor system may be more economical than trucks. But as a general rule the movement must be exceptionally heavy to justify the conveyor, and certainty that flexibility is not needed must exist to exclude the industrial trucks. The fifth consideration is the capacity of existing lifts and elevators, for unless these vertical movers will carry at least a 3-ton (2.7-t.) load the economical operation of trucks will be impaired owing to the impossibility of carrying full loads.

The conditions influencing selection of tractors are in general the same as those which govern selection of industrial trucks, with a few exceptions. A tractor costs about 33 1/3 per cent more than a 2-ton (1.814-t.) truck, but will pull loads from four to five times as great. It is exceptionally well adapted to handling incoming freight shipments to storage, while the work

of the trucks is confined more to interdepartmental transportation.

The problem of properly manning, charging and maintaining this fleet of vehicles is an important one. Each truck carries a crew of two men—a driver, who helps load and unload, and a helper. The trucks sometimes haul one trailer if handling light, bulky material, and in such instances an additional helper is required. The tractors haul any number up to ten trailers. A driver and a helper go with each train and the majority of actual work of loading is done by special crews stationed at proper points.

CARE AND MAINTENANCE OF THE FLEET

The entire truck and tractor fleet is housed and charged in an 80-ft. by 80-ft. (24.38-m. by 24.38-m.) garage, in which there are twelve 40-amp. mercury-arc rectifiers and fourteen 40-50-amp. motor-generator sets. Sets of small rating were chosen for this work on account of the gradual growth of the fleet. But even if the garage were to be re-equipped the small units would probably have preference because of the greater flexibility they give for charging one or two trucks at all hours of the day and night. The present practice in adding to this equipment, however, is toward the use of the motor-generator sets rather than rectifiers, on account of the high expense for tube renewal and the lower general maintenance cost of motor-generator sets when the equipment must be handled largely by unskilled labor. Moreover, the motor-generators permit of charging at high rates for short periods, which is necessary occasionally with the alkaline batteries used. The fact that these batteries are equipped with different numbers of cells, ranging from twenty-one to forty-two cells each, is another reason for the preference accorded small units, since each battery can be efficiently

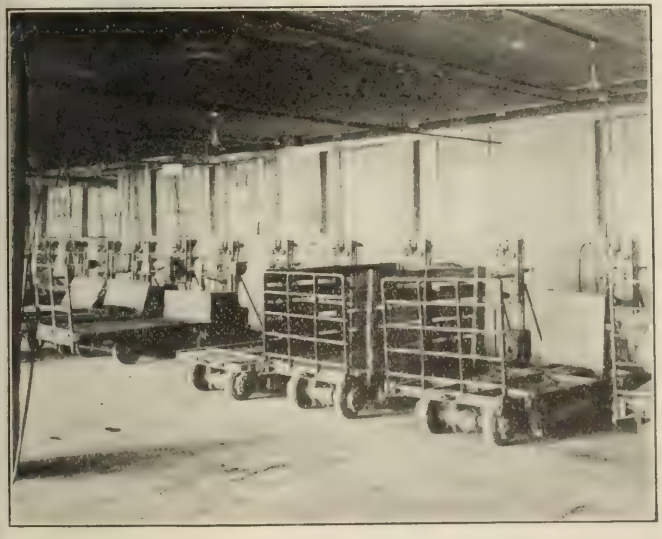


FIG. 2—THE TRUCKS ARE PLACED ON CHARGE IN THIS GARAGE BY THE DRIVERS

given just the charge it needs. A maintenance crew of two men is employed in the garage, but the trucks are ordinarily put on charge by the drivers.

OPERATING AND COST DATA

While no accurate over-all data are available on the total labor saving effected by the fleet, there are sufficient individual instances to be convincing. For example, where eighteen men were formerly needed to unload small 6-volt storage batteries from freight cars eight men and one industrial truck now do the same work and do it faster. Three men who formerly helped push hand-truck loads uphill through a long tunnel were released for other work, since tractors and trucks pull most of the loads. It is said by the foreman, H. Byers,



FIG. 3—THE TRUCK CARRYING BATTERIES HAS A LOAD OF 3080 LB.

Following it is another loaded with transmission and differentials weighing 3654 lb.

who is directly in charge of electric trucking, that, on the average, tractors under the Overland company's conditions have reduced the labor required by one-half and have at the same time speeded the handling of ma-

TABLE I—OPERATING RECORD OF A 2-TON TRUCK TAKEN OVER THIRTY-ONE DAYS

Date, March 8 to April 12, Inclusive	Hours in Service	Mileage, Loaded	Mileage, Empty	Tonnage	Ton-Miles	Average Tonnage per Hour	Average Weight per Load in Lb.	Maximum Load in Lb.	No. of Men in Gang	Wages of Men	Kw.-Hr. Charge	Cost of Power at 1.6 c. per Kw.-Hr.	Cost of Labor per Ton	Cost of Power per Ton	Maintenance per Ton	Invest. Deprec. per Ton
Thurs.	11	4.8	19	5.0	1.7	2110	3000	2	7.50	14	0.22	0.39	.011			
Fri.	11	4.6	19	4.1	1.7	1800	3000	2	7.50	8	0.12	0.39	.006			
Sat.	10	4.2	19¼	4.2	1.9	2020	3000	2	6.60	18	0.28	0.34	.014			
Mon.	8	2.0	9¼	1.5	1.1	1540	2800	2	4.80	11	0.17	0.52	.018			
Tues.	10½	3.8	11	3.1	1.0	1690	2000	2	7.05	3	0.04	0.64	.004			
Wed.	10½	4.2	23	4.2	2.2	2000	2000	2	7.05	12	0.19	0.30	.008			
Thurs	10½	4.5	22	3.8	2.1	1700	2000	2	7.05	13	0.21	0.32	.009			
Fri.	11	4.2	14½	3.5	1.3	1700	2000	2	7.50	14	0.22	0.51	.015			
Sat.	11	3.5	16½	3.1	1.5	1830	2000	2	7.50	15	0.24	0.45	.014			
Mon.	8	3.5	12	2.9	1.5	1710	2000	2	4.80	12	0.19	0.40	.015			
Tues.	10½	4.2	13	3.5	1.2	1730	3000	2	7.05	15	0.24	0.54	.018			
Wed.	11	4.8	7½	3.6	0.6	1500	3000	2	7.50	15	0.24	1.00	.032			
Thurs.	10½	4.5	19	4.0	1.8	1800	2000	2	7.05	16	0.25	0.38	.013			
Fri.	10½	4.8	13¾	4.8	1.3	2000	2500	2	7.05	28	0.44	0.51	.032			
Sat.	11	4.6	16¼	4.6	1.4	2000	3000	2	7.50	7	0.11	0.46	.006			
Mon.	8	3.8	11	3.2	1.3	1800	2000	2	4.80	21	0.33	0.43	.030			
Tues.	11	4.3	14½	3.8	1.3	1800	2000	2	7.50	16	0.25	0.45	.017			
Wed.	8	3.4	11¼	2.8	1.4	1700	2000	2	4.80	18	0.28	0.42	.025			
Thurs	10½	4.1	15	4.1	1.4	2000	2000	2	7.05	17	0.27	0.47	.018			
Fri.	10½	4.1	13½	3.7	1.2	1800	2000	2	7.05	11	0.17	0.51	.012			
Sat.	8	3.3	12	2.9	1.5	1800	2000	2	4.80	16	0.25	0.40	.020			
Mon.	11	4.9	13½	4.1	1.2	1700	2000	2	7.50	9	0.14	0.55	.010			
Tues.	8	3.2	12¼	2.8	1.5	1800	2000	2	4.80	14	0.22	0.40	.017			
Wed.	11	4.2	15	3.9	1.3	1900	3000	2	7.50	15	0.24	0.50	.016			
Thurs	11	4.3	18¼	4.0	1.6	1900	2000	2	7.50	14	0.22	0.41	.012			
Fri.	11	2.0	10	1.6	0.9	1660	2000	2	7.50	13	0.21	0.75	.020			
Sat.	8	3.8	17½	3.9	2.1	2150	2000	2	4.80	15	0.24	0.27	.013			
Mon.	11	1.8	7¼	1.6	0.6	1800	2000	2	7.50	20	0.32	1.03	.044			
Tues	11	2.8	12½	2.1	1.1	1560	2000	2	7.50	20	0.32	0.60	.025			
Wed.	11	3.4	12¼	2.5	1.1	1530	2000	2	7.50	15	0.24	0.61	.019			
Thurs	11	1.3	7¼	1.0	0.6	1600	2000	2	7.50	13	0.21	1.03	.029			
Total, 31 days	315	116.7	438	103.9					208.7	448						
Aver., 1 day.	10.0	3.7	3.7	14.1	3.3	1.4			6.73	14	0.22	0.51	.015	.036	.058	

Average cost per ton-mile, cents: Labor, 2.04; power, 0.066; maintenance, 0.010; investment and depreciation 0.017=$2.097.

terial. The trucks have reduced hand labor 40 per cent and also show an increase in handling speed. Perhaps the best evidence that the fleet is a factor in speeding production is the fact that the electrical department receives immediate and vigorous complaints from departmental production foremen whenever a single truck or tractor is in the garage for necessary repairs. The reason for this can be readily appreciated when it is stated that the fleet—forty trucks and nine tractors—handles in an average day more than 2,000,000 lb. (907,180 kg.) of material, each unit traveling an aver-

TABLE II—A ONE DAY'S HAULAGE RECORD FOR THE FLEET

Truck No.	Lb. per Day per Truck or Tractor	Miles per Day per Truck or Tractor, Loaded and Empty	Hours per Day in Service	Character of Material Handled
Tractors				
21	145,248	16	10	Sheet steel
22	145,248	16	10	Sheet steel
48	105,000	17	11	Sheet steel
47	105,000	17	11	Sheet steel
24	98,000	16	10	Miscellaneous
25	98,000	16	10	Miscellaneous
26	150,000	14	10	Miscellaneous
27	150,000	14	10	Miscellaneous
31	30,000	15	11¾	Cushions
Trucks.				
1	15,000	12	12	Miscellaneous
46	16,000	6	9	Tires
3	13,000	9	8	Miscellaneous
20	20,000	12	10	Miscellaneous
	15,000	11	9	Batteries
4	23,000	10	9	Generators and motors
45	36,000	9	9	Miscellaneous
16	42,000	12	10	Miscellaneous
41	33,000	7	11	Axle springs
2	26,000	12	11	Miscellaneous
37	10,000	14	11	Motors and transmission
32	45,000	13	11	Motors and transmission
35	43,000	13	11	Sheet steel
29	43,000	16	10	Miscellaneous
8	26,000	9	9	Miscellaneous
30	26,000	12	11	Miscellaneous
28	33,000	11	10	Running boards
43	33,000	11	10	Running boards
44	33,000	11	10	Miscellaneous
36	33,000	11	10	Miscellaneous
6	33,000	11	10	Miscellaneous
9	32,000	8	10	Cushion springs
10	10,000	8	10	Rims
7	42,000	6	11	Transmission
11	32,000	7	11	Torsion tubes
12	10,000	10	11	Miscellaneous
14	23,500	8	11	Miscellaneous
15	29,000	11	11	Batteries
17	18,000	7	11	Miscellaneous
18	22,000	12	10	Miscellaneous
19	17,000	12	10	Miscellaneous
34	14,000	14	11	Miscellaneous
33	42,000	9	11	Miscellaneous
23	20,000	12	11	Miscellaneous
39	16,000	12	11	Miscellaneous
42	16,000	12	11	Miscellaneous
13	16,000	12	11	Miscellaneous
5	16,000	12	11	Miscellaneous
40	14,000	8	9	Miscellaneous
Extra	25,000	12	11	Miscellaneous
Total	2,007,490			

age distance of 11.6 miles (18.669 km.). Detailed data on a typical day's hauling are given in Table II.

Data on the total cost of operating one of the 2-ton trucks for a month are given in Table I. From these data it will be seen that the total cost, including wages, electrical energy, maintenance, interest and depreciation, is $2.097 per ton mile ($1.431 per t.-km.). The truck to which these data apply was in service an average of ten hours a day. Its average daily mileage loaded was 3.7 (5.955 km.); its mileage empty was also 3.7. Its average daily total tonnage was 14.1 (12.7 t.), and its daily work was 3.3 ton-miles (4.82 t.-km.). Its average tonnage per hour was 1.4 (1.27 t.).

Labor is by far the largest item of cost. The energy for charging was purchased under the Overland company's general wholesale contract with the Toledo Railways & Light Company. Interest was figured at 6 per cent and depreciation at 12.5 per cent. The operating costs on tractors would be somewhat lower than these figures, it is believed, because of the greater tonnage they handle. These data are believed to give a more accurate idea of actual hauling costs than over-all data could give because the trucks are used at times for such other work about the factory as pulling cable into underground ducts, etc. The trucks and charging equipment were installed and are maintained under the direction of W. A. Hill, electrical engineer for the plant.

INSULATING BARRIERS FOR USE WITH TRANSFORMERS

These Barriers Are Formed of Totally Inclosed Impervious Casings Containing Oil in the Form of Films or Layers

Insulating barriers for transformers or the like where extra high tensions are present are the basis of an invention by Willis A. Ishler of Pittsfield, Mass., in patent No. 1,223,881. The insulating barriers are formed of totally inclosed impervious casings containing oil in the form of films or layers, preferably in the form of oil-soaked fibrous sheets. At one or both sides of the oil layer may be applied one or more thicknesses of other insulating materials as conditions may require. A structure of this kind may be made in the form of a fairly flexible pad which may be wrapped around the part to be insulated.

MERCURY-ARC RECTIFIERS

Three-Phase Current Converted Into Star-Connected Multiphase—Rectifying from Each Phase

In three-phase or even six-phase mercury-vapor rectifiers operating at a given voltage the output is limited by the electrical strain imposed upon the electrodes, as above a certain current strength the electrode temperature will become too high and impair the proper working of the rectifier. The output increases with the number of phases. Therefore the invention of Ernst Oelschlager (patent No. 1,218,952), assignor to the Siemens-Schuckertwerke of Berlin, Germany, is directed first to turning delta-connected three-phase current into star-connected multiphase, and secondly, to rectifying from each of the many phases so produced. The continuous-current mains to be supplied from the rectifier are connected on the one hand with the mercury of the rectifier and on the other hand with the zero point of the star-connected phase windings of the phase transformer. Each part or phase is connected at one end with the common zero point and at its other end with one of the electrodes of the rectifier. The number of these electrodes must, of course, be the same as that of the number of parts or phases of the winding. In connecting the several phases with the electrodes the same order of succession must be observed, so that a rotating field traversing the windings will cause the maximum voltage between the cathode and the series of anodes to travel circularly around the anodes.

Lighting in Automobile Factories

Relative Costs of Lighting Equipment and Factory Buildings, Losses Arising from Poor Lighting, and Examples of Good Lighting in Representative Plants

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SUMMARY.—The author touches briefly upon the magnitude of the automobile industry and points out the relation of investment required for lighting equipment to the total cost of modern factory buildings and also to the cost of such parts of the equipment as elevators, cranes and the ventilating system. The importance of lighting in improving production efficiency is emphasized and estimates are made of the loss occasioned by poor lighting. Special attention is called to some excellent examples of artificial lighting in representative plants.

GOOD illumination is one of the most important influences that contribute to efficient production in manufacturing plants. Without it the best laid plans of continuous-line work, etc., will not produce the desired results. Workmen will be delayed in groping for tools and materials or in adjusting their machines. The accuracy of the work performed under such conditions may also suffer seriously. Furthermore, as was pointed out in one of the preceding sections of this series, accidents will be increased by the absence of adequate light. These facts are particularly noticeable in the automobile industry, where men are required to concentrate on specialized work to keep up with the demand for pleasure cars and commercial trucks.

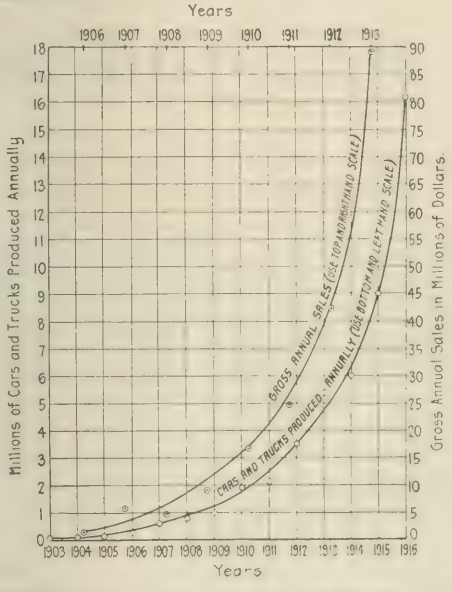


FIG. 1—GROSS ANNUAL SALES OF FORD COMPANY AND ANNUAL PRODUCTION OF ALL MAKES OF CARS

The increase in the manufacture of automobiles during recent years constitutes one of the most stupendous developments in the history of industry. According to the United States census, the value of the manufactured product in 1909 was $250,000,000 in round numbers, and the output was roughly 1,000,000 cars and trucks. In 1916 the output of cars and trucks of all makes was placed by reports at more than 16,000,000, the value of which may be estimated conservatively at close to $5,000,000,000. The last figure represents roughly a 2000 per cent increase over the corresponding figure for 1909. The gross annual sales during eight years of the Ford company's experience are shown graphically in Fig. 1, which also indicates the number of cars and trucks of all makes produced annually between the years 1903 and 1916 inclusive.[1]

RELATIONS OF COST OF LIGHTING EQUIPMENT TO COST OF PLANT

To illustrate the approximate cost of lighting equipment in its relation to the cost of the buildings used by modern automobile plants, and also to show how the cost of lamps and wiring compares with the initial costs of such parts of the plant equipment as elevators, cranes and the ventilating system, data based on the new shops of the Ford plant are cited. The total cost of these additions is given as $1,127,117.30, of which $1,039,793.89 represents the cost of the buildings only. The cost per square foot of floor is about $1.64 ($17.60 per sq. m.). A modern system of factory lighting, under normal price conditions, depending somewhat on the type of lamps and the methods of wiring, costs about $50 to $150 per 1000 sq. ft. ($537 to $1,610 per 1000 sq. m.) of floor area, or 5 to 15 cents per square foot ($0.54 to $1.61 per sq. m.). These figures are based on actual costs in old plants where the wiring was installed

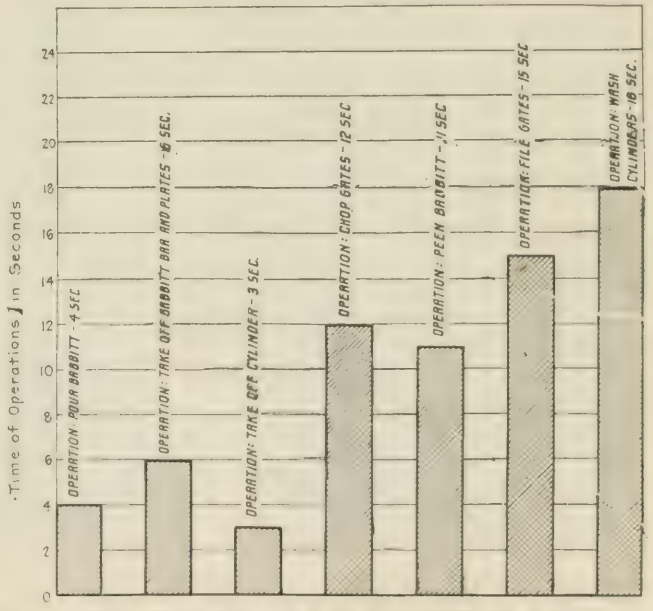
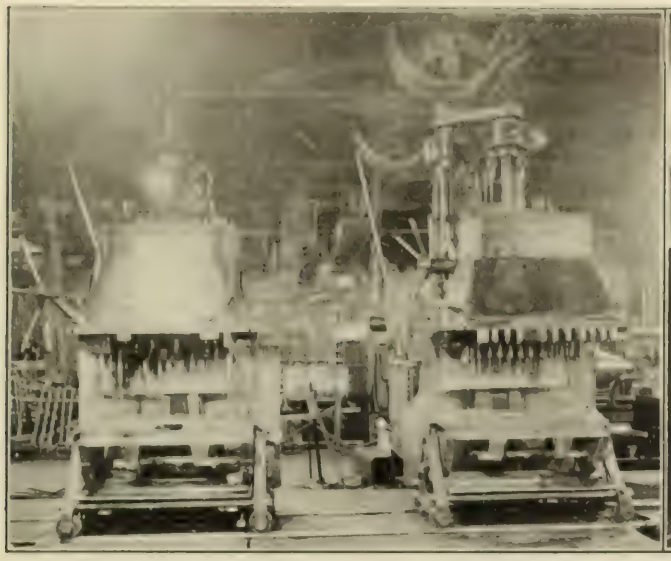
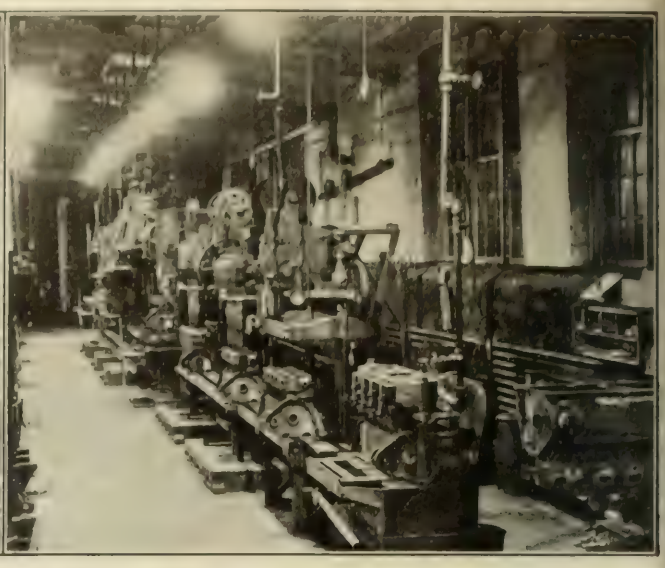


FIG. 2—OPERATIONS THAT CAN BE PERFORMED IN TIME SAVED BY GOOD LIGHTING

[1] Fig. 2 and the curve on the left in Fig. 1 have been plotted from data found in Arnold and Faurote's "Ford Methods and the Ford Shops," published by the Engineering Magazine Company, New York, and several references are made to this book in a portion of the text. The curve on the right in Fig. 1 is based on data in an article by D. M. Lay in the *Automobile* for March 15, 1917, page 549.

in an old structure. Taking the minimum value of 5 cents per square foot ($0.54 per sq. m.), because the installation was made in a new plant at the time of construction, it follows that the modern plant of the type referred to will require an initial investment for lighting equipment equal to about 3 per cent of the entire construction and equipment cost.





FIGS. 3 AND 4—NIGHT VIEWS IN MACHINE SHOPS OF HUDSON AND KISSEL AUTOMOBILE COMPANIES

In the Hudson shop 200 alternating-current mercury-vapor lamps are mounted 11 ft. above the floor, 20 ft. apart, making the power demand for lighting 0.97 watt per square foot of floor area. In the Kissel shop 100-watt gas-filled tungsten-filament lamps equipped with krinkled-glass reflectors are placed 10 ft. to 12 ft. apart at 12 ft. above the floor, making a demand of 0.7 watt to 1 watt per square foot of floor area that is illuminated.

It is interesting to compare the initial costs of elevators, cranes and the ventilation system with that for lighting. In the Ford additions the cost of elevators is given at $23,500, that of cranes at $11,950, and that of the ventilation system at $51,873.41, these figures amounting roughly to 2, 1 and 5 per cent of the total initial cost of the plant respectively. The cost of lamps and wiring will therefore roughly approximate the cost of the ventilating system. It is hardly necessary to point to the wisdom of including the lamps and wiring as a part of the initial outlay for such buildings, since it is believed that the value of sufficient artificial lighting is now becoming generally recognized by the managements of modern automobile plants.

Too much emphasis cannot be placed on the saving in minutes and seconds obtainable in connection with the many detailed operations of automobile manufacture. Having the production processes and assembly carried out in their logical order by men and at machines arranged in the corresponding order relative to each other has produced remarkable results. However, if the necessary light is not furnished, each man cannot perform his work in the minimum time nor with the best results, and the advantages theoretically obtainable with continuous-line work will be offset.

Some idea of the value of a second saved or lost by some influencing factor like lighting can be obtained from a study of the following data[2] and of Fig. 2. Machining of a cylinder, which requires forty-five minutes, costs roughly 1 cent a minute (based on $5 a day of eight hours). Upkeep of cutting tools and overhead expenses also amount to about 1 cent a minute each, making the total gross charge of manufacturing one cylinder, involving twenty-eight operations, $1.35. The actual assembly of a piston and rod, which takes one minute and twenty-four seconds including inspection, involves (1) driving out the pin, (2) dipping it in oil, (3) slipping it into the rod eye, (4) turning the pin to take the screw, (5) inserting set screw, (6) tightening the screw with a wrench, inserting cotter pin and spreading ends. Fig. 2 shows graphically the time required for each of seven operations out of eighty-four required in motor assembly. The entire assembly of a motor takes 226 minutes.

The annual or continuous charge for light will be very small in terms of wages. In marked contrast, the losses due to poor light will be correspondingly exaggerated. Thus if twenty men work in an area of 1000 sq. ft. of floor area (92.7 sq. m.) a good system of lighting for this space and number of men will cost about $80 per annum with certain assumptions as to energy cost, interest and depreciation on the investment, etc., while the gross labor charges, including upkeep and overhead, per annum may be as much as $80,000 for such a unit area. In other words, the cost of light would equal roughly one-tenth of 1 per cent of the wages, and in like manner a loss of one minute per day for every workman due to bad lighting conditions would result in a gross loss of about $180 per annum for the twenty men, or more than twice the total annual charges for light.

Essential Qualities in the Lighting System

From the foregoing data it can be seen that careful attention to lighting is as essential to production efficiency as the adoption of time-saving methods. There can be little or no question concerning the wisdom of installing the lamps overhead and of doing away as far as possible with the inconvenience and annoyance of drop lamps close to the work. A representative case of good lighting is illustrated in Fig. 3, which shows a section of the machine shop of the Hudson Motor Car

[2]These data are based on the present practice of the Ford company, where continuous-line assembly, use of work-carrying chutes and the plan of holding the motor as nearly at one level as possible during the entire course of assembly are employed.

Company, Detroit, illuminated by mercury-vapor lamps. Attention is called particularly to the large amount of light, all from overhead lamps, which reaches the drills at the point of greatest importance to the operator. It is of interest to note that the lamps in this shop are spaced on 20-ft. (6.1-m.) centers and are mounted 11 ft. (3.4 m.) above the floor, so that about 0.97 watt is



FIG. 5—NIGHT VIEW OF GARAGE ILLUMINATED BY TUNGSTEN LAMPS WITH REFLECTORS

required per square foot of floor space (10.3 watts per sq. m.). About 200 lamps of the mercury-vapor type are installed in this shop.

A night view in the assembly department of the Maxwell Motor Car Company, Detroit, is given in Fig. 6, which shows the good effects of the illuminaton system employed. In this building, which is more than 700 ft. (213.4 m.) long, the bodies of the cars are built up on trucks which may be moved along rails extending throughout the entire length of the building. The various parts are added as the car travels along, until at the end of the building the car is run off under its own power. It is interesting to note that in this shop one car is completely assembled practically every minute. The lamps in this section are of the mercury-vapor type spaced approximately on 20-ft. by 26-ft. (6.1-m. by 7.9-m.) centers, and the watts per square foot amount to approximately 0.75 (8.07 watts per sq. m.).

To indicate the results obtainable with gas-filled tungsten-filament lamps under approximately similar conditions, Figs. 4 and 7 are shown, representing machine-tool work and assembly respectively. In each case 100-watt units are used with X-ray No. 570 direct-lighting reflectors. The spacing of the lamps is from 10 ft. to 12 ft. (3 m. to 3.7 m.), and the mounting height is 12 ft. (3.7 m.) above the floor. From 0.7 watt to 1 watt per sq. ft. (7.53-10.75 watts per sq. m.) is required.[3] About 3 ft.-candles to 5 ft.-candles is used for garages in general.

METALLIC CONDUIT MOLDING

Provided with Beveled Corners at Base and Locking Ribs at Edges of Side Walls

A conduit system adapted for wall or ceiling work is proposed by William A. Bonnell of Brooklyn, N. Y., in patent No. 1,217,398. The conduit body consists of a base plate and side walls. At the junction with the base plate the side walls are beveled to meet the base plate, thus forming latching shoulders to be engaged by the ribs formed on the side walls of the box-like cover. Retaining fingers which are sheared out of the side walls of the body may be bent by hand or by a tool around the conductors after they are laid in place. In this case the retaining fingers are not cut back completely to the base plate, but only to the beveled portions of the body, so that when the cover is in place the side walls and ribs completely close up these openings. In this form the members may be assembled either by slipping the ribs over the outer edges of the side walls of the body member, or the ends of the body and cover may be engaged and the latter slid longitudinally over the former after the conductors are in place.



FIGS. 6 AND 7—NIGHT VIEWS OF ASSEMBLING DEPARTMENTS IN MAXWELL AND KISSEL AUTOMOBILE PLANTS

About 280 mercury-vapor lamps are used in the Maxwell shop, being mounted 20 ft. to 26 ft. apart at 14 ft. above the floor, making the demand 0.75 watt per square foot. In the Kissel shop 100-watt gas-filled tungsten-filament lamps equipped with krinkled-glass reflectors are mounted 12 ft. above the floor and 10 ft. to 12 ft. apart. The demand is 0.7 to 1 watt per square foot.

[3]Figs. 3 and 6 are shown through the courtesy of W. A. D. Evans of the Cooper Hewitt Electric Company, to whom are also due the data relating to these installations. Figs. 4 and 7 have been taken specially for this article in the works of the Kissel Motor Car Company, through the courtesy of J. L. Stair of the National X-Ray Reflector Company, who has furnished the data covering the installations shown.

Discussion of Insulator and Cable Problems

Eleven Papers Were Presented at Special Meeting of A. I. E. E. in New York—Cables, Insulators, Mining, Water Power and Heating of Apparatus Were Subjects Considered

MOST of the papers presented at the special meeting of the A. I. E. E. held in New York June 27 and 28 dealt with subjects connected with high-tension cables and insulators. Four of the eleven papers presented were on mining, water power and heating of apparatus.

Particular emphasis was laid in the insulator papers on the fact that mechanical causes are principally responsible for insulator failures, cracking, absorption and unequal expansion being given as frequent sources of trouble. Dielectric flux concentration as a cause of insulator failure and the need of standardization in joint construction were also brought out. Among the remedies suggested were to use elastic cement, minimize the amount of nesting, avoid flux concentration, and use materials that have similar coefficients of expansion.

The importance of keeping dielectric losses low was alluded to in all of the cable papers, it being pointed out that these have a considerable influence on cable rating. Dampening the ground surrounding cables or operating them under practically submarine conditions was again brought up as a means of increasing cable ratings so that existing installations as well as new ones can be used to better advantage.

One of the mining papers took up the considerations which affect the selection of apparatus and types of distribution systems for bituminous coal mines, while the other gave the performance of one of the largest mine hoists in the world, showing that the over-all efficiency was 46.7 per cent under working conditions. A paper on economical combinations of steam and hydroelectric plants contained a very interesting method of determining the annual costs of water-power and steam plants used separately or in combination.

Abstracts of nine of the papers follow.

OPERATION AND MAINTENANCE OF UNDERGROUND CABLES

Problems That Are Involved and Some of the Solutions for These Problems, Including Method of Increasing Radiation

Since the cost of underground cables for power distribution has doubled in the last two years, it is especially urgent at this time for operating engineers to devise methods whereby the ratings of existing installations may be increased considerably above the values they were supposed to give. Assuming that cables are made of good material with good workmanship and design, John L. Harper pointed out that the fundamental causes of cable failure are joint trouble, mechanical injury of lead sheaths, and overheating, the latter being the most important.

The incorporation of a joint-filling compound that has not the same characteristics as the insulating compound used in the cable may also cause trouble as a mixture of the two may have very different insulating characteristics from either of the original compounds. If cables are cut and allowed to hang down and bleed slightly, a bubble of air is liable to get into the cable. Later when the cable is in operation and thoroughly heated the bubble may expand, displace the insulating compound and eventually cause failure.

Overheating.—The retention of constantly produced heat, no matter how small, will build up temperatures which will not only impair the insulating characteristics of the cable but will destroy the cable itself. The problem, therefore, is one of controlling the dielectric loss and producing an even and rapid dissipation of all heat produced within the cable. The obstruction to rapid dissipation of heat from the cable or conduit may not be in the cable itself or in the conduit structure, but may depend on the quality and condition of the earth surrounding the conduit.

To decrease the first cost of the underground distribution of power the dissipation of the heat should be increased at least to the point where the power value of the I^2R losses may be made to balance the operating expense of increased construction and installation. This can be done by dampening* the earth surrounding cable ducts, by circulating water through porous tile, or by flooding the cable ducts and operating them under practically submarine conditions where possible.

INSULATION CHARACTERISTICS OF HIGH-VOLTAGE CABLES

Dielectric Losses and Chemical Instability of Insulation Constitute Important Factors in Rating of Cables

Practically all failures of high-voltage underground cables, W. S. Clark and G. B. Shanklin pointed out in their paper, are due to heating, usually not over their entire length, but at certain points known as "hot spots." Since the dielectric losses rise rapidly with temperature and have a cumulative tendency at high temperatures, they constitute an important factor in the rating of cables. Paper-insulated cable, which is the most generally used of all types of cable, is susceptible to the widest variation in its insulation characteristics.

The first tests referred to by the authors in their paper were for the 60-cycle dielectric energy loss in a standard type of mineral hydrocarbon-base cable compound. Tables and curves were given showing the variation of relative permittivity, power factor and specific gravity with temperature. The relative permittivity was found to decrease with increase of temperature, corresponding values of specific gravity varying in the same way.

The next set of tests were on single-conductor paper-insulated cables, data being obtained showing the vari-

*Suggested by L. E. Imlay in a paper before the A. I. E. E. in 1915.

ations of watts loss, per cent power factor, relative permittivity and specific resistivity with temperature. The authors bring out the fact that never yet have they found a case where cable trouble can be attributed to initial moisture. Sometimes the moisture may become entrapped in cable joints, but it never travels along the cable to any great extent. Rubber-insulated cable protected by lead sheathing undergoes a chemical change due to heating. Therefore chemical instability under temperature and voltage stress is a predominating factor in cable insulation trouble. Remarkable similarity is shown between watts and permittivity cycles with rubber, varnished cambric and other insulation. It is to be expected that the material with the highest effective alternating-current resistance at high temperature would be the least liable to deterioration at "hot spots" and is therefore the most desirable one to use.

From tests of three-conductor paper cable it was concluded that the highest possible surface resistance should be afforded especially at high temperatures. Stresses between the inner tangential points of the conductor, occurring where cable temperature is highest, will probably be the limitation to maximum voltage ratings of cables in the future. In one cable which had given trouble in operation the weak spot was found to be at a point heated above the average duct temperature by external sources, indicating that the dielectric energy loss must have been so high that it was comparable with the copper loss. With a power factor as high as the one tested (54 per cent) at 100 deg. C. it is safe to say that trouble will occur at "hot spots" in time.

Paper insulation has the poorest temperature characteristics, compared with varnished cambric and rubber-insulated cables, and must be of the highest grade to bring the 100-deg. C. resistivity well up in value. Varnished cambric excels paper in desirable quality. Although its resistivity characteristics are not particularly good, it is very stable and uniform and has good mechanical qualities. Rubber has the best temperature characteristics, but the physical changes that take place in it prohibit its use at high temperatures.

After a continuous run of a year or more at twice normal voltage, some coils were examined and found to have deposits on the walls of the gas spaces, although very little damage was done. Over-stressing cables to a point where internal ionization begins is to be avoided in practice.

CABLE JOINTS AND THEIR METHOD OF CONSTRUCTION

Necessity of Engineers Agreeing on Requirements to Permit Standardization—Costs and Time of Construction Now Vary

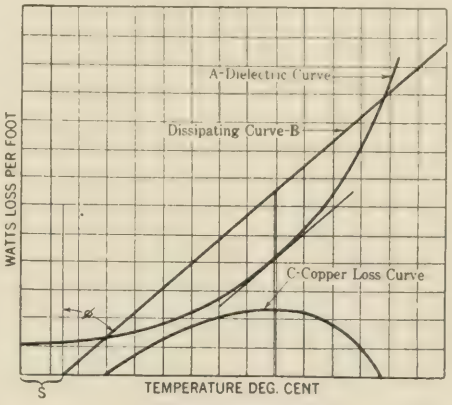
Owing to the fact that the number of companies installing cables for operation at 20,000 to 25,000 volts has increased in the last few years, D. W. Roper points out that it is essential that engineers come to some agreement on the fundamental requirements of joints so that their construction may be standardized. Some idea of the need of standardization may be obtained when it is considered that the labor cost for joints made under similar conditions varies from $5 to $30 and the time required for making them ranges from less than half a day to a day and a half, depending on the methods and construction employed.

Mr. Roper suggested a number of tentative specifications the adoption of which, he says, would be a step toward standardization. These will be presented in a later issue of the ELECTRICAL WORLD.

DIELECTRIC LOSSES AND CABLE RATINGS

Method of Calculating Rating of Cable from Dielectric Loss and Heat-Dissipation Curves—Effect of Soil Temperature

From a number of tests made by A. F. Bang and H. C. Louis to obtain information regarding the maximum permissible rating of cables it was found that a mineral oil base gives much better results than a rosin-oil base



GRAPHICAL METHOD OF DETERMINING CABLE RATING BASED ON DIELECTRIC LOSS AND RATE OF HEAT DISSIPATION

as an impregnating compound. The tests were made on four different specimens of cables from three different manufacturers, all of them being three-conductor No. 4/0 paper-insulated copper cable. The curves in the accompanying diagram show how the cable rating may be determined.

As it was evident that very unstable and dangerous conditions exist in high-tension duct lines when the critical temperature is reached, the authors developed a method for determining the critical temperature for any duct line and also the temperatures that will be reached under given loads. The method is as follows:

Determine the dielectric loss curve of this cable and represent as A in the cut. The heat-dissipating curve for the duct line and cable can be drawn as B. The soil temperature at a distance sufficiently far from the duct to be unaffected by the heat dissipated in the duct will determine the abscissa of the lower end of curve B.

If it is now assumed that constant conditions have been reached where no heat is used for increasing the temperature of the cable and duct, the watts which can be dissipated as indicated by B will equal the total losses generated (dielectric loss plus copper loss). Therefore the allowable copper loss can be determined graphically by subtracting A from B, giving C. From this curve the corresponding current can be calculated by the formula $I = \sqrt{W \div 3R}$, where W represents the watts taken from curve C, and R is the resistance of one conductor at a temperature taken from the corresponding point of curve B. A change in soil temperature will cause a parallel shifting of the heat-dissipation curve, producing an entirely different copper-loss curve.

DESIGN AND MANUFACTURE OF PORCELAIN INSULATORS

Cracking and Absorption Causes of Insulator Deterioration—Reduction of Nesting and Elasticity in Joints Recommended

The two most important elements producing insulator depreciation, A. O. Austin pointed out in his paper, are cracking and absorption. Insulators which crack usually fail suddenly. Hence it is impossible to anticipate their failure by any practical electrical tests. The largest and apparently the strongest insulators crack soonest, the size, shape and number of the cemented joints appearing to be the influencing factors. Old insulators when heated up slowly will often crack before they attain 150 deg. Fahr. (65.6 deg. C.). When their tops are sprayed with water after being heated up, as in a thunderstorm, a very much larger percentage of cracking occurs. In the first instance the parts which fail are the tops or shells outside of the large cement spaces, while in the second the failure is usually confined to the head of the insulator.

So long as insulators are subjected to the weather, the percentage of failures seems to be the same whether they are in service or not. The usual absence of any electrical indications of weakness goes to show that the cracking is due to the high mechanical stress rather than to electrical fatigue. The stress due to a slight expansion of the cement, though not serious in itself, might combine with other causes to produce failure.

Much effort has been expended to incorporate the following characteristics in modern pin-type insulators: (1) A few strong parts; (2) small heads with corresponding cement sections and areas; (3) minimum amount of nesting permissible with mechanical reliability, and (4) elasticity in the joint. Insulator joints, to be satisfactory, should have a minimum area for a given grip, should not slip and should have an elastic yield or ability to distribute a heavy load. Coated sanded surfaces fulfill all of these requirements to a marked degree. The author gave sketches and discussed various types of joints.

In order to insure the mechanical reliability of an insulator it is advisable that the cap should bear on the flange to prevent the escape of cement while setting. The present practice is to sand all grip surfaces and to use a moderate assembly temperature, so that dangerous shearing stresses will not be set up in cold weather. The use of elastic sanded surfaces very much reduces the danger of cracking. The best practice, however, for very heavy loads is to use insulators which transmit all their stress to a wood or fiber core. Still greater refinements are obtainable at minimum cost through the use of coated sanded surfaces, and it is probable that improvements in the near future will be along this line.

To obtain insulators which will not fail by absorption it is necessary that the body composition be vitrified to the extent that the pores are entirely sealed. In the firing or burning process the important factors are to have (1) a means of determining the firing history of each individual piece; (2) a body composition that is satisfactorily vitrified over as wide a temperature range as possible, and (3) a close control of the firing of the ware. Thermometers and pyrometric cones are used to check the temperatures and for indicating the finishing temperatures. Disks or rings whose shrinkage can be accurately measured are employed to determine the shrinkage which the insulators undergo in firing. With the present thickness of insulator materials voltage tests just below the flash-over value are hardly severe enough to be satisfactory. However, if the regulation of the circuit is poor and the voltage is raised so that a violent flash-over is produced, a very effective test is obtained, as a maximum stress is exerted on all zones.

INSULATOR TROUBLES AND SOME REMEDIES

Mechanical Stresses and Dielectric Flux Concentration Given as Sources of Trouble—Some Improvements Suggested

According to W. D. Peaslee, the porcelain insulators on the market to-day deteriorate too rapidly both in and out of service from certain inherent causes. Part of the difficulties may be overcome by correct mechanical design and by the proper distribution of the dielectric flux.

Not being satisfied with the generally accepted theory explaining the failures of insulators, Mr. Peaslee began an extended research in 1914, which included a microscopical analysis of insulators using polarized light and crossed Nicols prisms. From this investigation it was observed that some action takes place inside the cap of suspension units and between the shells of a pin-type unit which causes deterioration when the units are not in service. Some insulators in service deteriorate at a very rapid rate owing to dielectric stresses combining with other stresses.

The results of the investigation show four important contributing causes of failure: (1) Mechanical stresses due to temperature changes necessarily resulting from the different coefficients of cubical expansion of the materials; mechanical stresses due to the change of volume on account of different moisture contents, and mechanical stresses due to improper firing and cooling of the porcelain; (2) dielectric flux concentrations due to improper design of insulator shapes and defects in the porcelain; (3) dielectric flux concentrations due to the fact that the porcelain is inevitably made of two or more materials of widely different physical properties, one isotropic and the others anisotropic in character, and (4) mechanical stresses due to the difference in coefficients of expansion of the constituents of the porcelain acting to establish a separate surface between the crystals.

An examination was made of the cement in 218 insulators, the histories of which were well known. Of those failing electrically (207) all but fifteen contained cement whose absorption after two hours' baking at 120 deg. C. and four hours' boiling in water was over 12 per cent. In some failing quickly the absorption ran up to 45 per cent. Of those which had failed mechanically or were still good (eleven) one had cement whose absorption ran over 6 per cent. Microscopic examinations of a great many samples have shown that flow lines exist which are mechanically weak and have a great tendency to develop minute cracks, apparently during cooling.

To avoid the troubles mentioned the author lays down the following requirements for insulators: (1) A cement must be developed that will be elastic enough to with-

stand expansion and contraction under different temperatures. (Some compounds have been tried, but so far as the writer knows they are not a commercial success.) (2) Improve the design of the insulator to avoid flux concentrations, make it unnecessary to place dielectrics of different permittivities in series, and improve the workmanship to avoid defects. (3) Make the insulator from an amorphous, non-crystalline substance containing only one constituent, or only those of the same electrical and temperature characteristics.

Fused quartz gives promise of some success as an insulator material. Its temperature coefficient of expansion is about one-fifth that of porcelain, its dielectric strength is very high, its mechanical strength and elasticity are good, and it withstands indefinitely the action of high-frequency voltages. It has certain drawbacks, but these for the most part have been overcome. The problem now is to produce this material commercially so that the cost will not be prohibitive.

CALCULATING TEMPERATURE OF ELECTRICAL APPARATUS

Method Pursued in Determining—Rate of Cooling Said to Be a Function of the Watts per Pound of Copper

Three general methods of determining the temperature of electrical apparatus at shutdown were explained in a paper by V. M. Montsinger. The methods are: (1) to plot a cooling curve and extrapolate back to the instant of shutdown; (2) to use an arbitrary correction, and (3) to calculate the rate of cooling. A very simple formula is derived for carrying out the last method.

$$\theta = 1.95\, W_c^{0.7}\,(1 - \varepsilon^{-0.106\, Wc^{0.3}t}),$$

where θ = cooling in deg. C.

W_c = watts per pound of bare copper.

$$\text{at 75 deg. C.} = 2.577\, C^2\left(1+\frac{e}{100}\right)10^{-6},$$

e = eddy current loss in per cent of I^2R,

t = time in minutes after shutdown.

This formula is based on the observation that cooling of oil-immersed transformer windings for a limited time (four or five minutes) after shutdown is approximately a function of a watt per pound of copper.

EXPANSION A CAUSE OF INSULATOR DETERIORATION

Absorption of Moisture by Cement and Overfiring of Porcelain Given as Frequent Causes of Insulator Trouble

Expansion was given in the paper by J. A. Brundige as the principal cause for the continued and seriously high rate of depreciation experienced with high-voltage insulators of the cap and stud type. This stand was based on the fact that the temperature expansion coefficient of porcelain is only one-half that of steel, and that the volume of cement will change considerably under the influence of varying moisture conditions. Excessive loads also accelerate deterioration, although several instances point to the contrary.

From megger and oscillator tests made during the last three years on transmission systems in widely separate parts of the country and embracing over 600,000 suspension insulators the following observations were made: Although the end units of insulator strings are theoretically subjected to greater electrical stresses than the intermediate units, they do not appear to fail at a faster rate than the others. Tests on stored insulators showed that they depreciate as fast as those in service. According to oscillator tests of 877 insulators which had been subjected to the entire range of commercial firing, the overfired units showed a tendency to fail more than any of the others, including the underfired units. Owing to the rapid depreciation of some insulators it was concluded that their failure was due to cracking rather than porosity. Some old types of pin insulators were found to be exceedingly porous compared with modern suspension-type units. When insulators are very porous they may be readily "weeded out" by high-voltage tests, but this method is not of much service in detecting cracked units. Furthermore, high-voltage tests may break down insulators that would otherwise be suitable for service for some time.

ECONOMICAL COMBINATION OF WATER AND STEAM PLANTS

Price Conditions Favorable for Water-Power Development if Legislation Does Not Hinder—Determining Economical Combinations

In a paper by H. S. Putnam there is given a very simple method employing empirical formulas or curves for determining the most economical combination of water power and steam plants.

From the results obtained several conclusions were made. Where a market for the power is available or can be created, practically all water power should be developed beyond the minimum power available, and hence all water-power plants require steam plants in connection with them. Water-power plants are most valuable when developed in connection with steam plants. The point of economical development of the water power is increased as the operating cost of the plant is increased and as the value of money decreases. Therefore, under the present conditions of high fuel and labor expense and the downward tendency of money value, it is a particularly opportune time to develop water power. The policy under which additional burdens are imposed on water-power development, whether by the government or other authority, is against the true interests of the public, and contrary to the best utilization and preservation of our natural resources. If a plan could be devised so that the government funds at low interest rates could be used for such developments, they would be greatly facilitated and the natural values created would react to the great advantage of the government, Mr. Putnam declares.

To illustrate the use of the formulas several typical examples were solved. For instance, it was determined what size development of a water power would secure better results than a steam plant. Solutions were also given for the following problems: When is it better to construct a hydroelectric plant than to extend an existing steam station? What is the most economical water-power development under given conditions? What is the most economical combination development?

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

BONUS SYSTEM STIMULATES OHIO OPERATING MEN

Outline of Method Used by Ohio Company Based on Coal Consumption per Kilowatt-Hour Output

Every man employed by one Ohio electric-service company is being offered a bonus, the size of which depends upon the coal consumed per kilowatt-hour delivered to the switchboard. The system is as follows:

Coal Consumption per Kw.-Hr.	Bonus per Man	Coal Consumption per Kw.-Hr.	Bonus per Man
2.85 lb. to 2.95 lb.	$1.00	2.65 lb. to 2.75 lb.	$9.00
2.75 lb. to 2.85 lb.	3.00	2.55 lb. to 2.65 lb.	15.00

As the system has not been in force for a year, it is not known how the improvements which have been experienced have been affected by weather conditions, changes in personnel of the plant or increase in load. Results before and after the bonus system was adopted are given herewith:

COAL CONSUMED PER KILOWATT-HOUR

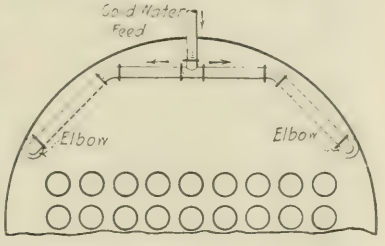
Before Adoption:	Lb.	After Adoption:	Lb.
June, 1916	3.10	October, 1916	2.87
July, 1916	3.38	November, 1916	2.76
August, 1916	3.11	December, 1916	2.88
September, 1916	2.98	January, 1917	2.84
		February, 1917	2.83

WATER HAMMER IN FEED PIPE

How Trouble with Cold-Water Feed Pipe in Fire-Tube Boiler Was Corrected

BY T. W. REYNOLDS

Having experienced serious water hammer in connection with the feed-water pipe supplying a fire-tube boiler, the piping was examined and peculiar conditions were observed where the water entered the boiler. As shown by the full lines in the accompanying drawing, the pipe branched inside the boiler at the T fitting and terminated at two 45 deg. elbows, allowing cold water to discharge directly into the steam space of the boiler. The difficulty was overcome by extending the pipes, as shown in dotted lines, from the 45 deg. elbows to points opposite the shell. After a lapse of time, however, it was found that the feed water impinging directly upon the shell at so close a range had corroded the metal at those points. As a remedy an elbow was fitted to the end of each pipe and turned so as to discharge the water along the length of the shell.

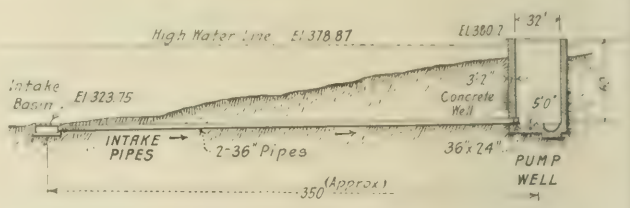


IMPROVED ARRANGEMENT OF BOILER FEED PIPE

SOLVING CONDENSING WATER SUPPLY PROBLEM

Pumping Station at River One Mile from Power House Built to Supply Condensing Water When Wells Prove Inadequate

Until recently the condensing water for the 9600-kw. power house of the Public Utilities Company of Evansville, Ind., was supplied from wells. As the supply from this source became inadequate it became necessary to determine whether to build a new power house at the river or bring water to the present power house from the river, 1 mile (1.6 km.) distant. The latter plan was adopted, a pumping station, a pump well, an intake in the river and two intake pipes from the intake to the pump well being installed. Construction of this system presented quite a problem, owing to the fact that the variation of the river level is nearly 50 ft. (15.2 m.). Further limitations were imposed because the Ohio River is a navigable stream and any construction work in it must conform to government rules.



LONGITUDINAL SECTION OF PUMP WELL, INTAKE AND INTAKE LINE

On account of the great rise and fall of the water it was necessary to construct the pump well 60 ft. (18.3 m.) deep. It is a hollow concrete cylinder with walls 3 ft. (0.9 m.) thick and was sunk by the open-caisson process, the entire structure settling as material was excavated beneath it by a clamshell bucket. The bottom of this caisson is floored with a heavy layer of concrete. The top of the pump well is slightly above the level of the ground and is designed to be above the highest water stage. The pumping station, which is circular, is constructed above it.

The intake pipes are laid on a horizontal level from the bottom of the well out into the river. They terminate in the intake proper, which is a large concrete box. The top of the box was placed approximately level with the bottom of the stream, since no obstruction to navigation was permitted by the government. Large circular openings were provided in this box to admit water, large floating drift being excluded by screens. Inside the pump well the two 36-in. (91.4-cm.) pipes, which lead from the intake through the wall of the pump well and connect with the pumps, are equipped with two 36-in. (91.4-cm.) Elliott strainers. Trenches for the intake and pipe line were constructed by the use of a cofferdam and by dredging when necessary. The river

cofferdam was continued into the bank for laying the pipe line.

The pumps are placed at the bottom of the pump well. Ultimately four centrifugal motor-driven 7000-gal.-per-minute Allis-Chalmers pumps will be installed, although only two are being placed at the present time. These pumps are driven by 150-hp., 2200-volt, three-phase, 60-cycle motors. Each pump is furnished with two sets of impellers, one for a high stage of water, when there will be a low head of water to pump against, and one for a low-water stage, when the resulting pumping head will be high. These pumps furnish sufficient head to force the water into 36-in. (91.4-cm.) cast-iron pipe leading to the station, through the condensers and into the waste pipe. The needs of the power house require only one pump at the present time, except on peak loads. Provisions have been made so that one of the pumps can be kept running while the impeller in the other is changed. A 6-in. (15.2-cm.) vertical motor-driven centrifugal sump pump is installed in the pump well to take care of leakage, overflow, seepage or other waste water that may enter the well.

All power for the pumping station is supplied from the power house over duplicate leads of underground cable to give maximum insurance against operating trouble. These circuits are controlled from the switchboard at the power house. In an emergency a telephone line connecting the power house with the pumping station may be used.

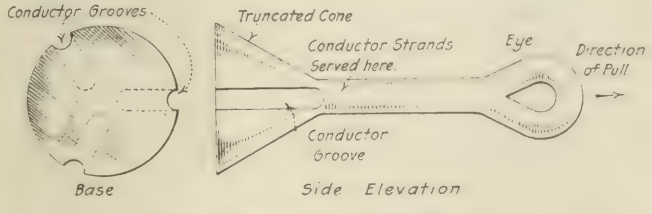
W. H. Koppelman, Louisville, Ky., was contractor for the well and pipe line; the Gould Construction Company, Nashville, Tenn., had the contract for the intakes and intake mains, and Joseph J. Gerringer was engineer for the Public Utilities Company.

CABLE-PULLING EYE

Design of Convenient Attachment for Pulling Conductors Where Long Runs Are Necessary

In pulling cable it is considered good practice among some cable men to make an attachment to the cable conductors as well as the sheath in all duct runs over 375 ft. (114.3 m.) in length. To facilitate such a connection, one of the foremen of the General Electric Company's cable-pulling crew, working on large cables at Cincinnati, developed an attachment eye shown herewith.

This device is made in two styles. One of them is a



DETAILS OF ATTACHMENT EYE

solid forging about 9 in. (22.8 cm.) long, having an eye at one end. The shank is made of 1-in. (2.54-cm.) round stock, one end being upset or spread out in the form of a truncated cone. In this cone are three grooves which extend from the base toward the shank of the device.

In using this device the sheath of the cable to be pulled is cut saw-tooth fashion for several inches back from the cable end. The lead is then turned back and the conductors are peeled. After this operation the conductors are laid in the grooves in the cone-shaped end of the pulling device, and the strands are served around the shank of the tool. The saw-toothed lead-sheath ends are then bent down closely around the conductors and solder is sweated into the joint, making a smooth wiped joint. With these joints properly made it has been possible to break ropes designed to stand a 7.5-ton (6.8-t.) load without parting the joint between the cable and the eye. The second style of attachment eye is like the first, except that a swivel is used in the shank.

PROLONGING THE LIFE OF HEAVILY TAXED CROSS-ARMS

Oak Cross-arms Carrying Heavy Loads in Good Condition After Fifteen Years' Service, as the Result of Treatment

The 18-ft. (5.5-m.) cross-arms carrying the heavy lead shown in the accompanying illustration have been in service in their present positions for fifteen years.



OAK ARMS AND CHESTNUT POLES WHICH HAVE WITHSTOOD FIFTEEN YEARS OF SERVICE

The long life is attributed to the fact that they were made of seasoned wood and that for the first three years they were in place they were painted annually with coal tar. This tar formed a protective scum over the arms, which is still in evidence. The circuits which these arms support consist of four No. 0 wires, eight No. 1 wires and fifteen No. 6 wires. The spans measure about 90 ft. (27.4 m.) in length, so that the average wire loading per span would be 625 lb. (283.5 kg.). The corner structure, which is built of oak arms and 40-ft. by 7-in. (12.2-m. by 17.8-cm.) chestnut poles set in concrete, is also fifteen years old. The two anchors attached thereto consist of wooden deadmen buried 8 ft. (2.4 m.) in solid earth under 7 ft. (2.1 m.) of cinder fill. The steep banks of the Ohio River just beyond the turn made it necessary to use "stiff-leg" braces instead of anchors to hold the line in the foreground.

These lines are on the joint system of the South Covington (Ky.) & Cincinnati Street Railway Company and the Union Light, Heat & Power Company, which are both subsidiaries of the Columbia Gas & Electric Company.

OUTDOOR LOCATIONS FOR ELECTRIC METERS

Meter Cabinets Installed at Rear of Buildings, on Poles, etc., to Prevent Theft of Energy and to Facilitate Reading and Testing

BY N. NESBITT TEAGUE

Unusual locations have been selected for meters by the Augusta-Aiken Railway & Electric Corporation in a number of cases where trouble has been experienced from persons tampering with meters and stealing energy and where indoor locations of meters are inconvenient for meter reading and testing. For instance, meters for some apartments, small office buildings and stores are mounted in sheet-steel or wood cabinets at the rear of the building served. This position makes the meters accessible for reading and testing and thereby saves time sometimes wasted in gaining admission to indoor meters. The service wires are brought to the box in conduit and are distributed in conduit after passing the meter. Arrangements are made in these cabinets for two to thirty-six meters and for disconnecting the customer's circuits readily.

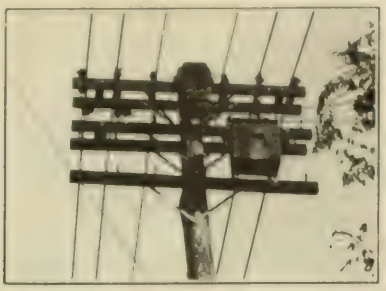


FIG. 1—INCLOSED METER MOUNTED ON POLE AND READ BY LINEMEN

In other cases where consumers such as industrial plants receive energy from individual outdoor substations the meters are inclosed in cabinets mounted on the substation structure. One installation of this kind is shown in Fig. 2. In this case the current transformers connected with the meters are mounted above the meter box. Use is made of the Detroit "Square D" switch and meter protective device. They have well warranted their cost and afford a neat-appearing installation. Where trouble has been experienced with consumers tampering with meters or attaching wires ahead of the meter the meters are sometimes mounted on a near-by pole and inclosed in strong steel boxes which are locked, not sealed. A small glass panel is provided in each cabinet to permit reading the meter. Linemen are employed to read these meters.

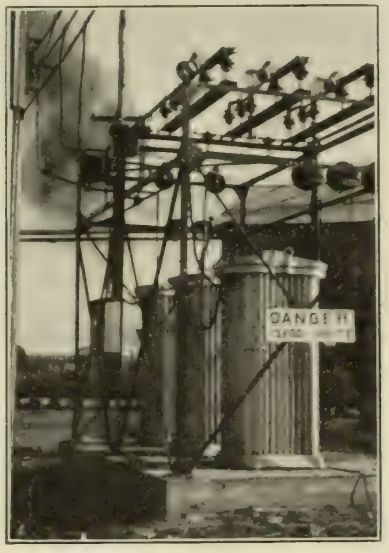


FIG. 2—METER CABINET ATTACHED TO SUBSTATION FRAMEWORK

On 13,000-volt installations the company also employs home-made steel cabinets instead of an expensive high-voltage manufactured outfit. The current and potential meter transformers are placed inside of the box with the meter. The meters are arranged so they may be read by the consumer and company without opening the door, and the box is kept locked save for occasions of periodic testing or authorized examinations.

CALCULATING RATINGS FOR ELEVATOR MOTORS

Factors That Determine Horsepower of Motor Used for Hoisting Service and Example of How to Use the Chart Given

Three factors determine the horsepower of the motor that should be used for elevator service, namely, the net weight to be hoisted, the speed of travel and the efficiency of the elevator. The chart shown herewith, which is for determining the horsepower required in any elevator installation, is based on average values of these factors. The efficiency of the elevator is assumed at 50 per cent. To determine the proper size of motor to use in any case follow the diagonal line corresponding to the unbalanced load up to the point where it crosses the vertical line corresponding to the speed desired. The value opposite the horizontal line through this point will indicate the horsepower of the motor required. If the efficiency is known to be other than 50 per cent, divide the horsepower obtained as explained above by twice the known efficiency in per cent.

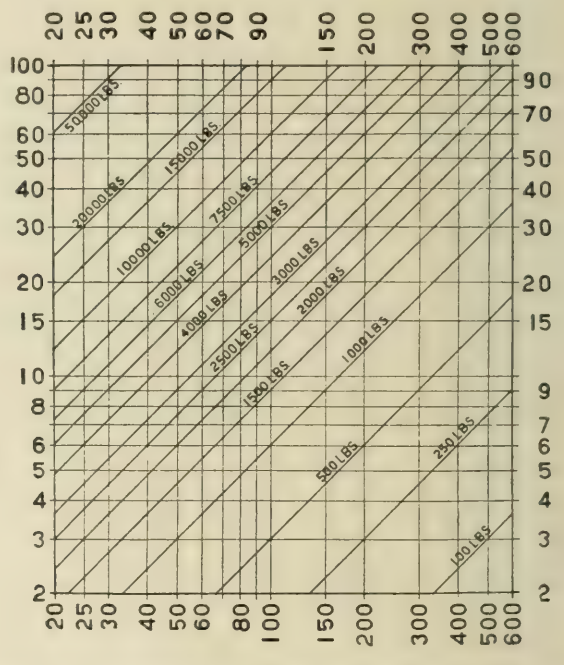


CHART FOR DETERMINING HORSEPOWER OF ELEVATOR MOTOR

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

TIME NECESSARY TO SELL NEW POLICIES TO PUBLIC

Many Complaints May Be Forestalled if Proper and Sufficient Explanations Are Made Before Changes Take Place

Before a new central station policy which may affect the public is adopted it is generally discussed pretty freely by the executive heads of the company, and they themselves become familiar with it, frequently it would seem without realizing that they are going to ask the public to become familiar with the policy, to like it, and to live up to it, within the short space of a few hours or days. In fact, on more than one occasion the time necessary to acquaint the public with the policy before making it effective has not been placed at the disposal of that department of the company which has as its duty explaining changes to the public, or what the advertising and public relations department of an Ohio company calls "selling a policy."

This department contends that before any change affecting the public shall be made sufficient time shall be given to advertise the change adequately—to acquaint the public with the new policy and the reasons back of it. The reason for the contention is the belief that the company can forestall many complaints about changes if it will take the time and go to the trouble to explain the necessity of changing before it actually issues the order which makes the change effective.

A 3-CENT RATE TO ENCOURAGE USE OF ELECTRIC APPLIANCES

Louisville Company's Salesmen Solicit Business for Dealers on Domestic Excess Consumption Rate Based on Number of Rooms

Since the Louisville Gas & Electric Company was organized through the merger of the five public utilities previously in the field its electrical sales attention has been concentrated on house wiring. Now that some 13,000 already-built homes have been wired, the company is changing its plan of attack and is just beginning a campaign which has for its sole object increasing individual consumption. It has just put into effect an arrangement by which its customers who are tolerably free users of energy may purchase all in excess of a stipulated amount at a net rate of 3 cents per kilowatt-hour. To encourage them to take advantage of this proposal a campaign has been mapped out in which the company's own salesmen will canvass the territory served, undertaking to sell electrical appliances for six of the leading dealers in the city. The lighting company itself handles no electrical appliances, not even lamps. Its house-wiring campaign ran through three years and a half on a plan by which the contracts signed by its own salesmen were divided among the electrical contractors of the city. All the company had at stake was the chance to sell its product to those with whom its salesmen made contracts. The same principle will apply in connection with the appliance sales campaign, which, while operative during June, does not go formally into effect until the first of July.

PLAN OF OPERATION

Instead of selling orders for installation of electric lighting systems in residences, each salesman for the lighting company will sell standard electrical appliances only to those who are now consumers of energy. All contracts will be turned over to one of the six local dealers who are participating with the company in the campaign. The rest of the transaction will be between this particular dealer and the purchaser of the appliance, terms of payment, etc., being standardized, however. Each of the six salesmen will operate on a flat salary, which will be supplemented by commissions paid on each appliance sale, the dealers in each case paying the commissions.

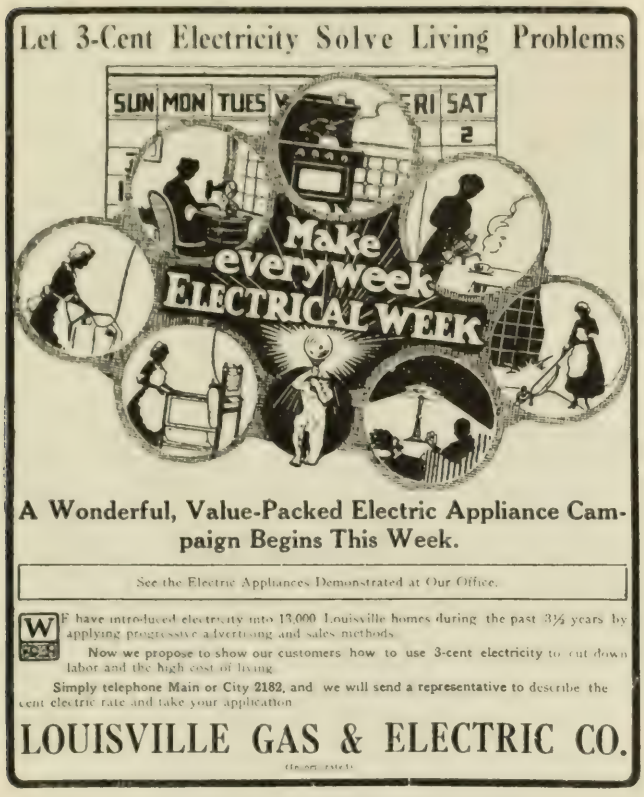
There are numerous points of interest to central station managers in connection with this campaign, whether the stations sell appliances or not. In the first place, the 3-cent rate proposition, which is not unique, is available on the excess consumption to all the domestic customers who will contract with the Louisville Gas & Electric Company for a monthly consumption of at least 3 kw.-hr. per room of their houses and will apply on all the energy used each month in excess of 6 kw.-hr. per month per room. The initial rate is 8 cents per kilowatt-hour inside and 9 cents outside city limits. This classification of the customers of the company at once lists some 10,000 domestic customers as logical "prospects" for the sale of appliances. They have been identified by the records on the company's books and by the reports of the meter readers.

ADVERTISING THE OPPORTUNITY

These customers were advised of the offer first through the newspapers. Then they were addressed through advertisements and also by means of information printed on the monthly statements which were sent out. Finally they were circularized, a few at a time. This plan will be continued as the campaign progresses, the 10,000-odd logical prospects getting the first attention. From week to week or day to day the salesmen will be provided with the names of those who have been addressed as well as with the names of those who have signed the contracts, and will follow these up with the personal calls. Each salesman will carry a book of photographs of the actual articles he is offering for sale. Everything in the way of an electrical appliance will be included—from sewing-machine motors up to motors of 5 hp., from percolators to enameling ovens, from washing machines to curling tongs, etc.—and the entire collection will represent the aggregate of the appliances handled by the dealers participating in the campaign.

The salesman gets tips to call at certain places from the office, as a result of inquiries made to the office, and in other ways. The company makes use on its bills of a form asking the customer to put a check mark opposite any of the listed proposals on which he may want further information. Bills are collected all through the month in all the salesmen's districts, and it often happens that they are kept busy responding to the inquiries so received. At all times they have lists of the non-wired houses on lines of the company and can at any time transfer their activities to a systematic canvass of their territory.

In the case of the appliance-selling campaign, the representative of the company obtains the signature of the customer to a contract. This is not with the gas and electric company, which expressly stipulates that



ONE OF THE OPENING ADVERTISEMENTS IN THE 3-CENT CAMPAIGN

it is not a party to the contract, but is between the purchaser and one of the six appliance dealers whose names are listed on the contract form. In case the purchaser has a preference for one or another dealer, the salesman so indicates, making out all contracts in triplicate, one of which goes to the customer, one to the dealer indicated, and one being held by the company for its files. If the purchaser has no preference, the contract is referred in blank to the commercial manager's office, where the assignment is made, attention being given to equalization of the distribution.

Three plans of payment are provided for—C. O. D., thirty days and a so-called club plan. The list price prevails on the first two, while there is an addition of 10 per cent of the purchase price to club plan purchasers, with certain exceptions. Club plan schedules call for payment of 20 per cent in cash, with the balance in six equal monthly payments or twenty-six equal weekly payments, a minimum monthly payment of $1 being provided for and a minimum of 25 cents for weekly payments, all to be direct to the dealer. The exceptions include fans, on which a 5 per cent addition to the list price is called for, one-third cash, with the balance in three equal monthly or twelve weekly payments; vacuum cleaners, on which a 10 per cent addition is called for, with a cash payment of $5 and the balance at the rate of $6.25 a month (where attachments are included the initial payment being raised to $6.25), and Eden washing machines, sold at a club plan price of $103, with a cash payment of $7.50 and the balance at the rate of $5 per month or $1.25 a week.

Rate of Salesmen's Compensation

Compensation for the salesmen is provided at a flat salary, which is $50 a month, with commissions of 10 per cent of the cash price on all appliances sold with the exception of the following: Electric fans, commission 5 per cent; motors, under 5 hp., commission 5 per cent; ironing machines, commission 5 per cent; additional wiring which is necessary to connect any motors, appliances or lighting units sold, commission 5 per cent; large electric ranges equipped with ovens, commission 7½ per cent. In addition to the commission allowed on the new lighting fixtures and the additional wiring, a bonus of $3 will be given the salesmen for each gas arc removed and replaced by an electric lighting unit. This bonus, however, does not apply unless the gas arc is taken down.

The month of June was devoted to preparation for the campaign. The newspaper advertising of the company was changed from housewiring to appliance-using, led by the general announcements of the appliance campaign. In addition, the company put on demonstration all of the items included in the list of appliances offered. This was in the big general offices of the company, to which many of the customers still come to pay their bills. The salary of one saleswoman is divided among the dealers and the company, each paying one-seventh. Whenever she can close with a customer she does so, making the same kind of a contract as the district salesmen do, although she does not obtain a commission as they do. When she cannot close she takes the name and address of the inquirer and turns it in to the office for the salesmen to take hold of.

Demonstrating the Appliances

In addition to the advertising of the company and its demonstration, practically all of the dealers in the city are doing something extra along the same line. Demonstrations of all kinds of appliances are being given; the dealers themselves are doing more advertising, and the department stores and the other retailers handling electrical appliances in a small way are also finding their stocks of this character of merchandise more active than they ever have been before. It was the experience of the gas and electric company that the contractors doing that kind of work got more wiring contracts independently of and during the company's campaign than they ever had been able to get before. The small retailers and a stray electrical supply concern or two not in the campaign with the company are jubilant over the prospects. The effort is moving their own stocks for them and, generally, making electrical appliances the livest items of merchandise in town.

During June the salesmen of the gas and electric

company were careful students of salesmanship, giving particular attention to the lines they would shortly set out to sell. Nearly every day during the month they were called together and heard talks on salesmanship from experts in their lines. Special attention will be paid by the company to special classes of prospects. For instance, the country lines reach into a wide radius and offer an excellent field for sales of power equipment to the farmers, who could thus get the 3-cent rate for the power appliances used on their farms.

SUPERIORITY OF ELECTRIC POWER FOR METAL MINING

A Number of Points Which May Be of Value to Power Salesmen Enumerated at Meeting of Colorado Mining Men

At a recent meeting of the Colorado Metal Mining Association E. S. Siekmann of the Colorado Power Company read a paper entitled "The Application of Electric Power to the Metal Mining Industry," in which he enumerated the following points of superiority of electric service over other service for mining purposes, which may be of value to power salesmen in other communities:

POINTS OF SUPERIORITY OF ELECTRIC SERVICE

"1. Electric energy requires no hauling or handling to make it available for instant use. You can go up one side of the hill and down the other side with equal facility. An inexhaustible supply is ready when you need it.

"2. The electric motor is much easier to handle in the inaccessible places so often encountered, owing to the fact that it weighs only one-half as much per horsepower of capacity as other forms of prime movers. Statistics show that a motor in the usual size weighs about 107 lb. per horsepower as against 198 lb. in the case of an internal-combustion engine. This latter figure would be greatly increased in case of a steam engine, owing to the boilers and the other steam accessories.

"3. The matter of space, especially in places where timber or tunneling is extensive, is quite an item. Investigations show that the electric motor requires approximately only 40 per cent of the space that is required for other forms of power producers.

"4. First cost is a very important consideration and is often the feature of many mining properties, and a rough estimate of average mining conditions shows a difference in favor of electric power of about 25 per cent.

"5. The ability to get any desired speed variations is a most desirable asset of electric power.

"6. Speed of starting and stopping cannot be overlooked by the operator who is seeking to reduce expenses and liability of accidents to his men. The electric motor is the acme of simplicity in regard to this point. A small controller or starter is all that is required, and its operation is so simple that the most inexperienced man can, with a very little instruction, make the most powerful motor do its duty. It also enables an operator to control his power from a distance without regard to the location of the motor or of the other machinery employed in the mine."

COMBINED BLOCK AND ROOM RATE FOR SMALL TOWN

Maximum of 10 Cents per Kilowatt-Hour, with Minimum Number of Active Rooms Three, Minimum Charge $1

An electric service rate schedule combining the theory of block rates with those for active rooms and at the same time prescribing a minimum monthly charge has been placed in effect in Janesville, a Wisconsin town of less than 15,000 inhabitants, by the Janesville Electric Company.

The schedule adopted by this company is briefly as follows:

For all or part of the first 12 kw.-hr. consumed per month in premises having three active rooms or less, 10 cents per kilowatt-hour, plus 3 kw.-hr. for each room in addition to the first three. For all or part of the next 12 kw.-hr. consumed per month, 7 cents per kilowatt-hour in premises having three active rooms or less, plus 3 kw.-hr. for each room in addition to the first three. For all energy consumed in excess of 24 kw.-hr. per month, 3 cents per kilowatt-hour in premises having three active rooms or less, plus 6 kw.-hr. for each room in addition. The table herewith presents this schedule in convenient form.

DETERMINATION OF ACTIVE ROOMS

In determining the number of active rooms all rooms containing outlets shall be counted with the following exceptions: Three bedrooms, bathrooms, basement, unfinished attics, porches, closets, halls and hallways, except those used and furnished as living or reception rooms and having an area in excess of 120 sq. ft., which shall be classified as active. One active room with an area of more than 300 sq. ft. will count as two rooms. When two or more rooms exceed 300 sq. ft. each, only one extra room will be counted for each 300 sq. ft. of excess area.

TABULATION OF RESIDENCE RATE USED BY THE JANESVILLE (WIS.) ELECTRIC COMPANY

Cents per Kilowatt-Hour	Number of Rooms											Each Additional Room
	1-3	4	5	6	7	8	9	10	11	12	13	
10 for the first.....	12	15	18	21	24	27	30	33	36	39	42	Add 3
7 for the next.....	12	15	18	21	24	27	30	33	36	39	42	Add 3
3 for all over	24	30	36	42	48	54	60	66	72	78	84	Add 6

Where service for a barn, garage or outbuilding is supplied through the same meter as that through which service for the residence is supplied all active rooms in the barn, garage or outbuilding shall be added to those of the house and the rate applied to the total. When separate meters are supplied, a garage, barn or outbuilding shall be treated as a separate residence.

A minimum of $1 per month is charged and 50 cents per month additional for every horsepower (750 watts) or fraction thereof for each motor or appliance having a capacity of 1 hp. (750 watts) or more, subject to the prompt-payment discount. The minimum charge for rural customers requiring special extensions or transformer installations is computed in the same manner, but in no case shall the total charge be less than $2 per month.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

SURGE BREAKDOWNS IN ELECTRIC NETWORKS

Susceptibility of End-Turn Insulation to Damage, and How to Guard Against It—Value of Condensers for Protective Purposes

TWO important breakdowns on a network of the Société Lyonnaise des Forces Motrices du Rhone were referred to in an article in the *Revue Générale de l'Electricité* by M. J. Sarolea. The author attributes them to resonance set up by overvoltage surges. When considering methods of protection, he points out that it must be remembered that although cables and the various distributing apparatus may legitimately be expected to resist surge voltages occasioned by everyday conditions of manipulation and operation, it is going too far to expect (and is hardly possible to secure) immunity from damage under the abnormal conditions arising from dead short circuits, earths, incorrect connections, and so forth. Protection against such conditions must be provided by special apparatus, to the principles and design of which too little attention is paid, even in the most modern distribution systems.

Safeguarding the Insulation

In alternators it is necessary to pay close attention to the insulation turn to turn. The windings of alternators generally lack rigidity, and are subjected continually to vibration, to the powerful air currents set up by salient-pole rotors, and, worst of all, to violent and repeated electromechanical shock due to short circuits in the network and the rush of current caused by inaccurate synchronizing. The final effect is to wear away the cotton insulation and produce weak (or bare) spots, easily susceptible to breakdown turn to turn. The risk is particularly great inside tubes through which the coils pass. Owing to defective cooling facilities, and particularly when overloads are frequent, the cotton covering of the wires loses tenacity, dries to a carbonized appearance, and becomes friable. In new machines or in old ones undergoing repair every care should be taken to secure absolute rigidity in the coils, which, so far as possible, should be former-wound and impregnated with insulating compound. Another important advantage of the latter construction is that by excluding air from the coils the destructive effect of ionization is avoided. This effect is serious in non-impregnated coils where pressures of 8000 to 10,000 volts or over are concerned. Other precautionary measures consist in preventing over-voltages and steep-fronted waves from reaching alternators, which are always the worst insulated elements in distribution installations.

Inductances of very low value should not be inserted in the feeders and near the generating station, for they are liable to cause resonance of surge waves due to earths or short circuits. In order to carry to earth as soon as possible any dangerous over-voltages which may be engendered, voltage limiters should be installed at frequent intervals. The author recommends that these be connected directly to earth through small fuses. The limiters may be protected against even a momentary excess of current by providing them with permanent, solid resistances—say of some tens of ohms, according to the characteristics of the network. As a protection against high-frequency pressures, Gino Campos suggests that conductors be electroplated with high-resistance metal, so as to increase the skin resistance and damping. He installs also along the line coils with secondaries closed on ohmic resistances, inductances shunted on ohmic resistances, condensers in series with resistances, or a combination of these devices. Laboratory tests show surge attenuations of 65 to 99.5 per cent for frequencies from 50 to 500 kilocycles.

Attention is called to a recent patent in which Steinmetz proposes to avoid local resonance in the windings of large transformers by building these from coils containing a different number of turns and arranging the coils in various ways in series and parallel. The windings are not then homogeneous, and neighboring coils have different natural periods of oscillation; hence waves are limited by interference and damping, whether they are brought into the windings or originate within the latter. Feldman and Herzog state that hysteresis and eddy-current losses in the sheathing of armored cables are forty times as great as in the conductor itself for high-frequency oscillations. The damping is therefore relatively high, but the energy available may be six hundred times as great as in unarmored cables. Petersen damps out oscillations by rapid damping, and prevents resonance between the inductances of cut-out coils, measuring transformers, wattmeters or ammeters, etc., and the capacity of busbars and alternators, by shunting the inductances with small graphite resistances.

The author has faith in the possibilities of large-capacity condensers installed in the station on the busbars. The capacity must, however, be sufficiently large. Guilbert has recently stated that several hundred microfarads, installed at the alternator terminals, is required to prevent with certainty resonance of the fundamental harmonic. Such a capacity is inadmissible in practice; hence one is obliged to rest content with partial limitation of harmonic surges when using a protective capacity. The latter representing only a small fraction of the total capacity of the network, its connection to the busbars hardly modifies the resonance conditions for forced waves. The author concludes that in his particular network a capacity of 5 mfd. would protect windings against breakdown, turn to turn, caused by steep-front surges. Large capacities for industrial service would be costly and would occupy much space, but it is worth while to attack the problem of their use.

Specifications for alternators, it was urged, should in-

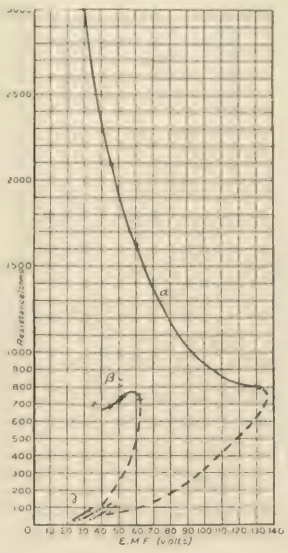
clude a clause requiring special insulation turn to turn and turn to frame on the leading-in sections of the winding (as in modern transformers). Pressure surges in generating stations, receiving stations or substations due to short circuits or "earths" on the line may, under present-day conditions, cause breakdowns which are very serious by reason of the interruption of service, as well as on account of the material damage caused directly. The study of such surges forms a special chapter in the technology of electrical distribution, and one which is yet scarcely opened.

Generation, Transmission and Distribution

Principles Involved in Computing Depreciation.—G. NICHOLSON.—In the opinion of the author, the policy of providing out of profits a sum sufficient to write off the plant during the term of its physical life is undoubtedly sound. So far as providing for improvements is concerned, however, the position is somewhat different, as shown below: (1) Such improvements will presumably result in increased efficiency and capacity, and therefore in increased profits. Why, then, should the profits of the earlier years be reduced by charging against the same improvements which will have the effect of increasing the profits of later years? That is certainly penalizing the shareholders of the early years and benefiting those of later years abnormally. In a new concern, of course, the original shareholders take the greatest risk, as they have no past results to guide them when contemplating investment. (2) Of course, if capital is charged with the same, it means that a higher revenue charge immediately commences to accrue so as to write down such increased capital; but as there is a larger revenue also accruing, this is not an additional burden. (3) The charging of improvements to revenue in the early years, having the effect of keeping down dividends, is bound to react when new capital is required, and it might be found very difficult to raise new capital even for necessary extensions (not improvements), which difficulty might seriously retard the development of what might otherwise have been a progressive concern. (4) Having regard to the prices obtainable for power and lighting supplies and to the cost of labor and materials, the author points out that there are many electrical undertakings in England operated by limited companies that are able out of profits (a) to provide for depreciation based on the physical life, (b) to provide for improvements based on the economic life of the plant, and (c) to pay a fair dividend to shareholders. (5) While it is of the utmost importance that every opportunity should be taken to strengthen the financial position of an undertaking, yet the management have a duty to perform to the shareholders, and therefore improvements of the nature indicated are more fairly treated as capital as and when they are incurred.—*Journal of the Inst. of Elec. Engrs.* (London), May, 1917.

Electrophysics and Magnetism

Electrical Properties of Molybdenite at High Temperatures.—A. T. WATERMAN.—Part of an article on the "Positive Ionization from Certain Hot Salts." Molybdenite has been found to possess a number of interesting electrical properties which include the following: In the range of temperature between that of the room and a brilliant red heat this mineral exists in two distinct states. The resistance in the low-voltage or low-temperature state is very nearly an inverse exponential function of the absolute temperature. At ordinary room temperatures the resistance is a function of the applied potential difference and appears to approach the value infinity as the potential approaches the value zero. The conduction of electricity is evidently carried on mainly by electrons. Two conclusions may be stated in regard to the thermionic emission from molybdenite: (1) A large emission from impurities—principally the ordinary K^+ emission; (2) a characteristic emission of Mo^+ ions, apparently having no exclusive relation to the break or to either state. The resistance of molybdenite after being subjected to an electric current at increasing voltages is shown.—*Philoso. Mag. and Journal of Science*, March, 1917.



ELECTRICAL RESISTANCE OF MOLYBDENITE

Structure of Atom.—Dr. SAUL DUSHMAN.—Second part of an article on this subject. In this section the author discusses several theories of the structure of the atom and shows how they agree or disagree with observed physical and chemical facts.—*General Electric Review*, May, 1917.

Electrochemistry and Batteries

Embrittling Action of Sodium Hydroxide on Soft Steel.—S. W. PARR.—From extensive investigations made by the writer, boilers using feed water containing sodium hydroxide often develop fine cracks radiating from rivet holes or extending from hole to hole. The experiments showed that the effect upon the metal is to cause brittleness which makes it less capable of withstanding steam pressure and temperature changes. Among the remedies suggested is the addition of a salt having properties which cause it to react with the alkali and yield a product which is entirely harmless. Magnesium sulphate ($MgSO_4 + 7H_2O$) is such a salt, the reaction being $2NaOH + MgSO_4 = Na_2SO_4 + Mg(OH)_2$. The resulting sodium sulphate remains in solution. The magnesium hydroxide, if the water is free from ammonia compounds, is insoluble and forms a precipitate or sludge. One pound of magnesium sulphate per 1000 gal. (0.12 kg. per 1000 l.) of water will react with an equivalent of 3 grains per gallon (0.05 grams per liter) of sodium carbonate. The water as used averages about 4.5 to 5 grains per gallon (0.077 to 0.085 grams per liter) of sodium carbonate, requiring a theoretical treatment of about 1.5 lb. of $MgSO_4$ per 1000 gal. (0.18 kg. per 1000 l.). By using 0.5 lb. to 2 lb. per 1000 gal. (0.059 kg. to 0.24 kg. per 1000 l.) it was found practicable to reduce the sodium hydroxide alkalinity to zero. When the treatment was discontinued the sodium hydroxide concentration would occasionally reach 75 grains per gallon (1.29 grams per liter) in the

boilers. A chemical which has been suggested in this connection is sodium dichromate. The reaction involved would be $Na_2Cr_2O_7 + 2NaOH = 2Na_2CrO_4 + H_2O$. It is possible that this salt may serve a dual purpose by taking up the nascent hydrogen which might otherwise go into the iron. Considerable hydrolization took place within the boiler, probably promoted by the presence of the organic matter, so that some chromium was precipitated in the form hydroxide $Cr(OH)_3$, and this material mixed with other solids had a tendency to fuse or bake as an incrustation along the highly heated surfaces of the flues. While the use of this material was of advantage in indicating the location of leakage conditions in the boiler, it was not continued long enough to prove it a neutralizer of the hydrogen that might be formed. Sulphuric acid has also been used. At first the amount of acid was 0.39 lb. per 1000 gal. (0.047 kg. per 1000 l.). It was soon increased to 0.54 lb. per 1000 gal. (0.065 kg. per 1000 l.). The entire amount of acid required for neutralization would be about 2.5 lb. per 1000 gal. (0.29 kg. per 1000 l.), which leaves an ample margin of safety between the free acid employed and the total alkalinity of the water. A quite uniform degree of sodium hydroxide alkalinity was the result. The sudden rise in the price of magnesium sulphate and sodium chromate was the chief argument in deciding upon the use of the free acid. It offers an advantage also in that it adds no further solids to the water, and from the viewpoint of the chemist it is more logical to add a free acid which will form magnesium sulphate within the boiler than to add the more expensive magnesium sulphate already prepared. It may not be wise, however, to recommend the use of the free acid except under conditions where absolute control and reliable supervision are assured.—*Bulletin No.* 94, University of Illinois.

Units, Measurements and Instruments

Concentric Standard Dynamometer Wattmeter.—A. E. Moore.—This paper discusses causes of defects in heavy-current dynamometer wattmeters, concentric main-current coils, progress in construction of experimental current coils and their defects, pressure coils for use with concentric current coils, and comparative tests between concentric and Duddell-Mather wattmeters. Other subjects taken up were calibration of reflecting concentric standard, wattmeters for high and for low power-factor measurements, double-element wattmeters for two-phase and three-phase power measurements and advantages of concentric construction. Use of reflecting concentric instrument as a standard ammeter for alternating currents was touched on and certain interesting facts brought out in connection with the construction of concentric non-inductive standards of low resistance and measurement of the phase errors in current transformers, and in the series coils of dynamometer wattmeters. An appendix was included. —*Journal of Inst. of Elec. Engrs.* (London), May, 1917.

Determination of Torque of Direct-Current Meters. —E. Alberti.—An ordinary spring dynamometer is used, in which the adjustment is made by turning a lever, which increases or decreases the tension of a spring to such an extent that the pointer is brought back to the zero mark. The tension of the spring is then a measure of the amount of the torque.—London *Electrician,* May 11, 1917.

Book Reviews

Transmission Line Co-ordinate Paper. Published by Raymond S. Brown, Columbus, Ind. Price, $1 per dozen sheets.

The use of this co-ordinate paper offers to electrical engineers a simple, rapid and theoretically exact method for finding the voltage and current at any point of a transmission line when these quantities are known at some particular point of the line. It is applicable to the solution of any transmission line in which it is necessary to take into account either of the shunt constants, capacity or leakage, and is adapted to lines of any length, construction, voltage or frequency, ranging from high-tension power lines at commercial frequencies to long telephone lines and cables. The solution, being graphical, may be applied by one who is not familiar with the higher branches of mathematics and avoids the handling of complicated equations and tables. The form of the sheet is such that it may be folded once and bound with typewritten matter in reports, etc. Complete instructions go with the sheets.

Interior Wiring and Systems for Electric Light and Power Service. By Arthur L. Cook. New York: John Wiley & Sons, Inc. 416 pages, 248 illustrations. Price, $2.

As a guide to modern practice in electric lighting and power applications and in the design and installation of the wiring for such purposes, this volume fills the need of electrical workers who wish to become familiar with good practice in these branches. The first eight chapters offer a comprehensive discussion of electric lighting systems, taking up in order incandescent lamps, arc lamps, principles of illumination, lighting accessories, fixtures, methods of calculating interior illumination, and outdoor lighting. The next three chapters cover motors for industrial purposes, motor-starting devices and controllers, and selecting motors for industrial purposes. The rest of the book is devoted to descriptions of apparatus and fittings for interior wiring, together with detail methods of calculating the sizes of circuits to meet various requirements. Examples illustrate each step. Of particular value to the electrical worker are the many diagrams of connections, illustrations of electrical apparatus and fixtures, curves and tables.

Books Received

Public Utility Rates. By Harry Barker. New York: McGraw-Hill Book Company, Inc. 388 pages. Price, $4.

Examples in Battery Engineering. By Prof. F. E. Austin. Published by the author. 90 pages, illustrated. Price, $1.25.

Hydroelectric Practice. By D. H. Braymer and W. T. Taylor. New York: McGraw-Hill Book Company, Inc. 416 pages, illustrated. Price, $5.

Organization in Accident Prevention. By Sydney Whitmore Ashe. New York: McGraw-Hill Book Company, Inc. 130 pages, illustrated. Price, $1.50 net.

The Application of Hyperbolic Functions to Electrical Engineering Problems. By A. E. Kennelly. New York: The McGraw-Hill Book Company, Inc. 302 pages, illustrated. Price, $2.50.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

ASSOCIATED MANUFACTURERS' MEETINGS AND ELECTIONS

Gathering of the Board of Governors and Dinner to Chairmen of the Various Sections—New Officers of Sections

The board of governors of the Associated Manufacturers of Electrical Supplies met at the association offices, New York, June 20. H. B. Crouse, the president, presided and there was a full attendance. Many matters of importance were considered and a number of new lines of activities were planned. The board will hold no meetings during the summer months, unless by special call; the next regular meeting will be in September.

Dinner to Section Chairmen

On the evening of June 20 the various chairmen of sections were the guests of the board of governors at a round-table dinner at Delmonico's. C. E. Patterson, comptroller General Electric Company and chairman of the cost accounting committee in the Electrical Manufacturers' Council, was also a guest, as were the cost experts of the companies of the section chairmen. Mr. Patterson discussed the matter of cost accounting very fully, inviting comments from those present and explaining in detail many points of interest. A number of other matters of importance to the sections were discussed and various section activities were planned.

Bureau of Industrial Statistics Considered

The outlet box section held a regular meeting on June 19 at the association offices. Frank W. Hall, Sprague Electric Works, chairman of the section, presided, and practically all members of the section were present. Many subjects of importance were discussed. Among other activities considered was the establishment of a bureau for industrial statistics, which will be handled through the office of the general secretary.

Meeting of Porcelain Section

The porcelain section held its regular meeting at the association offices on June 21. J. E. Way of R. Thomas & Sons Company, chairman, presided. The various standing committees made reports and other matters of importance were discussed. The regular election of officers was postponed until the next regular meeting.

Officers in Other Sections

At recent meetings of sections elections of officers were held for the coming year as follows: Attachment plug section, H. W. Bliven, Harvey Hubbell, Jr.; fan-motor section, John H. Barker, Diehl Manufacturing Company; fuse section, H. R. Sargent, General Electric Company; knife-switch section, J. H. Trumbull, Trumbull Electric Manufacturing Company; lamp receptacle and socket section, W. D. Steele, Benjamin Electric Manufacturing Company; lighting fixture section, A. F. B. Harraden, Shapiro & Aronson; panelboard and switchboard section, Charles L. Eidlitz, Metropolitan Electric Manufacturing Company; snap-switch section, E. Whitmore, Manhattan Electric Supply Company.

TRIBUTE TO SAMUEL INSULL ON TWENTY-FIFTH ANNIVERSARY

Quarter of a Century as Executor of Chicago Companies—Business Growth Results in Properties Capitalized at $445,000,000

Officers and directors of the Commonwealth Edison Company celebrated the twenty-fifth anniversary of Samuel Insull's presidency of the company and its predecessors by giving an "Edison family birthday party" at Customers' Hall in the Edison Building, Chicago, on June 25.

In addition to local employees and friends a number of others were invited. John W. Lieb, New York, and W. W. Freeman, Cincinnati, were among the out-of-town guests. Thomas A. Edison in expressing regret that government business prevented his attendance proclaimed Samuel Insull as "the greatest business man in America to-day." The directors presented Mr. Insull with beautiful candelabra.

In an address acknowledging the tributes Mr. Insull reviewed the gigantic growth of the company and its predecessors as well as of the other corporations composing what is commonly called "the Insull group." These companies have an aggregate capital of $445,000,000 and the gross annual turnover is $75,000,000. On the average this shows that the companies turn over their capital about once in six years. Mr. Insull said this record is not so bad when it is considered that theoretically the companies should turn over their capital once in five years. The companies pay a little less than $5,000,000 in taxes and serve 1,500,000 customers living within an area of between 58,000 and 60,000 square miles. They have between 20,000 and 25,000 employees. While these figures appear great, Mr. Insull predicted that captains of industry twenty-five years hence would regard them in the same light that we look upon the amount of capital and labor employed in businesses of the past.

Mr. Insull in a family talk with the young men said that it is a mistaken idea to believe that the opportunity in big business is less than in smaller concerns. The greater the amount of capital employed, the greater will be the price paid for brains to direct it. His experience had shown that it is not necessary to go afar for brains to direct great business. Assuming that the financial plan is fundamentally sound, it is possible for men of average foresight and ability chosen from the ranks of companies associated and absorbed to rise to the greater tasks of directing the business of the greater consolidated properties.

URGENT TRANSMISSION AND DISTRIBUTION PROBLEMS

Cable and Insulator Problems Principal Subjects Discussed at Special Meeting of A. I. E. E.—President Buck on Prominence of Engineers

To meet the urgent requirements of the electrical industry, the special meeting of the American Institute of Electrical Engineers held in New York June 27 and 28 was turned over to the discussion of cable and insulator problems, the best forms of power for operating bituminous coal mines, and the economical combination of water-power and steam plants. The first day's session was devoted to the first two subjects, these being treated almost exclusively from the practical standpoint. Seven papers were presented by engineers connected with prominent operating companies or institutions closely related thereto. Abstracts of these papers, as well as of two of the other four presented at the second day's session, are given on pages 1256 to 1259 inclusive.

Just after the opening of the first session Captain Gustave Paul Capart of the French Scientific Commission was called upon by President H. W. Buck for some word from the front. In responding Captain Capart extended greetings from the electrical engineers of France and said the war was one of engineers which America must help to win for democracy.

The Engineering Profession

In presenting his annual address on the evening of June 27, President H. W. Buck said in part:

"The engineering profession has passed through the preliminary stages of its growth and has reached the position where the engineer should work and act not only with proper attention to his work itself but with full consciousness of the important relation of his work to human affairs in general. Under the stress of commercial development and economic conditions, increasing specialization has taken place, and the engineer has become obliged to compass his mind with an ever-narrowing horizon. This specialization produces extraordinary proficiency in particular fields, but has the objectionable effect of narrowing the character and outlook of the man and of reducing his value as a citizen.

"The evils of specialization are being offset to a great extent, however, by the growing recognition of the fact that all branches of engineering are interdependent. This co-operative movement has quite recently had tangible expression in the formation of the Engineering Council, which represents about 30,000 engineers of sufficient scope and standing to create an engineering public opinion. Its influence is likely to be far-reaching in building up the prestige of engineers in both technical and civic affairs. A further development which has reached full recognition only in recent times is the mutual appreciation which has grown up between the engineer and the worker in pure science.

"From all the important movements which are taking place at the present time, and which center around the engineer and his work, I believe that the engineer is soon going to leave his position of isolation in independent fields of work and realize that he owes an obligation to the community broader than his daily engineering work. It matters not whether the problems before him are political, sociological, industrial or technical, I believe that the engineering type of mind, with proper breadth of view, is fitted to undertake them.

"Engineering training gives mental balance, the power of analysis, resourcefulness and the faculty of recognizing and promptly apportioning the various elements in a problem. Furthermore, scientists and engineers as a class have a strongly developed spirit of international understanding, a sympathy which may serve as an important safeguard against excessive nationalism and aggression.

"Out of this world chaos we now see men of engineering and scientific training rising to positions of commanding prominence on all sides. In this great movement not only must the individual engineer play his part, but the great engineering societies must realize the power of influence which they are developing in an ever-increasing degree in the community and the obligations which devolve upon them.

"And so I hope that the American Institute of Electrical Engineers as it passes along from one administration to another will acquire an increasing realization of its duty, not only in furthering the growth of science and engineering, but in furthering the influence of the engineer in the affairs of the country and of the world."

The Engineer and the War

President-elect E. W. Rice, Jr., on being introduced, voiced his indorsement of all that President Buck had said regarding the function of the engineer and the engineering profession, and expressed his appreciation of the great honor conferred on him by the Institute and his realization of the responsibility that goes with the position. Speaking on the text that war is a business and must be handled as a highly organized, centralized autocratic enterprise, Mr. Rice touched on the relations of the engineering profession to the present war. He decried the popular notion that the war will be settled quickly by some wonderful new invention or by the act of some hero or superman. He felt, however, that the war can be fought to a successful issue if the country is content to solve it by the simple, common-sense methods used by engineers and successful business men. He confessed that he had nothing theatrical, startling or novel to suggest, and said that if the problem is first carefully investigated and all available data are quickly obtained and checked and all new conditions considered, a broad-gaged, well-considered plan or plans could then be formulated, criticized and put into effect. This, if followed with patience, persistence and diligence, will prove successful and the war cannot be lost. Mr. Rice said that there is no question in his mind that all of the problems of the war involving the aeroplane, army, navy, food, manufacturing, farming, transportation, etc., can be successfully solved by scientific but simple and common-sense methods. All men must, however, co-operate and be ready to make reasonable compromises in a spirit of conciliation. Engineers, he said, have a great opportunity in this war and a heavy responsibility too. They have special knowledge, experience and a forward-looking point of view which the country needs, and it is their duty to see to it that they receive the opportunity to make effective use of their talents in the service of the nation, so that our civilization shall prevail.

Past-president C. O. Mailloux, who was the next speaker, told of the need of France for electrical engineers and asked for volunteers, not necessarily for the trench warfare, but back of the firing line to do the reconstruction work so greatly needed.

QUESTIONNAIRE ON FUEL FOR NATIONAL UTILITIES COMMITTEE

Full Data Desired by Committee on Coal Production of the Council of National Defense

The National Committee on Gas and Electric Service has sent a questionnaire on fuel to the electric and gas utilities. The data which it requests are desired for information and guidance of the committee on coal production of the Council of National Defense. Utilities are asked to return the forms at once to the committee headquarters, 1111 Munsey Building, Washington, D. C. In its circular the committee says:

The fuel questionnaire is designed to include a plant generating both gas and electricity. There is no objection to using two blanks, one for the gas division and the other for the electric division of a company. It would be important, however, for the electric division to indicate whether it obtained coke or water-gas tar from the gas manufactured in the generation of steam.

On Sheet 2 it will be noted that the entire coal year is included and there are two columns, one for the estimate and one for the actual results. Only two months of actual results can be reported, April and May, but the estimates should be filled in for the entire year. By the third day of each month the monthly statement should be sent to the secretary, 1111 Munsey Building, Washington, D. C., of the stock on hand on the first day of the month, together with the amount of fuel received under contract for the previous month and the amount of fuel received from other sources, per cent contract received for month and year, and reason shipper gives for shortage, if any. In this way the exact conditions of your coal stocks can be easily kept in Washington on the original form (Sheet 2) with the least amount of clerical labor, so that if you have any difficulty with your coal supply your joint committee will have full information for prompt attention to any request from your company for assistance in maintaining the fuel supply for public service.

Coal Report—Utility Companies Represented by National Committee on Gas and Electric Service

Fuel Data in Net Tons, 2,000 lbs. for "Coal Year" April 1st to April 1st — Date — Sheet No. 1
Reporting Company — Manufacturing Gas and Electricity
Address No. — Street — Place — County — State
Fuel Officer — Title — Telephone No. — Home Telephone
Electricity Generated K. W. H. — Annual — Max. Day — Min. Day
Gas Made, Cubic Feet — Annual — Max. Day — Min. Day
Surplus Coke for Sale — Annually. Surplus W. G. Tar — Coal Tar Sold — Annually
Do you produce Benzol or Toluol? — How much per annum? — By what process?
Drip or Holder Oil Recovered — Enriching Oil used per annum — B. t. u. or C. P. Standard req'd

No.	ITEMS	State Grades of Fuel, Coal, Coke, Oil or Tar normally used or desired in Coal Year 1917-18 A	B	C	D	E	F
1.	Contractor's Name / Address						
2.	Coal Company's Name / Address						
3.	From What Mine						
4.	Mining District and State						
*5.	Original Shipping Point						
*6.	Rail and Water Routing						
7.	Is Routing Same Winter and Summer						
8.	If Not, Why						
9.	Can Plant Receive by Rail and Water						
10.	Net Tons Required in Coal Year						
11.	How Much Has Been Contracted For						
12.	What Grade Fuel Might be Substituted						
13.	Are There Local Sources of Supply						
14.	Specify How Fuel Could be Routed Differently						
15.	Total Storage, Excluding Station Bunkers						
16.	Method Used in Handling Fuel						
17.	Any Affiliations With Other Utilities Capable of Supplying Fuel; Give Kind, Quantity and Grade						
18.	State KIND of Gas Produced (if steam is produced note same.)						

*REMARKS—Full information required including originating line, connecting lines and line to destination

Fuel Data Reported by Company — Coal Year 1917-18. — Sheet No. 2

No.	GRADE OF FUEL	A Estimated	A Actual	B Estimated	B Actual	C Estimated	C Actual	D Estimated	D Actual	E Estimated	E Actual	F Estimated	F Actual
19.	In Storage April 1st, 1917												
	April Receipts a/c Contracts												
	" " from other sources												
20.	In Storage May 1st, 1917												
	May Receipts a/c Contracts												
	" " from other sources												
21.	In Storage June 1st, 1917												
	June Receipts a/c Contracts												
	" " from other sources												
22.	In Storage July 1st, 1917												
	July Receipts a/c Contracts												
	" " from other sources												
23.	In Storage August 1st, 1917												
	August Receipts a/c Contracts												
	" " from other sources												
24.	In Storage September 1st, 1917												
	September Receipts a/c Contracts												
	" " from other sources												
25.	In Storage October 1st, 1917												
	October Receipts a/c Contracts												
	" " from other sources												
26.	In Storage November 1st, 1917												
	November Receipts a/c Contracts												
	" " from other sources												
27.	In Storage December 1st, 1917												
	December Receipts a/c Contracts												
	" " from other sources												
28.	In Storage January 1st, 1918												
	January Receipts a/c Contracts												
	" " from other sources												
29.	In Storage February 1st, 1918												
	February Receipts a/c Contracts												
	" " from other sources												
30.	In Storage March 1st, 1918												
	March Receipts a/c Contracts												
	" " from other sources												
31.	In Storage April 1st, 1918												

REMARKS

ILLINOIS CONTRACTORS

State Convention to Organize the Industry on Sound Basis

Manufacturing, jobbing, central station and contracting interests worked together at the convention of the Illinois Electrical Contractors' Association, Peoria, June 22 and 23, to make effective plans for better organization in the electrical industry.

President J. N. Pierce, Chicago, stated that the aim of the convention was to lay plans that will revolutionize methods in the industry. Col. Robley S. Stearnes, New Orleans, president National Electrical Contractors' Association, in a "heart-to-heart talk," declared that the contractor-dealer, the man who has heretofore been kicked from pillar to post, is about to come into his own. Colonel Stearnes predicted that the industry will be organized so that each branch will perform its logical function.

William L. Goodwin, New York, was introduced as "the man who is out to organize the industry on a practical commercial basis." Mr. Goodwin advised contractors to organize local and state associations which will be interrelated with the National Electrical Contractors' Association and will have as their purpose study and discussion of the industry problems and topics which will make better business men of retailers who are failing to-day through ignorance.

The contractors decided to appoint three committees to forward the work. One will meet with the Illinois State Electric Association, one will work for increased membership, and one will be a committee on co-operation to meet with Mr. Goodwin.

INDIANA COMPANIES JOIN FOR INCREASE IN RATES

General Appeal to Public Service Commission Follows Warning by That Body Against "Outrageous" Coal Conditions

The Indiana Electric Light Association has filed with the Indiana Public Service Commission a petition asking authority for companies to add a temporary surcharge of 30 per cent to each bill for services of any kind rendered by them to any customer. General operating expenses have increased 45 to 50 per cent over normal times, the petition avers.

The executive committee of the association met in Indianapolis on June 22 and later conferred informally with Chairman E. I. Lewis of the commission. High cost of fuel is the principal factor responsible for the movement of the companies. No indication was given by the chairman as to what attitude the commission will take.

The Indiana commission, however, as the vehicle of the recent investigation of the "outrageous" coal conditions in the State, frequently warned the public that continued high prices of coal were likely to result in widespread petitions from utility companies for increased rates.

The proceeding is an unusual one since it involves the question of a blanket increase in rates for many companies, thus precluding, probably, appraisal of all properties affected.

PROSPECTS FOR COAL FOR THE ELECTRICAL INDUSTRY

F. S. Peabody, Chairman Committee on Coal Production of the Council of National Defense, Believes Plants Will Be Provided For

F. S. Peabody of Chicago, now resident in Washington, chairman committee on coal production of the Council of National Defense, is of the opinion that the electrical industries will obtain all the coal necessary for their needs, according to a statement made by him this week to a representative of the ELECTRICAL WORLD.

"Nothing definite in regard to coal for any of the industries can be done until Congress passes the necessary legislation granting the required powers," Mr. Peabody said, "but we have with us here in Washington George W. Elliott, secretary National Committee on Gas and Electric Service, as a member of the committee on coal production. He was especially named to represent these industries by J. W. Lieb, chairman of the national committee, when I wrote the latter asking him to name some one to represent these industries. Mr. Elliott is an active member of our committee, and he will get all he wants in the way of coal for the electrical industries, inasmuch as he has my full committee behind him."

In explaining that Mr. Elliott is working hard for priority of the electrical industries in the supply of coal, Mr. Peabody would hazard no guess as to how these industries will stand on the list when it is finally made up. Much will depend upon just what powers Congress grants.

On the other hand, the coal producers, 600 in number, have been meeting in Washington during the last week, at the Department of the Interior, with government officials and the committee on coal production of the council, and hearings have been begun before the Senate committee on interstate commerce—the Newlands committee—on the recent report of the Federal Trade Commission recommending a pooling arrangement of operation by the government of transportation and coal mines. President Wilson has, moreover, created during the past week an "Exports Council," under which the shipment abroad of commodities, including coal, is to be licensed by a board, and it is expected that exportation of coal will be under control of this board within a few days.

The coal operators had some plain talk from Secretary Lane and Secretary Daniels.

NEW YORK EDISON PLAN DENIED BY COMMISSION

Public Service Body Holds Company to Tentative Promise of Further Reduction in Maximum Rate on July 1

After presentation of the reasons why the New York Edison Company desired release from its tentative promise to reduce rates further the Public Service Commission, First District, decided that the changes in operating cost did not justify abandonment of the tentative agreement of last November. Directors of the company accepted the decision of the commission to this effect, and the maximum rate will be lowered to 7 cents per kilowatt-hour on July 1.

President N. F. Brady said in a letter to the commission:

As you have fairly stated, this company, under the agreement which became effective Jan. 1, 1917, has the option on July 1 of reducing its maximum rate to 7 cents a kilowatt-hour, or of returning to the former schedule under which the maximum rate was 8 cents a kilowatt-hour. We have endeavored to show that a reduction under the existing conditions is unwarranted, but the commission has held that it is warranted. We are therefore prepared to accept this decision and reduce our rates to 7 cents a kilowatt-hour, with the understanding that if the results are of an adverse nature we may exercise the existing option and restore our former schedule of 8 cents a kilowatt-hour on Jan. 1, 1918.

NEW YORK TO HOLD ITS ELECTRICAL EXPOSITION

The 1917 Display Will Show How Electricity Makes Industry and the Home More Efficient and Economical

Arrangements are being made for the New York Electrical Exposition of 1917. The aim will be to show how electrical energy places industrial, commercial and home activities upon a higher plane of efficiency and economy. Exhibits will show methods of conserving life and health, increasing efficiency in manufacturing and commerce, eliminating coal waste, aiding medicine and surgery, and many other applications of electrical energy. Government exhibits are particularly appropriate, and efforts will be made to show the many uses of electricity in the army and navy. Electrically operated office and accounting machinery will be displayed, and the many uses of household appliances will be a particular feature. The electric vehicle display will be an important part of the exposition.

ELECTRIC RATE INCREASE BY THE TOLEDO COMPANY

Commercial and Industrial Light and Power Schedule Raised from 10 to 20 Per Cent, Beginning July 1—Domestic Rate Unaffected

Commercial and industrial light and power rates will be increased from 10 to 20 per cent by the Toledo (Ohio) Railways & Light Company, beginning on July 1. An announcement by the company said this is necessary because of the heavy increase in cost of operation. In the change the company has endeavored to make a more equitable adjustment of rates among patrons. About 5000 consumers will be affected.

The domestic rate, 7 cents per kilowatt-hour, has not been changed. The Public Utilities Commission has approved the schedule filed with it.

ELECTRICAL CONTRACTORS SAY "BUSINESS MUST GO ON"

Executive Committee of National Association, Meeting in Chicago, Enters Campaign to Forward the Interests of the Organization

A resolution expressing the opinion of the executive committee of the National Electrical Contractors' Association that "Business must go on" and that the annual convention should be held as planned was passed by the committee at Chicago on June 19 and 20. It follows:

Whereas it is of the highest importance that the United States having entered into the great war should use every endeavor to bring it to a successful issue, and whereas this can only be accomplished by every individual and every business concern doing its utmost to "keep business going" and endeavoring by every available means to increase the business of the country so that it can carry the necessary financial burden,

Resolved, That the N. E. C. A. hold its annual convention at the time and place already agreed upon, to wit, in New Orleans, La., Oct. 10 to 13.

Resolved, That the N. E. C. A. pledges its active support to the movement by which every business man agrees to do his part in carrying on mercantile enterprises, including the preparation of all electrical systems for the added demands which may be made upon them.

The meeting of the executive committee was the regular quarterly gathering. It was held at the La Salle Hotel. There was a full attendance and many subjects of utmost importance to the contractors were discussed and will be put in the proper channel for action at the New Orleans convention. This was the most successful meeting ever held by the executive committee. An extensive nation-wide propaganda was entered into which is expected to put the association on an equality with the foremost organizations of the country.

By invitation there were present W. L. Goodwin, New York; J. M. Wakeman, general manager Society for Electrical Development; E. McCleary, Detroit; Louis Kalischer, New York; Ernest Freeman, Freeman-Sweet Company, Chicago, former president of the association, and Mr. Hilton, treasurer of the organization, Syracuse.

Col. Robley S. Stearnes, New Orleans, the president, used every endeavor to have the association keep up its work, assured the committee that New Orleans was ready in every manner to receive the membership, and expressed the hope that each member would remember that the convention is to be very important. He said each member should make every reasonable sacrifice to attend, especially for the reason that there will be brought up for final action a complete change in the constitution and by-laws. A majority of the membership demands this and it will be settled at New Orleans.

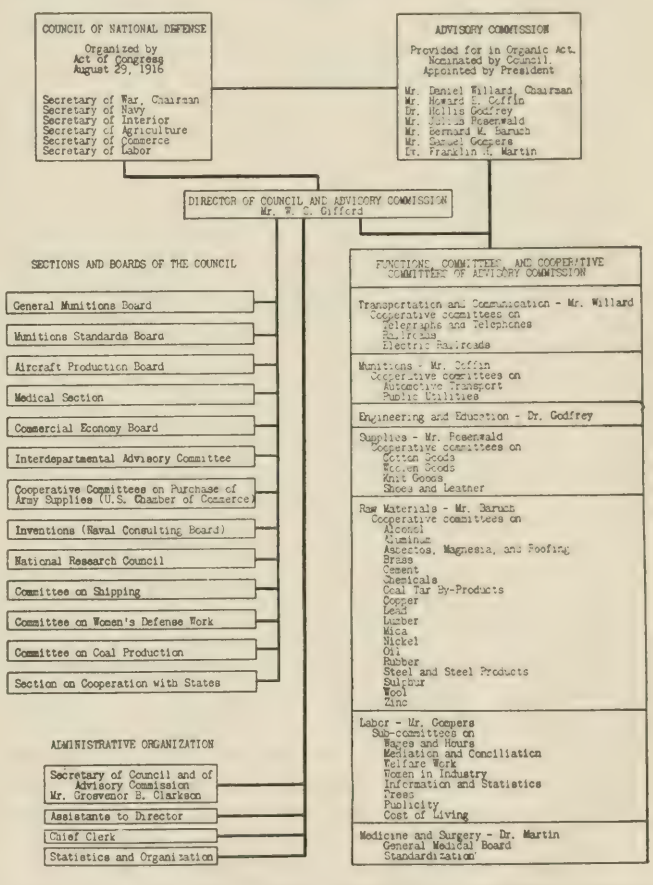
The slogan adopted by the executive committee was "Business Must Go On."

The National association is working along lines of profitable standardization and closer relations between manufacturers, jobbers, central stations and electrical contractors.

FAR-REACHING WORK OF THE NATIONAL DEFENSE COUNCIL

Report of Director Gifford on the Comprehensive Organizations Formed to Assist the Government—Affects Electrical Industries

Walter S. Gifford, director of the Council of National Defense and of its advisory commission, has made a report to Secretary of War Baker, chairman of the council. The report summarizes the far-reaching work of the Council of National Defense.



THOROUGHLY ORGANIZED, THE COUNCIL IS A POWERFUL AGENCY

Strike at General Electric Plant Settled

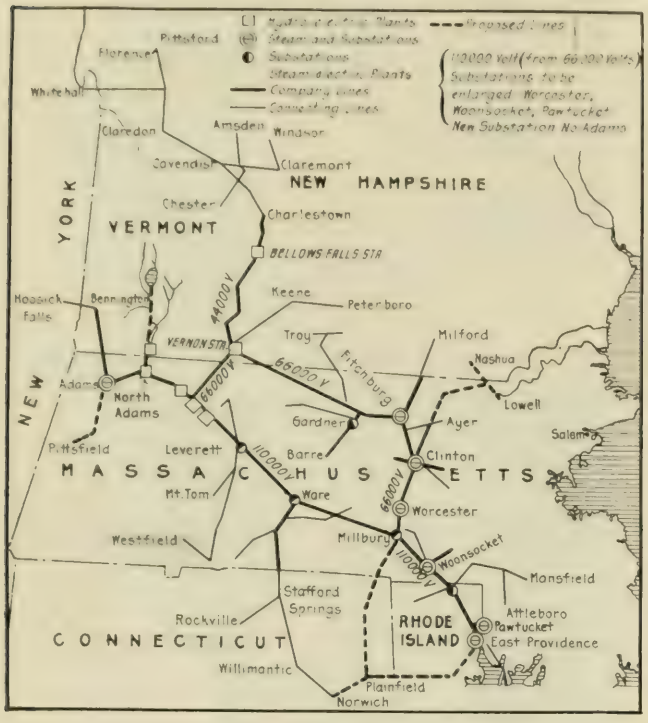
A strike of machinists in one of the plants of the General Electric Company at Schenectady has been settled and the men have returned to work. Satisfactory arrangements have been made by which the cause of the difficulty has been overcome.

NEW ENGLAND POWER COMPANY TO SPEND $7,000,000 ON PLANT

Important Extensions of Generating, Transmission and Substation Facilities Planned for Immediate Future

Important extensions of the generating plant, transmission and substation facilities of the New England Power Company, representing an estimated cost of about $7,000,000, are planned for the immediate future. The urgency of the coal situation in New England and the rapidly increasing demands upon the company for power are making plant expansion necessary as soon as it can be accomplished.

The total generating capacity now owned by the company in hydroelectric and steam-driven stations supplying energy in five of the six New England States and also in New York State is 70,000 kw. Through reciprocal power contracts the company also is electrically in



touch with plants whose installed capacity totals 100,000 kw. more. In the twelve months ended May 31, 1917, the output of the company was 271,000,000 kw.-hr., compared with 203,000,000 kw.-hr. in the corresponding period the year previous, or an increase of 35 per cent. The recent peak load reached 67,000 kw. At present the output is about 1,000,000 kw.-hr. a day.

Within the last year in New England the average cost of coal has risen from about $4 per ton to a present price of $9. New business in industrial lines has increased throughout the territory, and it is now planned to raise the transmission pressure from 66,000 volts to 110,000 volts, to increase the capacity of the substations in Worcester, Mass.; Pawtucket and Woonsocket, R. I., and to build a hydroelectric station of 22,000 kw. initial capacity in the upper Deerfield valley in Vermont. The operating head at the new plant will be from 300 ft. to 325 ft. As yet no contracts have been placed for electrical or hydraulic equipment.

The capacity of the Woonsocket and Pawtucket substations will be 12,000 kw. and 30,000 kw. respectively. To improve the power factor of the system a 7500-kw. General Electric synchronous condenser is being installed at the Greendale substation in the Worcester district and a duplicate is being installed at Woonsocket. About $100,000 will be expended in increasing capacity of the Greendale substation from 11,000 kw. to 24,000 kw., and about $225,000 will be devoted to Rhode Island substation enlargements. A new substation is to be built at North Adams, Mass., at a cost of $75,000. The immediate generating facilities to be provided will add a generating capacity of 150,000,000 kw.-hr. to the system, and will mean the further saving of 300,000 tons of coal annually in New England. The output last year prevented consumption of 450,000 tons of coal, so that with completion of the extensions planned the company will save New England from consuming 750,000 tons of coal a year, or 15,000 50-ton carloads.

In all new power contracts the company now inserts a coal clause based on the price of coal at tidewater in Providence, R. I. With the base price of coal between $4 and $4.50 per ton at this point no change is made in the power rate, but above $4.50 an additional charge is made at the rate of 0.01 mill for each cent increased cost per ton, and below $4 a corresponding deduction is scheduled. This change in rates is figured on a plant economy of 2 lb. of coal per kilowatt-hour, which gives the small-plant owner the benefit of the better efficiency of a larger station in comparing his fuel-cost increase under local operation with the company's differential.

GOOD CONVENTION OF THE INDIANA COMMERCIAL MEN

Co-operative Government Supervision and Rigid Standardization by the Manufacturers Are Advocated by F. S. Hunting

Eighty-six representatives of electric central station and manufacturing companies registered for the Fort Wayne meeting of the new-business committee of the Indiana Electric Light Association on June 20.

Through all papers and discussions there were frequent references to methods of increasing central station loads without great expenditures for construction. N. A. Perry of Indianapolis read the leading paper on this topic. New-business department efficiency and methods of selling appliances also were dwelt upon.

In an after-luncheon address F. S. Hunting, general manager Fort Wayne works of the General Electric Company, advocated with earnestness co-operative government supervision and rigid standardization in the manufacturing business. Milton Henoch of East Pittsburgh advocated calling appliance salesmen "demonstrators" and decried the practice of wasting manufacturers' sales literature.

Niagara Power Situation

As this issue of the ELECTRICAL WORLD went to press the Niagara power companies had not received information from Washington of extension of the temporary permit of the War Department under which they have been receiving an additional 4400 cu. ft. of water per second from the Niagara River. The permit under which this water has been diverted expires on July 1.

MIDDLE WEST UTILITIES RESULTS OF OPERATIONS

Details of Sources of Gross Earnings of Holding Company—Common-Stock Dividend Policy Outlined by Mr. Insull

The total income of the Middle West Utilities Company in the year ended April 30 was $1,824,069. The company has followed the practice, unusual for holding companies, of stating the general sources from which this amount was obtained. They are given in the annual report to shareholders as follows:

INCOME		
Interest received and accrued on bonds and debentures	$564,789	
Dividends received and accrued—		
On stocks of subsidiary companies	$600,071	
On stocks of outside companies	12,851	
	612,922	
Sundry interest on notes receivable, brokerage, etc.	189,454	
		$1,367,165
Profits derived from sale of properties and securities to subsidiary companies and others, for cash	127,233	
Profits derived from sale of properties and securities to subsidiary companies where proceeds in bonds have not yet been sold	98,042	
		225,275
Profit arising from revaluation of securities and from valuation of securities hitherto carried at nominal values—values determined by board of directors	159,304	
Securities received for services rendered and valued by board of directors	37,500	
		196,804
Fees for engineering and other services to the subsidiary companies		34,825
		$1,824,069
EXPENSES		
Administration expense	$170,344	
Miscellaneous charges, including taxes, etc.	86,913	
		257,257
		$1,566,812
Interest on collateral notes and bonds	$424,375	
Interest on collateral loans, etc.	115,852	
		540,227
Net income for year, carried to surplus account		$1,026,585

The balance in the surplus account as of April 30, 1916, was $1,398,356, which, with the $1,026,585 from the year just closed, gave $2,424,941. Dividends on the preferred stock were $645,862 and on the common $142,130, a total of $787,992. After an appropriation of $90,000 toward writing off the discount on the company's own securities the surplus as of April 30, 1917, was $1,546,949.

MR. INSULL ON THE COMPANY'S PROGRESS

Samuel Insull, the president, says in part:

"Gross earnings of subsidiary operating companies have been very satisfactory, amounting to $9,620,216, of which only $388,960 came from newly acquired operating companies. Operating companies have necessarily felt the increased cost of practically everything used in their operation. The increase in their aggregate operating expense ratio, however, only amounted to 1.63 per cent over that of the previous year. Under normal conditions the expense ratio would have decreased, as a result of the increase of $1,140,107 in gross earnings of operating companies owned for the entire period. Notwithstanding the increase in expenses the net earnings from operation of all subsidiary companies were very satisfactory and amounted to $3,502,756, an increase of $424,995 over the fiscal year ended April 30, 1916. It is anticipated that the increase in gross earnings and the practice of strict economy in the operation of the subsidiary companies during the coming year will produce equally satisfactory earnings.

"During the fiscal year the company acquired the Kentucky Light & Power Company of Kentucky, the Central Power Company, operating in Nebraska, the Citizens' Gas Light Company of Jackson, Tenn., and the Houghton County Gas & Coke Company of Houghton, Mich. In addition a few small properties adjacent to existing operating companies have been acquired.

"Following an established policy of consolidating its small operating companies, in the interests of economy of operation, those in the State of Michigan, consisting of the Constantine Hydraulic Company, the Three Rivers Light & Power Company, the Three Rivers Gas Company, the Marquette County Gas & Electric Company, the Milling & Power Company and the Houghton County Gas & Coke Company, have been consolidated into the Michigan Gas & Electric Company. For the same reason the Freeport Railway & Light Company, the Tri-County Light & Power Company and the Illinois Northern Utilities Company were consolidated early in the current fiscal year under the name of the last-named company. All three properties were situated adjacent to one another in northern Illinois.

COMMON STOCK DIVIDEND POLICY

"In view of the company's rapid growth and the character of its business requiring large amounts of new capital from time to time, your directors gave careful consideration to the basic policy upon which dividends on the common stock should be disbursed. They concluded that a portion of the surplus earnings invested in the company and represented by stock dividends would accomplish the twofold object of lessening the requirement for outside capital and, by increasing the equity behind the company's senior securities, strengthening their standing. It was therefore decided that common stock dividends when declared should be made payable in cash and stock in such proportion as the requirements of the business would from time to time seem to make desirable. The present policy of the directors is to pay, as already stated on April 2 last, a cash dividend at the rate of 2 per cent per annum and a stock dividend at the rate of 2 per cent per annum. When the earnings of the company justify it the policy will probably be pursued of increasing the stock dividend rather than increasing the cash dividend.

"A list of the subsidiary companies shows that they regularly employ 2500 people and have an aggregate annual payroll of approximately $1,900,000. Rendering service to an estimated total population of 1,055,300, they have 131,000 electric, 43,000 gas, 16,600 water and 1900 heating customers. They transmit electrical energy, which is their principal business and which provides 55.9 per cent of their income, over 2473 miles of transmission lines and distribute it in 388 communities to a connected load aggregating 200,000 kw., or 268,000 hp. Connected to their distributing systems are 99,600 hp. of electric motors and 1121 electric cooking ranges, besides the domestic and municipal lighting loads of the communities served."

The various surplus accounts belonging to the company aggregate $3,456,977.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Negligence Involving Third Person.—An electric railroad is not liable for burns to a pedestrian coming in contact with loose wire which a third person had attached to a pole carrying the current of the railway, it was held by the Supreme Judicial Court of Massachusetts (116 N. E., 218). Where a car shifter for an electric railway was told that a trolley support was charged with electricity, and he knew that people would be likely to be in the vicinity thereof, and that wire had been dumped close to the post and that persons would suffer therefrom, and it was his duty to report the condition to his superior officer, and for a long time prior to the accident children and other persons without the railway's permission but with knowledge of the division superintendent and other employees had used the path, the conclusion was warranted that failure to report the condition constituted reckless or wanton negligence.

Provision of Safe Poles for Linemen.—The exception to the rule of duty of an employer to furnish employees a reasonably safe place to work, that it is not a company's duty to furnish a lineman a safe pole on which to work, is not applicable to defects in original construction, the Supreme Court of Vermont held (100 A., 762). The duty of employer as regards original construction is succeeded to by the successor in ownership and operation of the line as soon as it ought in the exercise of reasonable diligence to have learned of the defect. Risks which ought not to exist and would not but for the employer's negligence are not assumed by a lineman unless he knows and comprehends them or they are so obvious that the law will charge him with knowledge and comprehension. The employer being charged with duty to its employee lineman of original safe construction, the latter could assume that a pole was properly set till something came to his notice from which he ought, in the exercise of reasonable prudence, to have learned that it was not. If, however, he was inexperienced in the work and ignorant of the risks attending it and how to avoid them, and this ought to have been known by the employer, then he should have been cautioned and instructed regarding them. Instructions to linemen to make a personal inspection and examination of conditions of poles are not enough to charge a lineman with knowledge of what could be learned by digging to the bottom of a pole. A defect, though not obvious but latent and hidden, may be a risk ordinarily incident to the employment which a lineman assumes.

Injuries Received by Person on Private Ground Used by Public as a Common Highway. A seventeen-year old boy was not negligent as matter of law because upon a dark and stormy night he failed to see a broken electric wire lying in the grass, or because he mistakenly believed that sparks emanating from it were fireflies, the question whether he failed to exercise due care being a question for the jury, the Supreme Judicial Court of Massachusetts held (116 N. E. 251) in Bouthier vs. City of Malden. Whether the accident occurred within the limits of the highway or outside of it was for the jury. In such action evidence was held sufficient to justify finding that plaintiff's intestate was a traveler on the highway. In such action, where the first and second counts of the declaration alleged that decedent was a traveler on the highway and was injured by reason of a defect and want of repair in the way, but there was nothing to show when the wire was broken or how long it had been hanging in the street, and there was no evidence that the city knew or by the exercise of proper care and diligence might have had reasonable notice of a defect in the way, if such existed, verdict was rightly ordered for the city. If the poles and wires of the defendant electric company were maintained without permission of a town or a city, and without any permission it authorized another electric company to place wires upon its poles, negligence of the electric company was thereby shown. Though an electric company did not own high-tension wires below its own on its poles, if the high-tension wires were placed under its own with its knowledge, the electric company might be found liable for death of a boy from shock when he touched a wire of the electric company which had broken and fallen against the high-tension wires below, the insulation on which was defective, if the electric company failed to adopt such precautions as were reasonably necessary to avoid danger to persons lawfully traveling on the highway. If an open space between a house and an electric-wire pole had been used by the public as a playground and a common passageway, and had been used for travel by persons going from one street to another, and such uses had been made with the knowledge and consent of the owner, there was an implied invitation by the owner to the public to travel over the space, and doing so was not trespass. If electric companies maintained poles upon a highway and near the line between the highway and an open lot used by the public with the owner's permission, on which poles wires were attached carrying a high voltage of electricity, the companies were bound to exercise reasonable care to maintain their wires so that persons rightfully on the lot would not be injured. A boy on land in proximity to an electric-wire pole by the implied invitation of the owner of the land was there in the owner's right and had the same rights against electric companies whose wires were strung on the pole as the owner would have had.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Financing Southern California Consolidation.—The Southern California Edison Company has filed with the California Railroad Commission an application for authority to sell 15,000 shares of common stock at 88 a share, par value $100, the proceeds to acquire in whole or part $5,000,000 bonds of the Pacific Light & Power Corporation, to discharge obligations of that corporation, or to pay for additions and betterments to the Edison company's plant. The commission a few days ago authorized the company to issue 10,000 shares of this stock at 88. The company proposes to offer the 15,000 shares, together with the 10,000 shares previously authorized, to stockholders pro rata in proportion to their holdings, and that any stock not taken will be offered to others, including employees and patrons.

Transmission Line Law in Nebraska.—The ninth annual report of the Nebraska State Railway Commission comments as follows on the law providing for regulation of construction of high-voltage electric transmission lines outside of cities of the metropolitan, first class and second class, and putting the supervision and enforcement of that act upon the commission: "This legislation came at just the right time, for construction of high-voltage transmission lines has developed exceedingly during the two years since the enactment of the law. All indications point to a still more rigid development. The presumption is warranted that development of this kind will be one of the most marked characteristics of the next ten years. Construction to carry electric currents of highly destructive capacity should be made with due regard to the rights of other industries using overhead wiring, and also with due regard to the safety of the public. The act carries no specific penalties of its own for violations of its provisions. It provides that 'the provisions of the existing law with regard to appeal, penalties and other procedure before the State Railway Commission shall apply.' Since enactment of the law transmission lines have been constructed without the authority of the commission and without its knowledge. Since no orders had been issued by the commission in regard thereto the penalties of the railway commission act did not apply. If the act carried penalties of its own applicable to those who violated its provisions by constructing without the requisite authority from the commission, following the necessary showing as to specifications and location, these companies which in the last two years have ignored the law could be reached."

Dinner to Rotary Club After Demonstration.—As the concluding feature of an electrical appliance demonstration week recently the Albuquerque (N. M.) Gas, Electric Light & Power Company gave an electrically cooked luncheon to the Rotary Club.

Brooklyn Edison Directors.—At a meeting of the board of directors of the Edison Electric Illuminating Company of Brooklyn on June 18, Charles A. Boody and Herbert L. Bridgman were elected directors to fill vacancies created by the deaths of the late William Berri and William F. Sheehan.

Wisconsin Edison Company Reduces Dividend.—Directors of the Wisconsin Edison Company, Inc., declared a quarterly dividend of 50 cents a share, payable on July 16, as compared with $1 per share in the last quarter. Gross operating revenues in May were $966,073, an increase of 19.17 per cent over May, 1916; operating expenses were $709,989, an increase of 40.57 per cent; net revenues were $256,084, or a decrease of 16.20 per cent.

Sale of West Virginia Water Power Properties.—Public sale of the New Richmond and Hawk's Nest water power properties will be held on July 23 at Charleston, W. Va. These powers are located 42 miles apart on the New River. The United States government has just located its armor plate and munition works at Charleston. These plants are to be constructed at once at an estimated cost of $12,000,000. A statement from J. M. Morehead, People's Gas Building, Chicago, executor of the estate, says that the New Richmond falls are rated conservatively at 8500 hp. and the Hawk's Nest at 22,000.

Proposal to Change Cities Service Company Stock.—Abolition of the present par value of $100 and exchange of ten shares of new common stock without par value for each present share is recommended to directors of the Cities Service Company by a special committee. Application to the New York Stock Exchange to list preferred and common stocks of the company is also favored. Both matters were referred to counsel for report. A suggestion that debenture bonds be issued as a method of future financing of the company and its subsidiaries was reported adversely, so far as action at this time is concerned.

Anticipated Results in Associated Gas & Electric Company.—John H. Pardee, president Associated Gas & Electric Company, New York, in the seventh annual report, covering 1916, says: "In the matter of efficiency your company's properties are in better physical condition than ever before; the company is doing a larger volume of business, has greater capacity, more compact corporate organization, and should have a better opportunity for success than for a number of years. The constantly increasing cost of all kinds of fuel and operating supplies and the upward trend in wages will, however, very probably militate against improvement in the net results from operation so long as present abnormal conditions exist."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Ordinance Permitting Rate Cutting by Columbus Municipal Plant to Be Submitted to Referendum. — Mayor Karb of Columbus, Ohio, has signed the Holton ordinance, providing for submission to voters at the fall election of an amendment to the charter allowing the city to sell energy from the municipal plant below cost in order to compete with the privately owned plant and in this way build up patronage for the city's plant.

Colorado Power Company Reservoir Filled.—The Colorado Power Company reports that its largest storage reservoir, the Parker reservoir in Boulder County, Colorado, on which it mainly depends to supply power for winter electric service, was completely filled on June 18. In 1916 the reservoir was cut off to meet the needs of irrigation when it was only two-thirds full. Officers estimate that as a result of the early filling of the reservoir profits this year should be increased by $20,000 in comparison with 1916.

Oklahoma Gas & Electric Company's New Bond Issue.—William P. Bonbright & Company, Inc., and H. M. Byllesby & Company have underwritten and are offering a new issue of $2,500,000 two-year 6 per cent notes of the Oklahoma Gas & Electric Company. The proceeds will be used to retire outstanding 6 per cent debenture bonds, to create a fund from which to liquidate the floating indebtedness, including the cost of new properties, and for extensions and additions. The company has completed arrangements for acquiring the properties of the Enid Electric & Gas Company, the electric lighting business in Norman, Okla., and control by stock ownership of the Muskogee Gas & Electric Company.

General Gas & Electric Passes Dividend. — General Gas & Electric Company directors notified preferred shareholders in advance of the regular dividend meeting on June 29 that because of the extraordinary car shortage the company would have to pass the dividend. This dividend has been paid regularly during the last five years. The company has its own coal mine, and if cars could be obtained and deliveries assured within moderately reasonable time the dividend could be paid; but conditions are beyond control. The business of the company is expanding greatly as industrial operators appreciate the coal situation too well to try to meet their own power needs. Officials believe that more unified operation of railroads and control of coal supplies will be obtained with the advent of centralized control at Washington.

Investigation in Toledo.—Prof. Oscar Irvin and Prof. A. N. Laird of Toledo (Ohio) University, at the request of Dr. Milo R. Maltbie, who has been employed by the city of Toledo to assist in the readjustment of lighting rates with the Toledo Railways & Light Company, have been making an examination of the street lamps operated by the company. At a recent meeting of the Council committee on gas and light they testified.

Industrial Lighting in Ohio.—In order to further minimize industrial accidents, the Ohio Industrial Commission has arranged to have a light code prepared under its direction. Prof. F. C. Caldwell, Ohio State University, has been selected to head a committee, the other members of which are H. H. Craiglow, Buckeye Steel Castings Company, Columbus; S. E. Doane, National Lamp Works of the General Electric Company, Cleveland; George W. Walker, Cincinnati; H. L. Jenkins, Newark; Thomas J. Donnelly, secretary Ohio State Federation of Labor, and John Graney, labor representative, Youngstown.

Electric Car Makes Atlantic City Record Run.—That the electric automobile is adapted for long runs has been proved by a run from Atlantic City to New York City on June 19, under the auspices of the New York Electric Vehicle Association. The run was made in a Baker R. & L. stock car, model BX 7, a new model. The car left New York on June 18, driven by Edward Smith of the Baker R. & L. Company with Waldo W. Sellew, a passenger, as official observer for the New York Electric Vehicle Association. The run from Atlantic City to New York was made in five hours and fifty-eight minutes, actual running time, with a boost of one hour and a half at Lakewood. The mileage was 123½ miles, making the average running time 20½ miles per hour; 283 amp.-hr. were used, an average of 2.29 per mile, the cost of which at a 5-cent kilowatt-hour rate, the maximum charging rate in New York City, would total $1.55.

Cleveland Municipal Plant Coal Problems.—President Thompson of the Cleveland City Council has prepared a resolution to be offered at the next meeting which will request the large cities of Ohio to unite in an appeal to Governor James B. Cox to solve their fuel and power problems by establishing a State-owned power plant in one of the coal fields. Commissioner Davis said that coal for the municipal plant is now costing more than $5 per ton, but he expressed the belief that a plant in the coal field could produce energy at a rate low enough to permit its use for heating purposes as well as light and power. President Thompson has asked City Clerk Collins to obtain data from the Ontario Hydro-Electric Commission in regard to the distribution of energy from the Niagara Falls station. He contends that Cleveland must settle its fuel and power problems if it desires to continue its present industrial growth and progress and that cost of energy must be within reason.

Norwegian-American and Canadian Engineers and Architects.—An informal congress and reunion of American and Canadian engineers and architects of Norwegian birth or descent will be held in Chicago, Sept. 27-29, at the Chicago Norske Club.

Dallas Electric Club and Jovian League.—The manufacture of raw-water ice with electric power was the subject of a talk given before the Dallas Electric Club and Jovian League by C. S. Dawley, assistant general manager of the Southern Iced Utilities Company, June 18.

Connecticut Electric Light Association.—Lightning protection was the subject of an illustrated talk given by Dr E. C. Creighton, General Electric Company, at a recent meeting of the Connecticut Electric Light Association. Officials of several Connecticut utility companies were present.

Minneapolis Jovian League.—The Minneapolis Jovian League held a combination educational and entertainment meeting on June 21 at which Martin J. Wolff of St. Louis was the principal speaker. The league is laying plans for a big electrical palace at the Minnesota State Fair this summer.

Public Service Electric Company Section, N. E. L. A.—At the June 18 meeting of the Public Service Electric Company section of the National Electric Light Association Sergeant Major Nelson of the Canadian army spoke on "Trench Life and Trench Warfare in France." P. S. Young, vice-president of the company, spoke on "Liberty Loan Subscriptions by the Company and Its Employees." It was brought out that 65 per cent of all the employees subscribed for bonds amounting to $670,350. In addition to this the company subscribed for $100,000, making a total of $770,350. The following officers were elected: Chairman, M. P. Pembleton; first vice-chairman, E. W. Kent; second vice-chairman, F. B. Burrows; secretary, R. T. Rossi.

American Society for Testing Materials.—The twentieth annual meeting of the American Society for Testing Materials was held June 26 to 29 at Atlantic City, N. J. Among the subjects discussed which were of interest to electrical engineers are the following: "Electrical Insulation," C. E. Skinner; "Corrosion of Iron and Steel," S. S. Voorhees; "Some Applications of Magnetic Analysis to the Study of Steel Products," C. W. Burrows; "Interior Surface Defects in Brass Condenser Tubes as a Cause of Corrosion," W. Reuben Webster; "The Hardness of Hard-Drawn Copper," D. H. Peirce; "The Electrolytic Determination of Tin on Tinned Copper Wire," George G. Grower; "Preservative Coatings for Structural Materials," E. H. Walker; "Lubricants," C. C. Van Gundy; "Comparison of the Heat-Insulating Properties of Materials Used in Fire-Resistive Construction," W. A. Hull; "Refractories," A. V. Bleininger, and "Suggested Improvements in the Manufacture of Silica Brick," C. E. Nesbitt and M. L. Bell.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next to last text page.

Cleveland Engineering Society.—To give the public a better idea of the nature and importance of the service rendered by engineers the Cleveland Engineering Society has issued in magazine form, under the title of "The Conquerors," a series of articles on the work of the engineer.

Jovian Electric League of Los Angeles.—At the weekly meeting of this association held in Los Angeles June 13 Charles L. Logan, Los Angeles County Recorder, spoke on "Safeguards to Be Observed in Dealing in Real and Personal Property." H. W. Doubrara, local manager of the Wagner Electric Manufacturing Company, acted as chairman of the day.

Louisville Jovian League.—Members of the Louisville Jovian League are making elaborate preparations for an excursion on the Ohio River. Numerous electrical appliances, donated by electrical appliance dealers of the city, will be given to excursionists who hold lucky numbers. W. D. Myers of the Louisville Gas & Electric Company is chairman of the committee which has charge of the excursion.

Electrical League of Cleveland.—Ward Harrison, illuminating engineer of the National Lamp Works, General Electric Company, addressed the Electrical League of Cleveland June 17, the subject being new departures in the use of light, particularly for industrial purposes. The previous week's meeting was a record affair as a demonstration of enthusiasm. The total sales of the Liberty bond sale campaign amounted to tween $75,000 and $100,000. At the recent annual meeting of the Electrical League of Cleveland J. M. Bateman was elected president for the coming year.

Society of Industrial Engineers.—The Society of Industrial Engineers, consisting of professional technical engineers, accountants, managing executives in commercial and industrial activities, technical writers, educators and students, was organized in Washington, D. C., on June 15. It is planned to tender the services of the organization to the government through Howard E. Coffin, chairman of the advisory committee, Council of National Defense, and such other committees as can utilize the services of industrial engineers. A bureau has been organized under the direction of the president of the society to list all the industrial specialists in the country who may be called upon to serve either as advisers or actual directors of efficiency work. D. C. Dent, Chicago, is acting secretary of the organization.

Associated Electrical Contractors.—At a recent meeting of the Associated Electrical Contractors of Paterson and Passaic, N. J., resolutions were adopted offering the services of the members of the association as a whole to the mayors of the cities represented. H. W. Desaix is secretary of the association.

Engineers' Club of Columbus, Ohio.—Under the direction of President E. G. Bradbury the Engineers' Club of Columbus is making an excellent growth, although organized only two months ago. It already has 125 members, and it is hoped to increase the number to 300 by the end of this month. The officers are working on plans to make the club of particular service to the community in assisting in the solution of civic problems.

Lynn Section, A. I. E. E.—At the annual meeting of the Lynn Section of the American Institute of Electrical Engineers, held on June 20, talks were given by Walter C. Fish, manager of the Lynn works, and R. C. Ellis of the standardizing library. Officers were elected for 1917-1918 as follows: Chairman, J. M. Davis; secretary-treasurer, R. D. Tomson, and executive committee, H. A. Warren and C. A. B. Halvorson.

Society for the Promotion of Engineering Education.—The annual meeting of the Society for the Promotion of Engineering Education will be held in Washington, D. C., on July 6 and 7 in connection with the educational committee of the advisory commission of the Council of National Defense, instead of in the Northwest as formerly planned. The topic which will be discussed at this meeting is "The Relation of the Engineering School to the National Government During the Present Emergency." F. L. Bishop is secretary of the society.

National Electrical Credit Association.—The eighteenth annual meeting of the National Electrical Credit Association was held June 28 and 29 at the Boston City Club, Boston. The hotel headquarters were at the Copley-Plaza. The annual meeting was an innovation this year, as it was the first time that a fixed program had been scheduled. Among the subjects that were discussed at this meeting were the following: "The Scope of the Electrical Credit Association," by Guy V. Williams, New York City; "Trade Acceptances," by J. D. Meek, Indianapolis Electric Supply Company; "What and Why Is the Cash Discount?" by David Kerr, Lewis Electrical Supply Company, Boston; "Should Interest Be Charged on Overdue Accounts?" by D. E. Crane, Macbeth-Evans Glass Company, Pittsburgh; "The Small Risk—Definition, Exploitation and Control," by R. P. Tracy, Joseph E. Greene Company, Boston; "Contractors' Accounting Methods—The Best Credit Barometer," by J. W. Smith, General Electric Company, New York City, and "Municipal Mumps—Prevention and Cure," by J. F. Thomas, Elliott-Lewis Electrical Company, Philadelphia. Norman I. Adams, manager credit department of National Shawmut Bank, was scheduled to address the meeting on Thursday, June 28.



HENRY D. SHUTE

Henry D. Shute, who was last week promoted from treasurer to vice-president of the Westinghouse Electric & Manufacturing Company, has been associated with the company since 1893. Mr. Shute was born in Somerville, Mass., and was graduated in electrical engineering from the Massachusetts Institute of Technology in 1892. He later spent some time studying in Germany at the school of mines in Clausthal and also at the technical school in Dresden. He has had a wide and varied experience in the Westinghouse company. His first two years were spent in the testing department, he being later engaged on erection and laboratory work. Subsequently he became associated with L. B. Stillwell. For a short time afterward he was an assistant foreman of the experimental department in the Niagara Falls power plant work. Later he was transferred to the engineering department, where he designed alternating-current apparatus, being prominently identified with the steam railroad electrification work done by the Westinghouse company. After five years' service with the company he took up work in the sales department, in which he remained until 1903, when he was made assistant to Vice-President L. A. Osborne, which position he filled until 1910, when he was elected acting vice-president. In 1914 he was made treasurer of the company, succeeding T. W. Siemon. Mr. Shute has always taken an active interest in civic and other outside affairs. He was a member of the Pittsburgh committee on the Anglo-French loan, and more recently served on the manufacturers' committee which was so successful in securing the large over-subscription by Pittsburgh to the Liberty Loan bonds.

James L. Stone, new-business manager of the Mansfield (Ohio) Electric Light & Power Company, was recently elected president of the Mansfield Jovian League of America.

William P. Guinan, new-business manager of the Danbury & Bethel Gas & Electric Light Company, was recently re-elected chairman of the mercantile bureau and director of the Chamber of Commerce of Danbury, Conn.

Men of the Industry

Changes in Personnel and Position — Biographical Notes

Morris Schaff has been reappointed by Governor McCall to the Board of Gas and Electric Light Commissioners of Massachusetts.

James G. White, president of J. G. White & Company, Inc., New York City, was recently elected second vice-president of the Merchants' Association of New York for the ensuing year.

Lewis A. McArthur, general manager of the Pacific Power & Light Company, Portland, Ore., has been elected a member of the executive committee of the Northwest Electric Light and Power Association, to take the place of J. E. Davidson, resigned.

J. N. Moncrieff has resigned as local manager for the Wisconsin-Minnesota Light & Power Company at La Crosse, Wis., to become connected with a New York utilities company. Prior to going to La Crosse in the fall of 1914 he was manager of the electric lighting plant at Bloomington, Ind.

Gen. George H. Harries, president of the Louisville Gas & Electric Company and vice-president of H. M. Byllesby & Company, has volunteered for service in the federal army, of which he is a retired Major General. He expects to be assigned for duty shortly. He has a leave of absence from the Byllesby company, to which he will return after the war.

W. A. Wadsworth, who for several years has been directing the electric sales force of the Union Gas & Electric Company of Cincinnati, Ohio, has resigned to accept a position as manager of the Kansas Gas & Electric Company's property at Wichita, Kan. Mr. Wadsworth went to Cincinnati from the Alabama Power Company three and a half years ago. For two years before that he was acting sales manager of the Schenectady (N. Y.) Illuminating Company.

James T. Hutchings, who has been general manager of the Rochester (N. Y.) Railway & Light Company since early in 1909, has been elected vice-president and general manager of the company. Shortly after graduation from the Massachusetts Agricultural College at Amherst in 1889, Mr. Hutchings became connected with the Thomson-Houston company. He was later appointed assistant superintendent of the West End Electric Company, Philadelphia, then superintendent until the Philadelphia Electric Company was organized in 1897, when he was appointed its electrical engineer. In 1904 he became superintendent of the electrical department of the Rochester company and, two years later, he was promoted to be assistant general manager.



WALTER CARY

Walter Cary, who since 1904 has been associated with the Westinghouse Lamp Company, filling for the greater part of the time the position of vice-president and general manager, last week was elected a vice-president of the parent company, the Westinghouse Electric & Manufacturing Company. Mr. Cary was born in Milwaukee, Wis., and received his education in the schools of that city and at Harvard University. After leaving college he became associated with the Gibbs Electric Company of Milwaukee as secretary, and in 1889 he, with some other local men, formed the Milwaukee Electric Company, manufacturer of dynamos and motors, becoming its vice-president and in 1902 becoming president.

George H. Sampson has recently resigned as assistant to C. H. Austin, electrical engineer and contractor, Nashua, N. H., to accept the appointment of electrical engineer for the Public Service Commission of New Hampshire, with headquarters in Concord.

D. T. Millican has resigned as chief of the power department of the Choctaw Portland Cement Works, Hartshorne, Okla., to take a similar position with the Denver Cement Corporation. He will be stationed at Superior, Neb., in charge of the Nebraska Cement Company's plant.

Howard A. Holmes has been appointed assistant electrical engineer of the Mahoning & Shenango Railway & Light Company at Youngstown, Ohio. He was formerly with the company, but left about eight years ago for another connection. Of late he has been with the aeronautic station of the Pensacola navy yard.

Herbert Thacker Herr, who has been identified with the Westinghouse Machine Company since 1908, filling respectively the positions of general manager, second vice-president and general manager, and finally vice-president and general manager and a director of the company, was elected last week a vice-president of the Westinghouse Electric & Manufacturing Company. Mr. Herr was born in Denver, Col., and received his education in the public schools of Denver and at Yale University.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

A STILL HIGHER PRICE IS EXPECTED IN WIRING SUPPLIES

Advances on Galvanized Iron Conduit, Sockets, Plugs, Receptacles, Switches, Etc., May Be Announced Very Soon

Higher prices on certain items of wiring supply are expected in some parts of the trade. How long before these advances will be announced is not known, but it is believed that higher prices will be put into effect very shortly.

One item on which an advance is looked for is galvanized iron conduit. So far both galvanized and black conduit have been selling at the same price, although the demand for galvanized far outstrips that for the black. No such increase is expected on the black, but only on the galvanized, for which the bulk of the demand exists.

There is also a strong feeling that another advance can be expected in sockets, switches, plugs, receptacles and such material. The prices that manufacturers have had to pay for labor and material, especially brass, are believed to be such that higher prices will be necessary. Only a couple of weeks ago one of the New England manufacturers of this class of material withdrew all quotations, and this manufacturer now accepts orders subject to the previous price at the time of the receipt of the order.

CLOSER CREDIT CO-OPERATION AMONG ELECTRICAL JOBBERS

Risk Involved by Contractors and Dealers Purchasing Apparently Legitimate Amounts from More Than One Firm

It has not been unusual for contractors and dealers, particularly those newly started, to become heavily obligated to some jobber and then when they have reached the end of their credit with him to go to another jobber and run up a second account. For the jobbers this is a very dangerous practice. The risk run by the first jobber may have been reasonable and legitimate, but the additional credit given by other houses acts against all to whom the buyer is indebted.

For this reason co-operation among jobbers in spreading credit information is growing. On the Pacific Coast this form of co-operation has become very definite. If a customer becomes heavily obligated to some jobber and is unable to keep his account in proper shape, the account is allowed to remain with that jobbing house and the other electrical supply men refrain from accommodating that customer or taking his trade until his financial affairs are again in a stable condition.

There is, however, another side to this situation that is undoubtedly far more dangerous to the jobber than the condition above cited, that arising when a contractor or other buyer purchases apparently legitimate amounts from a number of supply men and manufacturers. He may be a reasonable thousand-dollar risk, but as a matter of fact his obligations may be running nearer $4,000 to $5,000. A few years ago it would have been impossible to detect such a condition because of the absolute lack of credit information co-operation. Now, however, that jobbers and manufacturers realize the benefits to be derived from such action it is not so difficult to find out a buyer's obligations to other supply men. There are, however, so many supply houses and so many manufacturers from whom a contractor or dealer may obtain credit that the chance of obtaining exact information is not yet very great. Probably the most successful plan yet developed to take care of such cases is the trade acceptance system. The banks on which the acceptances are drawn will be able to tell very quickly if the merchant is exceeding his ability to pay promptly.

THE STANDARDIZATION OF TRADE LITERATURE SIZES

A. M. E. S. Committee Recommends 8 Inches by 10½ Inches for Letter Paper, Catalogs, Bulletins and Various Other Forms

Standardization of sizes for trade literature has received considerable attention recently from the electrical industry, and it is becoming more and more evident that some definite and concrete action will result before long. The committee appointed by the Associated Manufacturers of Electrical Supplies has, after a careful study, submitted the following report and recommendations to the board of governors of the association:

"Your committee on the standardization of letter paper, catalogs, price lists, etc., has tabulated the replies received from various manufacturers and begs to submit herewith the results attained.

"The sizes of letter paper given are taken from actual measurements made by the committee, and while the dimensions, 8½ in. by 11 in. (21.59 cm. by 27.94 cm.) are those given by a majority of the manufacturers for letter paper and are also the dimensions recommended by the Electric Power Club, as forwarded to you in Mr. Dustin's [secretary of the association] original letter of April 26, your committee proposes to recommend to the Manufacturers' Council that the dimensions of 8 in. by 10½ in. (20.32 cm. by 26.67 cm.) for letter paper, catalogs, bulletins, contract forms, specifications and engineering forms be adopted as our standard for the following reasons:

"1. A large portion of the manufacturers in replying to Mr. Dustin's request for data stated that they would be glad to adopt any standard dimensions recommended by the committee.

"2. The 8-in. by 10½-in. (20.32-cm. by 26.67-cm.) sheet has approximately 10 per cent less paper than the 8½-in. by 11-in. (21.59-cm. by 27.94-cm.), and in times of conservation of resources it is believed that economy is an important consideration from a general-welfare point of view. One manufacturer estimates that this item alone will save his company $12,000 a year, and all manufacturers are vitally interested in a saving of this nature.

"3. Our investigations indicate that these dimensions have been adopted as the United States government standard.

"4. As a rule photographs of electrical apparatus are made on 8-in. by 10-in. (20.32-cm. by 25.4-cm.) plates, and it being a simple matter to trim the finished prints 8 in. by 10½ in. (20.32 cm. by 26.67 cm.), this size of photograph lends itself to binding with other papers of these standard dimensions.

"5. The American Institute of Architects has recommended the size of 8 in. by 10½ in. (20.32 cm. by 26.67 cm.) for all catalogs of building material, and this size of sheet permits the advantageous listing and displaying of electrical wiring devices and other building materials. A thin catalog of this size when folded once will fit readily the average pocket, whereas a 6-in. by 9-in. (15.24-cm. by 22.86-cm.) catalog when not folded will not fit in the pocket.

"6. The Electrical Supply Jobbers' Association has adopted as the standard for its loose-leaf catalog a page

8½ in. by 10 in. (21.59 cm. by 25.4 cm.), and the same plates used for printing a bound 8-in. by 10½-in. (20.32-cm. by 26.67-cm.) catalog can be very satisfactorily used for printing on the 8½-in. by 10-in. (21.59 cm. by 25.4 cm.) sheets of the Electrical Supply Jobbers' Association, thus leaving ample room for binding on the binding edge. It is customary in a catalog to leave a little greater border at the top and bottom than is found to be desirable in the jobbers' handbook sheets.

"7. This size of sheet for letter paper, catalogs, etc., will file much more readily in standard letter files than will the larger size.

"8. In addition to the actual saving in paper mentioned under No. 2, there would be an additional saving in envelopes and a very great saving in postage, due to reduced shipping weight of catalogs. The manufacturer referred to estimates that this additional saving in his particular case would amount to approximately another $12,000. The question of postage will probably become a very serious matter of expense to the manufacturer in the near future and should receive careful consideration.

"In conclusion: It has been argued that the paper mills adhere to certain long-established standard sizes for their kinds and grades of paper. On the other hand, those manufacturers who are using 8-in. by 10½-in. (20.32-cm. by 26.67-cm.) cut sheets have no difficulty in obtaining their paper at considerable saving, and the adoption of these dimensions by an association of the size of the A. M. E. S. will immediately lead paper mills to produce paper of proper size to cut up to these dimensions.

"As far as we are able to ascertain, any arguments in favor of the larger size apply equally well to the size which your committee recommends.

"With regard to price lists, your committee recommends the dimensions of 4 in. by 7 in. (10.16 cm. by 17.78 cm.), which dimensions have been adopted by the Electric Power Club and seem to be used by the majority of the members of our association."

GOVERNMENT DECIDES TO LICENSE EXPORTS

Action Taken, Among Other Things, to Prevent American Products, Including Electrical Goods, from Reaching Germany

Definite information is now at hand at the Department of Commerce at Washington that a large quantity of American products, including certain lines of electrical goods, are finding their way into Germany through neutral channels, in spite of the fact that the United States and its allies are using every means at their disposal to prevent supplies from entering enemies' territory. It is undoubtedly true that American electrical manufacturers have had no reason to believe that their exports were going to other than neutral countries.

To prevent American exports from entering Germany the government at Washington has taken steps in the last week to direct American exports. An Exports Council has been authorized to act in an advisory capacity to the President in this matter. The object of the council is threefold—to regulate the amount of exports on such commodities as are needed in this country, to regulate the tonnage, and to prevent supplies from reaching Germany.

In explaining the executive order creating the council President Wilson has issued a statement from which the following is quoted:

"There will, of course, be no prohibition of exports. The normal course of trade will be interfered with as little as possible, and so far as possible only its abnormal course directed.

"This policy will be carried out, not by prohibitive regulations, therefore, but by a system of licensing exports, which will be as simply organized and administered as possible, so as to constitute no impediment to the normal flow of commerce.

"The free play of trade will not be arbitrarily interfered with; it will only be intelligently and systematically directed, in the light of full information with regard to needs and market conditions throughout the world and the necessities of our people at home and our armies and the armies of our associates abroad."

This action of the American government will undoubtedly go a long way toward eliminating the official supervision now exercised by the English government over all exports to neutral European countries. It seems most probable that there will be set up in the principal export ports of the country local officers to go over the exports and officially license them. In this way considerable time will, of course, be saved, inasmuch as Great Britain will no longer have occasion to interfere with American goods in their progress to countries not at war.

FREIGHT SITUATION IS BECOMING BETTER

May Statistics Indicate a Reduction Amounting to Approximately One-Third in the Railway Car Shortage

One of the greatest difficulties to be met by manufacturers has been the freight situation. The shortage of available rolling stock has slowed up the transportation both of raw materials and of finished product. The situation, however, seems now to be much improved.

A letter has been sent out by the American Railway Association regarding the freight car shortage and is quoted in part as follows:

"The shortage of freight cars in the United States was reduced during the month of May from 148,627 to 105,127 cars—almost one-third.

"The progressive improvement in the situation is indicated in that on March 1 reports made by railroads to the American Railway Association showed a shortage in the entire country of 130,082 freight cars. The shortage grew to 144,797 by April 1, and on May 1, when the railroads' war board was just starting to operate all the railroads as a continental system with the aim of producing a maximum national transportation efficiency, the shortage had reached 148,627 freight cars."

METAL MARKETS CONDITIONS

Copper Prices Expected to Go Below 30 Cents on Government Price Announcement

For the most part the market in metals of the different industrial classes is dull. Buyers are still awaiting the action of the government.

There is a feeling that the government will probably pay between 20 and 25 cents a pound for copper. This, it is believed, will have the general effect of bringing copper prices below the 30-cent level. As an indication of this belief electrolytic fell more than half a cent during last week.

Nominal quotations on electrolytic copper on Monday last were as follows: June, 32.37½ cents; July, 31.5 cents; third quarter, 30.5 cents; fourth quarter, 29 cents.

NEW YORK METAL MARKET PRICES

	June 18 Selling Prices Bid	Asked	June 25 Selling Prices Bid	Asked
Copper:	£ s d		£ s d	
London, standard spot	130 0 0		130 0 0	
Prime Lake	31.00	to 32.00†	30.50 to 31.50†	
Electrolytic	32.50	to 32.75†	32.25 to 32.50†	
Casting	30.00	to 31.00†	30.00 to 30.50†	
Copper wire base	37.00	to 38.00†	37.00 to 38.00†	
Lead	11.00		11.00	
Nickel	50.00		50.00	
Sheet zinc, f.o.b. smelter	19.00		19.00	
Spelter, spot	9.42½	to 9.55	9.30 to 9.42½	
Tin, Straits	63.00†		62.87½†	
Aluminum, 98 to 99 per cent	56.00	to 58.00†	56.00 to 58.00†	

OLD METALS

Heavy copper and wire	27.75	to 28.25	27.75 to 28.00
Brass, heavy	17.50	to 18.00	17.50 to 18.00
Brass, light	14.50	to 14.75	14.50 to 14.75
Lead, heavy	10.00	to 10.25	10.25 to 10.50
Zinc, scrap	7.00	to 7.25	7.00 to 7.25

†Nominal.

Current Prices of Electrical Supplies

NEW YORK AND CHICAGO QUOTATIONS

The prices quoted are those prevailing in standard package or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists to contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

The variation in prices may be due to the difference in grade of products made by different manufacturers, to local conditions or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List, per 1000 Ft
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

No. 14 solid:	
Less than coil	+10% to $54.90 Net
Coil to 1000 ft.	3% to 48.80 Net
No. 12 solid:	
Less than coil	+10% to 63.90 Net
Coil to 1000 ft.	3% to 56.80 Net

Twin-Conductor

No. 14 solid:	
Less than coil	+10% to $78.00 Net
Coil to 1000 ft.	3% to 75.00 Net
No. 12 solid:	
Less than coil	+10% to 121.00 Net
Coil to 1000 ft.	3% to 108.00 Net

CHICAGO

Single-Conductor

No. 14 solid:	Discount
Less than coil	Net to +10%
Coil to 1000 ft.	10% to 15%
No. 12 solid:	
Less than coil	Net to +10%
Coil to 1000 ft.	10% to 15%

Twin-Conductor

No. 14 solid:	
Less than coil	Net to +10%
Coil to 1000 ft.	10% to 15%
No. 12 solid:	
Less than coil	Net to +10%
Coil to 1000 ft.	10% to 15%

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each. Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	+20% to 12%
1/5 to std. pkg.	10% to 20%
Std. pkg.	24% to 34%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+10% to +20%
1/5 to std. pkg.	10% to 20%
Std. pkg.	30% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.35	$0.35
12 to 50	.30	.30
50 to barrel	.28	.28 to .29
Barrel lots	.24	.25

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.35	$0.35
12 to 30	.30	.30
50 to barrel	.25½ to .26¼	.26½ to .27¼
Barrel lots	.24 to .24¾	.25 to .25¾

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
5/16	250	$5.00
⅜	250	7.50
½	100	10.00
¾	50	13.00
1	50	21.00
1¼	50	26.00
1½	25-50	35.00
2	25-50	45.00
2½	25-50	52.00

DISCOUNT—NEW YORK

	Less than Coil	Coil to 1000 Ft.
⅜-in. single strip	.....	.....
⅜-in. double strip	.....	.....
½-in. single strip	Net to 10%	7% to 20%
½-in. double strip	Net to 5%	4% to 15%

NET PER 1000 FT.—CHICAGO ....

	Less than Coil	Coil to 1000 Ft.
⅜-in. single strip	$71.25 to $75.00	$60.00 to $63.75
⅜-in. double strip	75.00 to 78.75	67.50 to 71.25
½-in. single strip	95.00 to 100.00	80.00 to 85.00
½-in. double strip	100.00 to 105.00	90.00 to 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, in.	List, per Foot	Size, in.	List, per Foot
7/32	$0.05½	1	$0.25
¼	.06	1¼	.33
⅜	.09	1½	.40
½	.12	1¾	.47
⅝	.15	2	.55
¾	.18	2¼	.65

DISCOUNT—NEW YORK

Less Than $15 List	$15 to 60 List	$60 to $150 List
Net to 33⅓%	45% to 50%	53% to 55%

NET PER 1000 FT.—CHICAGO

	Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.	$36.67	$27.50	$23.10 to $24.75
¼-in.	40.00	30.00	25.50 to 27.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 38

Size, in.	Conduit, List per Foot
¼	$0.08½
⅜	.08½
½	.08½
¾	.11½
1	.17
1¼	.23
1½	.27½
2	.37
2½	.58½
3	.76½

	Couplings, List	Elbows, List
¼	$0.05	$0.19
⅜	.06	.19
½	.07	.19
¾	.10	.25
1	.13	.37
1¼	.17	.45
1½	.21	.60
2	28	1.10
2½	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	¼ In. to ½ In.	¾ In. to 3 In.
Less than 2500 lb.	6% to 8%	8% to 10%
2500 to 5000 lb.	9% to 11%	11% to 13%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ In. to ½ In.	¾ In. to 3 In.
Less than 2500 lb.	3.8% to 7.8%	5.8% to 9.8%
2500 to 5000 lb	6.8% to 10.8%	8.8% to 12.8%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

Net ..... $3.15 to $3.50

CHICAGO

Net ..... $3.75 to $3.85

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	28%
1/5 to std. pkg.	38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	28%
1/5 to std. pkg.	38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	$5.75 to $6.30
1/5 to std. pkg.	4.50 to 5.25

Standard package, 500. List, $0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	$6.25
1/5 to std. pkg.	5.25

Standard package, 500. List, $0.07.

LAMPS, MAZDA

105 to 125 Volts

	Std. Pkg.	List, Each
Regular, clear:		
10 to 40-watt—B	100	$0.27
60-watt—B	100	.36
100-watt—B	24	.65
75-watt—C	50	.65
100-watt—C	24	1.00
200-watt—C	24	2.00
300-watt—C	24	3.00
Round bulbs, 3½ in., frosted:		
15-watt—G 25	50	.50
25-watt—G 25	50	.50
40-watt—G 25	50	.50
Round bulbs, 3¾ in., frosted:		
60-watt—G 30	24	.72
Round bulbs, 4¾ in., frosted:		
100-watt—G 35	24	1.05

105 to 125 Volts

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$30.00 to $35.17
Coil to 1000 ft.	21.00 to 26.73

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$37.20 to $38.16
Coil to 1000 ft.	27.90 to 28.62

LAMP GUARDS, WIRE

Standard packages from 50 to 150.

NEW YORK

Net per 100	$18.00 to $29.00

CHICAGO

Net per 100	$20.00 to $28.35

OUTLET BOXES

Nos.	List, per 100
101—A, A1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200 S.E., 300, A.X. 1½, 4 S.	30.00
103—C.A., 9, 4 R., B 1½	25.00
106—F.A., 7, C.S. 1½, 3 R.	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	List to 33%	List to 27%
$10.00 to $50.00 list	42%	18% to 37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	40% to 43%	35% to 37%
$10.00 to $50.00 list	50%	40% to 48%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	$14.00 to $20.00
1/5 to std. pkg.	13.00 to 15.80

Standard package, 2200. List per 1000, $20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	$14.00 to $18.00
1/5 to std. pkg.	13.00

Standard package, 2200. List per 1000, $20.

PORCELAIN KNOBS

NEW YORK

Per 1000 Net	5½ N.C.—Solid Std. Pkg. 3500	Nail-It—N.C. Std. Pkg. 4000
Less than 1/5 std. pkg.	$10.50 to $24.30	$21.10
1/5 to std. pkg.	9.75 to 12.15	28.00

CHICAGO

Per 1000 Net	5½ N.C.—Solid Std. Pkg. 3500	Nail-it—N.C. Std. Pkg. 4000
Less than 1/5 std. pkg.	$8.40 to $18.00	$20.75 to $28.00
1/5 to std. pkg.	7.80 to 9.75	16.30 to 21.50

SOCKETS AND RECEPTACLES

	Std. Pk.	List
⅛-in. cap key and push sockets	500	$0.33
⅛-in. cap keyless socket	500	.30
⅛-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15%

DISCOUNT—CHICAGO

Less than 1/5 std. pg.	Net list
1/5 to std. pkg.	15%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

	List
High Grade:	
30-amp. S. P. S. T.	$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

Less than $10 list	
$10 to $25 list	11% to 16%
$25 to $50 list	14% to 24%

DISCOUNT—CHICAGO

Less than $10 list	+5% to 5%
$10 to $25 list	11% to 16%
$25 to $50 list	14% to 24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single pole	250	$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp., three-point	100	.56
10-amp., three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	Net list to +20%
1/5 to std. pkg.	Net list to 15%
Std. pkg.	30%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar	List, Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	Net to 23%	Net to 18%
$2.00 to $10.00 list	23% to 50%	18% to 40%
$10.00 to $50.00 list	23% to 60%	18% to 52%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $2.00 list	25% to 50%	20% to 40%
$2.00 to $10.00 list	25% to 50%	20% to 40%
$10.00 to $50.00 list	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

Net price	$2.10 to $3.50

CHICAGO

Net price	$2.80 to $3.50

WIRE, ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.52 to $0.62
No. 18, full spools	0.48 to 0.53

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.565 to $0.6885
No. 18, full spools	0.495 to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

No.	Price per 1000 Ft. Net—Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$15.00-18.00	$12.00-14.50	$11.50-12.50
12	21.06-27.05	18.96-22.85	18.01-20.95
10	29.60-39.27	26.64-33.66	24.68-25.31
8	42.40-51.44	38.16-48.42	33.51-36.25
6	72.19-89.57	64.98-76.80	56.63-61.73

CHICAGO

No.	Price per 1000 Ft. Net—Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$18.00	$16.00	$14.00
12	25.92-29.89	21.96-25.62	19.44-23.48
10	36.48-42.28	30.84-36.24	27.36-33.22
8	43.80-60.13	40.15-51.54	33.77-47.25
6	69.24-82.20	63.47-68.00	56.55-68.50

WIRE, WEATHER-PROOF

Solid-Conductor, Triple-Braid, Sizes 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	$40.25 to $45.00
25 to 50 lb.	39.25 to 42.00
50 to 100 lb.	38.00 to 38.25

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.	$42.35 to $45.50
25 to 50 lb.	41.35 to 44.50
50 to 100 lb.	40.35 to 43.50

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Circulating-Water Heater

A combined circulating-type water heater and temperature-control device which may be attached to any ordinary kitchen hot-water tank has been de-

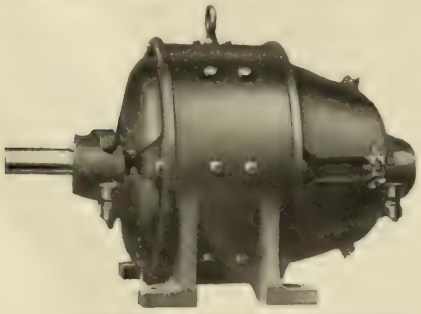


TEMPERATURE-CONTROL HEATER

veloped by the Automatic Electric Faucet Company, San Francisco, Cal. No heating coils are used in this apparatus, the heat being produced by electricity passing through the water between a carbon cylinder and a graphite electrode. Either 220-volt or 110-volt alternating current can be employed satisfactorily. The power demand can be adjusted by changing the size of the electrodes. A Kercher temperature-control switch is employed. To minimize the radiation of heat from the tank and circulating pipe they are covered with an asbestos coating.

Direct-Current Motor for Heavy Duty

A new direct-current motor designed especially for heavy duty work and known as the type "T" is being manufactured by the Reliance Electric & Engineering Company of Cleveland, Ohio.

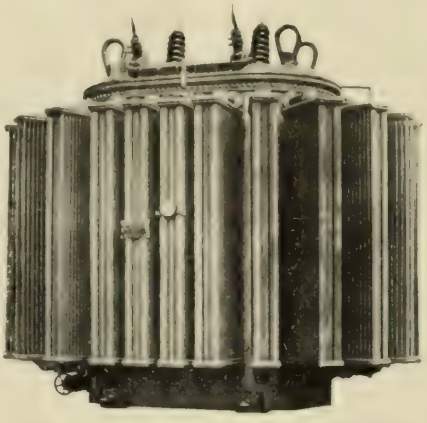


HEAVY-DUTY DIRECT-CURRENT MOTOR

Cast-steel frames are used on the machine and the specially heavy feet are cast integral with the frame. Four laminated poles are supplied on all frames and secured by large cap screws. Soft open-hearth steel is used on the commutating poles, and the field coils are particularly well insulated to adapt them to severe service. The bearings are ring-oiled, and a deep oil well with a sediment pocket is provided on each bearing. The armature coils are built up of electrical sheet-steel punchings, insulated with core-plate varnish. The motor is intended primarily for use in iron and steel mills, railway shops and machine shops.

Mammoth Self-Cooled Transformers

Six of the largest self-cooled transformers in the world, aggregating 48,000 kva., have been built by the General Electric Company of Schenectady, N. Y., for the Carnegie Steel Company, Each transformer is a single-phase, 25-cycle, 8000-kva. unit and steps the voltage from 44,000 to 6600. A unique feature of these transformers is the use of twenty-four external radiators which are attached to the containing tank, giving a radiating surface of approximately 1,000,000 sq. in. (6,452,000 sq. cm.). Cooling is obtained by an automatic circulation of oil through the radiators. All of the principles and characteristics of the circular-coil, type H design with the circular disk-coil interleaved windings and three-legged core were incorporated.



8000-KVA. SELF-COOLED TRANSFORMER

The radiating units consist of vertical flattened tubes rigidly welded into headers which are flanged for bolting to the tanks. There are cast-iron elbows between the tank and each radiator, flanges being provided for bolting thereto. The absence of any screwed pipe fittings assures oil-tight joints, the manufacturer claims.

All seams and joints in the tank and radiators are welded to prevent oil leakage. None are soldered, brazed or riveted. The radiators are self-draining and have no pockets, which would accumulate air at the top or moisture and sediment at the bottom. These refinements have considerably increased the kilowatt-ampere rating of self-cooled transformers and made possible a wider latitude in their field of application.

Industrial Tractor

After a comprehensive study of problems involved in the short-haul movement of materials, the Lansing (Mich.) Company has developed and placed on the market a line of tractors like those shown. Two sizes have a rated capacity of trailer load of 5000 and 12,000 lb. respectively. The motor and control equipment, which was furnished by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., was designed especially for this type of service. One of the most important features of the tractor is the dividing of the battery into two parts connected in parallel, thus requiring resistance in the circuit only on the first notch of the controller.

When a standard automobile wheel is used for steering it is at the operator's right, with the controller handle. A lever, at the left, may be substituted for the wheel. The brake pedal is under the left foot. It is held by a latch and released by a slight shifting of the operator's foot. Interlocking of brakes and controller is a feature peculiar to this tractor. Setting the brakes automatically throws the controller to the "off" position and locks it.

A single steel casting forms the drive axle; it incloses all transmission gearing in an oil chamber and has a bracket to carry the motor. The front axle is of standard automobile construction and supports the frame through leaf springs. Short wheelbase and small



INDUSTRIAL TRACTORS IN USE

over-all dimensions make turning easy in limited space. The standard equipment includes a lead storage battery, but a nickel-iron battery will be furnished on order.

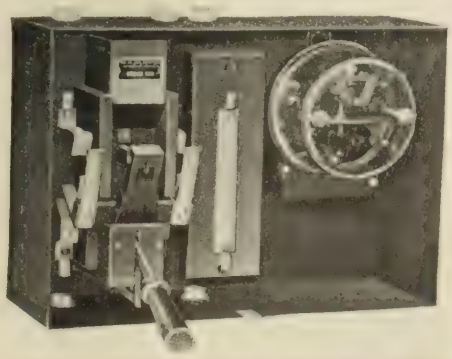
Industrial Truck Operable from Either End

Electric industrial trucks that may be controlled from either end have been developed by the Orenstein-Arthur Koppel Company of Koppel, Pa. Control is afforded by two pedals and the handles. This tractor can be operated in narrow aisles without turning, the operator merely changing his seat. The cells are divided between the two battery boxes carried on the truck platform, the larger box containing three trays of six cells each, the remaining six cells being housed in the smaller front box. The covers of the boxes serve as seats for the operator. Each tractor will push or pull 20,000 lb. (9071 kg.) at a maximum speed of 7 miles per hour. Twenty-four-cell, fifteen-plate Ironclad batteries of 220 amp.-hr. capacity are employed on account of the unusually heavy duty the tractors are called upon to perform.

Circuit Breakers for Polyphase Motors

Circuit breakers which are specially recommended for use with polyphase motors operating without supervision are being manufactured by the Palmer Electric & Manufacturing Company, Boston, Mass. The type Q breaker, which is especially adapted to this service, opens on phase reversal, upon the blowing of a fuse in one leg (provided the single-phase operation causes a load which would injure the motor), when the energy supply is interrupted or when trouble develops within the control coils or contacts.

The control equipment is mounted in a metal box arranged for open-wire or conduit connections, a slot being provided in the cover of the box, through which the operating handle projects. The arm carrying the breaker contacts is held closed by a relatively frictionless latch that is controlled by an electromagnet in circuit with the contacts of the relay. The relay consists of a standard watt-hour-meter element, without dial or gear train, carrying on its shaft a platinum bar that

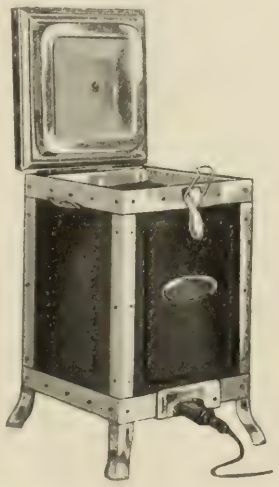


CIRCUIT BREAKER FOR POLYPHASE MOTOR

moves into or out of contact with two flexible tungsten contacts that complete the circuit to the control magnet in the breaker. With normal excitation the disk of the relay makes a partial revolution to a point where its contact is in such a position that the breaker may be closed. In the event of phase reversal the relay disk instantly revolves, thereby operating its contact, causing the breaker to open and locking the breaker against reclosing so long as the circuit is improperly excited for motor operation. Types S and T breakers made by this company are similar in appearance and construction, but the type S unit opens only on phase reversal.

Electric Cooker with Time Switch

An electric cooking outfit that combines the principle of the fireless cooker with electrically generated heat is now being built by the Standard Electric Stove Company of Toledo, Ohio. Food is placed in aluminum containers, which in turn are inserted in the range. The time clock is then set for a period of full heat in order to bring the "calorator" or heat distributer to cooking temperature. At the expiration of the time limit the switch automatically turns off the full heat produced by a 620-watt element and continues the heating with a 40-watt element, which remains in service until disconnected by the operator. It is claimed that the smaller element is sufficient to keep the stove at an effective cooking temperature for an indefinite period, thus making the operating cost very moderate.



COOKER THAT PREPARES A DINNER WITH A 40-WATT HEATER

Recording-Demand Watt-Hour Meter

Both energy consumption and integrated demand can be measured with the recording-demand watt-hour meter shown herewith. The total kilowatt-hours consumed are indicated on a four-counter dial, and the integrated demand over successive predetermined intervals is recorded on a chart. The apparatus may be installed as an ordinary watt-hour meter and requires no additional apparatus or wiring. The measuring and recording elements are mechanically interconnected and there are no contacts to become inoperative. The recording mechanism is controlled by a high-grade clock, and the measuring element is a standard Westinghouse type OA watt-hour meter with a special gear train.

Under load, the gear train of the

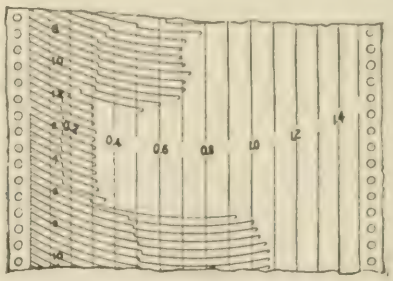
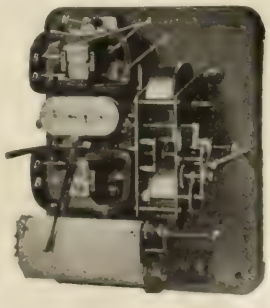


CHART RECORD OF DEMAND METER

watt-hour meter advances the counters in the regular manner. At the same time the gear train causes the ink-carrying pen to advance across the record sheet in proportion to the energy registered. At the end of a predetermined time interval a stud on the reset wheel releases the pen gear from mesh with the gear train, and a balancing weight returns the pen to zero where it is again meshed with the gear train to repeat its advance during the next time interval. Meters are made for fifteen, thirty or sixty-minute intervals, but any one of these meters may be converted to operate at any one of the other intervals.

Irrespective of the time interval of the meter, an operating spring controlled by the clock causes the paper to advance 1/16 in. every fifteen minutes. Thus if the meter is arranged to have a fifteen-minute interval the paper advances just before the pen is reset, so that the pen makes a distinct and readily observed record of the maximum pen travel. If the mechanism is arranged for thirty-minute intervals between resets the paper will advance one fifteen-minute space between periods, causing an offset mark on the chart at the middle of the thirty-minute interval. Three similar offset marks are produced each hour on the charts of meters designed for sixty-minute intervals. The



RECORDING-DEMAND WATT-HOUR METER

recording-demand watt-hour meter, which is known as type RA, is made by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa.

Trade Publications

STEEL FORMS.—A substitute for wood forms in constructing concrete work is the subject of a leaflet issued by the Rex Steel Construction Company, Pittsburgh, Pa.

LIGHTING GLASSWARE.—Decorative glassware for use in connection with modern lighting fixtures is attractively illustrated in catalog No. 81 issued by the Macbeth Evans Glass Company, Pittsburgh, Pa.

SOLDERING TOOLS.—Features, advantages and applications of various types of soldering tools developed by the Clemons Electrical Corporation, Buffalo, N. Y., are brought out in this company's catalog No. 2.

GRINDING AND BUFFING TOOL.—A self-contained motor-driven grinding and buffing machine is the subject of a folder recently issued by the United States Electrical Manufacturing Company, Los Angeles, Cal.

HEADLAMP LENS.—Some of the features of the Macbeth lens for use with automobile lamps having high intrinsic brilliancy are pointed out in catalog No. 109, issued by the Macbeth-Evans Glass Company, Pittsburgh, Pa.

METERS.—An improved form of recording-demand watt-hour meter is described and its operation explained in catalog 3-A, supplement 1, recently issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

OIL ENGINES.—Features of construction and operation of the type FH oil engine, manufactured by the De La Vergne Machine Company, East 138th Street, New York City, are discussed in bulletin No. 166 issued by that company.

VENTILATING FANS.—The application of motor-driven ventilating fans to public assembly halls and other places is touched on in booklet 3429, which is being distributed by the Sprague Electric Works of the General Electric Company.

PORTABLE LAMPS.—Uses for a combined spot lamp, trouble lamp and automobile lamp are illustrated in a folder entitled "The Anderson Auto-Reel Spot-Lite," which has been prepared by the Anderson Electric Specialty Company, Chicago.

SWITCH COMPARTMENT UNIT.—Compartment-type assemblies of switches, relays, meters and instrument transformers are described in a leaflet entitled "High-Tension Interlocking Ironclad Cubicles," recently sent out by Ferranti, Ltd., Hollenwood, Lancashire, England.

ELECTRIC RANGE.—Some of the chief advantages of the Standard Electric Range are recounted in a folder recently mailed by the Standard Electric Stove Company, Toledo, Ohio. An electric cooker built on the fireless-cooker principle is described in another folder issued by this company.

BUSINESS HELPS.—A number of reprints of advertisements have been mailed by the General Electric Company, Schenectady, N. Y. These refer to its standard unit panels, wire and cable, graphic demand meter, floodlight projectors, Mazda lamps, fans, rock drill and fabroil gear.

SYNCHRONOUS MOTORS.—Advantages of synchronous motors in driving compressers, rubber mills, fans and blowers, high-pressure pumps, etc., are brought out in bulletin No. 168, recently prepared by the Electric Machinery Company, Minneapolis, Minn. Numerous curves that are useful in making motor calculations are included.

STOKERS.—Bulletin B-2, which has recently been sent out by the Combustion Engineering Corporation, New York City, contains a description of its type "E" underfeed stoker, which is particularly adapted to burning low-grade fuels. Attention is called to methods of distributing the air, regulating the air and coal supply, and operating under forced and natural draft.

BALL BEARINGS.—Precautions which should be taken in applying ball bearings to preserve their inherent efficiency are brought out in a folder entitled "How to Apply Them," which is being distributed by the Hess-Bright Manufacturing Company, Philadelphia, Pa. Another folder on the application of ball bearings to the airplane has also been mailed by this company.

VENTILATING EQUIPMENT.—"Westinghouse Electrical Equipment for Ventilating Service" is the title of an attractive pamphlet just issued by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., in its motor-applications circular No. 7193. Types of motors and controllers adapted to this service, its highly developed and the amount of power required to drive different types of fans and blowers is also given.

ELECTRIC RANGES.—The Hughes Electric Heating Company of Chicago has issued a forty-eight page booklet entitled "What Every Kitchen Needs." Twenty-four pages of this book are devoted to the publication of electric cooking recipes by Alice Bradley, principal Miss Farmer's School of Cookery, Boston; Marion Harris Neil, former cookery editor *Ladies' Home Journal*; Janet McKenzie Hill, editor *American Cookery*; Mrs. E. K. Lunn, Barbizon-Plaza principal Greater New York Cooking School, and the Good Housekeeping Institute, Mildred Maddocks director. The remainder of the book is given over to illustrations and descriptions of the Hughes electric range. A feature of these descriptive pages is the legend near each picture which says: "See what 'Watt' means on page 17." On that page, for the edification of the non-electrical public, there is a simple explanation of the electrical term "watt."

New Incorporations

THE ELECTRIC SERVICE COMPANY of Quincy, Ill., has been incorporated with a capital stock of $2,500 by Abbott Merrylees, Matthew J. Dickman and others.

THE AMERICAN INSULATION COMPANY of Philadelphia, Pa., has been incorporated with a capital stock of $10,000 by B. T. Conwell, Jr., and others. The company proposes to manufacture insulation specialties.

THE LIEBEL-FLORSHEIM COMPANY of Cincinnati, Ohio, has been chartered with a capital stock of $30,000 to deal in electrical appliances. The incorporators are: John G. H. Liebel, Edwin S. Florsheim, George Stugard and others.

THE MILLS ELECTRIC COMPANY of Lafayette, Ind., has been incorporated by Byron J. Mills, Herbert A. Keller and Eldon L. Lewis. The company is capitalized at $100,000 and proposes to manufacture automobile parts and accessories.

THE ROSS VULCANIZING & BATTERY COMPANY of Elmira, N. Y., has been incorporated with a capital stock of $10,000 by Harry M. Swartz, Leslie W. Jennison and Thomas M. Losie. The company proposes to operate a general garage.

THE MULTI-BATTERY SYSTEM of Wilmington, Del., has been incorporated by Herbert E. Latter, Henry A. Robinson and Clement N. Egner. The company is capitalized at $225,000 and proposes to manufacture battery systems, electrical machinery, etc.

THE AJAX ELECTRIC & MANUFACTURING COMPANY of Newark, N. J., has been chartered with a capital stock of $125,000 to deal in hardware, tools, etc. The incorporators are: Rudolph Bauman of Newark, W. W. Bliecke and R. S. Hicks of Orange, N. J.

THE STORAGE BATTERY SERVICE & SALES COMPANY of Memphis, Tenn., has been incorporated by W. H. Daniel, W. P. Metcalfe, Roger Stanley, Lake Hays and I. M. Craig. The company is capitalized at $5,000 and proposes to deal in storage batteries.

THE HOPPIE ELECTRIC WINDOW CONTROL, Inc., of Wilmington, Del., has filed articles of incorporation with a capital stock of $250,000 to manufacture a patented electric window control. The incorporators are F. D. Buck, M. L. Horty and K. E. Longfield of Wilmington, Del.

THE ELECTRIC CONTROL COMPANY of New York, N. Y., has been incorporated by Frank P. Fahay, Julius G. Acheves and George J. Gillespie, of 146 East Sixty-second Street, New York City. The company is capitalized at $10,000 and proposes to do a general contracting business and electrical work.

THE LIGHT FINDER SALES CORPORATION of New York, N. Y., has been incorporated with a capital stock of $1,000 to manufacture electrical apparatus. The incorporators are: Alanson P. White, D. Berkowitz and Alexander Aaronson. The company proposes to manufacture electrical apparatus.

THE SECRET TELEGRAPH COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $300,000 to perfect secret methods of telegraphy and devices and instruments for transmitting messages. The incorporators are: C. A. Auer of New York, N. Y.; H. Lee Sellers and R. H. Sellers both of Montclair, N. J.

Trade Notes

THE ERIE PUMP & EQUIPMENT COMPANY of Erie, Pa., has changed its name to the Northern Equipment Company.

THE CARBO STEEL POST COMPANY of Chicago, Ill., has moved its offices to 764-5 Transportation Building, Chicago.

THE COOPER HEWITT ELECTRIC COMPANY has moved its Philadelphia office from 124 South Eighth Street to the Drexel Building.

THE MAIN ELECTRIC MANUFACTURING COMPANY, Pittsburgh, Pa., has enlarged its factory for the fourth time, again more than doubling its production facilities.

FOREIGN TARIFF NOTES NO. 23 has just been issued by the Bureau of Foreign and Domestic Commerce. The bulletin covers proposed tariff changes in the different countries of the world, import and export restrictions, etc.

THE BUILDERS' IRON FOUNDRY, Providence, R. I., states that on all orders for Globe special castings received on or after June 20, 1917, the price will be list plus 40 per cent f. o. b. cars Providence, R. I., instead of list plus 30 per cent f. o. b. cars Providence as at present.

M. M. MOORE, formerly with the machine tool department of Gaston, Williams & Wigmore, Inc., New York, has severed his connection with that firm and is now associated with the sales department of John W. Thorne & Company, Inc., in its commercial offices, 165 Broadway, New York City.

THE CROCKER-WHEELER COMPANY, Ampere, N. J., has declared an extra dividend of 1 per cent on the common stock for the quarter ended June 30. The directors also declared the regular dividends of 1¾ per cent on the preferred and 2 per cent on the common stock for the same period.

JOHN C. BRIDGMAN, general manager of the Hazard Manufacturing Company, Wilkes-Barre, Pa., manufacturer of insulated wire and cable, died quite suddenly at his home on May 28. Mr. Bridgman first became connected with the Hazard company in 1888 as sales agent and later was promoted to be secretary. About twenty-two years ago he became general manager of the company, which position he retained until his death.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has discontinued the Chicago branch of its automobile equipment department with the resignation of M. W. Hanks, former local representative. This district will now be combined with and handled from Indianapolis by H. S. Johnson, with the title of Western district representative. Mr. Hanks has taken up standardization work with the Society for Automotive Engineers.

THE CONNECTICUT ELECTRIC MANUFACTURING COMPANY, Bridgeport, Conn., has advised the trade that owing to continual advances in raw material and labor it withdrew all previous prices on material of its manufacture on June 1. New quotations, effective June 1, will be furnished upon application, subject to change without further notice. All orders received on and after June 1 will be accepted at prices prevailing at time of receipt of order.

THE SPEER CARBON COMPANY announces that work has been started on the first unit of a new factory which will form a large addition to the present plant at St. Mary's, Pa. When completed, an expenditure of approximately $500,000 will have been involved, including land, buildings, machinery, etc. The first building will be devoted entirely to the manufacture of the larger-sized carbon electrodes for electric furnaces. The new factory will be equipped to turn out both round and square electrodes in all sizes from 6 in. to 24 in. in diameter.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY at its recent meeting elected the following officers: Guy E. Tripp, chairman of board; E. M. Herr, president; L. A. Osborne, Charles A. Terry, H. P. Davis, H. D. Shute, H. T. Herr, Walter Cary, vice-presidents; T. P. Gaylord, acting vice-president; James C. Bennett, comptroller and secretary; Warren H. Jones, assistant secretary; H. F. Baetz, treasurer and assistant secretary; S. H. Anderson, assistant treasurer and assistant secretary; L. W. Lyon, assistant treasurer; F. E. Craig, auditor; W. B. Covil, Jr., assistant auditor; W. J. Patterson, assistant auditor.

New England States

EVERETT, MASS. — Arrangements are being made for extension of the ornamental lighting system from the Boulevard and Broadway to Marie Avenue, a distance of more than a mile.

FALMOUTH, MASS.—The Buzzards Bay Electric Company has filed a petition with the Board of Gas and Electric Light Commissioners for authority to erect an electric transmission line between its stations in Falmouth and Chatham for the purpose of supplying electricity to substations at Hyannis, South Yarmouth, North Harwich, Chathamport and Osterville.

FOXBORO, MASS.—The Norfolk & Bristol Street Railway Company is contemplating the purchase of a condenser pump.

NORTH BROOKFIELD, MASS.—The Quaboag Rubber Company has closed a contract with the North Brookfield Electric Light & Power Company to equip its plant for electrical operation. The contract calls for an expenditure of about $30,000.

SALEM, MASS.—Bids will be received at the office of the Massachusetts Board of Education, Room 217, State House, Boston, Mass., until July 7 for removing present fixtures and installing new electrical fixtures and wiring in the State Normal School Building at Salem. Specifications may be obtained at the office of the school, Salem, or at the office of Richard D. Kimball Company, 6 Beacon Street, Boston, Mass.

SPRINGFIELD, MASS.—The sectional three-wire system for the elimination of electrolysis, installed for the lines of the Springfield Street Railway on the west side of the Connecticut River several months ago, has proved so satisfactory that the same system will be used for the city lines when the new power arrangements are completed and all energy is received from the Turners Falls Power & Electric Company.

WORCESTER, MASS.—Plans are under consideration by the New England Power Company whereby the capacity of the local substation will be increased from 11,000 kw. to 24,000 kw., at a cost of about $100,000. The plants at Pawtucket and Woonsocket will be enlarged and a new station erected at North Adams at a cost of $75,000.

NEW HAVEN, CONN.—The Housatonic Power Company has announced its intention of building a large dam, 100 ft. high, on the Housatonic River, about 1½ miles below Zoar Bridge. The proposed basin will inundate 25 miles of territory along the river and will mean wiping out parts of Southbury, Oxford, Newton and Monroe. A large part of this territory has been acquired. Electricity generated at the dam will be utilized to operate factories in the Housatonic Valley and to supply energy to a portion of the New York, New Haven & Hartford Railroad.

Middle Atlantic States

AKRON, N. Y.—The Public Service Commission has approved the franchise granted to the Genesee Light & Power Company of Batavia under which the company will supply electricity for the municipal electric-light plant in Akron.

CHATEAUGAY, N. Y.—The Public Service Commission has approved a bond issue of $3,000 of the Chasm Power Company, of which the proceeds will be used to erect an electric transmission line to the plant of the High Falls Pulp & Paper Company in Jefferson County.

DUNKIRK, N. Y.—The Niagara & Erie Power Company of Buffalo has been granted a franchise to supply electricity for lamps and motors in certain sections of Dunkirk.

EDEN, N. Y.—The Public Service Electric Company has approved franchises for the erection of an electric transmission line in the town of Eden, along the Gowanda state highway from the Hancock road to the houses of residents who are holders of the franchise. They propose to erect the line on poles of the Postal Telegraph Company and secure electricity from the Inter-Village Electric Company of Hamburg. Walter D. Henry, Henry George and others are interested in the project.

LONG ISLAND CITY, N. Y.—The Patterson-Sargent Company, 8 Jay Street, New York City, is planning to erect a power plant, 35 ft. by 50 ft., one story, in Long Island City, to supply power for its new group of factories here.

NEW YORK, N. Y.—Plans have been filed by the Merchants' Refrigerating Company, 616 Chambers Street, for the installation of a new transformer station at its plant on North Moore Street.

NEW YORK, N. Y.—Plans have been filed by the Interborough Rapid Transit Company for the erection of a power station, 30 ft. by 60 ft., one story, on West Fifty-ninth Street, to cost about $15,000.

NEW YORK, N. Y.—Plans have been filed for alterations to a three-story power house, to cost about $10,000, at the Rockefeller Institute, Avenue A, Sixty-fourth to Sixty-sixth Street. Coolidge & Shattuck are architects.

NEW YORK, N. Y.—The New York Telephone Company has awarded a contract to the E. E. Paul Company, 101 Park Avenue, for the construction of a five-story addition, 66 ft. by 84 ft., to its exchange building at 336 West 150th Street, to cost about $100,000.

STONY POINT, N. Y.—The Buttermilk Falls Electric Company of Highland Falls has petitioned the Public Service Commission for permission to construct and operate an electric-light plant in Stony Point.

THIELLS, N. Y.—Bids will be received by Frank A. Vanderlip, president of the board of managers of Letchworth Village, 7 Wall Street, New York City, until July 12 for refrigeration equipment for storehouse, bakery, refrigerating plant and cold storage building at Letchworth Village, Thiells. Drawings and specifications may be seen at office of the board of managers, 7 Wall Street, New York City; at the New York office of the Department of Architecture, Room 1224, Woolworth Building. Copies may be obtained at the Department of Architecture, Albany. Lewis F. Pilcher is state architect.

DOVER, N. J.—The New Jersey Power & Light Company is negotiating with the Hackettstown (N. J.) Electric Light Company to furnish energy to the latter company for distribution in Hackettstown and vicinity. It is proposed to erect an electric transmission line from Hackettstown to Netcong to connect with the transmission system of the New Jersey Power Company there.

MERCHANTVILLE, N. J.—The Public Service Electric Company is contemplating the installation of a street-lighting system here. An electric transmission line will be erected from its power plant in Burlington to Merchantville to furnish energy for the service.

NEWARK, N. J.—Bids will be received by the Board of Trustees of the Newark City Home until July 16 for electrical work at the home. John Waferling, 810 Broad Street, Newark, is architect; Carl Heller is secretary of board.

ROCKAWAY, N. J.—To conserve the local water supply, the borough has requested manufacturing plants utilizing this service to provide other means for operation. This will necessitate the installation of electric motors with energy supplied by the New Jersey Power & Light Company of Dover, which operates in this district. E. E. Yensel of Dover is president of the power company.

SOUTH AMBOY, N. J.—The City Council is negotiating with the Middlesex & Monmouth Electric Light, Heat & Power Company for improvements in the local street-lighting system.

BANGOR, PA.—The Pennsylvania Utilities Company has secured a contract from the North Bangor Slate Company to supply energy to operate the plant of the latter company.

BEAVER FALLS, PA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 20 for plumbing, gas piping, conduit and wiring and lighting fixtures in the United States post office at Beaver Falls. For details see Searchlight Section.

BETHEL, PA.—The Blue Mountain Electric, Mount Aetna, and the Marion Electric Companies in Berks County; Union Electric, Bethel Electric and Bunker Hill Electric Companies in Lebanon County have been consolidated under the name of the Blue Mountain Electric Company with headquarters at Bethel. Energy to operate the consolidated plants and lines will be obtained from the Reading (Pa.) Transit & Light Company.

CHESTER, PA.—The Seaboard Steel Casting Company, recently acquired by the American Locomotive Company, is contemplating the construction of a new power house in connection with other extensions to its works.

HARRISBURG, PA.—Plans are being completed by the Western Union Telegraph and the Postal Telegraph-Cable Company for the establishment of a joint conduit system in the business section to replace the present aerial lines.

HAZLETON, PA.—The Harwood Electric Company has entered into a contract to supply electricity to operate the works of the Girard-Mammoth Colliery at Raven Run.

MILLERSBURG, PA.—The Millersburg Electric Light, Heat & Power Company is erecting a new electric transmission line to Halifax via Juniata and Montgomery's Ferry, to furnish local electric light and power service. A new lighting system will be installed in Millersburg by Jan. 1. The erection of an electric transmission line to Liverpool, and also the acquisition of the property of the Liverpool Electric Company, is under consideration by the Millersburg company.

NORRISTOWN, PA.—Application will soon be made for charters for the following new electric companies: Washington Square Electric Light & Power Company, to operate in the township of Whitpain; the Railway Electric Light & Power Company, to furnish electrical service in Lower Gwynedd; the Gwynedd Farmers' Electric Light & Power Company, to supply electricity in Upper Gwynned Township, and the Superior Electric Light & Power Company, to furnish electrical service in Upper Dublin Township.

PHILADELPHIA, PA.—After a delay of three years the Public Service Commission has approved the proposed lease of space in the Keystone Telephone Company's conduits to the Philadelphia Electric Company.

PHILADELPHIA, PA.—The Crew Levick Company, Land Title Building, is contemplating the construction of a power station in connection with its new oil plant to be erected on Petty's Island, Delaware River.

PHILADELPHIA, PA.—The United Electric Construction Company, 1727 Sansom Street, has been awarded a contract for electrical apparatus in one of the new buildings to be erected at the League Island Navy Yard.

PHILADELPHIA, PA.—Contracts have been awarded by the Penn Chemical Works, 1332 Washington Avenue, to Nickson Duggan & Company of Philadelphia, for the erection of addition 25 ft. by 50 ft., three stories, and a power house, 40 ft. by 100 ft., to cost about $75,000.

PHILADELPHIA, PA.—Bids will be received at the office of the Department of City Transit, 754 Bourse Building, Philadelphia, until July 10 for building removal and erection Frankford Elevated Railway, including electrical installation for station buildings. Plans and specifications may be obtained at Room 758 Bourse Building upon deposit of $10 for each set of plans. William S. Twining is director.

PHILADELPHIA, PA.—Bids will be received by George E. Datesman, director of the Department of Public Works, and the board of trustees of the Free Library of Philadelphia, Room 216, City Hall, Philadelphia, until July 12 for the erection of the building for the Free Library of Philadelphia, to be located on a plot bounded by Vine, Nineteenth, Wood and Twentieth Streets, as follows: (1) For the entire work, except plumbing, heating and ventilating and electrical work; (2) plumbing and drainage; (3) for electrical equipment work. Plans may be obtained from Horace Trumbauer, architect, 1406 Land Title Building, Philadelphia.

READING, PA.—Plans are being considered by the Metropolitan Electric Company for rebuilding its power plant at Klapperthal, which was destroyed by fire some months ago, causing a loss of about $100,000.

ANNAPOLIS, MD.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 9 for construction of a new wing and connecting building, including a conduit and wiring system, forming an extension to Isherwood Hall at the Naval Academy at Annapolis. Lighting fixtures will be furnished under another contract. Plans and specifications can be obtained upon application to the above bureau.

BALTIMORE, MD.—Plans are being prepared by the Consolidated Gas, Electric Light & Power Company for the erection of another substation, to be known as Station D, at Westport. Work will begin on the new station as soon as Station C is completed.

CUMBERLAND, MD.—Plans have been completed by S. Diescher & Sons, engineers, of Pittsburgh, Pa., for the proposed new plant of the Kelly-Springfield Tire Company of Akron, to be located on property recently acquired here. A large power station will be installed in connection with

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

the proposed works. The cost of the entire project is estimated at $1,200,000.

LYNCHBURG, VA.—Contract has been awarded by the Johnson Overall Company to C. W. Hancock & Son of Lynchburg for the construction of a building 64 ft. by 146 ft., equipped with steam heat and freight elevator. The equipment will consist of 150 sewing machines driven by electric motors. The cost of the building without equipment is estimated at $30,000.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 23 for the installation of an exciter plant in connection with the extension to each of the following buildings: The United States post office and court house at East St. Louis, Ill., and Huntington, W. Va.; the United States post office and custom house at Nashville, Tenn. For details see Searchlight Section.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 9 for eight 600-hp. boilers with superheaters and stokers for the navy yard at Norfolk, Va.; six 600-hp. boilers with superheaters and stokers for the navy yard, Philadelphia, Pa.; two 600-hp. boilers with superheaters and oil-burning equipment, for the navy yard at Puget Sound, Wash.; one 600-hp boiler with stoker and stokers for seven existing boilers for the Naval Academy, Annapolis, Md.; stokers for ten existing boilers for the navy yard, Washington, D. C.; two 350-hp. boilers with superheaters and stokers for the navy yard at Charleston, S. C., and two 600-hp. boilers with superheaters and oil-burning equipment for the naval station at Pearl Harbor, Hawaii. Drawings and specifications (No. 2411) may be obtained on application to the bureau or to the commandants of the naval stations named.

North Central States

DETROIT, MICH.—Plans have been prepared by Albert Kahn and E. Wildy, 58 West Lafayette Boulevard, architects, for the construction of a power house on Third Avenue for the Burroughs Adding Machine Company.

LANSING, MICH.—The contract for lighting the State Capitol for the next two years has been awarded to the Lansing municipal electric-light plant. The Michigan Power Company now furnishes the service.

PETERSBURG, MICH.—The Petersburg Electric Light & Power Company, recently incorporated with a capital stock of $5,000, proposes to supply electricity for lamps and motors in Petersburg. William Schroder, William McAran and G. A. Guggenbihler of Petersburg are the incorporators.

BOWLING GREEN, OHIO—The Ohio Northern Public Service Company, recently organized, has taken over the property of the Lake Erie, Bowling Green & Napoleon Railway Company, from the bondholders, who secured same from the receiver. The company has been granted a franchise to erect an electric transmission line (three phase, 60 cycles) to Portage.

CINCINNATI, OHIO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 5 for mechanical stokers, etc., for the United States custom house and post office at Cincinnati, Ohio. Specifications may be obtained at the above office or at the office of the custodian, Cincinnati.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, until July 10 for condenser discharge line; ornamental standards for the ornamental lighting system; also ornamental lanterns of the ornamental lighting system, for the division of light and heat. Separate bids to be submitted on each item. Drawings and specifications may be obtained at the office of the division of light and heat, Room 204, City Hall.

COLUMBUS, OHIO.—Additions are being made to the power plant of the Columbus Railway, Power & Light Company on Spring Street. Contracts have been placed for the boilers.

COLUMBUS, OHIO—The City Council is considering the financial side of the proposal for improvements to the municipal electric-light plant recommended by Herman Gamper, city engineer. To put the plant in proper condition with the latest type of lamps installed throughout the city will cost approximately $114,000.

DAYTON, OHIO.—The construction of a new power building, 60 ft. by 180 ft., seven stories high, to cost approximately $250,000, has been announced by H. E. Talbott.

DAYTON, OHIO—The Dayton Metal Products Company, it is reported, will soon award a contract for a power plant to cost about $250,000, adjoining its works on North Taylor Street.

DE GRAFF, OHIO.—The sale of the municipal electric plant is under consideration, for which bids are now being asked.

EAST LIVERPOOL, OHIO.—Bids will be received by the director of public service of the city of East Liverpool, Ohio, until July 2 for furnishing and installing steam, exhaust feed water and miscellaneous small piping, pipe covering for same, damper regulator and ash conveyor and other appurtenances in connection with equipment of the new pumping station for the city water-works station. Chester & Fleming, Union Bank Building, Pittsburgh, Pa., are engineers.

HAMILTON, OHIO.—A decision handed down by Judge Harlan, giving the Ohio Gas & Electric Company of Cincinnati the right to erect poles in Butler County and cross roads with its wires without obtaining permission of the county officials gives the municipal electric plant in this city a competitor for furnishing electricity for lamps and motors.

IRONTON, OHIO.—The capital stock of the Ironton Electric Company has been increased from $15,000 to $150,000.

MANSFIELD, OHIO.—The Mansfield Electric Light & Power Company is building a 12,000-kw. power plant and erecting a 44,000-volt electric transmission line to Mansfield and Ashland, Ohio. It is expected to have the plant in operation by Sept. 1, 1917. A. V. Wynne is general superintendent.

MARION, OHIO.—Extensive improvements are being made to the power plant of the Marion Railway, Light & Power Company, including the installation of a Heine steam boiler, large steam turbine, surface condenser, air pump, circulating pump, boiler-feed pump and motor-driven exciter. A new modern cooling system will replace the old pipe spray system. The cost of the system is estimated at $37,000.

MINERAL CITY, OHIO—Bids will be received by the Village Council at the office of Fred Hoover, village clerk, Mineral City, until July 9 for lighting the street of the village with electricity for a period of ten years, according to plans and specifications, and for a franchise to furnish electricity in the village for a period of 25 years.

ST. PARIS, OHIO.—The City Council has accepted the bid of the Dayton Power & Light Company for $17,000 for the municipal electric-light plant. Improvements, it is understood, will be made to the plant and street-lighting system.

SPRINGFIELD, OHIO.—The Springfield Gas & Electric Company has applied for permission to erect a 6600-volt transmission line over the tracks of the Baltimore & Ohio Southwestern Railroad at Jefferson Street and South Grand Avenue East. The proposed line will furnish electricity to the Jones & Adams coal mine.

WARRENSVILLE, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, Room 218, City Hall, Cleveland, Ohio, until July 5 for construction of a nurses' home building, school building and three cottage ward buildings for the Tuberculosis Sanatorium at Warrensville as follows: (1) General contract; (2) heating and plumbing; (4) electrical work. Drawings and specifications may be obtained at the office of the city architect, 604 City Hall.

ZANESVILLE, OHIO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 20 for the installation of an electric freight elevator in the United States post office at Zanesville. For details see Searchlight Section.

ASHLAND, KY.—The City Council has appropriated $5,000 for the installation of a new street-lighting system in the business section of the city.

BICKNELL, IND.—The Commissioners of Knox County have granted the Indiana Power & Water Company a franchise to furnish electricity in Edwardsport, Westphalia, Freelandville and Sandborn.

PETERSBURG, IND.—The Indiana Water & Power Company of Bloomfield has taken over the Pike County electric system in Petersburg, at $48,000. A high-tension transmission line will connect Petersburg with the power plant of the company at Edwardsport.

SPRINGFIELD, ILL.—Extension of the franchise of the Springfield Gas & Electric Company as a compensation for placing all its wires in a conduit system is proposed by the Springfield Commercial Association in a communication in form of an ordinance offered the City Council. Thomas Rees is chairman of the conduit committee of the commercial association.

THOMSON, ILL.—Bids will be received at the office of Franklin J. Stransky, attorney for the Savanna and York Drainage District, Savanna, Ill., until July 6 as follows: (a) For furnishing all material, machinery and labor for the construction of a pumping station and appurtenances, (b) for furnishing and installing pumping machinery, electrical apparatus and auxiliaries. Alternate bids will be received on an oil engine or steam-driven plant. Plans and specifications may be obtained from the Edmund T. Perkins Engineering Company, First National Bank Building, Chicago, Ill., and from N. D. French, secretary, Thomson, upon deposit of $10.

MEDFORD, WIS.—The Medford Lighting & Heating Company is reported to be considering the installation of new lamps.

MOSINEE, WIS.—The Wisconsin Valley Electric Company, it is reported, is contemplating erecting an electric transmission line from Mosinee to Stevens Point.

TOMAH, WIS.—The City Council has awarded the Wisconsin-Minnesota Light & Power Company of Eau Claire a contract for lighting the streets of the city for a period of five years. The contract calls for the installation of 90 bracket lamps of 100 cp. each. The company has also submitted a proposal to supply electricity for the pumping station of the municipal water-works system.

CEYLON, MINN.—Extensions and improvements are being made to the municipal electric-light plant.

LAKEFIELD, MINN.—Bids will be received by the Village Council until July 10 for the construction of a concrete smoke stack or chimney for the municipal power plant.

MORGAN, MINN.—The Wherland Electric Company is reported to be considering extending its service to the villages of Vesta and Seaforth.

ST. CLOUD, MINN.—The ornamental lighting system will be extended from East Germain Street to the Hinckley.

ST. PAUL, MINN.—Bids will be received at the office of the Minnesota State Board of Control, State Capitol, St. Paul, for furnishing and installing complete, including glassware and lamps, fixtures in the Minnesota Historical Society Building, St. Paul. The sum of $5,000 has been appropriated for the work. Specifications may be seen at the office of the Minnesota State Board of Control, Builders' Exchanges of St. Paul, Minneapolis and Duluth.

ST. PETER, MINN.—Bids will be received by W. H. Holz, auditor of County of Nicollet, Court House, St. Peter, until July 9, for erection of addition to the Nicollet County Court House as follows: (A) For general construction and wiring; (B) heating. George Pass & Sons of Mankato are architects.

WILLMAR, MINN.—The St. Cloud (Minn.) Public Service Company is contemplating extending its electric transmission lines to the city of Willmar to furnish electrical service.

CLERMONT, IOWA.—The Northeastern Iowa Power Company, recently incorporated by C. Miller & Sons of Clermont, who have been operating under the name of the Turkey River Power Company, it is reported, will take over the electric-light and power system that serves 18 towns. Further extensions are contemplated to the system.

ELLSWORTH, IOWA—The farmers on the Story Road from Ellsworth for a distance of 3 miles are considering making a connection with the electrical service of the city of Ellsworth.

GRANT, IOWA—The cost of installing an electric-light and power plant in Grant is estimated at $5,000.

GRINNELL, IOWA.—The Iowa Light, Heat & Power Company is contemplating extending its electric transmission lines from Grinnell to Newburgh, a distance of 7 miles.

LE MARS, IOWA.—The Iowa Light, Heat & Power Company of Grinnell, it is reported, will build a central power station in Le Mars.

PELLA, IOWA—D. S. Umbenhauer, 932 Park Street, Pella, is reported to be interested in the construction of an electric railway in connection with the Wabash Railroad.

HARRISONVILLE, MO.—At an election held recently the proposal to grant a franchise to L. K. Green & Sons of Pleasant Hill to furnish electricity for commercial purposes in Harrisonville was defeated. The City Council will soon call an election to submit to the voters the proposal to issue $25,000 in bonds to install a complete plant.

KIRKSVILLE, MO.—A committee has

been appointed by the City Commissioners to make investigations relative to the installation of a street-lighting system.

CAYUGA, N. D.—The citizens of Cayuga have voted in favor of installing an electric-lighting system.

CHURCH'S FERRY, N. D.—The installation of an electric-lighting system in Church's Ferry is reported to be under consideration.

GLEN ULLIN, N. D.—The Hannes Light & Power Company is planning an extension to its power station and the installation of engines and other equipment.

MICHIGAN, N. D.—The municipal electric-light plant and fire hall were recently destroyed by fire, causing a loss of about $9,000.

MINNEWAUKAN, N. D.—The installation of an electric-lighting system in Minnewaukan is under consideration.

BONESTEEL, S. D.—Plans are being prepared by Bruce & Standeven, engineers, Omaha, Neb., for the installation of an electric-lighting system.

COLOME, S. D.—The installation of an electric-light plant in Colome is under consideration.

ISABELLA, S. D.—The installation of an electric plant in Isabella is under consideration.

SCRIBNER, NEB.—The Council has granted the Nebraska Gas & Electric Company of Omaha a franchise to furnish electricity in Scribner.

THEDFORD, NEB.—The city of Thedford, it is reported, has awarded a contract to B. A. Kirkpatrick of Anselmo for the installation of an electric-light and power plant.

BEATTIE, KAN.—Plans have been prepared for improvements to the local electric-light plant, owned by Daniel Hockman, involving an expenditure of several thousand dollars.

KANSAS CITY, KAN.—The City Commissioners have decided to discard the arc lamps now in use and substitute incandescent lamps of 250, 400 and 600 watts.

Southern States

WILMINGTON, N. C.—Bids will be received by the Cape Fear Packing Company, Southern Building, Wilmington, until July 11 for construction of packing house as follows: (1) For a reinforced concrete and brick packing house; (2) for insulation; (3) elevators; (4) boilers; (5) engine; (6) generator and switchboard; (7) for special packing-house equipment; (8) refrigerating machinery and piping; (9) steam fitting, lard and grease lines. Plans and specifications may be seen at the office of the Cape Fear Packing Company, and may be obtained on application to Wilson & Sompayrac, Palmetto Building, Columbia, S. C., architects, or the Packers' Architectural & Engineering Company, Manhattan Building, Chicago, Ill., upon deposit of $25.

ST. HELENA ISLAND, S. C.—MacDonald, Wilkins & Company of Beaufort has awarded contract to the Georgia-Carolina Utilities Company, Whitaker and Harris Streets, Savannah, for the installation of an electric-light plant of sufficient output to maintain 400 lamps to be operated in connection with the present water system. The installation is to consist of a 240-amp.-hr. storage battery, with duplicate generating plant and heavy auxiliary fire pump for present water system and possible fire service. Post office address St. Helena, Frogmore.

KNOXVILLE, TENN.—A petition has been presented to the City Council asking for lamps in Marble City.

CORINTH, MISS.—B. F. Liddon, owner of the Corinth elevator feed mill, it is reported, contemplates the purchase of crude oil engines and other machinery.

JACKSON, MISS.—The installation of an ice and cold storage plant at Jackson, Miss., is reported to be under consideration by the Mississippi State Penitentiary Board.

ARKADELPHIA, ARK.—The management of the Arkansas Light & Power Company has announced extensive improvements at its plants throughout the State. Two electric transmission lines, one 75 miles long, are under construction. One is to connect Pine Bluff, England, Lonoke and Carlisle, the other to connect Paragould, Marmaduke, Rector, Greenway and Piggot. Work will soon begin on laying new mains here and rebuilding the local plant.

DURANT, OKLA.—The Pioneer Telephone & Telegraph Company of Oklahoma City is contemplating improvements to its local plant, to cost about $35,000, and will include the installation of a switchboard with a capacity of 4000 telephones.

DURANT, OKLA.—Contract has been awarded to J. J. Rooney of Muskogee for the construction of a power house for the Normal School, at $11,210. The Cook & McDonnell Company of Oklahoma City was awarded the contract for heating at $4,100.

FICHER, OKLA. (Not a Post Office).—The Central Ice Water Company is reported to be contemplating the purchase of pumps and power equipment, water tower, etc.

TULSA, OKLA.—The City Council is considering extensions to the fire-alarm system, including the installation of additional alarm boxes in the business and residential districts and complete equipments in West Tulsa and Kendall, at a cost of about $35,000.

FORT SAM HOUSTON, TEX.—The Council of National Defence has awarded a contract to the Stone & Webster Engineering Corporation of Boston, Mass., for the erection of about 2000 buildings at the Fort Sam Houston cantonment for the accommodation of 40,000 soldiers. The plans provide for the installation of a complete lighting system. The cost of the entire work is estimated at $3,500,000.

FREEPORT, TEX.—Surveys are being made by the Freeport Sulphur Company, which is owned by the Swenson syndicate of New York City, for the proposed interurban electric railway, to be constructed between Freeport and Houston, via Rosenberg and several other towns, covering a distance of about 100 miles. It is proposed to utilize the waste power of the large steam power plant at the sulphur mines of the company to generate electricity to operate the proposed railway. W. A. Randle, engineer of the Freeport Sulphur Company, has charge of the surveys.

STARK, TEX.—The Weir-Reynolds Lumber Company, recently organized, contemplates the construction of a lumber mill with a daily capacity of 300,000 ft. of lumber and to build an industrial city in connection with same. The proposed project will include the construction of a railroad 30 miles long, water-works, electric-light plant, ice factory, dwellings, etc. The property consists of 90,000 acres of virgin long-leaf yellow pine in Newton. R. W. Wier is president, and J. B. Reynolds secretary, both of Houston.

Pacific and Mountain States

COLVILLE, WASH.—The Stevens County Light & Power Company has petitioned the County Commissioners for a franchise to erect and operate electric transmission lines over certain roads in the county.

EVERETT, WASH.—The Commissioners of Snohomish County have granted the Everett Gas Company permission to erect and operate electric transmission lines over certain roads in the county in the vicinity of Snohomish for a period of 50 years.

OKANOGAN, WASH.—The Okanogan Power Company is planning to rebuild its local lines.

SEATTLE, WASH.—The City Council is planning to build the municipal car line to the Todd shipbuilding plant by August 15, providing that equipment can be secured.

EUGENE, ORE.—The Comet Electric Company of Eugene has been awarded the contract for electrial work in connection with the erection of the Woman's Dormitory at the University of Oregon, Eugene.

MYRTLE CREEK, ORE.—A special election will be held on June 30 for the purpose of voting upon the adoption of a new charter. This is being done primarily in order to clear the way for the construction of a municipal power, light and water plant.

BEVERLY HILLS, CAL.—The State Railroad Commission has granted the Beverly Hills Utilities Company, which furnishes electrical service in and about Beverly Hills, permission to sell its system to the Southern California Edison Company of Los Angeles, at about $23,347.

FRESNO, CAL.—The San Joaquin Light & Power Company has been awarded a contract for the erection of a 250-hp. reciprocating booster pumping station in the vicinity of Taft, Kern County. The station will be located about midway between Taft and Buena Vista Lake and will cost about $50,000.

LOS ANGELES, CAL.—Plans have been announced by the Los Angeles Investment Company for the construction of a number of colonial bungalows in Rodgers Park. A new street-lighting system is also included in the new project.

LOS ANGELES, CAL.—The Southern California Telephone Company, recently organized, has set aside $750,000 for consolidating the Pacific and Home systems in and around Los Angeles. About $250,000 will be expended for new switchboards, additions to existing switchboards and other apparatus; long distance systems, $14,000; installing and improving private branches, $50,000, and the remainder in consolidating the Pacific and Home exchanges at various points.

OAKLAND, CAL.—Permits have been taken out by the Pacific Pipe & Tank Company for the construction of a sawmill, dry kiln, power house, etc., in Oakland, to cost about $12,000.

RICHMOND, CAL.—Steps have been taken by the lighting committee for the installation of an electrolier lighting system on McDonald Avenue, from First to Twenty-third Avenue.

RIVERSIDE, CAL.—The City Council has adopted a resolution canceling a contract awarded to a Los Angeles firm for installing electric-lighting system on Main Street. The work will be done under the supervision of the city.

RIVERSIDE, CAL.—The contract for the erection of electric transmission and telephone lines in connection with the Paradise Valley irrigation project in Butte County has been awarded to the City Electric Supply Company of Riverside.

SAN DIEGO, CAL.—Congress has appropriated the sum of $600,000 for the installation of an electric-lighting system and other improvements on a site to be used for a marine brigade post.

SAN FRANCISCO, CAL.—The construction of an additional power house about 600 ft. below the Spaulding Dam, where it is estimated that 5000 hp. can be generated under a 173-ft. head of water, is under consideration by the Pacific Gas & Electric Company.

YOSEMITE, CAL.—Word has been received that Congress has appropriated $253,000, the full amount asked by the Department of the Interior, for Yosemite National Park. This will provide sufficient funds to complete the new power plant this fall and continue the building of the new roadway connecting El Portal with the park. The power plant will have an output of 2000 kw.

BOISE, IDAHO.—Extensive improvements are contemplated to the Swan Falls plant of the Idaho Power Company during the summer, involving an expenditure of more than $500,000 and increasing the output by 8000 hp. The company will also begin work this summer on the erection of an electric transmission line into the Jarbridge district.

GRANGEVILLE, IDAHO.—Plans are being made by the Grangeville Electric Light & Power Company for the construction of a dam and flume and power plant, to cost about $75,000. The new dam will be built below the present dam, which is near Grangeville, and will develop from 1500 to 2000 hp. The new flume will be 1500 ft. in length and will replace a flume 4000 ft. long. Eugene Enloe is president.

SALT LAKE CITY, UTAH.—Work will start soon on equipping the Saltair, Garfield & Western Railroad for electrical operation.

HARLEM, MONT.—A company has been organized by local business men to establish an electric-light plant. The company will be known as the Citizens' Electric Company and will be capitalized at $25,000. R. G. Barton is president, J. M. Rantschler is secretary, and H. C. Anderson is treasurer.

OSWEGO, MONT.—The local electric-light plant is reported to have been destroyed recently by a tornado.

Miscellaneous

JUNEAU, ALASKA.—The Council has entered into a contract with the Alaska Treadwell, the Alaska United and the Alaska Mexican Gold Mining Companies for the purchase of electrical energy for the city, for a period of ten years. The contract provides that in event the city does not install an electrical distributing system, it may make arrangements with the Alaska Light & Power Company to use its distribution system, including lines.

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until July 12 for galvanized steel cable clips, bronze, copper, brass and copper tubing, solder link fuses, fusible plugs, etc. Blanks and information relating to this circular may be obtained from the above office or the office of the assistant purchasing agents, 24 State Street, New York, N. Y.; Audubon Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

1,229,119. Riveting Apparatus. Frank P. Robert, Amityville, N. Y. App. filed June 24, 1916 (reissued). Relates to apparatus for use in electric riveting.

1,229,133. Art of Electric Welding. Thomas C. Cary, Brooklyn, N. Y. App. filed March 31, 1911. Relates to the art of electric welding and a reduction of the metal along the line of the seam or weld.

1,230,147. Telephone Exchange System. Henry P. Clausen, Mount Vernon, N. Y. App. filed Nov. 6, 1914. Provides means for facilitating the handling of connections at a telephone switchboard.

1,230,169. Starting Internal Combustion Engines; Otto Heins, Edgewater, N. J. App. filed Oct. 28, 1915. Utilizes the accumulated kinetic energy of rotation to assist the motor in starting the engine.

1,230,170. Telephony; Morton L. Johnson, Chicago, Ill. App. filed April 5, 1913. Relates to telephone exchange systems.

1,230,172. Automatic Circuit-Controlling Device; James H. Kiefer, Dayton, Ohio. App. filed Aug. 24, 1911. Operates the circuit breaker automatically after a certain time interval of flow of the current.

1,230,175. Electric Mechanism for Starting Automobiles and the Like; Cyrus B. Kurtz, Grinnell, Iowa. App. filed Dec. 1, 1916. Principle of unipolar or homopolar induction. Dynamo incorporated in flywheel.

1,230,193. Railway Signal; Alonzo C. Mather, Chicago, Ill. App. filed April 7, 1914. Electrically operated block signals where no electrical energy is necessary excepting when a train enters the block.

1,230,213. Insulated Pipe Joint; Oscar H. Pieper, Rochester, N. Y. App. filed Oct. 4, 1915. Affords a tight joint for the transmission of fluids and maintains an electric circuit through the joint.

1,230,218. Outlet Box; Joseph G. Raquette, Cleveland, Ohio. App. filed Dec. 10, 1915. Relates to switch-box structure.

1,230,221. Rheostat; Thomas Rhodus, Chicago, Ill. App. filed Oct. 2, 1916. Provides a structural formation whereby an effective contact between the annular resistance member and the circumferentially adjustable contact member is constantly and yieldingly maintained.

1,230,247. Burglar Alarm; Louis Weitzman, Toronto, Ontario, Canada. App. filed July 1, 1916. An alarm automatically operated to produce simultaneously an audible signal in a house and at the police station, a visual signal in the house and a photographic record of the burglar.

1,230,280. Sound-Transmitting Apparatus; Albert E. Coy, Chicago, Ill. App. filed Sept. 14, 1914. The degree of amplitude of the vibrations of the transmitter diaphragm can be readily adjusted to attain the desired intensity, purity and distinctness in the sound transmitted.

1,230,281. Sound-Transmitting Apparatus; Albert E. Coy, Chicago, Ill. App. filed July 8, 1916. Relates to electrical sound transmitting apparatus.

1,230,283. Electromedical Device; Albert H. Davidson and William C. McKellar, Huntington, W. Va. App. filed March 30, 1917. Apparatus adapted for treating the human body by creating static currents.

1,230,342. Electric Disinfector and Deodorizer; Royden Thornberg, San Francisco, Cal. App. filed Feb. 19, 1917. Substance is volatilized by means of heat generated by an electric current.

1,230,357. Device for Controlling Energy Delivered to Welding Electrodes; Harry R. Woodrow, New York, N. Y. App. filed Nov. 17, 1915. Device for measuring the amount of energy passing to welding electrodes and for automatically disconnecting said electrodes from the source of energy when a predetermined amount has passed.

1,230,372. Electric Switch; Augustus J. Bowie, Jr., San Francisco, Cal. App. filed Dec. 9, 1909. Provides a switch to open the circuit promptly and to destroy the resulting arc, without damage of any nature.

1,230,384. Electric Toaster; John F. Delahant, New York, N. Y. App. filed Oct. 19, 1916. Toast becomes wholly inclosed in a casing.

1,230,390. Portable Battery; Louis H. Flanders, Jenkintown, Pa. App. filed March 22, 1917. Provides a portable battery which can be placed in any position, even upside-down, and the plate space may be filled to increase the capacity without increasing outside dimensions.

1,230,393. Secondary or Storage Battery; Bruce Ford, Philadelphia, Pa. App. filed Feb. 11, 1915. To simplify the construction and arrangement of storage batteries.

Record of Electrical Patents

Notes on United States Patents issued on June 19, 1917

1,230,394. Storage Battery; Bruce Ford, Philadelphia, Pa. App. filed April 24, 1916. To simplify and cheapen the construction of storage batteries of the general type used in vehicles.

1,230,407. Electrical Switch; Bryson D. Horton, Detroit, Mich. App. filed March 24, 1915. Switch in which the normally stationary contacts are housed within a metallic housing.

1,230,410. Operator's Key; William Kaisling, Chicago, Ill. App. filed April 15, 1912. Provides a "listening and ringing key" with a novel arrangement of parts which enables the key to be economically manufactured while leaving it compact and simple in construction.

1,230,421. Automatic Telephone-Exchange System; Alben E. Lundell, New York, N. Y. App. filed June 28, 1915. Provides a circuit arrangement for insuring the proper and quick operation of the selector switches.

1,230,429. Electromagnetic Device; Joel C. R. Palmer, New Rochelle, and Frank J. Holmes, New York, N. Y. App. filed June 8, 1915. A polarized magnetic structure suitable for polarizing relays, telephone receivers and the like, and to increase the sensitiveness of such a device.

1,230,434. Automatic Timer for Starting Elevators; George H. Rowe, Berwyn, Ill. App. filed Aug. 14, 1913. Provides means for automatically giving signals, both to ascend and descend, at regular, predetermined intervals.

1,230,471. Power System; John D. Firmin, Philadelphia, Pa. App. filed May 29, 1912. Particularly adaptable to use in motor vehicles, to provide positive starting means for the gas engine.

1,230,480. Push-Button Connection for Snap Switches; Monroe Guett, Hartford, Conn. App. filed Oct. 28, 1916. Provides simple means by which a push-button can be connected with a switch-operating lever.

1,230,497. Impulse Motor; Leslie R. McDonald, Montreal, Canada. App. filed Jan. 29, 1915. Adapted to the driving of advertising devices, such as movable signs and rotary or reciprocating display tables.

1,230,524. Method for Separation of Finely Divided Substances from Coarse and Foreign Matters; Botho Schwerin, Frankfort-on-the-Main, Germany. App. filed May 13, 1915. Relates to improvements in a method for separating substances in suspension.

1,230,540. Ignition System and Apparatus; Richard Varley, Englewood, N. J. App. filed Aug. 29, 1914. Electrical systems for exploding the combustible mixture in the cylinders of an engine.

1,230,541. Ignition System; Richard Varley, Englewood, N. J. App. filed June 16, 1916. Refers to electrical systems such as are employed to ignite the combustible charges in the cylinders of an internal-combustion engine.

1,230,544. Electrical Bond for Railways; Frederick W. Walker, Milwaukee, Wis. App. filed Nov. 2, 1914. Facilitates electrically bonding railway rails.

1,230,564. Telephone-Exchange System; Henry P. Clausen, Mount Vernon, N. Y. App. filed Dec. 12, 1914. Means whereby a central office operator may effect the automatic connection of a busy signal to a calling subscriber's line.

1,230,565. Telephone-Exchange System; Henry P. Clausen, Mount Vernon, N. Y. App. filed April 1, 1915. Means for automatically determining the connection of a device with one end or the other of a circuit uniting two telephone stations.

1,230,566. Telephone-Exchange System; Henry P. Clausen, Mount Vernon, N. Y. App. filed Oct. 29, 1915. Facilitates the re-establishment of connections between two subscribers who have been accidentally disconnected.

1,230,578. Telephone Signaling System; Edward E. Hinrichsen, New York, N. Y. App. filed July 19, 1915. Device gives a plurality of signals by varying the strength of current.

1,230,582. Telephone Exchange System; Lewis H. Johnson, Bloomfield, N. J. App. filed March 11, 1915. Provides improved signaling means for telephone exchange systems.

1,230,598. Thermometer Unit; Horace N. Packard, Milwaukee, Wis. App. filed Nov. 30, 1914. Particularly applicable to meters of the type known as Thomas meters.

1,230,607. Protective Apparatus; Theodore Schidorsky, New York, N. Y. App. filed Jan. 26, 1917. Sounds an alarm and illuminates a compartment in the event of an attempt to open a door of the same.

1,230,610. High-Potential Insulator; Sol. S. Sonneborn, Brooklyn, N. Y. App. filed Dec. 9, 1916. Provides protective features against high-frequency, high-potential oscillations.

1,230,615. Protective Device; Charles P. Steinmetz, Schenectady, N. Y. App. filed June 19, 1913. Protects electrical apparatus, such as transformers, included in a high-voltage electrical transmission system.

1,230,619. Carburetor-Heating Device; Oliver P. Strickler and Burdette C. Lewis, Mason City, Iowa. App. filed Oct. 25, 1916. Provides a heating device for carburetors.

1,230,639. Semi-Automatic Telephone System; Bernard D. Willis, Chicago, Ill. App. filed Oct. 7, 1913. Improved means for supervising in semi-automatic telephone systems to indicate to the operators when a called line is busy.

1,230,662. Electric Light Socket; Albert H. Buckelew, New York, N. Y. App. filed March 2, 1917. Relates to electric light fixtures or sockets for incandescent lamps.

1,230,676. Sound Reproducer; John J. Comer, Chicago, Ill. App. filed July 24, 1914. Electromagnetic type adapted for use in connection with telephonic or loud-speaking circuits.

1,230,680. Protection of Transmission Systems; Elmer E. F. Creighton, Schenectady, N. Y. App. filed April 29, 1909. Electric transmission systems are protected from high-potential stresses.

1,230,681. Protection of Transmission Systems; Elmer E. F. Creighton, Schenectady, N. Y. App. filed Dec. 18, 1910. Protects transmission systems against prolonged intermittent or arcing grounds.

1,230,694. Two-Wire to Three-Wire Telephone System; Edward D. Fales, La Grange, Ill. App. filed April 16, 1910. Relates to automatic or semi-automatic telephone exchange systems.

1,230,708. Vapor Electric Apparatus; Peter Cooper Hewitt, Ringwood Manor, N. J. App. filed Oct. 1, 1912. Relates to rectifying apparatus which is adapted to operate with large currents of the character utilized in commercial service.

1,230,727. Dining-Table Plate-Heating Appliance; Wesley W. Kuhlmann, Woodcliffe-on-the-Hudson, N. J. App. filed March 9, 1917. To be used on a dining table for the purpose of keeping the plate warm while the meal is proceeding.

1,230,728. Voltage Regulator; Harry A. Laycock, Schenectady, N. Y. App. filed Jan. 12, 1916. A regulator which is particularly adapted for use upon a moving vehicle.

1,230,737. Lighting Fixture; Wilfrid Lumley, Conneaut, Ohio. App. filed May 5, 1913. Electrical connection between the body or junction part employed in chandeliers and other lighting fixtures.

1,230,742. Clamp; Adnah McMurtrie, New York, N. Y. App. filed Nov. 21, 1916. Clamp for electrical conduit.

1,230,787. Automobile Alarm; Charles E. Robison and Morris Askin, Philadelphia, Pa. App. filed Aug. 26, 1915. Designed for use upon motor vehicles to insure against theft or unauthorized use of the latter.

1,230,788. Electric Heater for Steering Wheels; Even J. Rohne, Minneapolis, Minn. App. filed Dec. 4, 1915. Electric heater or warming device for steering wheels of automobiles.

1,230,807. Telegraph Sending and Recording Device; Leo C. Shearer, Latrobe, Pa. App. filed Aug. 3, 1916. Provides a mechanism for automatically making a permanent record of the messages sent out from a telegraph sending station.

1,230,810. Signal; Joseph Shiflet, McKeesport, Pa. App. filed Nov. 11, 1916. Relates to a signaling apparatus upon an automobile for giving visible indications to a car in the rear as to the direction the first automobile is to take.

1,230,826. Circuit-Completing Plug for Lamp Sockets; James L. Campbell, Barryton, Mich. App. filed April 5, 1916. Adapted for electric lighting systems on automobiles.

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